



# Landscape of Green Finance in India

India's green investment flows in FY 2021/22

December 2024



CLIMATE  
POLICY  
INITIATIVE



Center for  
Sustainable  
Finance **India**

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**ABOUT CPI**

CPI is an analysis and advisory organization with deep expertise in finance and policy. Our mission is to help governments, businesses, and financial institutions drive economic growth while addressing climate change. CPI has seven offices around the world in Brazil, India, Indonesia, South Africa, the United Kingdom, and the United States.



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## **DESCRIPTORS**

### **SECTOR**

Green Finance

### **REGION**

India

### **KEYWORDS**

Landscape, Green Investments, Climate Finance, Private Finance, Public Finance, Sustainable Finance

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Figure ES1: Landscape of green finance<sup>1</sup> in India for fiscal years 2021/22

# LANDSCAPE OF GREEN FINANCE IN INDIA FOR FISCAL YEARS 2021/22

Green finance flows in India along their life cycle in 2021 and 2022. Values are averages of two years' data to smooth out fluctuations, in INR billions.

ANNUAL AVERAGE  
**3,712** BILLION INR  
**50** BILLION USD

## SOURCES AND INTERMEDIARIES

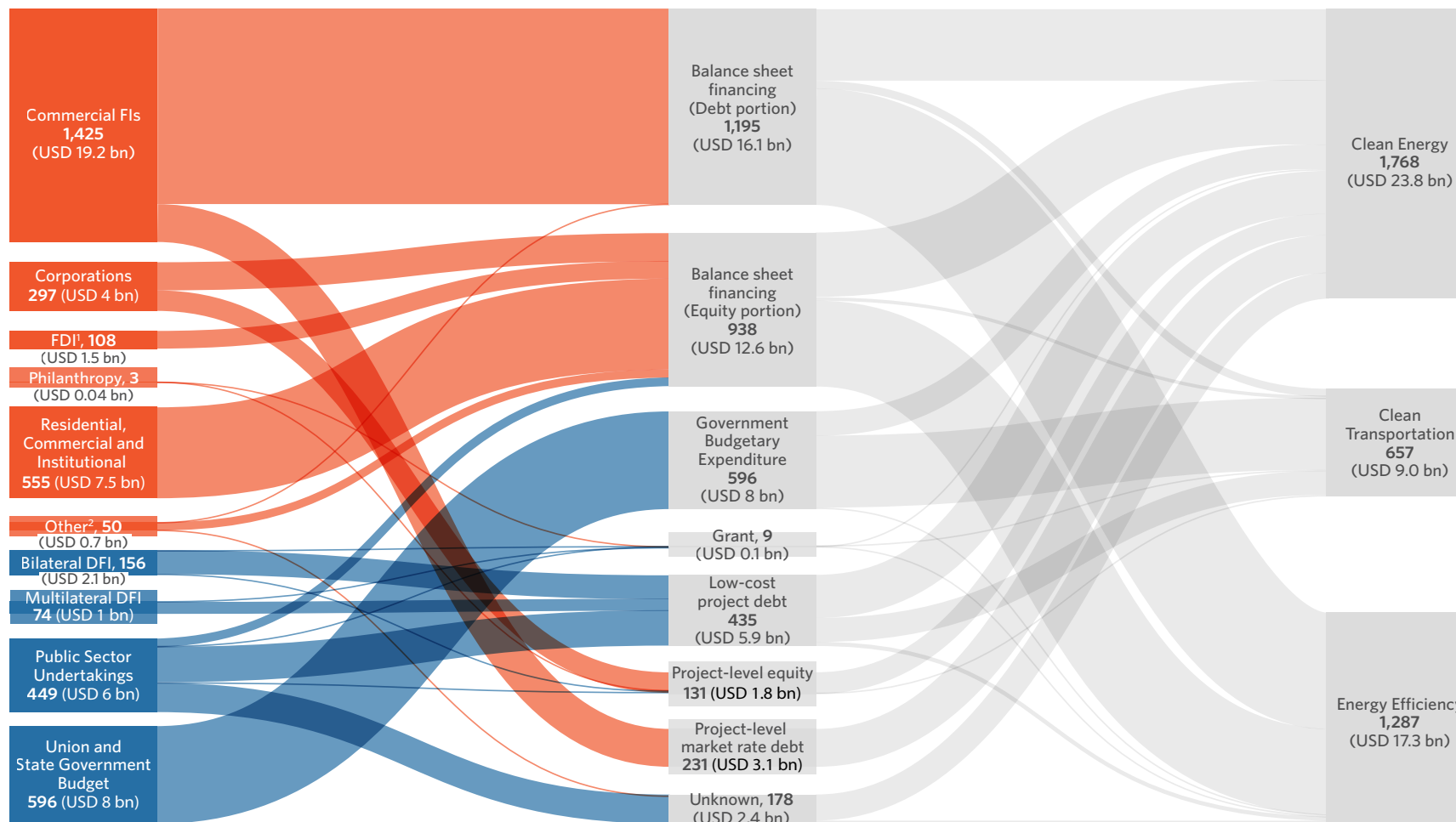
Which type of organizations are sources or intermediaries of capital for climate finance?

## INSTRUMENTS

What mix of financial instruments is used?

## SECTORS

What is the finance used for?



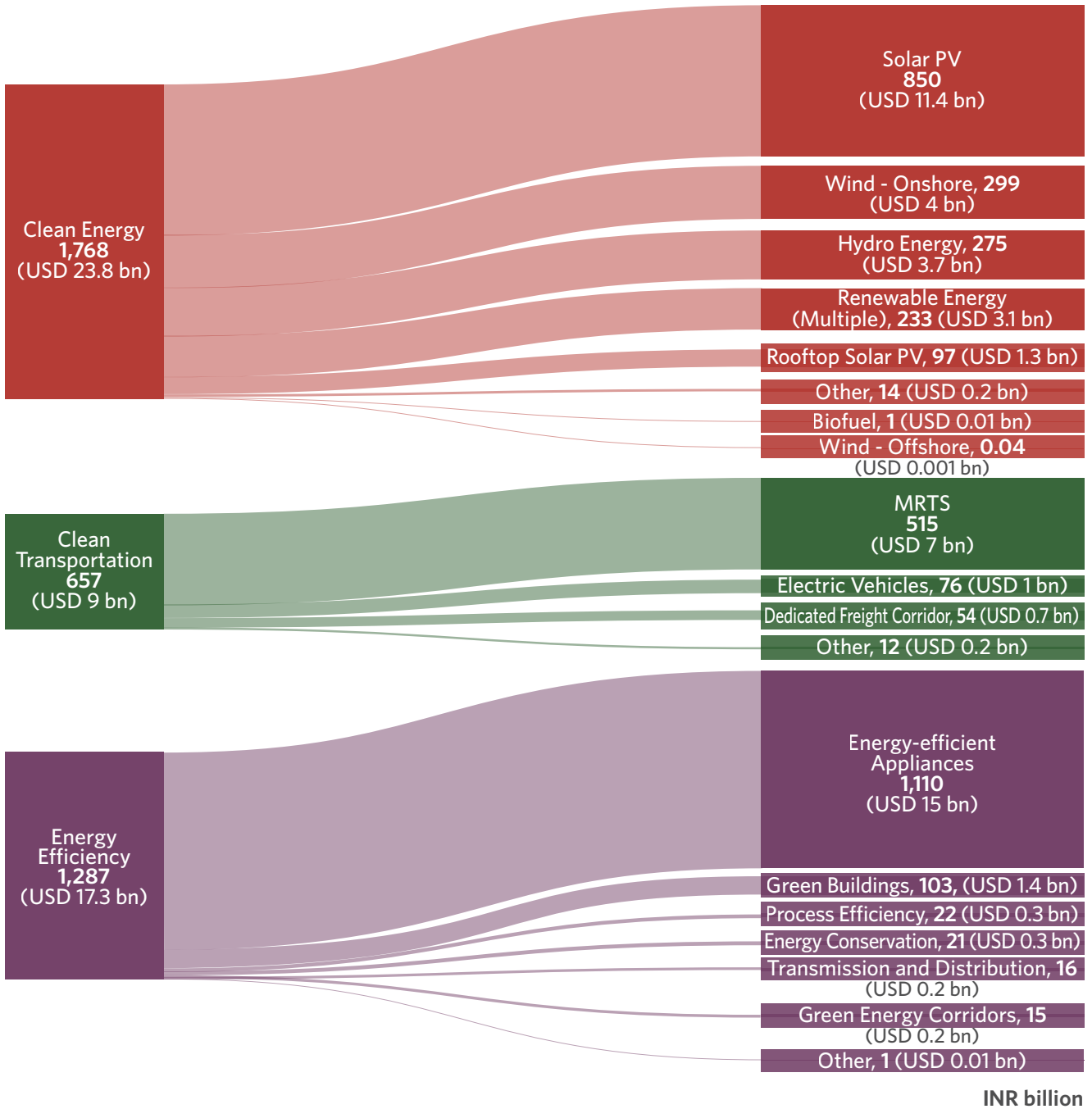
**Private** **Public**

<sup>1</sup> "FDI" stands for Foreign Direct Investment.  
<sup>2</sup> "Other" comprises PE and VC funds.

1 This Sankey diagram represents only finance to tracked mitigation sectors. Unless otherwise indicated, all numbers have been rounded off to the nearest whole number and all growth calculations are on INR values.

**SECTORS**

**SUBSECTORS**



# EXECUTIVE SUMMARY

## WHERE ARE WE NOW?

**India's tracked green finance reached an all-time high in 2021/22.<sup>2</sup> However, at least three times more investment is required to meet India's climate targets.**

Green finance flows for mitigation sectors reached INR 3,712 billion (USD 50 billion) per annum in the financial years 2021/22,<sup>3</sup> a 20% increase since 2019/20. This is a significant step up, especially since it comes in the context of the COVID-19 pandemic, which led to a massive disruption in the Indian economy<sup>4</sup> (Dhingra and Ghatak 2022). The increase in green finance flows stems from a rise in both domestic and international sources and is likely a result of an array of policy interventions, fiscal instruments, and market mechanisms put in place by the government to promote green investment.

Finance for adaptation-related sectors<sup>5</sup> rose by nearly threefold in the same period, reaching INR 1,092 billion (USD 15 billion) per year in 2021/22.<sup>6</sup> This increase is due not only to growth in financial flows but also to increased coverage in terms of the number and depth of sectors by this study (see Box ES1).

### Box ES1: What is tracked?

The Landscape of Green Finance in India ("Landscape report") covers both public and private sources of green finance in India—domestic and international—to track flows of finance from their sources to end beneficiaries through different instruments.

This year's study tracks finance to the same real economy sectors as the 2022 India Landscape report: clean energy, clean transportation, and energy efficiency.

As before, the report also tracks finance for adaptation to the following select sectors: disaster risk management, flood and cyclone mitigation, and drought management. It also expands the scope for tracking finance for adaptation to include a first-of-its-kind analysis of flows to on-farm adaptation-related interventions in the agricultural sector.

<sup>2</sup> All tracked years are financial years (April 01-March 31).

<sup>3</sup> Across this report, finance for 2021/22 indicates the annual average of flows for the two financial years 2020-21 and 2021-22. This presentation aims to smoothen out any single-year anomalies. FY 2020-21 and FY 2021-22 indicate individual financial years.

<sup>4</sup> The overall rate of contraction in India in 2020 is noted to be, "the worst year in terms of economic contraction in the country's history" (Dhingra and Ghatak 2022).

<sup>5</sup> The report includes only some specific sectors within adaptation and does not track adaptation comprehensively. Adaptation numbers are not represented in the overall Sankey diagram (ES1).

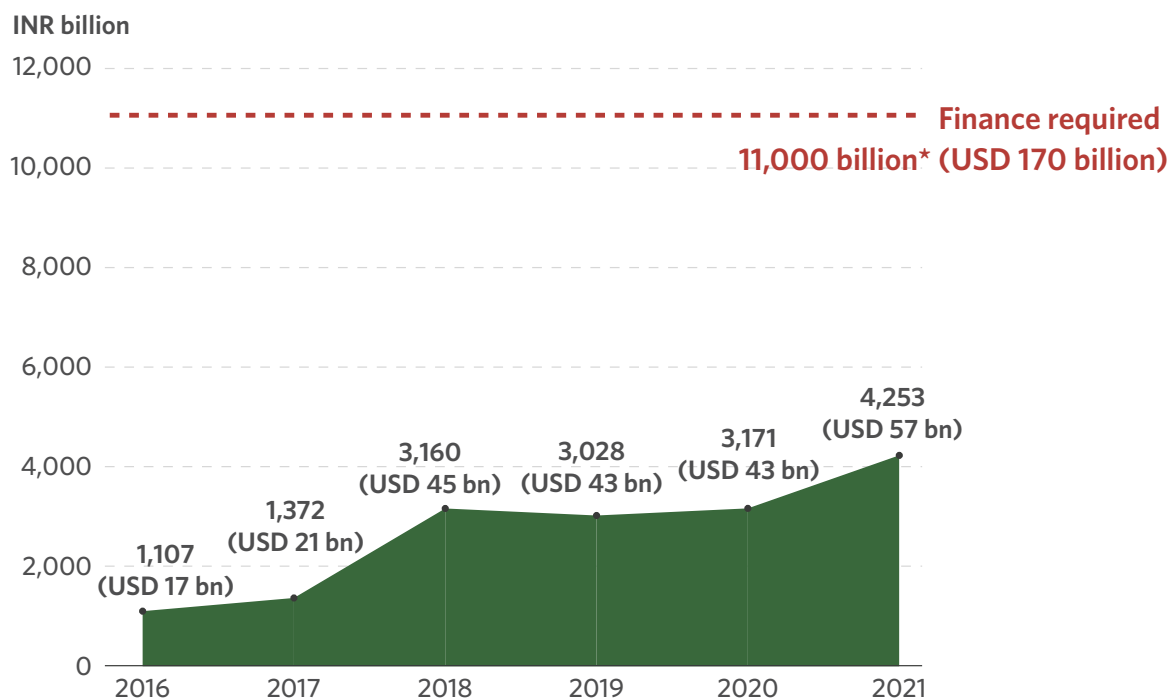
<sup>6</sup> Given that this report does not include all sectors considered as adaptation-related by the Government of India, the figures presented here are lower than India's Third National Communication and Initial Adaptation Communication to the UNFCCC, 2023, which reported adaptation-relevant expenditure of around INR 13 trillion for FY 2021-2022 (MoEFCC 2023).

## INDIA'S CLIMATE FINANCE NEEDS

Preliminary estimates by the Government of India suggest that India needs INR 162.5 trillion<sup>7</sup> (USD 2.5 trillion) by 2030—or INR 11 trillion annually (USD 170 billion)—to achieve its Nationally Determined Contributions (NDC) (GoI 2015).<sup>8</sup>

The latest tracked green finance for mitigation in India represents approximately 30%<sup>9</sup> of the total finance needed to meet the country's NDC (GoI 2015) (see Figure ES2).

**Figure ES2:** Tracked green investment and estimated requirements to meet current NDC (INR bn)



\*This amount represents the annual average of INR 162.5 trillion required over 2015-2030 as per India's NDC 2015 targets.

India scaled its climate ambitions significantly in November 2021. To fully implement these climate goals in a timely manner, there is an urgent need to scale up green finance.

India's adaptation investment needs are substantial and likely to increase. Estimates suggest that India's cumulative adaptation-related investment needs amount to at least INR 85.6 trillion (USD 1 trillion)—or INR 5,733 billion (USD 67 billion<sup>10</sup>) per year—for the period of 2015 to 2030 (DEA 2020). Finance for adaptation interventions must increase significantly for India to avoid the worst impacts of climate change.

<sup>7</sup> This is a conversion of the estimate cited in NDC 2015 -USD 2.5 trillion- to INR value, using exchange rate for 2014-15.

<sup>8</sup> A significant proportion of the required amount of investment mentioned in the NDC refers to needs for mitigation interventions.

<sup>9</sup> In December 2023 the government of India announced that two quantifiable targets (reducing the emissions intensity of India's GDP by 33% to 35% by 2030 from 2005 level; and achieving about 40 % cumulative electric power installed capacity from non-fossil fuel-based energy resources by 2030) of NDC 2015 have been achieved well ahead of the time (PIB, 2023b). However, since this report tracks finance flows from 2020 to 2022, benchmarking was done on the previously estimated numbers of the NDC 2015.

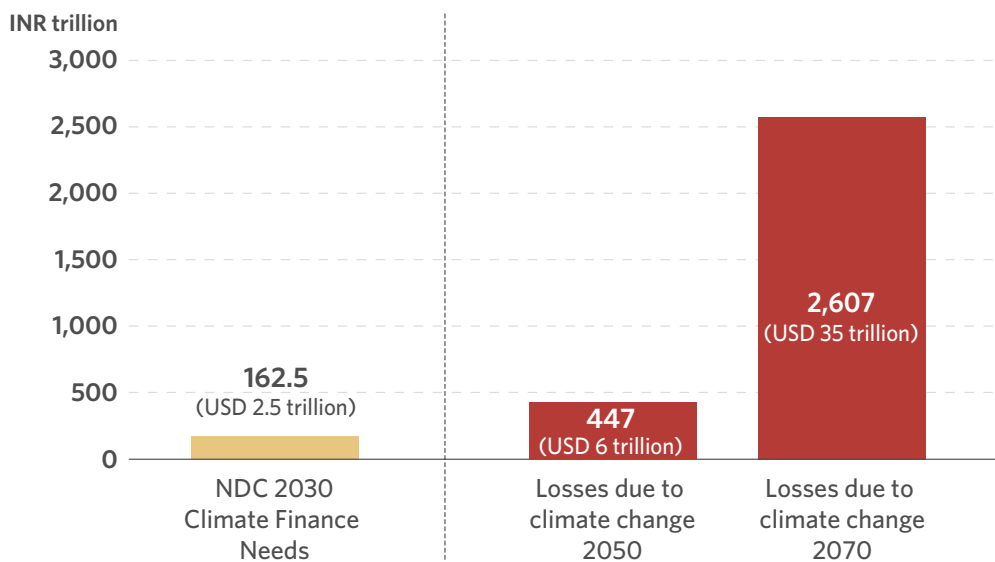
<sup>10</sup> SSEF 2022



## THE COST OF INACTION

India is exceptionally vulnerable to the adverse consequences of climate change. This means that the economic cost of inadequate action is extremely high. In a future where India and the rest of the world do not significantly reduce emissions relative to current levels, global average warming can reach up to 3°C by 2070 (Deloitte Economics Institute 2021). This pathway can result in an estimated economic loss of INR 2,607.5 trillion<sup>11</sup> (USD 35 trillion) by 2070<sup>12</sup>, with the loss to economic potential projected to equal 12.5% of Gross Domestic Product (GDP) in 2070 alone (Deloitte Economics Institute 2021). Other estimates note that in the absence of adequate and timely climate action, India could lose anywhere from around 3% to 10% of its GDP annually by 2100 (Kompas et al. 2018; ODI 2021). While estimates vary, it is well established that climate change poses a serious threat to India's economic growth and overall development, and climate action today can significantly reduce expected economic, human, and environmental losses.

**Figure ES3:** Cumulative climate finance needs vs. losses under 3°C scenario



<sup>11</sup> Using exchange rate of INR 74.5 to 1 USD as given by RBI for 2021 -22 in accordance with the date of publication of the cited report.

<sup>12</sup> In present value terms

## WHAT DOES THE DATA TELL US?

India continues to progress in increasing green finance flows to both mitigation and adaptation, with domestic capital playing a strong role.

### CLIMATE MITIGATION

#### GREEN FINANCE FOR MITIGATION SECTORS IS ON THE RISE

Finance flows to mitigation sectors increased by 20%, reaching INR 3,712 billion (USD 50 billion) per annum in FY 2021/22, compared to INR 3,093 billion (USD 44 billion) in FY 2019/2020.

#### FINANCE FOR MITIGATION WAS PRIMARILY DOMESTICALLY SOURCED

Around 83% of India's tracked green finance for mitigation was sourced **domestically**<sup>13</sup>. The private sector contributed 66% (INR 2,048 billion/USD 28 billion) of domestic mitigation finance. Of the 34% (INR 1,045 billion/USD 14 billion) from public sources, government budgetary expenditure—both central and state—accounted for INR 596 billion (USD 8 billion) in 2021/22, up from INR 574 billion in 2019/20. Public sector undertakings (PSUs) contributed the remaining 43%.

**International finance** increased to 17% (INR 620 billion/USD 8.3 billion) of India's total mitigation flows in 2021/22 from around 15% in 2019/20. Notably, private investment rose to account for 63% (INR 390 billion/USD 5.2 billion) of total international mitigation flows in 2021/22, up from 40% in 2019/20. This increase was driven by commercial financial institutions (FIs), providing 55%, and foreign direct investment (27%). This also indicates that the market for certain sectors/subsectors, such as solar energy, has become more mature. The remaining 37% (INR 230 billion/USD 3.1 billion) of international mitigation funding came from public sources, including official development assistance and other official flows.<sup>14</sup>

#### HOWEVER, THE INCREASE WAS FOCUSED ON CERTAIN SECTORS AND SUBSECTORS

Among tracked mitigation sectors, finance went primarily to clean energy in 2021/22 (47%, up from 42% in 2019/20). Finance for energy efficiency accounted for 35%, and clean transportation received 18%.

**Clean energy** was primarily funded by domestic sources—75% (INR 1323 billion/USD 18 billion) in 2021/22. The remaining 25% came from international funding, marking a rise from 18% in 2019/20. Private finance flows, primarily driven by domestic players, stood at 65% (INR 1159 billion/USD 16 billion). This represents an 80% increase in private flows to clean energy compared to 2019/20 (INR 645 billion/USD 9 billion). This signals stronger private sector confidence in the revenue potential of the clean energy sector, which will be instrumental in scaling investments and reducing the investment gap. Within the sector, solar projects continued

<sup>13</sup> While we recognize that a certain percentage of domestic financing may have originated internationally via External Commercial Borrowings and Non-sovereign debt, lack of any data on the subject has necessitated the classification as such. Refer to the methodology for details.

<sup>14</sup> The OECD defines official development assistance as government aid designed to promote the economic development and welfare of developing countries. It defines other official flows as official sector transactions that do not meet official development assistance criteria.

to attract the most investment in 2021/22, totaling INR 947 billion (USD 13 billion), or 54% of the sector's total flows. This marked a 75% increase from INR 542 billion (USD 7.5 billion) in 2019/20. This increase is primarily driven by large grid-scale solar projects, which have seen substantial capacity additions, enhanced competitiveness, and significant government policy support, such as providing the necessary infrastructure for large solar power project setup and incentives for PV module sales. The government has also promoted solar energy in the agriculture sector, including through subsidies for the installation of solar-powered water pumps, converting existing grid-connected pumps to solar, and setting up small solar power plants.

**Clean transportation** too was primarily funded through domestic sources—77% (INR 509 billion/USD 6.8 billion) in 2021/22, with the rest financed through international sources. Of the total flows (domestic and international) to the sector, public sources remained the dominant provider of finance, accounting for nearly 90% (INR 587 billion/USD 7.9 billion) in 2021/22. However, private finance also increased—totaling 10% (INR 69 billion/USD 0.9 billion) in 2021/22, up from just 4% in 2019/20. Within the sector, mass rapid transit systems (MRTS) received the largest share of finance (78%) in 2021/22. The electric vehicle subsector received nearly 12% (INR 76 billion/USD 1 billion) of clean transportation funds in 2021/22, marking a threefold increase from 2019/20.<sup>15</sup> Initiatives by the government to promote the adoption of electric vehicles by providing tax incentives and subsidies on the purchase of electric vehicles have aided this increase (PIB 2021).

**Energy efficiency** received 98% of its funding from domestic sources. Private participation was also notable, accounting for 95% of this sector's total funds. Within the sector, finance to green buildings increased by 27% to INR 103 billion (USD 1.4 billion) in 2021/22 from INR 81 billion (USD 1.2 billion) in 2019/20, and flows for energy-efficient appliances increased by 18% to INR 1,110 billion (USD 15 billion) in 2021/22 compared to INR 937 billion (USD 13 billion) in 2019/20. Enabling government policies and incentives such as free-of-charge additional floor area ratio for rated green buildings, subsidies in the form of reimbursement for adopting green building measures, reduction in building and property tax for green building projects, and energy and cost savings have facilitated this increase (IGBC 2024).

## CLIMATE ADAPTATION

Finance for adaptation saw a nearly threefold increase, reaching INR 1,092 billion (USD 15 billion) per annum in the same period<sup>16</sup>.

### TRACKED FINANCE FOR ADAPTATION CONTINUED TO BE DOMINATED BY DOMESTIC SOURCES

**Domestic sources**, mainly central and state government budgets, accounted for 98% of finance for adaptation in 2021/22. Domestic private finance from private equity and venture capital (PE/VC) funds, tracked for on-farm adaptation-related activities in agriculture, was negligible (<1%).

<sup>15</sup> The rest 10% went to dedicated freight corridors and 'other'.

<sup>16</sup> This report tracks finance for adaptation only in select sectors and is yet to track adaptation finance in key sectors such as water, health, infrastructure and ecosystems and biodiversity. With each edition, the report's sectoral coverage has been increasing and the subsequent editions will continue attempting to track additional sectors.

**International finance for adaptation**<sup>17</sup> increased by 19% in 2021/22 compared to 2019/20. Public sources, primarily multilateral DFIs, constituted 92% of the total international finance for adaptation.

## FINANCE FLOWS TO ADAPTATION SECTORS INCREASED PARTLY DUE TO IMPROVED TRACKING

**Disaster risk management** received the most funding (INR 461 billion / USD 6.2 billion) within adaptation, accounting for 42% of flows. This sector also saw a tenfold increase from 2019/20 (from INR 47 billion / USD 0.7 billion), primarily driven by a notable increase in government budgetary expenditure in the sector, and the tracking of budgetary expenditure of an additional government ministry in this edition. This significant increase could be attributed to the government's prioritization of strengthening the country's disaster risk management and preparedness.

**Flood and cyclone mitigation** received 32% of India's adaptation funds, while **on-farm adaptation-related agricultural activities** received 24%. Crop insurance received the highest share (58%) of the total finance to on-farm adaptation-related agricultural activities, with central and state government budgets accounting for the total flows. Public sources financed 99% of on-farm adaptation activities. Domestic sources (96%) also dominated flows to this sector. Domestic private finance to the sector amounted to INR 0.7 billion or USD 0.01 billion and was mainly directed towards soil and water conservation, research and capacity building, and resilient cropping systems.

The increase in total finance flows for adaptation is partly due to improved data collection. However, limited availability of data and reporting on private sector adaptation finance make it extremely difficult to capture the actual amount (CPI 2024c). This poses a significant challenge not only in assessing the current level of adaptation finance but also in attracting more investment.

## CONCLUDING OBSERVATIONS

India urgently needs to scale green finance to enable low-carbon and climate-resilient development. Based on this report's findings, CPI proposes the following priorities to increase green investment in India.

### 1. FURTHERING POLICY AND REGULATORY MEASURES TO MOBILIZE GREEN FINANCE ACROSS ALL SECTORS

With the country's economic recovery picking up pace in the aftermath of the pandemic, it is important to keep up the momentum witnessed for green finance growth. The policy environment can play a pivotal role in driving investment in India, both domestic and international. Attracting finance flow in mitigation and adaptation sectors will require the following:

<sup>17</sup> This report tracks data on disbursement and not commitments, and it is possible that enough data on disbursement is not available

- **Government policies and guidelines to signal ambition and commitment** to low-carbon and resilient development. Over the years, the government has introduced an array of climate policies covering a multitude of sectors. In the Budget 2024-25, for instance, the government announced a slew of measures to promote renewable energy, including initiatives such as the PM Surya Ghar Muft Bijli Yojana for promoting solar rooftop energy for households. Policy support, as demonstrated in the past, has facilitated the expansion of RE capacity, increased adoption of EVs in the country. Continued policy support to critical sectors under green is crucial for building investor confidence and mobilizing finance.
- **Developing and operationalizing a green/climate finance taxonomy.** The announcement in the Union Budget 2024-25 on establishing a climate finance taxonomy (PIB, 2024) is a welcome step toward establishing standardized definitions and classifications to help navigate and steer the country's economy toward a resilient and low-carbon economy. A taxonomy that provides clear definitions of green and climate finance and builds synergies with existing national goals, such as the country's NDC updated in 2022 and the upcoming National Adaptation Plan, can help to reduce uncertainty and build investor confidence, thereby helping to scale green/climate finance. A comprehensive, descriptive taxonomy that harmonizes with and builds upon existing attempts to define and classify adaptation activities and finance from the public and private sectors is crucial for scaling adaptation finance (CPI 2024c). Alongside, it is important to ensure the taxonomy remains a live document such that it can be updated to adequately reflect policy updates and progress, and new economic activities and green technologies such as green hydrogen, the Internet of Things, earth observation, among others.
- **Introducing national and subnational level regulations on adaptation.** India has national and subnational climate plans and strategies in place and has integrated adaptation considerations across its sectoral plans and policies. However, introducing updated and comprehensive adaptation-focused regulations at the national and subnational levels can help drive adaptation action and investments across governance levels and key economic activities. These can be mandatory integration of adaptation and resilience considerations in infrastructure projects, climate risk assessments and disclosures, and monitoring and reporting on climate risks and adaptation action.

## 2. COORDINATED ACTION TO SCALE UP GREEN FINANCE AT A FASTER PACE.

Scaling up green finance at a faster pace requires coordinated action as described below:

- **Creating market-based incentives, innovative financial products, and de-risking investments to accelerate green finance.** Sustainable development has been a key goal of the government, which is reflected in the Budget 2022-23 announcement on the issuance of sovereign green bonds to mobilize resources for the development of green infrastructure. The proceeds are to be deployed for public sector projects that help to reduce the carbon intensity of India's economy. Another welcome step is the emphasis on blended finance in the Budget 2022-23. To leverage public finance to attract private finance, it has been proposed to have thematic funds for areas such as climate action, and climate technology, with the government

share being 20% and the funds being managed by private fund managers. Through such initiatives, the Budget 2022-23 has tried to send an important signal to markets and FIs.

- **Augmenting development banks' and FIs' important roles in mobilizing green finance through interventions that direct capital to green initiatives.** Given the massive requirement of financial support for climate actions in the country, additional measures need to be taken to direct capital to green initiatives. This could take the shape of a green bank, green fund or facility, or a window within existing national alternative investment funds or development finance institutions.

### 3. ENHANCING FINANCE FOR ADAPTATION

Given its vulnerability to climate change, India could lose anywhere from 3% to 10% of its annual GDP by 2100 in the absence of adequate and timely climate action (Kompas et al. 2018; ODI 2021)<sup>18</sup>. To enhance the country's finance flows to adaptation sectors, the following steps are essential:

- **Fostering concerted effort and collaboration across various ministries and departments** to plan, invest, and execute adaptation projects is essential for mainstreaming adaptation action across sectors.
- **Ensuring that state-level adaptation plans indicate estimated adaptation funding gaps, including sectoral gaps, to boost understanding of where finance needs to flow.** This could inform public action and provide guidance on where private finance would be most appropriate.
- **Boosting private sector investment in adaptation by using public finance.** Private investments in adaptation are yet to be scaled due to various challenges, such as lack of information, uncertain investment returns, and unavailability of bankable projects, among others. Public finance can be better leveraged to mobilize private finance for adaptation. This can be done through various means, such as implementing policies, regulations, and incentives around climate risk disclosures and reporting, using public-private partnerships as entry points for channeling private finance, minimum investment return assurance on adaptation projects, setting up project preparation facilities, and supporting innovative financial mechanisms (CPI 2024a).

### 4. MAKING COORDINATED EFFORTS ACROSS DATA COLLECTION, REPORTING, AND ACCESS

Information asymmetry on green finance hampers further investment, especially from the private sector and international sources. Although the availability of green finance data has improved over the last two India Landscape reports, data gaps across actors and sectors remain. This could be tackled through the coordinated action of various stakeholders:

- **Standardizing and mandating disclosures.** Regulatory institutions, including the Reserve Bank of India (RBI), the Securities and Exchange Board of India (SEBI), and the Insurance Regulatory and Development Authority of India can play a leading role in mandating,

<sup>18</sup> These estimates mainly cover economic costs and not other losses.



standardizing, and harmonizing green finance-related disclosures. In 2021, SEBI introduced sustainability reporting requirements for the top 1,000 listed entities in India by market capitalization, with mandatory reporting from 2022-23 onwards. Recently, RBI has released draft guidelines on the “Disclosure Framework on Climate-Related Financial Risks” to mainstream climate risk assessment, and measuring and reporting requirements in the Indian financial sector’s compliance framework (RBI 2024). RBI and SEBI’s initiatives, aligned with global standards and frameworks such as the Task Force on Climate-related Financial Disclosures, pave the way for implementing national-level legislation and mandates around climate risk disclosure.

- **Increasing availability and accessibility of climate finance data.** The importance of data for understanding climate investment gaps, building effective solutions, informing investors, and measuring progress cannot be overemphasized. While online data availability has increased, there is a need to make data more accessible, from both private and public actors, in all the tracked economic sectors such as clean energy, clean transportation, etc.
- **Putting in place an integrated domestic measurement, reporting, and verification (MRV) system.** India has made significant efforts in strengthening its existing MRV arrangements. Extensive work has been done on updating and creating technical data repositories and dashboards and improving their access (MoEFCC 2021). However, a detailed, integrated MRV system that streamlines financial attributes is not yet available. An integrated MRV system like this can help provide a uniform framework and methodology to track finances, identify financing constraints, identify key areas in need of additional finance and efficiency for every rupee spent, and enhance transparency. Green budget tagging is one way to monitor progress, identify gaps, and increase transparency in green finance from public sources. Some states in India have initiated green/climate budgeting. However, there is a need to develop a uniform national strategy for such budgeting and reporting to effectively integrate state actions with national climate targets (see Annex).

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# 1. INTRODUCTION

**Climate change is already slowing the pace of development in India and putting future economic growth at risk (RBI 2023).** India is highly vulnerable to the impacts of climate change, ranking the 7th most affected by weather-related losses and climate risks globally in the 2021 Germanwatch Global Climate Risk Index. Furthermore, over 80% of India's population lives in districts highly vulnerable to extreme hydro-met disasters (CEEW, 2021a).

Research suggests that climate change is already adversely affecting lives, livelihoods, and the country's economy (ODI 2021).

- In 2021 alone, heat exposure led to a loss of 167 billion potential labor hours, resulting in an income loss of around USD 159 billion or 5.4% of the country's GDP (Climate Transparency Report 2022).
- India's poverty rate could increase by 3.5% due to declining agricultural productivity and rising food prices by 2040, as compared to a zero-warming scenario (ODI 2021).

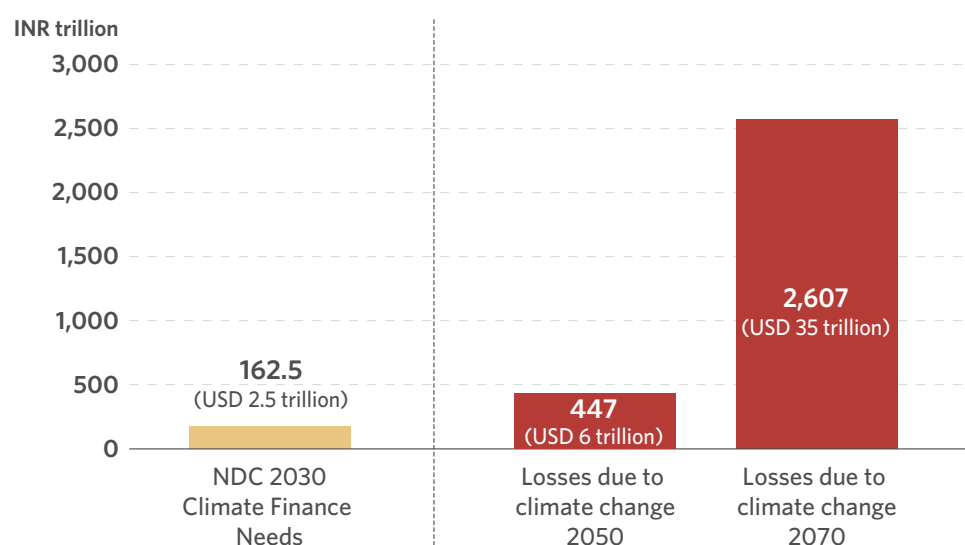
These estimates underscore the need to expedite effective climate policies, investments, and action to address climate risks and reduce impacts.

**The economic cost of inadequate action is extremely high for India, owing to the country's vulnerability<sup>19</sup>.** In a future where India and the rest of the world do not significantly reduce emissions relative to current levels, global average warming can reach 3°C by 2070. This pathway can lead to estimated economic losses of INR 447 trillion (USD 6 trillion)<sup>20</sup> by 2050 and INR 2,607.5 trillion<sup>21</sup> (USD 35 trillion) by 2070 in present value terms for India (Deloitte Economics Institute 2021). The loss of economic potential is projected to equal 12.5% of GDP in 2070 alone (Deloitte Economics Institute 2021). Other estimates show that without adequate and timely climate action, India could lose around 3% to 10% of its GDP annually by 2100 due to climate change (Kompas et al. 2018; ODI 2021). Many such estimates are yet to capture indirect costs incurred due to the impacts of climate change on biodiversity loss, and social inequalities, indicating that the costs of inaction may be much higher.

<sup>19</sup> As CPI 2023 report indicates, the cost of inaction globally in a business-as-usual scenario could be as high as USD 1,266 trillion, if global climate investments do not increase to the levels required by 2050 to achieve a 1.5°C scenario (USD 266 trillion cumulatively).

<sup>20</sup> Using exchange rate of INR 74.5 to 1 USD as given by RBI for 2021-22 in accordance with the date of publication of the cited report.

<sup>21</sup> Using exchange rate of INR 74.5 to 1 USD as given by RBI for 2021-22 in accordance with the date of publication of the cited report.

**Figure 1:** Cumulative climate finance needs vs. losses under 3°C

While India has adopted a proactive, ambitious, and forward-looking development approach through its NDC, much more needs to be done to finance this ambition.

## 1.1 RATIONALE AND OBJECTIVES

India needs sufficient, timely, and directed investments to achieve its climate goals.

The country's NDC suggests that it will require at least INR 162.5 trillion (USD 2.5 trillion) from 2015 to 2030, or roughly INR 11 trillion (USD 170 billion) per year (GoI 2015), to meet its climate ambition between 2015 and 2030.<sup>22</sup> As per an estimate by the Department of Economic Affairs (DEA), Ministry of Finance, the cumulative investment needs for adaptation alone between 2015 and 2030 amounts to INR 85.6 trillion (approximately USD 1 trillion<sup>23</sup>) at 2011-12 prices (DEA 2020). Furthermore, an estimate by the Reserve Bank of India (RBI) notes that India needs additional annual investment of 2.5% of GDP (at least USD 85 billion)<sup>24</sup> to replenish the infrastructure gap caused by climate events by 2030, indicating that actual funding requirements are likely to be higher if investment needed for adaptation and mitigation due to climate change is considered (RBI 2023).

<sup>22</sup> In December 2023 the government of India announced that two quantifiable targets (reducing the emissions intensity of India's GDP by 33 to 35 percent by 2030 from 2005 level; and achieving about 40 percent cumulative electric power installed capacity from non-fossil fuel-based energy resources by 2030) of NDC 2015 have been achieved well ahead of the time (PIB 2023b). However, since this report tracks finance flows from 2020 to 2022, we have followed the previously estimated numbers.

<sup>23</sup> SSEF 2022.

<sup>24</sup> Based on India's GDP of USD 3.39 trillion in 2022 as per IMF's World Economic Outlook data.

In November 2021, India raised its climate commitments<sup>25</sup> by announcing plans to:

- Reduce the carbon intensity of its economy by 45% by 2030 (increasing its previous target of 33-35%).  
Increase its renewable energy capacity to 50% of installed capacity<sup>26</sup>, which is expected to reach 500 GW by 2030.
- Reduce total projected absolute carbon emissions by one billion tonnes between then and 2030 (PIB, 2022a).

Strong financial support and timely policy interventions from the Government of India can play a crucial role in financing the transition to a low-carbon pathway and incentivizing the private sector participation to scale up green investments.

**A systematic assessment to track current investment is the first step in gauging whether India is on track to achieve its climate goals.** Credible and timely reporting of green finance will help build confidence with domestic and international investors. Identification and measurement of existing sources of green finance offer numerous benefits:

- **Identifying and tapping the right capital providers for green sectors; improving transparency and accountability of government action plans on climate change; and enabling better macro-level reporting on green and climate investments.**  
The identification and assessment of means of financing can help in evaluating whether the right financial instruments are used to deploy capital in green sectors. The uses of finance in different green sectors can help identify funding gaps and aid stakeholders in taking appropriate steps to bridge the financing gap.
- **Policymakers can better understand the investment needs** based on sectoral targets set under the national missions, schemes, and national/state action plans for climate change.
- **Private investors**, both domestic and international, looking for avenues for green investments can understand current nationwide green investment trends, the growth potential of different green sectors, and future pipeline possibilities for related activities.
- **Governments across the globe and their agencies, particularly development finance institutions (DFIs) or multilateral development institutions, can understand the general nature and extent of green finance received by India.** This can help them comprehend how India's investment flows align with the Paris Agreement and how it can be better enabled.

## 1.2 SCOPE

This study presents an analysis of actual spending and investment data from India's union and state budgets; national and international DFIs; corporates, residential, commercial, and institutional stakeholders; and PSUs for two financial years: 2021 and 2022. It establishes a trail of funding flows from sources and intermediaries through different financial instruments to sectors and subsectors. Data mapping is done retrospectively to capture more comprehensive data on actual disbursements, as opposed to commitments.

<sup>25</sup> Many of these translated into the updated NDC submitted to the UNFCCC in August 2022.

<sup>26</sup> Up from 40% mentioned in NDC 2015.

Our scope includes mitigation finance for three sectors—clean energy, energy efficiency, and clean transportation.<sup>27</sup> This study does not map pollution abatement activities, biodiversity, forestry, and other land use.

While all adaptation uses are not covered by this report, expenditures for natural disaster risk management,<sup>28</sup> flood and cyclone mitigation, and drought management have been tracked. This year's report also expands its scope of adaptation tracking to include a first-of-its-kind analysis of fund flows to on-farm activities in the agricultural sector contributing to adaptation.<sup>29</sup>

While this report presents the most comprehensive information available on India's green finance, methodological issues and data limitations persist. Tracking green finance faces multiple issues related to the availability, quality, and robustness of investment data on both the public and private sectors (see Section 3).

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<sup>27</sup> Mitigation sectors, as defined by the Green Climate Fund, are: a) Energy generation and access, b) Transport, c) Buildings, cities, industries, and appliances, and d) Forests and Land Use. This study focuses on the first three and does not include tracking of finance for forests and land use.

<sup>28</sup> Disaster, Monitoring, and Emergency Response System in the 2022 Landscape of Green Finance in India Report.

<sup>29</sup> See section 3.2 and the methodology document for further details on our approach to tracking on-farm adaptation activities.



## 2. FINDINGS

### 2.1 CLIMATE MITIGATION

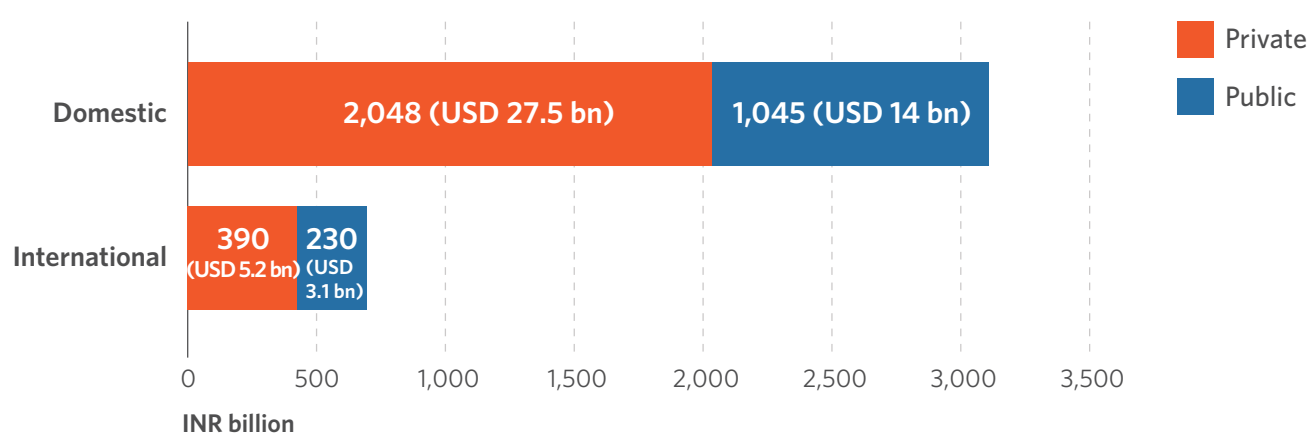
Finance flows for mitigation sectors in India amounted to **INR 3,712 billion (USD 50 billion) per annum for 2021/22**, representing an increase of 20% (INR 3,093 billion/USD 44 billion) from 2019/20. Mitigation flows have grown from both domestic and international sources, likely due to an array of policy interventions, fiscal instruments, and market mechanisms put in place by the Indian government to promote green investment (PIB 2022c).

#### 2.1.1 SOURCES

Similar to 2019/20, green finance for mitigation sectors in India for 2021/22 has primarily come from domestic sources<sup>30</sup> (around 83%), both public and private. Like in 2019/20, domestic flows in 2021/22 were evenly distributed between clean energy (43%) and energy efficiency (41%).

Tracked green finance for mitigation from domestic and international sources increased in 2021/22 compared to 2019/20. Domestic finance increased by 17%, rising from INR 2,637 billion (USD 37 billion) in 2019/20 to INR 3,093 billion (USD 41.5 billion) per annum in 2021/22. International finance grew 36%, reaching INR 620 billion (USD 8.3 billion) in 2021/22. Notably, the share of international finance increased, largely driven by a 110% increase in private finance, with substantial contributions from commercial FIs. The increase in finance flows was mainly to the clean energy sector.

**Figure 2:** Green finance (mitigation sectors) by sources (INR bn)<sup>31</sup>



<sup>30</sup> While we recognize that a certain percentage of domestic financing may have originated internationally via External Commercial Borrowings and Non-sovereign debt, lack of any data on the subject has necessitated the classification as such. Refer to the methodology for details.

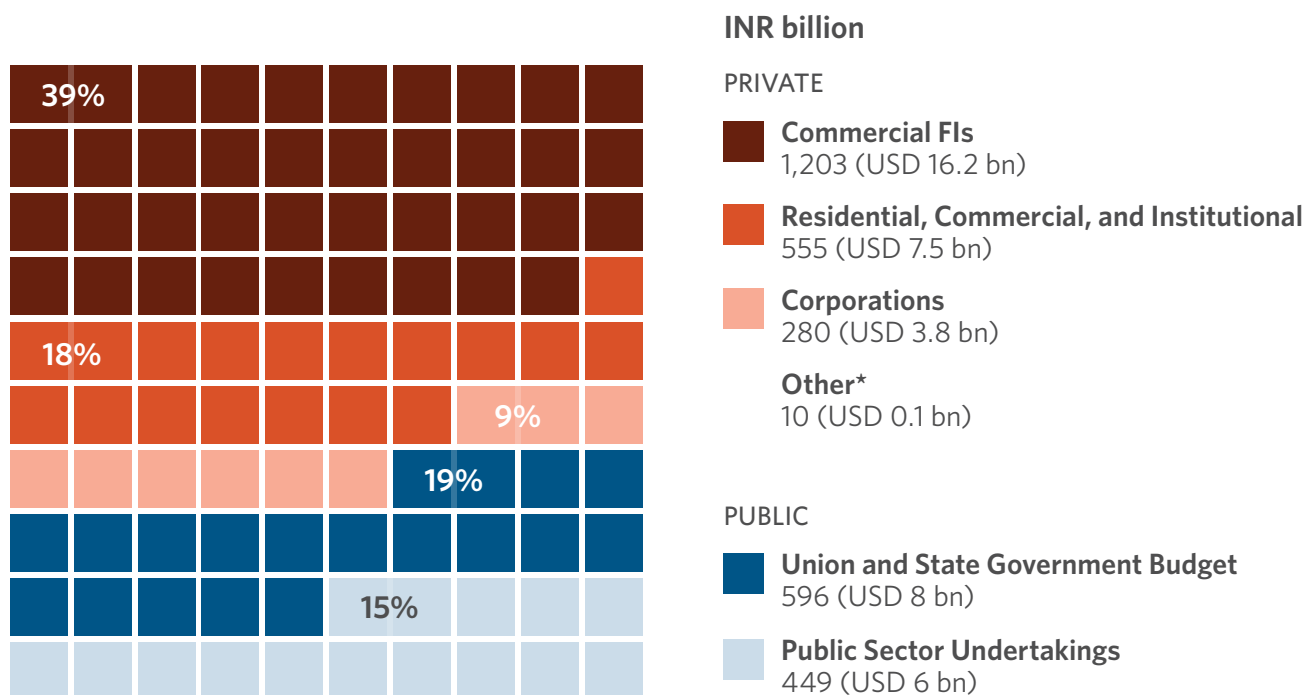
<sup>31</sup> Unless otherwise stated, all figures shown in this report relate to annual averages in India for the period 2021/22.

## DOMESTIC SOURCES OF FINANCE

In 2021/22, domestic private sources constituted around 66% (INR 2,048 billion/USD 28 billion) of the total domestic mitigation flows. Commercial FIs accounted for 39% of the domestic private finance flows for mitigation and mainly contributed to the energy efficiency sector (59%), followed by the clean energy sector (40%). Flows from residential, commercial, and institutional sources, on the other hand, went mainly to the energy efficiency sector (87%).

Domestic public sources in 2021/22 accounted for 34% (INR 1,045 billion/USD 14 billion) of total domestic finance for mitigation. Of this, government budgetary spending accounted for INR 596 billion/USD 8 billion (57%) in 2021/22, up from INR 574 billion in 2019/20. A significant proportion of government budgetary expenditure flowed to the clean transport sector (74%), followed by the clean energy sector (24%). Public Sector Undertakings (PSUs)<sup>32</sup> contributed mainly to the clean energy sector (93%) (see Box 1).

Figure 3: Domestic green finance (mitigation sectors) by public and private sources (INR bn)



\*Other private sources comprise PE/VC funds

32 PSUs are companies and other bodies in which the national or state governments have a financial interest. These companies aim to ensure India's self-reliant economic growth.

### Box 1: Significance of sector-specific PSUs in mobilizing green finance

As India traverses its low-carbon development pathway to meet its NDC goals, PSUs can play a critical role in mobilizing green funds, including from the international market. Sector-specific PSUs, in particular, are instrumental in enabling green finance. PSUs such as Rural Electrification Corporation Limited (REC) and Power Finance Corporation (PFC), which are public financial institutions focused on the power sector, have been successful in raising money from international markets through green bonds (CPI 2024b).

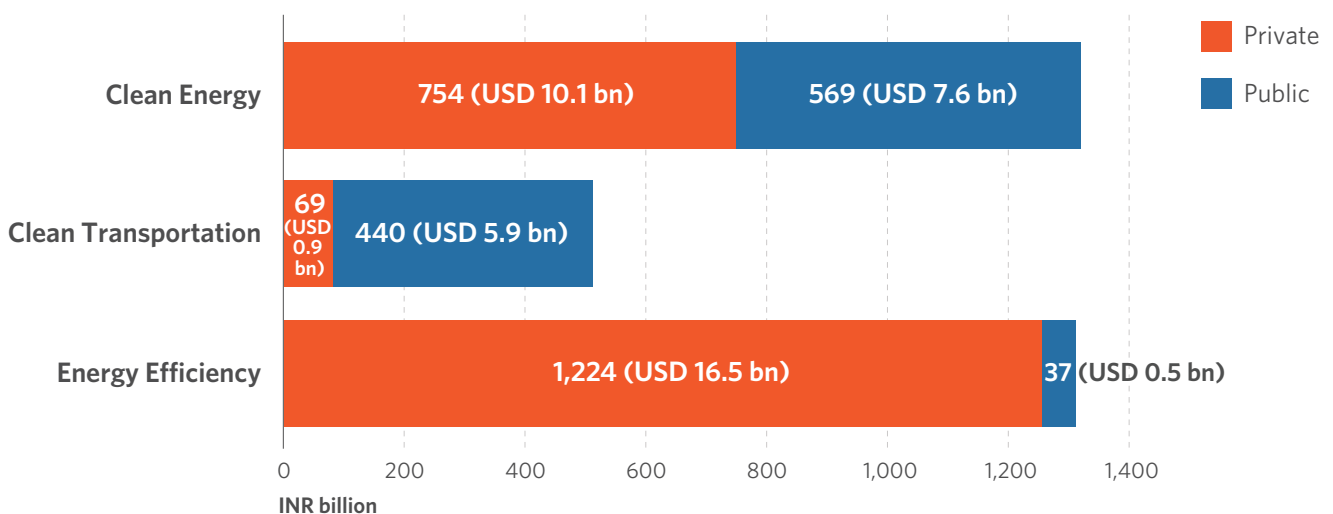
These sector-specific PSUs, such as PFC and REC, often have specialized knowledge that enables them to create innovative financial products tailored to the sector's unique ecosystem and requirements. The expertise in risk assessment and mitigation that sector-specific PSUs have is crucial for advancing green finance. These PSUs' in-depth understanding of the sector equips them to comprehensively assess the distinct risks that low-carbon projects face and to design financial products that address them effectively. Such risk mitigation encourages investment in renewable energy.

"Partnerships form another essential aspect of how sector-specific FIs like PFC and REC accelerate the mobilization of green funds" (CPI 2024b). Collaborations between these FIs, development banks, and international investors help create synergies to leverage expertise and resources and enhance the overall effectiveness of green finance initiatives by pooling knowledge and capital.

(PSUs are critical sources of green finance as well as important channels for the disbursement of funds by the central and state governments, bond markets, and international development agencies (CPI 2022). Therefore, to avoid double counting of these various flows, this study only tracks the actual annual expenditures reported by the PSUs in their annual financial statements).

While private sources dominated overall finance for mitigation sectors, accounting for around 97% of finance in energy efficiency and 57% in the clean energy sector, public sources continued to contribute the majority of flows to clean transportation.

**Figure 4:** Domestic green finance flows to mitigation sectors (INR bn)



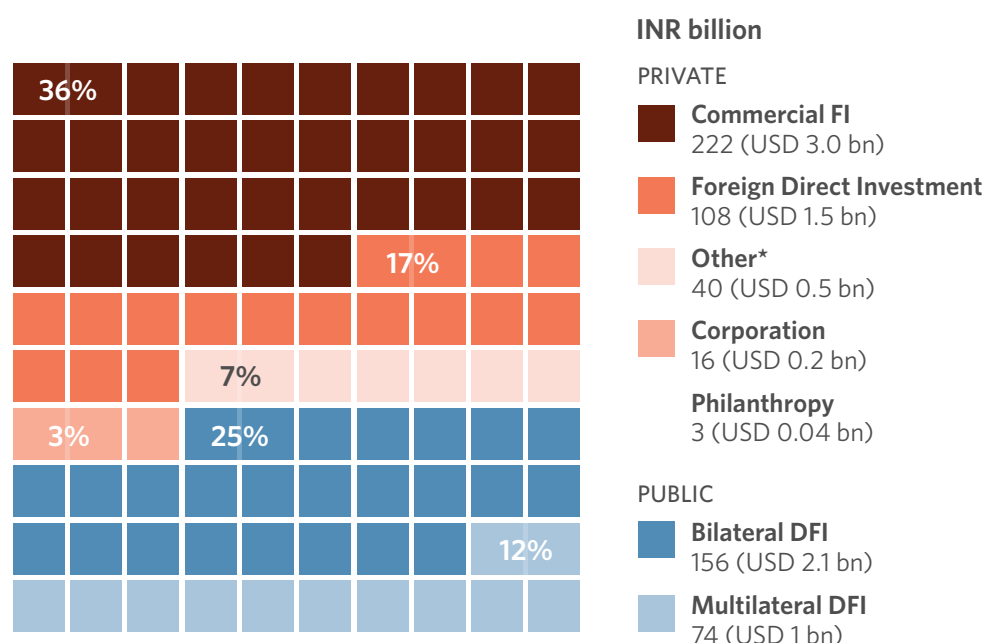
## INTERNATIONAL SOURCES OF FINANCE

**International green finance for mitigation in 2021/22 amounted to INR 620 billion (USD 8.3 billion), 36% higher than in 2019/20.** This likely indicates greater confidence of international private players in specific sectors that are important for India to meet its NDC goals.

Notably, finance from private sources overtook public sources in 2021/22, at approximately 63% and 37%, respectively. Of the total **private international finance**, commercial FIs constituted around 57%, followed by foreign direct investment at 28%. A major share of flows from commercial FIs went to clean energy, particularly for solar.

Of the total **public international finance**, flows from DFI-bilateral accounted for the major share (68%) – INR 156 billion (USD 2.1 billion), with DFI-multilaterals constituting the rest (INR 74 billion/USD 1 billion).

**Figure 5:** International green finance (mitigation sectors) by public and private sources (INR bn)

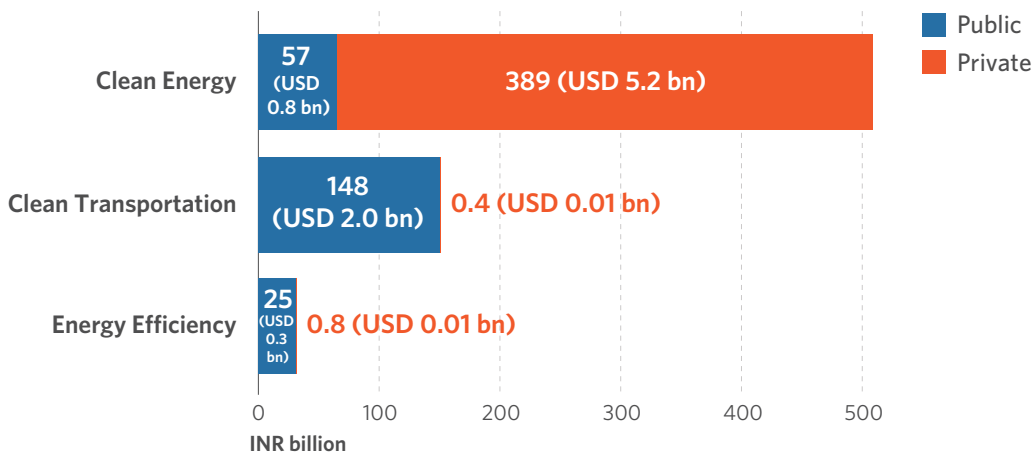


\*Other private comprises PE and VC funds.

Similar to previous years, clean energy was the sector that received the highest international funding in India, followed by clean transportation. The proportion of international finance received for clean energy reached 72% in 2021/22, much higher than in 2019/20. Clean transportation accounted for nearly 24% of total international finance flows for mitigation sectors.

More than 90% of the **international private funding** flowed to the clean energy sector. On the other hand, the major share (nearly 65%) of **international public finance** went to clean transportation, almost mirroring the trend in domestic finance flows. This can be attributed to substantial investments in mass rapid transit systems (MRTS), which received 43% of international flows to clean transportation, as well as in dedicated freight corridors (37%).

**Figure 6:** International green finance flows to mitigation sectors (INR bn)



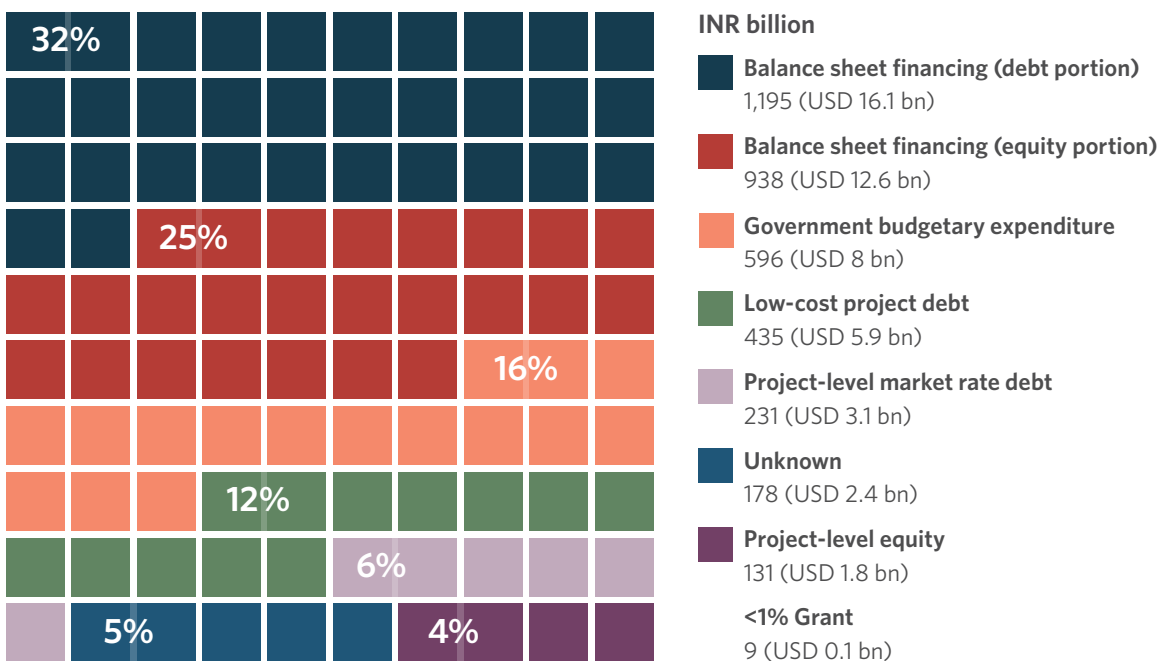
### 2.1.2 INSTRUMENTS

**Debt was the primary instrument used to channel finance for mitigation in India in 2021/22, contributing INR 1,860 billion (USD 25 billion) or 50% of the total.**

The share of debt in the total tracked mitigation finance stood at 50%, almost similar to 49% in 2019/20, reflecting continuing confidence among lenders in the successful rollout of green projects. Of the total debt finance, direct issuances through balance sheets accounted for 64%, 24% from low-cost project debt, and 12% from project-level market-rate debt.

**Equity** made up 29% of the total finance for mitigation, while direct **government spending**, tracked through government budgetary expenditure, accounted for 16%. Investments by the government also include funds intermediated through PSUs, which use a mix of debt, equity, and grants.

**Figure 7:** Green finance flows (mitigation sectors) by instruments (INR bn)

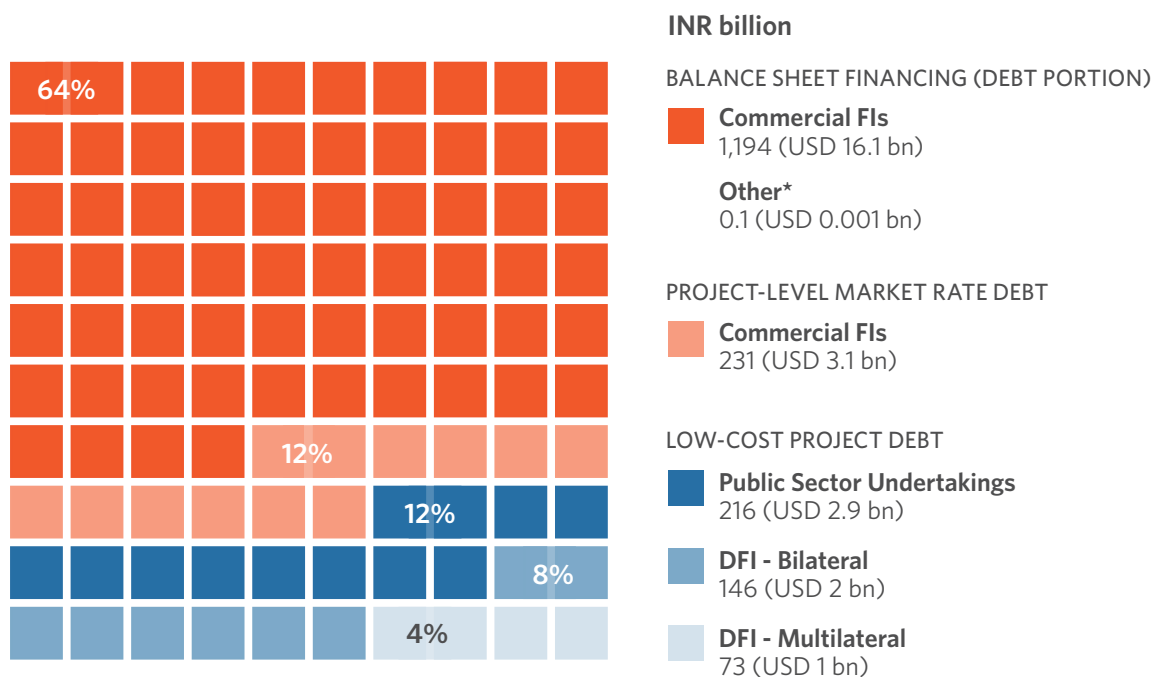


Within debt, balance sheet financing came primarily from domestic commercial FIs (95%). In contrast to 2019/20, international commercial FIs predominantly contributed to market-rate project funding, while low-cost project debt continued to be funded equally by domestic PSUs and international DFIs (bilateral and multilateral), each accounting for 50%. Overall, commercial FIs were the primary contributors (76%), with the remaining portion split equally between DFIs and PSUs.

Nearly half of the debt was raised in the clean energy sector, followed by 40% in energy efficiency and the remaining 10% in clean transportation. In 2021/22, the energy efficiency sector received the largest share of balance sheet debt financing at 60% (INR 710 billion/ USD 10 billion). Notably, project-level market rate debt was raised only in the clean energy sector (INR 231 billion/USD 6 billion), indicating the growing commercialization of renewable energy technologies.

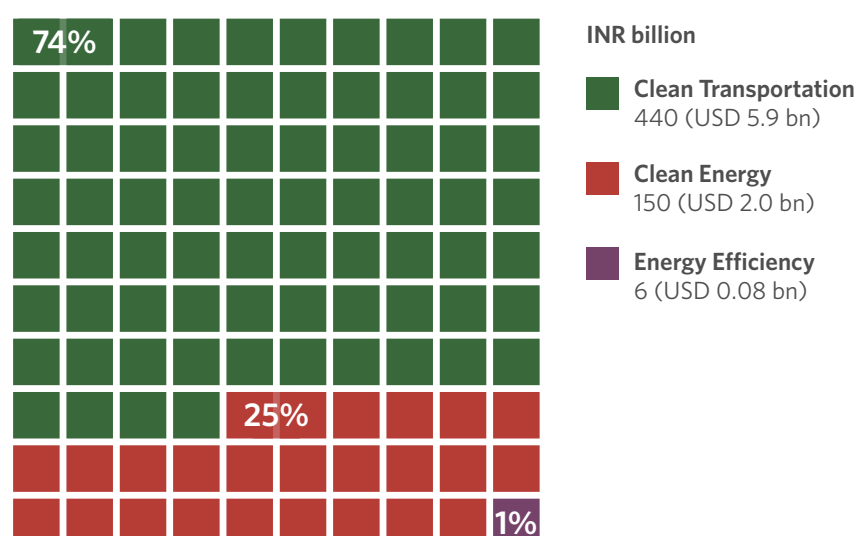
Equity financing was equally split between clean energy and energy efficiency sectors (49% each). Within equity financing, energy efficiency accounted for the majority (56%) of the balance sheet financing, while project-level equity primarily flowed into the clean energy sector.

**Figure 8:** Finance flows via debt instruments (INR bn)



Government budgetary expenditure was predominantly directed to clean transportation (74%) in 2021/22, while clean energy received 25%. Similar to previous years, MRTS received 99% of government clean transportation expenditure in 2021/22, making up 73% of total government spending. Notably, government spending on EVs has doubled compared to 2019/20, facilitating India's target for EVs to reach a 30% share in new vehicle sales by 2030 (NITI Aayog and Rocky Mountain Institute 2019).



**Figure 9:** Government budgetary expenditure across mitigation sectors (INR bn)

### Box 2: Green finance through capital markets: Instruments and challenges

Much of India's green finance is sourced from banks and FIs, DFIs, government, and PSUs through debt, equity, and grants. Diversifying funding sources and recycling existing capital can help scale up climate action. Increasing participation of private players and leveraging capital markets are also essential (CPI 2019).

In recent years, Indian capital markets have expanded significantly, achieving a market capitalization of 104% of GDP as of 2021-22 (CEIC). This growth, coupled with a strengthening regulatory framework and resilience to global shocks, positions the Indian capital markets as an attractive source for funding India's climate ambitions.

Several innovative financial instruments are already in place to finance and re-finance green projects by leveraging capital markets, such as green bonds, alternative investment funds (AIFs), infrastructure investment trusts (InvITs), and securitization.

India's green bond market is expanding, positioning the country as the second-largest issuer of green bonds among Asian emerging markets as of February 2023 (Hussain and Dill 2023). The government introduced sovereign green bonds in 2022, and SEBI also revised its guidelines for green debt securities in 2023, aligning them with global standards and making it easier to attract international investments. Despite these advancements, India's underdeveloped corporate bond market remains a major challenge. As debt becomes increasingly important for financing green projects, a deeper and more liquid corporate bond market is crucial.

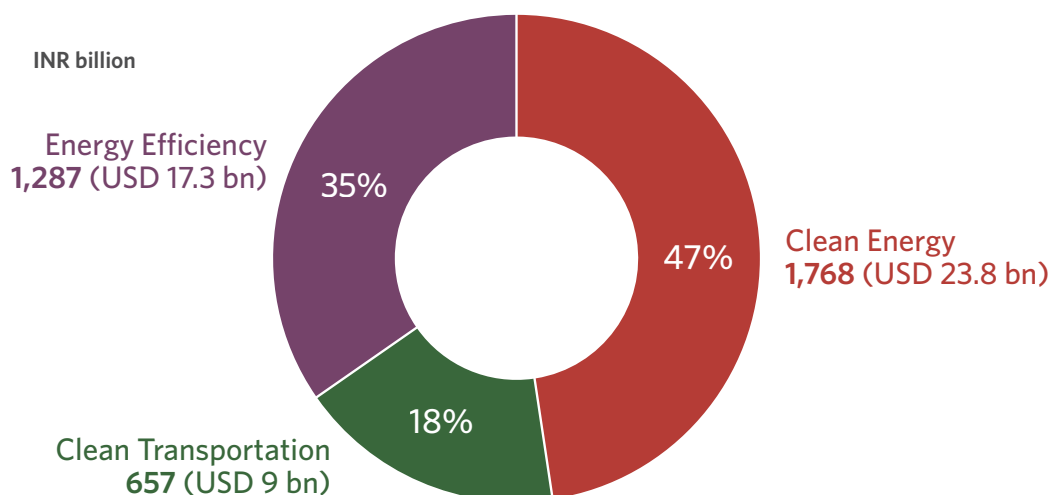
Other asset classes, such as AIFs and InvITs, are in their early stages, but regulations can play a crucial role in unlocking their potential. For instance, SEBI's 2022 update to AIF regulations expanded "social venture funds" into broader "social impact funds," covering a wider range of impact areas. This will encourage investment in socially and environmentally beneficial projects. Similarly, regulatory changes for InvITs, such as allowing domestic institutional investors and foreign portfolio investments and easing investment limits, have helped increase capital flows to green sectors through this asset class.

By addressing these challenges and expanding the range of financial instruments while de-risking existing instruments, India can more effectively channel investments into climate action.

### 2.1.3 SECTORS

Clean energy attracted the largest share of mitigation financing in 2021/22, accounting for 47% of total mitigation funds, followed by energy efficiency at 35% and clean transportation at 18%.<sup>33</sup> Although clean transportation received the smallest share of funds, the sector experienced significant growth, with a 94% increase in financing from 2020-21 to 2021-22.

**Figure 10:** Green finance flow to mitigation sectors (INR bn)



Within sectors, the largest share of finance went to the energy-efficient appliances subsector (30%), followed by solar (26%) – both solar PV and rooftop PV, and MRTS (17%).

### CLEAN ENERGY

**Clean energy investments reached INR 1,768 billion (USD 23.8 billion) in 2021/22, representing 47% of the total finance flows for mitigation.** While this marked a 36% increase compared to 2019/20 (INR 1,298 billion), there remains substantial room for further investment.

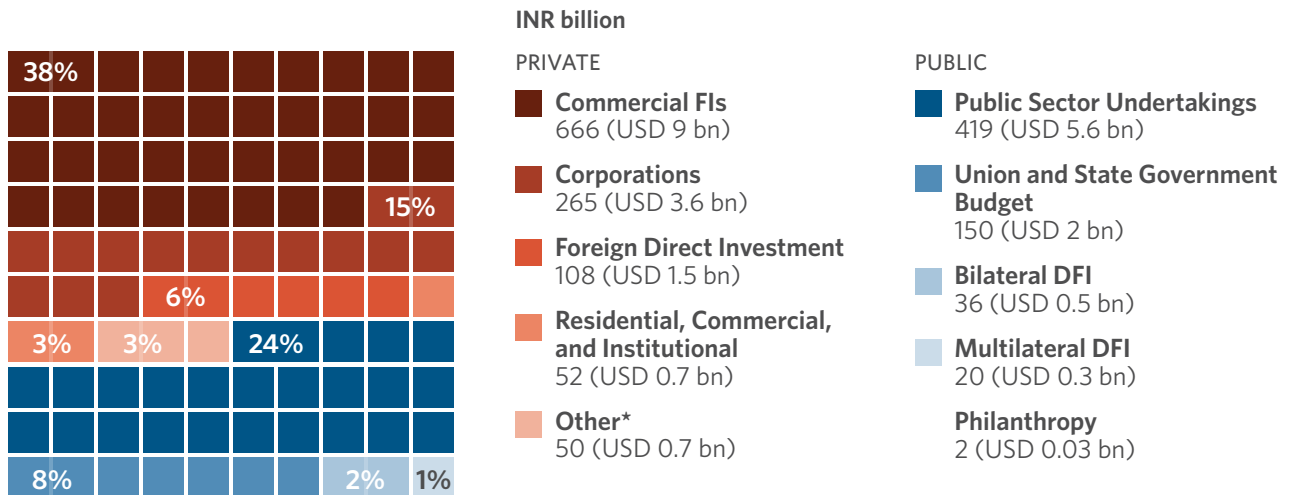
To meet India's NDC 2030 clean energy targets, the Central Electricity Authority's (CEA) optimal generation capacity mix suggests that around two-third of the country's installed capacity should be sourced from zero-carbon technologies. Achieving this objective requires a substantial expansion of solar and wind installations. While India's renewable energy capacity witnessed 11% year-on-year growth in 2021-22, renewables still accounted for only 22% of the nation's total power generation (ICED). Estimates suggest that an annual investment of approximately INR 1,893 billion (USD 27 billion)<sup>34</sup> is required for solar, wind, and battery storage projects alone to meet these targets (BNEF 2022). Tracked financial flows for 2021/22 amounted to INR 1,246 billion (USD 17 billion) in these sectors, indicating the gap and the potential for increased investment.

<sup>33</sup> Mitigation sectors, as defined by Green Climate Fund, are a) Energy generation and access, b) Transport, c) Buildings, cities, industries, and appliances, and d) Forests and Land Use. For the purpose of the study, we have focused on the first three sectors and have not included Forests and Land Use in our study.

<sup>34</sup> Exchange rate of INR 70.90 to 1 USD, as given by RBI for FY2020, since the investment requirement pertains to years 2020-2029.

In 2021/22, commercial FIs were the primary source of clean energy funding, accounting for 38% of total flows, followed by PSUs at 24%. Finance from international sources increased to 25% (up from 18% in 2019/20), largely due to an increased involvement of international commercial FIs. Nonetheless, 75% of investment flows still originated from domestic players.

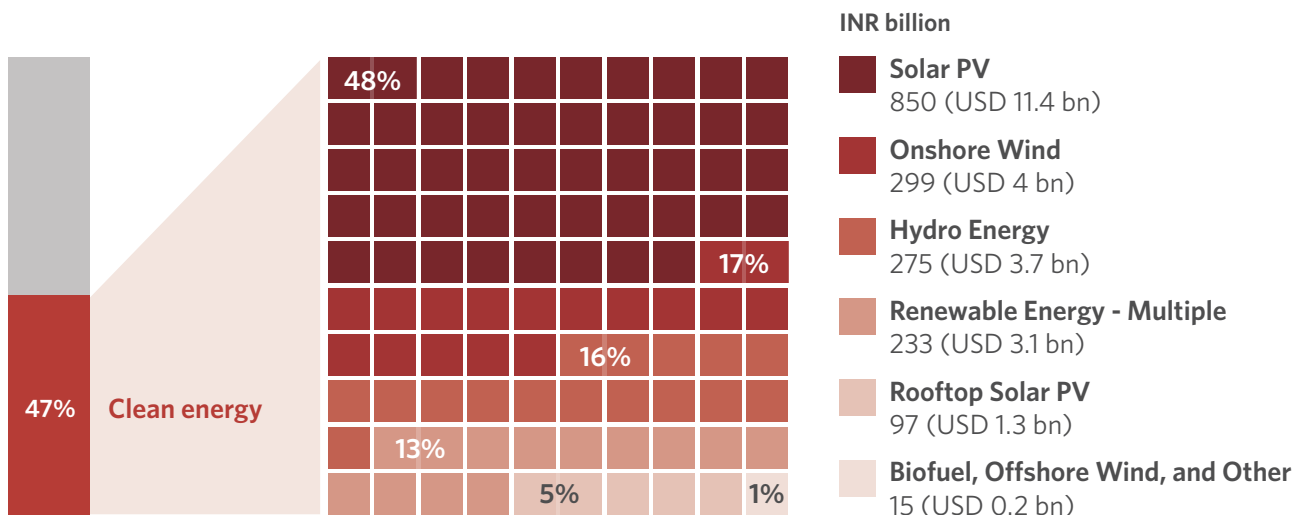
**Figure 11:** Finance flows to clean energy by sources (INR bn)



\*Other private comprises PE and VC funds.

Within the clean energy sector, solar projects, including rooftop, received INR 947 billion (USD 13 billion) per year in 2021/22, accounting for 54% of the total clean energy flows, **marking a 75% increase compared to 2019/20** (INR 542 billion or USD 7.5 billion). This increased investment is primarily driven by large grid-scale solar projects that have reached commercial maturity and are supported by significant domestic policy development (see Box 3). Achieving India’s renewable energy targets will also require more investment in decentralized renewable energy, which offers significant scalable potential (CPI 2021).

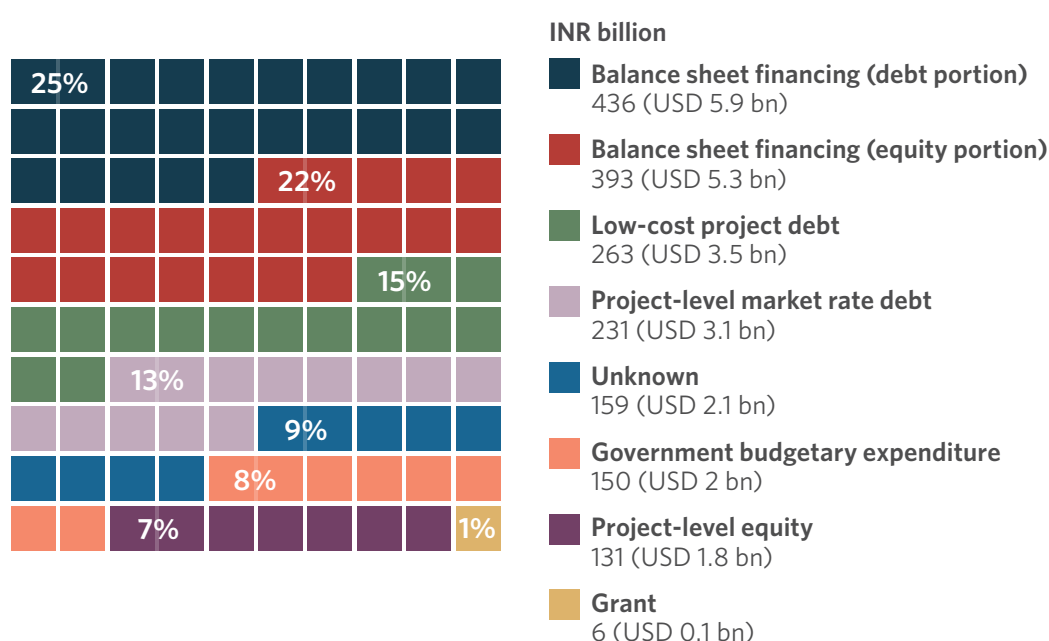
**Figure 12:** Finance flows to clean energy subsectors (INR bn)



Debt instruments made up 53% of clean energy investments, including balance sheet debt, project-level market-rate debt, and low-cost project debt. Equity made up 29%, comprising balance sheet equity and project-level equity. The majority of projects were financed at the company level through balance sheet funding, with nearly equal contributions from debt (53%) and equity (47%).

The renewable energy sector continued to grow despite disruptions due to COVID-19 lockdowns, power shortages, and geopolitical instability such as the Russia-Ukraine conflict. Going forward, renewable energy capacity expansion can be fueled by a more conducive policy environment, increased financial support, greater private sector involvement, etc.

**Figure 13:** Clean energy funding instruments (INR bn)



### Box 3: Renewable energy: trends, driving forces, and way ahead

In November 2021, India announced targets to install 500 GW of non-fossil fuel power capacity and meet 50% of the electricity demand from renewable sources by 2030. As of October 2022, 172.72 GW of non-fossil fuel capacity has been installed in the country, highlighting the significant potential for future growth (MNRE 2022). Despite the drop in energy sector investments overall due to the COVID-19 pandemic, renewable energy (RE) generation, primarily solar and wind, grew by 15% in 2020 (IEA 2021). The following factors are pivotal in driving increased investments and enhancing RE capacity.

**Significant capacity addition and increased competitiveness of RE:** India's leading RE sources, solar and wind, have seen significant expansion in capacity in recent years. By 2021-22, solar installed capacity reached 54GW, marking a 34% year-on-year increase, while wind capacity stood at 40.36 GW, reflecting a 2% increase (ICED). The growth in capacity is accompanied by a decline in tariffs for both energy sources. Solar tariffs declined by over 75% between 2014 to 2022, while wind tariffs fell by around 55% during the same period (Takyar 2023; CEEW 2021b). Additionally, the risk profiles of utility-scale

renewable projects have also decreased, as reflected in improved credit ratings, with 90% of the solar projects achieving investment-grade ratings in 2020, compared to 2012, when all projects were rated non-investment-grade (CEEW 2021b).

**Policy support:** The government's commitment to achieving India's renewables target of 2030 is evident through continuous policy support, which helps reduce sector risk and attract private investments.

One such initiative is the **Pradhan Mantri Kisan Urja Suraksha evam Utthaan Mahabhiyaan (PM-KUSUM) scheme**, launched in 2019, which promotes solar energy in the agriculture sector, enhancing energy security and additional avenues of income for farmers. The program subsidizes the installation of solar-powered water pumps, converting existing grid-connected pumps to solar, and the setting up of small solar power plants (up to 2 MW) on farms.

Launched in 2014 and extended until 2026 (MNRE 2023), the **Scheme for Development of Solar Parks and Ultra Mega Solar Power Projects** aimed to add 40 GW (MNRE 2024) of solar capacity by simplifying the process of setting up a solar power project and providing the necessary infrastructure like land, transmission lines, grid connectivity, etc. This initiative by the government has accelerated private investments in the solar energy sector, created jobs, and contributed significantly to India's RE targets.

To boost domestic solar PV manufacturing and reduce dependence on imports, the Ministry of New and Renewable Energy (MNRE) expanded the Production-linked Scheme to include solar PV modules and issued guidelines for the **National Program on High-efficiency Solar PV Modules** in 2021. The scheme provides incentives for PV module sales. With an outlay of 45 billion (USD 0.6 billion) in the first tranche (MNRE 2021), it has attracted interest from several private RE developers, PSUs, and foreign developers.

Strong policy support and declining costs have facilitated the expansion of RE capacity in India, but there remains substantial room for improvement. As the share of renewables in the energy mix continues to grow, challenges related to energy storage, grid integration, and the development of fully integrated RE equipment manufacturing must also be addressed.

## CLEAN TRANSPORTATION

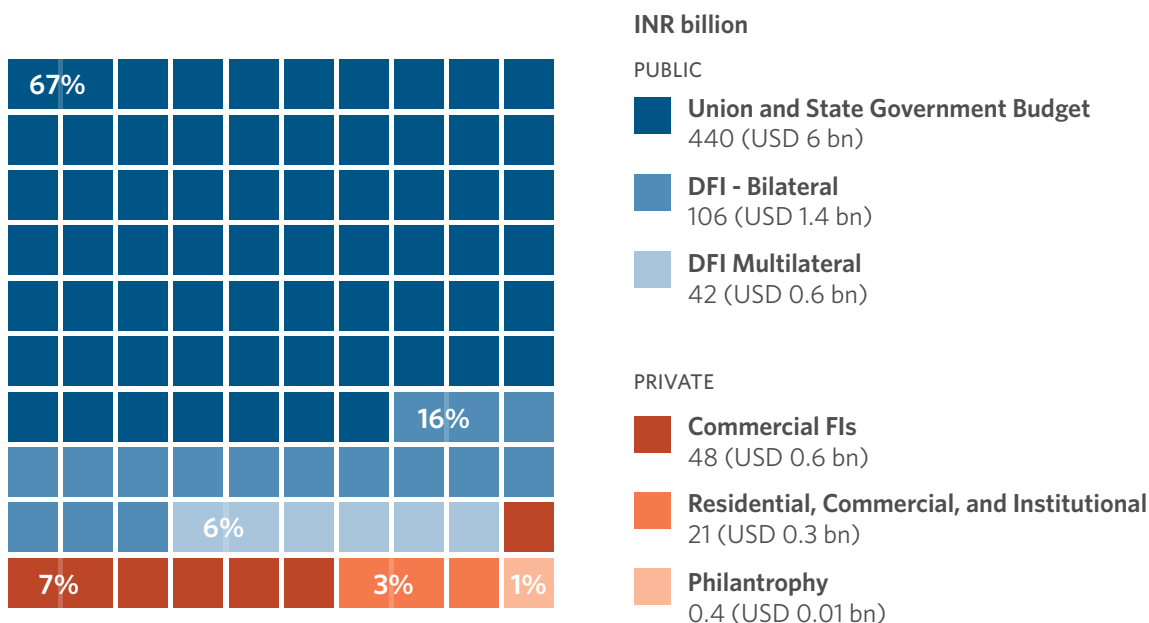
**Finance flows to clean transportation increased to INR 657 billion (USD 9 billion) per year in 2021/22 from INR 607 billion per year in 2019/20, with public sources (domestic and international) continuing to provide almost 90% of clean transportation finance.** Nevertheless, the share of private finance flows to this sector has increased to more than 10% (INR 69 billion/USD 0.9 billion) in 2021/22 (up from 4% in 2019/20), primarily driven by flows to the EV segment. However, finance for EVs still falls far short of what is required.

As per India's Long-Term Low-Carbon Development Strategy 2022 submitted to the United Nations Framework Convention on Climate Change (UNFCCC), the transport sector accounts for 9.7% of the country's total GHG emissions (MoEFCC 2022). In line with its NDC goals, India is adopting measures to promote EVs and MRTS, among others (Agora Verkehrswende and GIZ 2023).

The government has been focusing on initiating and expanding mass rapid transportation projects, which explains the dominant share of domestic public sources in the sector.

Electric mobility has also emerged as one of the government's priority areas, with India setting a target of a 30% EV share in passenger light-duty vehicle<sup>35</sup> sales by 2030 (NITI Aayog and Rocky Mountain Institute 2019). Studies indicate that for India to achieve this EV penetration, annual investment needs amount to over INR 1,250 billion (USD 18 billion) until 2030 in vehicle production and charging infrastructure (CEEW 2020).

**Figure 14:** Finance flows to clean transportation by sources (INR bn)



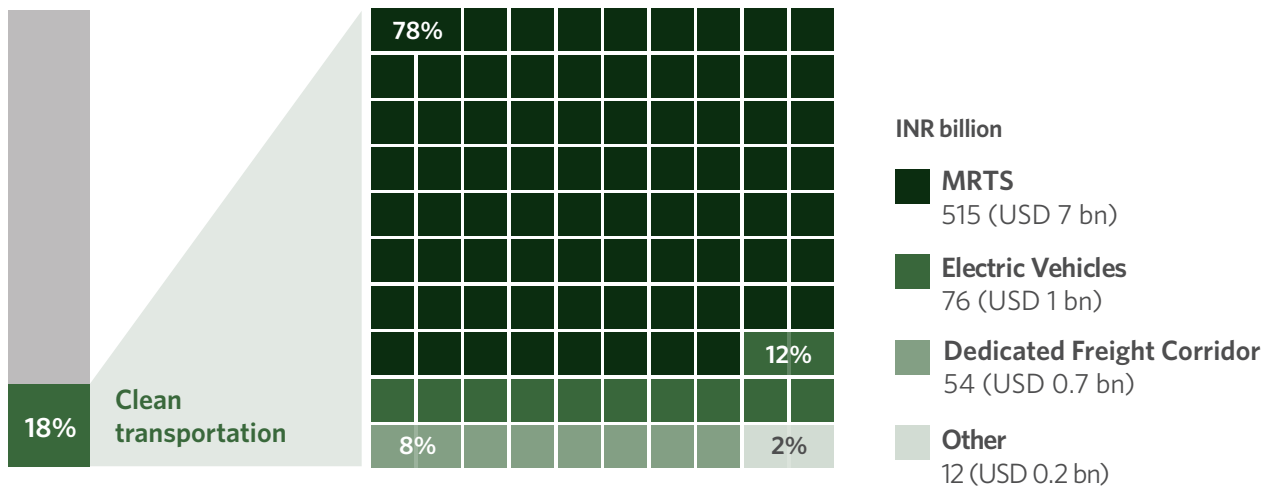
Within the sector, finance for MRTS accounted for 78% of total flows, followed by EVs (11%). Flows to MRTS were affected due to COVID-19 associated lockdowns and subsequent construction delays in 2020-21 but picked up significantly in 2021-22 (Indian Infrastructure 2021; Agora Verkehrswende and GIZ 2023). The increase in 2021-22 is largely due to the expansion of metro rail projects in Indian cities, including Bengaluru and Chennai (Indian Infrastructure 2021).

Finance to the EV segment increased to INR 76 billion (USD 1 billion) per year in 2021/22 from INR 26 billion (USD 0.38 billion) per year in 2019/20. While tracked finance for EVs in 2021/22 fell far short of investment needs, it is expected to grow in the coming years, with increased private sector participation and policy measures to facilitate EV adoption (see Box 4).

<sup>35</sup> 70% of all commercial cars, 30% of private cars, 40% of buses, and 80% of two-wheeler and three-wheeler sales are targeted to be electric by 2030.

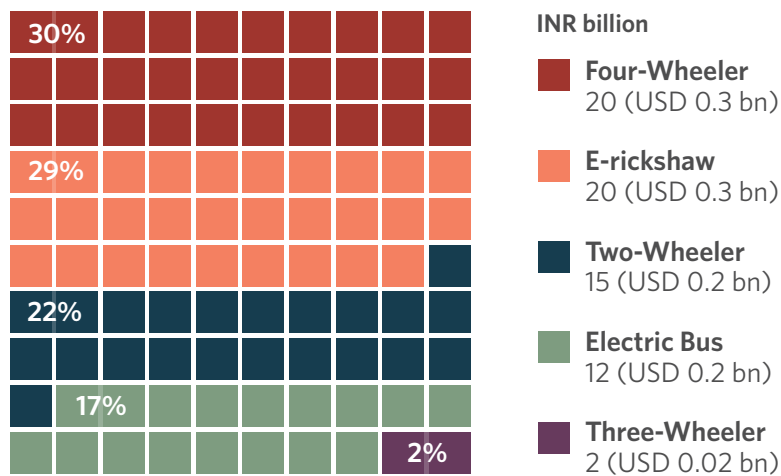


**Figure 15:** Finance flows to clean transportation subsectors (INR bn)



EV sales in India rose significantly in 2021/22 compared to 2019/20. In terms of units sold, while e-rickshaws continued to dominate, other EV categories also saw a significant increase. Nonetheless, EVs still have a long way to go for India to achieve its targets of increasing the share of EV sales (including two- and three-wheelers) to between 80% and 95% by 2030 and 100% by 2040<sup>36</sup> (Agora Verkehrswende and GIZ 2023).

**Figure 16:** EV sales in India by categories (INR bn)<sup>37,38</sup>



<sup>36</sup> EVs comprised 2.6% of the country's total auto sales in 2021/22 (CEEW 2023)

<sup>37</sup> This represents private investment in the clean transportation sector which is arrived at by identifying the average ex-showroom price of the vehicles and multiplying it with segment-wise annual sales for both years.

<sup>38</sup> The percentages for four-wheelers and e-rickshaws appear the same due to the rounding off of percentages.

#### Box 4: The way forward for electric vehicles

Data shows that EV adoption in India increased substantially in 2021-22. Studies note that even though India's EV sector contracted by 19% during the COVID-19 pandemic, it was quick to recover, growing by three times in 2021-22 compared to 2020-21 (CEEW 2023).<sup>39</sup> In tandem, tracked finance flows to EVs increased from INR 38 billion (USD 513 million) in 2020-21 to nearly INR 114 billion (USD 1.5 billion) in 2021-22. This includes finance for cars, buses, three-wheelers (including e-rickshaws), and two-wheelers.<sup>40</sup> It is important that the growth in EV adoption witnessed in FY 2021-22, continues in the future.

#### What the EV sector requires for rapid growth

**Policy and financing support:** Policy support is crucial for the EV sector's growth. The government has revised existing policies and initiated new measures in this sector. For instance, the Faster Adoption and Manufacturing of Hybrid and Electric Vehicles in India (FAME) II Scheme, launched in 2019, was redesigned in 2021 based on experience during the COVID-19 pandemic and feedback from industry and users (PIB 2021). The revised scheme aims to speed up the proliferation of EVs by reducing their upfront costs, including through increased demand incentives. The Government of India has also approved other programs, including the production-linked incentive (PLI) schemes<sup>41</sup> to encourage the domestic manufacturing ecosystem to facilitate increased adoption of EVs. Additionally, by 2021-22, several states (Assam, Gujarat, Maharashtra, Meghalaya, Odisha, Rajasthan, West Bengal) have brought in policies and launched incentive schemes, including tax incentives.

The redesign and extension of the FAME II scheme, the introduction of programs such as the PLI schemes, and the EV-related policies implemented by several states should drive EV sales. At the same time, support is required to surmount barriers, such as the availability of financing to enable rapid uptake of electric two- and three-wheelers and increase the market share of EVs from the present single digits.

**Charging Infrastructure:** Adequate charging infrastructure, including slow and fast chargers, and battery swapping facilities, is critical in driving EV adoption. Charging infrastructure is a chicken-and-egg problem on the Indian EV landscape: while observers note that having charging infrastructure in place is essential for increased adoption, current limited demand is one reason for charging point operators being cautious about installing chargers (Invest India and SAREP 2023).<sup>42</sup> Further, studies show that the payback period of five to seven years for a charging station "makes for an unconvincing business case" (Invest India and SAREP 2023). So far, both PSUs and private sector players have set up charging infrastructure, but the number of charging stations needs to go up significantly to increase EV penetration in the country.<sup>43</sup>

39 From comprising 1% of all monthly auto sales in January 2021, the share of EVs in auto sales rose to 2% in August 2021 and reached 4% in March 2022 (CEEW 2023).

40 The two-wheeler segment is broadly divided into high- and low-speed vehicles. As the latter do not require licenses or registration, they are not recorded in the Vahan database and financing for them is therefore not tracked in this study.

41 In May 2021, the government rolled out a Production-Linked Incentive Scheme (PLI) for ACC Battery Storage Manufacturing, which will incentivize the domestic production of such batteries and reduce dependence on imports. Additionally, in September 2021, the government approved a PLI Scheme for the automobile and drone industry, which intends to incentivize high value advanced automotive vehicle technology and products, including 'green automotive manufacturing.' The production-linked schemes focus on creating a local domestic manufacturing ecosystem to support the target and goal of better adoption of EV and E-mobility (India Briefing 2022).

42 As per the Invest India and SAREP 2023 study, unlike captive charging stations which reach high utilization rates, "public charging infrastructure utilization rates are as low as 6% according to some public charging point operators."

43 A report by EY, Indus Law, and IVCA 2022 states that as of early 2022, there were only 1,742 charging stations in India.

## ENERGY EFFICIENCY

Finance flows to the energy efficiency sector increased to INR 1,287 billion (USD 17.3 billion)<sup>44</sup> per annum in 2021/22 from INR 1,189 billion (USD 16.8 billion) in 2019/20. Commercial FIs provided 55% of the funding, followed by residential, commercial, and institutional entities at 37%.

According to India's Long-Term Low-Carbon Development Strategy 2022, the country's residential electricity demand is projected to triple by 2050 (MoEFCC 2022). In addition, exponential urban population growth will require the country's building space to more than double over the next two decades, with 70% of new construction occurring in urban areas (IEA 2021). Over the past decade, India's electricity consumption has almost doubled, driven by growing appliance use (IEA 2021). Therefore, energy efficiency initiatives, especially for new construction and appliance use, will play a crucial role in shaping energy use patterns and achieving India's goals to reduce the emissions intensity of its GDP.

**Figure 17:** Finance flows to energy efficiency by sources (INR bn)



Finance flows for energy efficiency saw an upward trajectory in 2021/22, increasing by 8% compared to 2019/20. This was driven by an 18% increase in finance to energy-efficient appliances and a 27% increase to green buildings, compared to finance in these subsectors in 2019/20.

An interannual comparison of finance flows to energy efficiency shows an increase of 17% from 2020-21 to 2021-22. However, two key subsectors—process efficiency and green buildings—saw decreases in finance by 17% and 51%, respectively, from 2020-21 to 2021-22. The decrease in process efficiency may be due to lower emissions reduction targets set for the Perform, Achieve, and Trade (PAT)<sup>45</sup> cycles during this period.<sup>46</sup>

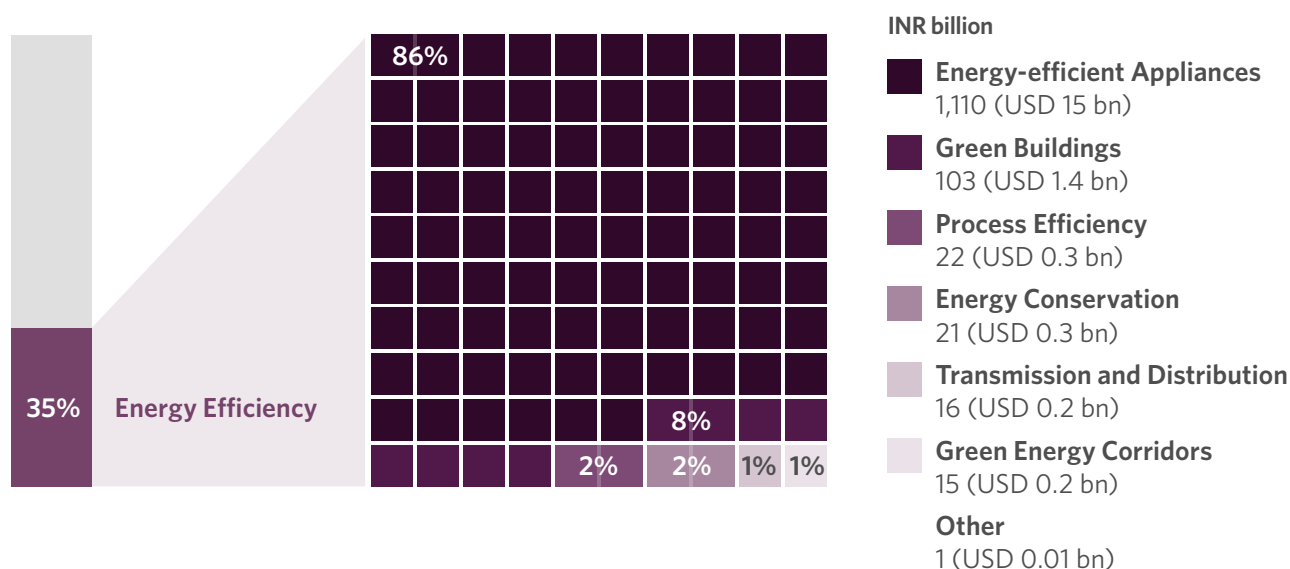
44 The USD conversions for energy efficiency finance for FYs 2021/22 and 2019/20 have been rounded off to one decimal place as the difference is marginal.

45 The Perform, Achieve, and Trade (PAT) scheme is a regulatory instrument introduced to reduce energy consumption in energy-intensive industries. The scheme has an associated market-based mechanism to enhance cost effectiveness through certification of excess energy savings, which can be traded. Specific high energy-intensive industries are identified as Designated Consumers (DCs) and given energy savings targets for a three-year cycle. See: <https://beeindia.gov.in/en/programmes/perform-achieve-and-trade-pat>

46 2020-21 was covered under PAT Cycle IV with 109 notified DCs, a total energy savings target of 0.701 Million Tonnes of Oil Equivalent (Mtoe), and the achievement of 0.750 Mtoe energy savings, while 2021-22 fell under PAT Cycle V with 110 notified DCs, energy savings target of 0.5130 Mtoe and achievement of 0.680 Mtoe. While DCs overachieved the energy savings target in both cycles, the reduced targets entailed an overall reduction in energy savings achievement. See: [https://beeindia.gov.in/sites/default/files/publications/files/Impact%20Assessment%202022-23\\_%20FINAL%20Report.pdf](https://beeindia.gov.in/sites/default/files/publications/files/Impact%20Assessment%202022-23_%20FINAL%20Report.pdf)

Where green buildings are concerned, a substantial reduction in the certified green building area was observed for one of the certifiers, despite an increase in their number of certified projects. This is due to the certification of a few large projects in 2020-21, leading to significantly higher certification area, and therefore higher outlay.

**Figure 18:** Finance flows to energy efficiency subsectors (INR bn)



### Box 5: Green buildings in India: Status, challenges, and opportunities

Green buildings have seen significant growth in India in the past decade, largely due to progressive government policies and sustainability initiatives. Climate Policy Initiative (CPI) analysis finds that finance to green buildings increased from 2019/20 to 2021/22, even amid a considerable drop in the incremental costs of constructing green buildings (Patel and Patel 2021; WorldGBC 2021).

India is at the juncture of a residential and commercial construction boom to cater to its increasing urban population and rapid economic growth. This provides an opportunity to accelerate the greening of buildings to enable low-carbon and resilient urban development and help achieve the country's emissions intensity reduction targets. Analyses indicate that the demand for green buildings has been increasing in India due to a strong push by the government to increase energy efficiency in homes and the industry, rising consumer awareness, and the introduction of minimum energy standards for new commercial buildings (NIUA 2021; IFC 2022).

The Government of India's National Building Code, 2016, the updated Energy Conservation Building Code 2018, and the ECO Niwas Samhita (Energy Conservation Building Code for Residential Buildings) 2018 are key guidelines and standards provided for green buildings. The National Mission for Sustainable Habitat, one of the eight missions under India's National Action Plan on Climate Change, identifies "Energy and Green Buildings" as one of its five thematic areas (MoHUA 2021). India also has multiple rating and certification systems in place, including Green Rating for Integrated Habitat

Assessment, India Green Building Council, Leadership in Energy and Environmental Design, and IFC EDGE. Subnational policies and regulations, such as the Odisha Development Authorities (Planning and Building Standards) Rules 2020, property tax rebates for green-certified buildings, and building permission discounts have also encouraged developers to opt for sustainable building projects. Furthermore, since 2019, FIs have been offering green building loans, green bonds, and financial incentives. Examples include the Small Industries Development Bank of India's financial assistance to green building-certified projects and Piramal Capital & Housing Finance Ltd.'s support to the affordable green housing segment (IFC 2020).

Green buildings have immense potential in India, with the IFC estimating an investment opportunity of USD 1.4 trillion in green buildings by 2030 (IFC 2017 and 2022). Measures to ensure a level playing field for incentives, uniformity of standards and codes across the country, and widespread awareness programs for all stakeholders can help scale green building construction in India. Green building financing can also be substantially increased by channeling green bonds, of which only 14% of proceeds go to low-carbon buildings at present (IFC 2022).

## 2.2 ADAPTATION

**Green finance for tracked adaptation sectors reached INR 1,092 billion (USD 15 billion) in 2021/22, an increase of almost threefold from 2019/20 levels.**<sup>47</sup> This is attributable not only to the growth of financial flows but also to increased coverage both in terms of the number and depth of sectors. Specifically, the increase is attributable to the additional tracked finance for on-farm adaptation-related activities in agriculture (INR 265 billion / USD 3.6 billion), which included additional sources of private finance (FDI and PE/VC), and an almost tenfold increase in flows to disaster risk management from INR 47 billion (USD 0.7 billion) in 2019/20 to INR 461 billion (USD 6.2 billion) in 2021/22. The increase in finance flows to disaster risk management is partially due to the tracking of budgetary expenditure of an additional government ministry.

<sup>47</sup> According to India's Third National Communication and Initial Adaptation Communication to UNFCCC, 2023, the government's total adaptation relevant expenditure amounted to around INR 13 trillion, or 5.6% of the GDP in FY 2021-2022 (MoEFCC 2023). This report tracks adaptation finance for select sectors and tracks adaptation finance conservatively, which explains the much lower amount for adaptation relevant flows.

Figure 19: Sankey diagram for adaptation

# LANDSCAPE OF FINANCE FOR ADAPTATION IN INDIA 2021/2022

Finance flows for adaptation in India along their life cycle in 2021 and 2022. Values are averages of two years' data to smooth out fluctuations, in INR billions.

ANNUAL AVERAGE  
**1,092** BILLION INR  
**15** BILLION USD

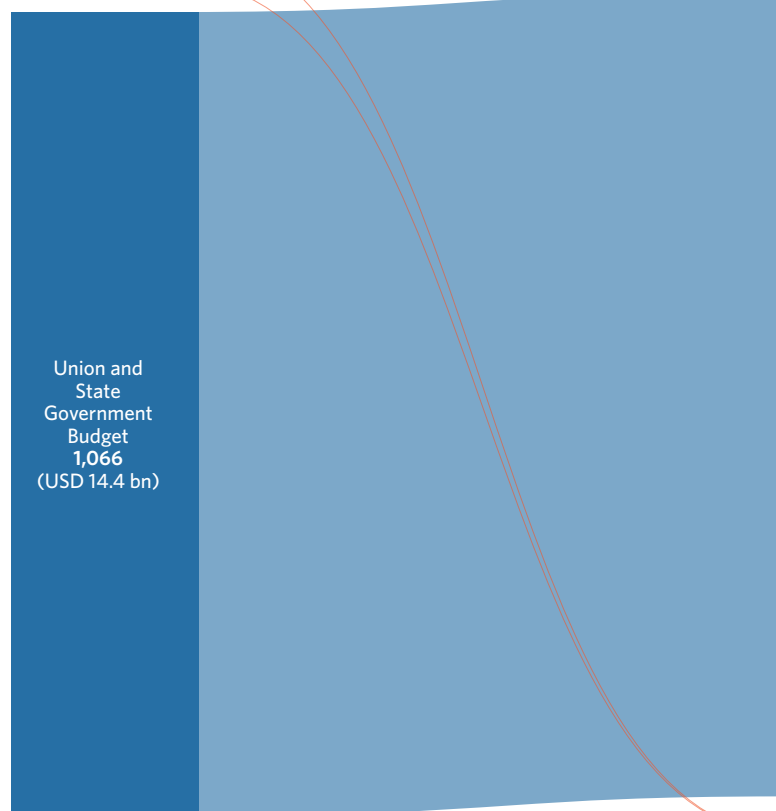
## SOURCES AND INTERMEDIARIES

Which type of organizations are sources or intermediaries of capital for climate finance?

FDI<sup>1</sup>, 0.6 (USD 0.01 bn)

Philanthropy, 0.3 (USD 0.004 bn)

Other<sup>2</sup>, 2 (USD 0.02 bn)



Bilateral DFI, 2 (USD 0.03 bn)

Multilateral DFI, 21 (USD 0.3 bn)

**Private** **Public**

## INSTRUMENTS

What mix of financial instruments is used?

Balance sheet financing (Equity portion), 2 (USD 0.03 bn)

Government Budgetary Expenditure, 1,066 (USD 14.4 bn)

Grant, 3 (USD 0.05 bn)  
 Low-cost project debt, 20 (USD 0.3 bn)

## SECTORS

What is the finance used for?

Agriculture 265 (USD 3.6 bn)

Disaster Risk Management 461 (USD 6.2 bn)

Drought Management, 19 (USD 0.3 bn)

Flood and Cyclone Mitigation 347 (USD 4.7 bn)

<sup>1</sup> "FDI" stands for Foreign Direct Investment.  
<sup>2</sup> "Other" comprises PE and VC funds.

While India's green finance flows to adaptation sectors have increased over the years, available estimates indicate that the country's adaptation investment needs are substantial and likely to increase in the future (GoI 2015; DEA 2020). The Department of Economic Affairs estimates that the cumulative investment needs for adapting India's key vulnerable sectors to the impacts of climate change between 2015 and 2030 are around INR 85.6 trillion (USD 1 trillion) (DEA 2020), amounting to roughly USD 67 billion annually (SSEF 2022).

Finance for adaptation has been tracked partially and only includes select sectors. The sectors tracked are:

- Disaster risk management.
- Flood and cyclone mitigation.
- Drought management.
- Agriculture (on-farm adaptation-related activities)—tracked for the first time this year.<sup>48</sup>

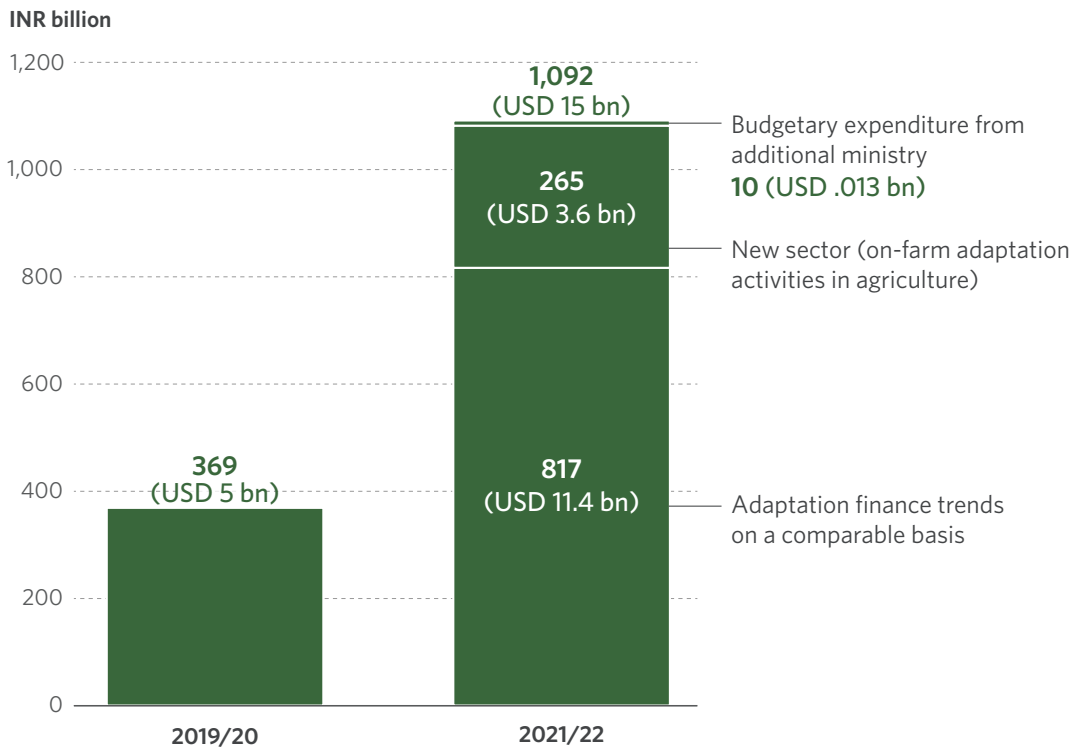
The increase in finance flows to adaptation sectors in 2021/22 from 2019/20 was primarily due to the following:

- **An increase in the annual average flows in sectors tracked in India Landscape Reports 2022 and 2024 and tracking of budgetary expenditure from an additional ministry:** Finance for disaster risk management, flood and cyclone mitigation, and drought management increased from INR 369 billion (USD 5 billion) in 2019/20 to INR 817 billion (USD 11.4 billion) in 2021/22. This report also tracked finance to disaster risk management from an additional government ministry (the Ministry of Earth Sciences), which amounted to INR 10 billion (USD 0.13 billion).
- **Partial tracking of adaptation-related finance flows in an additional sector for 2021/22:** INR 265 billion (USD 3.6 billion) or 24% of the tracked finance for adaptation is finance flows for a new sector: agriculture (on-farm activities). Tracking of flows to this sector included additional sources of private finance, including foreign direct investment and PE/VC.

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<sup>48</sup> India's agriculture sector is highly climate-vulnerable, with on-farm activities the most sensitive to the impacts of climate change (DST 2020). Government initiatives to enhance climate resilience of the sector, therefore, focus on on-farm interventions such as crop diversification, crop management, water use efficiency, soil regeneration, and weather-based insurance (Ministry of Agriculture, 2014). This report partly tracks finance to adaptation-related agricultural activities—focusing on on-farm activities, in line with the country's adaptation priorities for the sector.

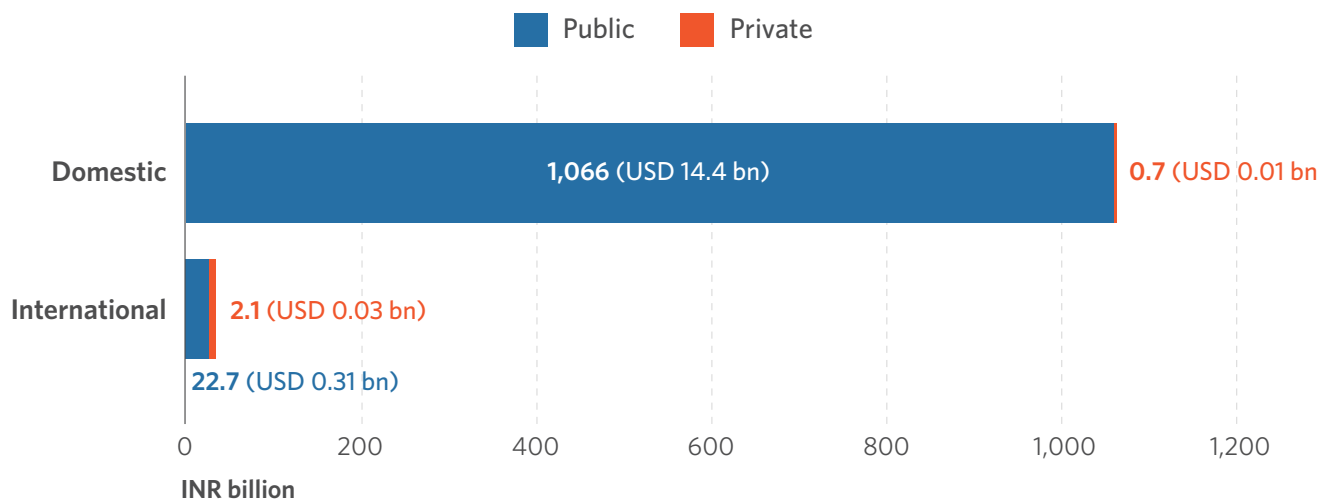
**Figure 20:** Finance for adaptation in 2019-2022, biennial averages



### 2.2.1 SOURCES AND INSTRUMENTS

Most adaptation funding in 2021/22 came from domestic sources (98%), largely driven by central and state government budgets.

**Figure 21:** Finance for adaptation by sources (INR bn)

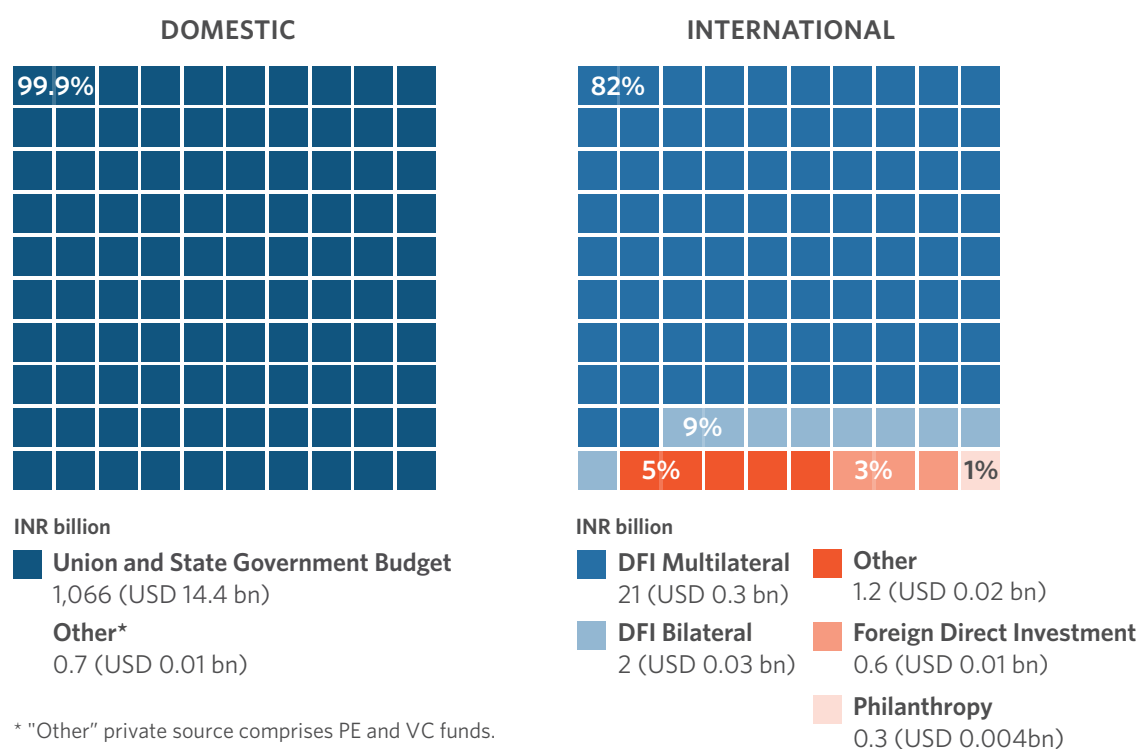




## DOMESTIC AND INTERNATIONAL SOURCES OF FINANCE

Finance from domestic sources for tracked adaptation sectors reached **INR 1,067 billion (USD 14 billion)**, a marked increase from **INR 348 billion (USD 4.7 billion)** in 2019/20. Government budgetary expenditure of INR 1,066 billion accounted for more than 99% of the total domestic finance for adaptation. Domestic private finance from PE/VC to on-farm adaptation-related agricultural activities was tracked for the first time for 2021/22. However, the amount was negligible (<1%),<sup>49</sup> indicating that domestic finance for adaptation continues to be driven by government budgetary expenditure, and there is a need to scale private finance for adaptation. While the share of private finance was negligible, the tracked amount likely represents a fraction of the total adaptation flows to on-farm adaptation related activities in agriculture from private sources. Limited availability of data and reporting on private sector adaptation finance makes it extremely difficult to capture the actual amount (CPI 2024c).

**Figure 22:** Domestic and international finance for adaptation by public and private sources (INR bn)



**Adaptation flows from international sources<sup>50</sup> increased by 19% from INR 21 billion (USD 0.29 billion) in 2019/20 to INR 25 billion (USD 0.33 billion) in 2021/22.** Public sources constituted 92% of the total international finance for adaptation, following 2019/20 trends. Finance from public sources increased from 2019/20 to 2021/22, largely driven by an increase in finance from bilateral DFIs.

49 One reason for this could be that we have only tracked PE/VC and not flows from private FIs. It is to be noted that tracking private finance for adaptation is more difficult due to the absence of standardized terminologies and limited data availability. Consequently, the private sector's actual contribution to adaptation may fluctuate.

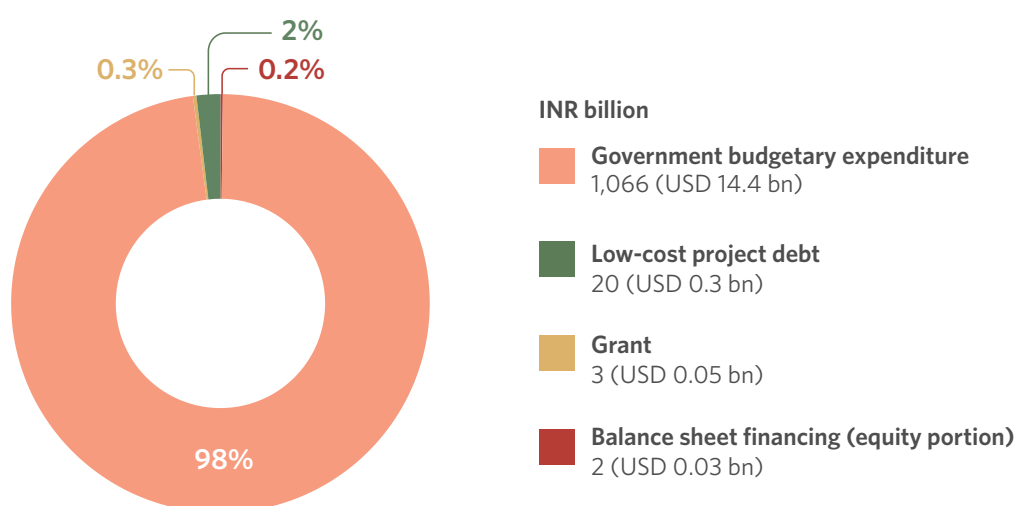
50 This report tracks data on disbursement and not commitments, and it is possible that enough data on disbursement is not available.

International finance from private sources increased from 2019/20 to 2021/22 as well, driven by an increase in flows from international philanthropies and the additional tracking of foreign direct investment to on-farm adaptation-related agricultural activities.

**Government budgetary expenditure was the main instrument for domestic funding.** Balance sheet financing (equity portion) at INR 0.7 billion or USD 0.01 billion, constituted <1% of domestic funding.

**Low-cost project debt accounted for 79% of total international finance in 2021/22.** Grants from bilateral and multilateral FIs and philanthropies accounted for 14% of international flows, and balance sheet financing (equity portion) accounted for the remaining 7%.

**Figure 23:** Finance for adaptation by instruments (INR bn)



## 2.2.2 SECTORS

**In 2021/22, disaster risk management received the highest adaptation flows, accounting for 42%, followed by flood and cyclone mitigation (32%), and on-farm adaptation-related agricultural activities (24%).**

Disaster risk management saw a significant increase in finance from INR 47 billion (USD 0.7 billion) in 2019/20 to INR 461 billion (USD 6.2 billion) in 2021/22, primarily driven by a notable increase in government budgetary expenditures in the sector. This can be attributed to the recommendation of the 15th Finance Commission (FC)<sup>51</sup> to significantly increase allocation for disaster risk management (PIB, 2023a), and tracked finance to disaster risk management from an additional government ministry.

<sup>51</sup> The Finance Commission is a constitutional body formed every five years to recommend the division of tax revenues between central and state governments, as well as their distribution among states. The 15th Finance Commission made recommendations for the period FY2020-21 to FY 2025-26 (Fifteenth Finance Commission 2021).

### Box 6: The role of the 15th FC in increasing finance for disaster risk management

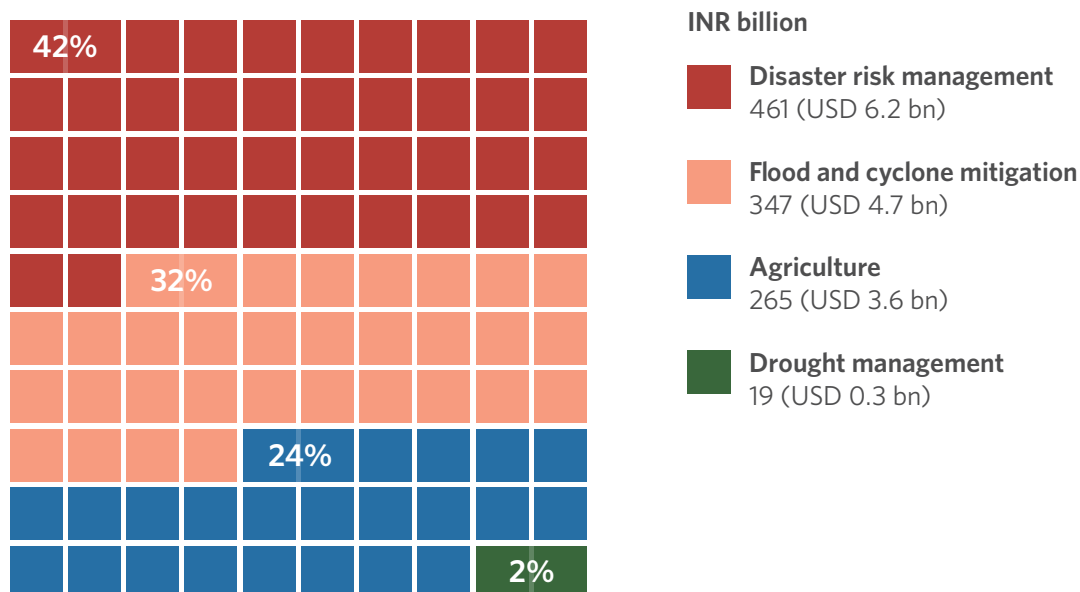
The 15th FC (FY 2020-21 to FY 2025-26) has played a pivotal role in India's approach to disaster management by moving from short-term disaster response to more comprehensive long-term disaster risk management and resilience building.

The FC is crucial for addressing fiscal imbalances between the revenue-raising capacities of state governments and their expenditure needs. It recommends the division of taxes between the central and state governments, as well as distributing these resources among states (CPI 2024a). Typically established every five years, the FC's transfers to states consist of tax devolution and other grants. These transfers, particularly tax devolution, form the backbone of unconditional fiscal support to states (Chakraborty 2021). The FC's fiscal transfers are vital for maintaining states' overall financial health and are increasingly essential for climate adaptation and disaster resilience initiatives.

In a significant step forward, the 15th FC recommended a shift in focus from merely responding to disasters to preventing them and mitigating their impact. It introduced two new funds—the National Disaster Risk Management Fund and the State Disaster Risk Management Fund—to bolster disaster preparedness and risk mitigation efforts. These funds are designed to supplement the existing Disaster Response Fund, shifting the emphasis from reactive disaster response to proactive disaster risk management. Fiscal transfers to individual states through the SDRMF are determined based on their specific risk profiles. These profiles are calculated using the Disaster Risk Index, which evaluates states' vulnerability to events such as cyclones, floods, and droughts (Kapur et al. 2020).

By embedding disaster resilience into its fiscal transfer mechanisms, the 15th FC has laid the groundwork for a more sustainable, long-term approach to managing climate and disaster risks in India.

Figure 24: Finance for adaptation by sectors (INR bn)



**Finance to on-farm adaptation-related agricultural activities—tracked for the first time in this report—amounted to an annual average of INR 265 billion (USD 3.6 billion) for 2021/22.**

The tracked on-farm adaptation-related activities have been further categorized into the following subsectors:

- Agroforestry.
- Crop insurance.
- Efficient irrigation.
- Research and capacity building.
- Resilient cropping system.
- Soil and water conservation.

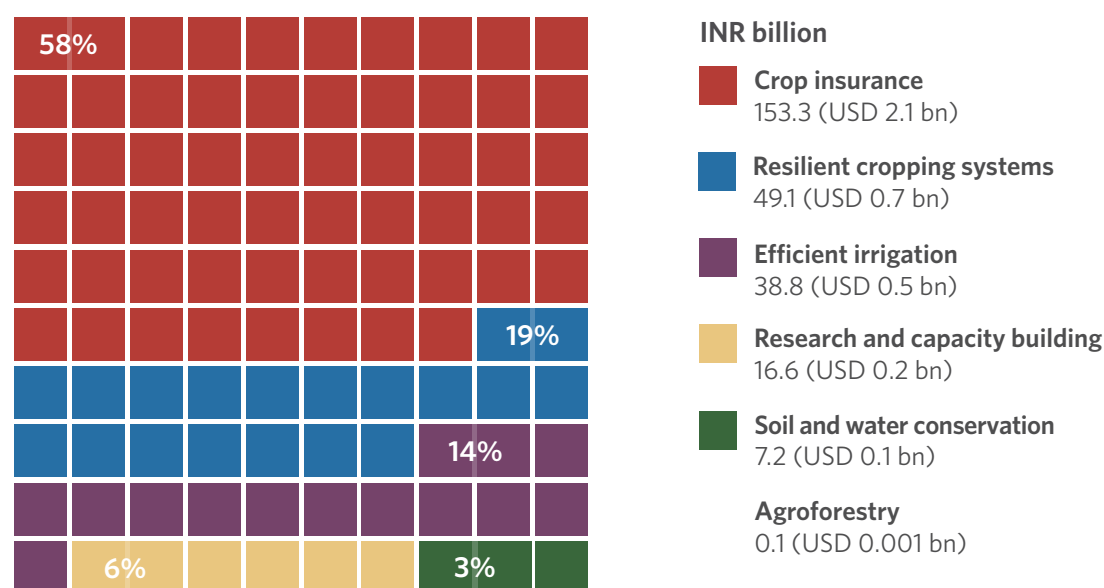
**Box 7: Flows to on-farm adaptation-related activities in agriculture**

The government of India lists key national agriculture adaptation strategies, policies, programs, and schemes. Government budgetary expenditure on on-farm adaptation related activities, based on the government’s categorization, is much higher.

Considering the flows tracked in this report represent the conservative, lower bound amounts going to climate-related activities, the analysis categorizes the adaptation relevant amount for these schemes based on their objectives (see the methodology document for details). The report’s tracked flows to on-farm adaptation-related activities from government budgetary expenditure therefore amounted to an annual average of INR 252 billion (USD 3 billion).

**Crop insurance received 58% of finance to on-farm adaptation-related agricultural activities, with central and state government budgets accounting for the total flows.** Resilient cropping systems (19%) and efficient irrigation systems (15%) were the other two subsectors that received the remaining major portion of finance to on-farm adaptation activities in agriculture.

**Domestic private finance from PE/VC to on-farm adaptation-related activities in 2021/22 amounted to INR 0.68 billion (USD 0.01 billion).** Domestic private finance to soil and water conservation was the highest, followed by research and capacity building and resilient cropping systems.

**Figure 25:** Finance to on-farm adaptation activities by subsectors (INR bn)

**International flows to on-farm related adaptation agricultural activities went mainly to efficient irrigation (46%) and resilient cropping systems (29%).** Public sources of international finance dominated flows to both these subsectors. International private finance accounted for 17% of the total international flows to the sector.

#### Box 8: Private finance flows to on-farm adaptation-related agricultural activities

Private finance flows to on-farm adaptation-related agricultural activities amounted to an annual average of INR 2.7 billion (USD 0.037 billion). International sources accounted for 75% of private flows, and domestic sources for 25%.

Multiple studies indicate that private adaptation finance to this sector largely goes to digital agribusiness marketplaces and post-harvest and supply chain startups (Climake and Unitus Capital, 2022; AgFunder, 2024). Finance to on-farm adaptation solutions is yet to be scaled.

One study finds that in India, on-farm solutions including agri-biotechnology and novel farming systems received USD 0.032 billion (5% of the total calculated agritech funding) in 2020 and 2021, mainly to test product-market fit, indicating the nascent stage of on-farm investments (Climake and Unitus Capital, 2022).

Another study indicates that total investment in agrifood tech in India totaled USD 1.9 billion between 2012 and 2023, with preference given to digital marketplaces, as aggregation of farmers to supply inputs and markets was found to be a scalable business opportunity (AgFunder, 2024).

## 3. APPROACH AND METHODOLOGY

### 3.1 APPROACH

#### DEFINING GREEN FINANCE

This report is based on empirical data drawn from a range of primary and secondary sources. For the collection, preparation, and analysis of data, we adopted an operational definition of green finance, as well as an accounting methodology to ensure comparability across data sets, and to avoid overlaps to the extent possible.

We have adopted the green finance taxonomy used in the previous report—“Landscape of Green Finance in India 2022”—which aligned the taxonomy with the findings of a study developed by CPI and cKinetics and the CPI published study *Accelerating Green Finance in India: Definitions and Beyond* (CPI 2020). These publications define climate, green, and sustainable finance as follows:

- **Climate finance** refers to “local, national or transnational financing, drawn from public, private and alternative sources of financing, that seeks to support mitigation and adaptation actions that will address climate change.” (UNEP Enquiry 2016).
- **Green finance** includes climate finance as well as other environmental objectives that are necessary to support sustainability, and in particular, aspects such as biodiversity and resource conservation.
- **Sustainable finance** covers a broader set of the investment universe with the aim of building an inclusive, economically, socially, and environmentally sustainable world.

### 3.2 METHODOLOGY

CPI is a leading authority in tracking global climate finance flows. Building on CPI’s decade of tracking finance flows, we developed a dedicated methodology for India, with further details available in a separate document.

An Advisory Committee, comprising experts from academia, industry, and research, provided further guidance on the project approach. We have identified the sources of data specific to India and adjusted this methodology to include investments in each of the sectors shown in Table 1. For each of these sectors, we have collected disaggregated data on actual disbursements as opposed to commitments.

**Table 1:** Sectors covered in the Landscape of Green Finance in India 2024

Sectors	Subsector
Clean energy	<ul style="list-style-type: none"> <li>▪ Wind</li> <li>▪ Solar</li> <li>▪ Tidal</li> <li>▪ Geothermal</li> <li>▪ Biomass</li> <li>▪ Hydrogen</li> <li>▪ Renovation and modernization of thermal power technologies</li> <li>▪ Manufacturing of clean energy plant and energy-efficient equipment</li> <li>▪ Energy storage</li> </ul>
Clean transportation	<ul style="list-style-type: none"> <li>▪ Purchase of EVs</li> <li>▪ EV charging infrastructure</li> <li>▪ Public transportation</li> </ul>
Energy efficiency	<ul style="list-style-type: none"> <li>▪ Energy-efficient equipment</li> <li>▪ Process efficiency</li> <li>▪ Bulk energy services</li> <li>▪ Green buildings</li> <li>▪ Green renovation of existing buildings</li> <li>▪ Green energy corridors</li> </ul>
Climate adaptation	<ul style="list-style-type: none"> <li>▪ Disaster, monitoring, and emergency response systems</li> <li>▪ Flood and cyclone mitigation</li> <li>▪ Drought management</li> <li>▪ Agriculture (on-farm adaptation-related activities)</li> </ul>

### 3.3 DATA GAPS AND ASSUMPTIONS

Green finance tracking faces multiple issues related to the availability, quality, and robustness of investment data for both the public and private sectors. The key challenges encountered during data collection are outlined below.

- **Unavailability of consistent data on disbursements:** Focusing on finance disbursements over commitments affects the magnitude of trackable flows because large, committed amounts are often disbursed over several years. Consistent data on disbursements is often lacking across international public finance actors but is usually available through national budget and expenditure systems. Extracting this information can be challenging due to the lack of an effective, integrated measurement, reporting, and verification (MRV) system. While reforms in the Public Financial Management System<sup>52</sup> have been initiated recently (PIB 2022b), granular information on the flows and end uses of finance is still not readily available.
- **Difficulty in green tagging of budget entries:** The lack of a harmonized green finance taxonomy in India and non-standardized data reporting makes green tagging of domestic entries arbitrary and vulnerable to user discretion. Projects often have different names or codes in budget documents vis-à-vis policy documents. This problem is exacerbated by the

<sup>52</sup> Public Financial Management System is a financial management platform for schemes. It is a database of all recipient agencies that integrates with banks that handle plan funds, as well as with state treasuries, enabling tracking of fund flows to the lowest levels of implementation. It is implemented by the Ministry of Finance Office of the Controller General of Accounts.

time lag in the availability of data on budget actuals, making it difficult to establish causality with other sectoral developments.

- **Large variations in granularity, format, and categorization of data at the state level:** It is necessary to assess and analyze various divisions of government expenditure (recurrent, investment expenditure, or transfer payments) and revenue. This requires intense engagement with various stakeholders, as different ministries and departments are responsible for managing budgetary data. Moreover, the format and granularity of State Budgets vary considerably and are often not user-friendly.
- **Limited to no data availability and reporting on private finance for adaptation** due to various factors, such as lack of a mandatory reporting mechanism around adaptation for private actors.

Despite these challenges, CPI was able to improve upon data gaps observed in the previous Landscape report by making the following changes:

- **The tracking of on-farm adaptation-relevant activities in the agricultural sector**, with a further breakdown into more granular subsectors—agroforestry, crop insurance, efficient irrigation, resilient cropping systems, research and capacity building, and soil and water conservation.
- **Addition of new sources** for tracking finance for adaptation, primarily due to the tracking of private finance (mainly PE/VC) in on-farm adaptation-relevant activities in agriculture. Additionally, finance through foreign direct investment in on-farm adaptation agricultural activities has been tracked.

While data reporting has improved in some areas since the previous India Landscape report, information on private investments remains limited. To overcome this challenge, certain assumptions have been made based on definitions outlined in the methodology document.



## 4. CONCLUDING OBSERVATIONS

To fully implement its climate goals in a timely manner, India's green finance must increase significantly and as quickly as possible. Preliminary estimates suggest that India needs INR 162.5 trillion (USD 2.5 trillion) until 2030 for its NDC, amounting to INR 11 trillion annually (USD 170 billion) (GoI 2015). For adaptation-related interventions, estimates suggest that India's cumulative investment needs are at least INR 85.6 trillion (USD 1 trillion), or INR 5,733 billion (USD 67 billion) per year, for the period 2015 to 2030 (DEA 2020).

The tracked green finance for mitigation sectors in 2021/22, as per conservative estimates, increased to INR 3,712 billion (approximately USD 50 billion) per annum from INR 3,094 billion (USD 44 billion) in 2019/20. This is a significant step up from 2019/20, especially in the context of the economic disruption due to the COVID-19 pandemic. Private sector flows dominated green finance for mitigation sectors, reflecting the consistent commitment from private sources—both domestic and international. However, much more needs to be done as the current tracked green finance for mitigation in India represents approximately 30%<sup>53</sup> (up from 25% in 2019/20) of the total investment needs just to meet the NDC goals.

For adaptation-related sectors, tracked green finance increased to INR 1,092 billion (USD 15 billion) in 2021/22 from INR 369 billion (USD 5 billion) in 2019/20. Increases in government budgetary expenditure explain this substantial rise in adaptation flows, as well as tracking of additional sectors in this year's report. However, as the investment required for adaptation is large and likely to increase in the future, there is a need to scale up funding for adaptation considerably.

Based on the findings of this report, CPI proposes the following priorities to increase green investment in India:

### 1. FURTHERING POLICY AND REGULATORY MEASURES TO MOBILIZE GREEN FINANCE ACROSS ALL SECTORS

With the country's economic recovery picking up pace in the aftermath of the pandemic, it is important to keep up the momentum witnessed for green finance growth. The policy environment can play a pivotal role in driving investment in India, both domestic and international. Attracting finance flow for mitigation and adaptation sectors will require the following:

- **Government policies and guidelines to signal ambition and commitment** to low-carbon and resilient development. Over the years, the government has introduced an array of climate policies covering a multitude of sectors. In the Budget 2024-25, for instance, the government announced a slew of measures for the promotion of renewable energy, including initiatives such as the PM Surya Ghar Muft Bijli Yojana for promoting solar rooftop energy for households. Policy support has facilitated expansion of RE capacity, increased adoption of

<sup>53</sup> In December 2023, the government of India announced that two quantifiable targets (reducing the emissions intensity of India's GDP by 33 to 35 percent by 2030 from 2005 level; and achieving about 40 percent cumulative electric power installed capacity from non-fossil fuel-based energy resources by 2030) of NDC 2015 have been achieved well ahead of the time (PIB, 2023b). However, since this report tracks finance flows from 2020 to 2022, benchmarking was done on the previously estimated numbers.

EVs, in the country. Continued policy support to critical green sectors is crucial for building investor confidence and mobilizing finance.

- **Developing and operationalizing a green/climate finance taxonomy.** The announcement in the Union Budget 2024-25 on establishing a climate finance taxonomy (PIB, 2024) is a welcome step toward establishing standardized definitions and classifications to help navigate and steer the country's economy toward a resilient and low-carbon economy. A taxonomy that provides clear definitions of green and climate finance and builds synergies with existing national goals such as the country's NDC updated in 2022 and the upcoming National Adaptation Plan, can help to reduce uncertainty and build investor confidence, thereby helping to scale green/climate finance. A taxonomy that is comprehensive, descriptive, and harmonizes with and builds upon existing attempts to define and classify adaptation activities and finance from the public and private sector is crucial for scaling adaptation finance (CPI 2024c). It is also important to ensure the taxonomy remains a live document such that it can be updated to adequately reflect policy updates and progress, and new economic activities and green technologies such as green hydrogen, the Internet of Things, and earth observation, among others.
- **Introducing national and subnational level regulations on adaptation.** India has national and subnational climate plans and strategies in place and has integrated adaptation considerations across its sectoral plans and policies. However, introducing updated and comprehensive adaptation focused regulations at the national and subnational levels can help drive adaptation action and investments across governance levels and key economic activities. These can be in the form of mandatory integration of adaptation and resilience considerations in infrastructure projects, climate risk assessments and disclosures, and monitoring and reporting on climate risks and adaptation action.

## 2. COORDINATED ACTION TO SCALE UP GREEN FINANCE AT A FASTER PACE

Scaling up green finance at a faster pace requires coordinated action as described below:

- **Creating market-based incentives, innovative financial products, and de-risking investments to accelerate green finance.** Sustainable development has been a key goal of the government, and this is reflected in the Budget 2022-23 announcement on the issuance of sovereign green bonds to mobilize resources for the development of green infrastructure. The proceeds are to be deployed for public sector projects that help to reduce the carbon intensity of India's economy. Another welcome step is the emphasis laid on blended finance in the Budget 2022-23. To leverage public finance to attract private finance, it has been proposed to have thematic funds for areas such as climate action and climate technology, with the government share being 20% and the funds being managed by private fund managers. Through such initiatives, the Budget 2022-23 has tried to send an important signal to markets and FIs.
- **Augmenting development banks' and FIs' important roles in mobilizing green finance through interventions that direct capital to green initiatives.** Given the massive requirement of financial support for climate actions in the country, additional measures need to be taken to direct capital to green initiatives. This could take the shape of a green bank, green fund or facility, or a window within existing national alternative investment funds or development

finance institutions.

### 3. ENHANCING FINANCE FOR ADAPTATION

Tracked finance for adaptation in 2021/22 stood at INR 1,092 billion (USD 15 billion) per annum—marking a significant increase from 2019/20. This increase is driven mainly by finance to disaster risk management and, to an extent, the tracking of flows to adaptation-related on-farm agricultural activities for the first time in this phase. However, given the country's high vulnerability to the impacts of climate change, much more needs to be done.

- **Fostering concerted effort and collaboration across various ministries and departments** (e.g., the ministries of finance; environment, forest and climate change; and housing and urban affairs) to plan, invest, and execute projects, is essential for mainstreaming adaptation action across sectors.
- **Ensuring that state-level adaptation plans indicate estimated adaptation funding gaps, including sectoral gaps, to boost understanding of where finance needs to flow.** Given that climate vulnerabilities are local and context-specific, adaptation interventions are too. India has, therefore, focused on developing adaptation investment plans at the state level. Understanding investment gaps at the state level could inform both public action and guide where private financing would be most appropriate.
- **Boosting private sector investment in adaptation by using public finance.** Private investment in adaptation is yet to be scaled due to various challenges such as lack of information, uncertain investment returns and unavailability of bankable projects, among others. Considering that adaptation continues to be primarily financed through public sources, public finance can be leveraged to increasingly mobilize private adaptation finance. This can be done through various means, such as implementing policies, regulations and incentives around climate risk disclosures and reporting, using public-private partnerships as entry points for channeling private adaptation finance, minimum investment return assurance on adaptation projects, setting up project preparation facilities and supporting innovative financial mechanisms (CPI 2024a).

### 4. MAKING COORDINATED EFFORTS ACROSS DATA COLLECTION, REPORTING AND ACCESS

It is well recognized that information asymmetry hampers investment, especially from the private sector and international sources. Although the availability of green finance data has improved over the last two India Landscape reports, data gaps across actors and sectors still exist. Information asymmetry could be reduced through coordinated action of various stakeholders:

- **Standardizing and mandating disclosures.** Regulatory institutions like the Reserve Bank of India (RBI), the Securities and Exchange Board of India (SEBI), the Insurance Regulatory and Development Authority of India (IRDA) and Pension Fund Regulatory and Development Authority (PFRDA) can lead disclosure requirements. In 2021, SEBI introduced new sustainability reporting requirements for the top 1,000 listed entities in India by market capitalization and has made reporting mandatory from 2022-23 onwards. Recently, RBI has released draft guidelines on “Disclosure Framework on Climate-Related Financial Risks”, to mainstream climate risk assessment, measuring and reporting requirements in the Indian

financial sector's compliance framework. RBI and SEBI's initiatives, aligned with global standards and frameworks such as the Task Force on Climate-related Financial Disclosures, pave the way for implementing national level legislation and mandates around climate risk disclosure.

- **Increasing availability and accessibility of climate finance data.** Climate finance data is crucial for understanding investment gaps, building effective solutions, informing investors, and measuring progress. Such data needs to be made available online for easy accessibility. While compared to previous years, online data availability has increased; it is still not at the stage where most, if not all, the data is available online. We have acquired data for several sectors/subsectors by contacting the relevant stakeholders, which can be time-consuming. This shows that while data is available, ease of accessibility of the same is still lacking.
- **Putting in place an integrated domestic measurement, reporting, and verification (MRV) system.** India already adheres to global reporting obligations such as the biennial update report to the UNFCCC as a measure to improve transparency and accountability. India has also made significant efforts in to strengthen its existing MRV arrangements. Extensive work has also been done on updating and creating technical data repositories and dashboards and improving their access (MoEFCC 2021). However, a robust, integrated MRV system that streamlines financial attributes is not yet available. Such a system can help provide a uniform framework and methodology to track finances, identify financing constraints, identify key areas needing additional finance and efficiency for every rupee spent, and enhance transparency. Green budget tagging is one way to monitor progress, identify gaps and increase transparency in green flows from public sources. Some states in India have initiated green/climate budgeting. However, there is a need to develop a uniform national strategy for such budgeting and reporting to effectively integrate state actions with national climate targets (see Annex).

## 4.1 NEXT STEPS FOR RESEARCH

The 2022 India Landscape report listed the next steps that included preparing a methodology to track finance for adaptation in India. This 2024 India Landscape report has achieved this for on-farm agricultural activities, improving the numbers reported for the adaptation sector. For the next iteration, we aim to achieve the following:

- Build on the existing research to enable financing at the sectoral level and at the subnational level.
- Build on the current study to track finance flows to adaptation sectors in India, based on India's Green Finance Taxonomy, which will be available by 2025-26.

# ANNEX

## GREEN/CLIMATE BUDGETING IN STATES

Green/climate budgeting is an innovative approach that integrates green/climate considerations into the budgeting process. Green budgeting can contribute to institutionalization and integration of green/climate concerns across departments and sectors. It also offers the opportunity to report climate-related expenditures along with actions envisaged in a monitorable format to help ensure that public finances are aligned with climate and environmental objectives.

At present, **India does not have a green/climate budget at the Union Government level, but some states have initiated such budgets.** Four states—Odisha, Bihar, Assam, and Meghalaya—and a Union Territory—Pondicherry—have adopted green/climate budgets. These are presented as a Special Statement on Green Budget with their annual budget releases.

Odisha was the first state to initiate a dedicated climate budget in 2019-20, followed by Bihar releasing a green budget in 2020-21. Thereafter, Assam, Meghalaya, and the Union Territory Pondicherry introduced green/climate budgets in 2023-24.

**These jurisdictions use different frameworks for estimating the green relevance of their budgets depending on the local context.** Odisha initiated its dedicated climate budget using Phased Climate Change Impact Appraisal to prioritize programs and enhance climate readiness. Assam categorized schemes into Green, Yellow, Grey, and Brown based on climate relevance in nine sectors and across climate change adaptation, mitigation, and environment sustainability. Meghalaya's climate budget focuses on departmental allocation for climate change adaptation and mitigation activities. Bihar and Pondicherry's green budgets adopted a framework based on Rio Marker definition whereby programs/activities are tagged to various categories defined on their relevance. These green budgets specify schemes involving environmental sustainability components and estimate the quantity of public expenditure in the state budget for these purposes.

Given the differing approaches and methodologies adopted by these states, financial resources dedicated to green/climate action across these states are not comparable. **There is a need to develop a uniform national strategy for such budgeting and reporting to effectively integrate state actions with national climate targets.**

## REFERENCES

1. AgFunder 2023. Climate Capital: Financing Adaptation Pathways for Smallholder Farmers. Available at: <https://agfunder.com/research/climate-capital-financing-adaptation-pathways-smallholder-farmers/>
2. Agora Verkehrswende, GIZ. 2023. Towards Decarbonising Transport 2023. A Stocktake on Sectoral Ambition in the G20. Available at: [https://www.niti.gov.in/sites/default/files/2023-07/98\\_Towards\\_Decarbonising\\_Transport\\_2023\\_compressed.pdf](https://www.niti.gov.in/sites/default/files/2023-07/98_Towards_Decarbonising_Transport_2023_compressed.pdf)
3. Asian Development Bank. 2023. Resolving Demand-Side Issues in Electric Vehicle Financing in India. ADB South Asia Working Paper Serie <https://www.adb.org/sites/default/files/publication/945841/sawp-099-electric-vehicle-financing-india.pdf>
4. Bloomberg New Energy Finance (BNEF). 2022. Financing India's 2030 Renewables Ambition. Available at: [https://assets.bbhub.io/professional/sites/24/BNEF-Financing-India%E2%80%99s-2030-Renewables-Ambition\\_FINAL.pdf](https://assets.bbhub.io/professional/sites/24/BNEF-Financing-India%E2%80%99s-2030-Renewables-Ambition_FINAL.pdf)
5. Chakraborty L. 2021. Mainstreaming Climate Change Commitments through Finance Commission's Recommendations. Working Paper No. 341, National Institute of Public Finance and Policy (NIPFP) New Delhi. Available at: [https://www.nipfp.org.in/media/medialibrary/2021/08/WP\\_341\\_2021.pdf](https://www.nipfp.org.in/media/medialibrary/2021/08/WP_341_2021.pdf)
6. CEIC. India Market Capitalization: % of GDP. Available from: <https://www.ceicdata.com/en/indicator/india/market-capitalization--nominal-gdp>
7. Climake and Unitus Capital. 2022. The State of Climate Finance in India. Available at: <https://unituscapital.com/downloads/>
8. Climate Policy Initiative (CPI). 2024a. Financing Adaptation in India. Available at: <https://www.climatepolicyinitiative.org/publication/financing-adaptation-in-india/>
9. Climate Policy Initiative (CPI). 2024b. Blog: Transforming India's Climate Finance through Sector-Specific Financial Institutions. Available at: <https://www.climatepolicyinitiative.org/transforming-indias-climate-finance-through-sector-specific-financial-institutions/#:~:text=India's%20pursuit%20of%20a%20sustainable,%20low-carbon%20future%20amidst>
10. Climate Policy Initiative (CPI). 2024c. Tracking and Mobilizing Private Sector Climate Adaptation Finance. Available at: <https://www.climatepolicyinitiative.org/publication/tracking-and-mobilizing-private-sector-climate-adaptation-finance/>
11. Climate Policy Initiative (CPI). 2024d. Landscape of Climate Finance in Africa 2024. Available at: <https://www.climatepolicyinitiative.org/publication/landscape-of-climate-finance-in-africa-2024/>
12. Climate Policy Initiative (CPI). 2023. Global Landscape of Climate Finance 2023. Available at: <https://www.climatepolicyinitiative.org/publication/global-landscape-of-climate-finance-2023/>

13. Climate Policy Initiative (CPI). 2022. Landscape of Green Finance in India 2022. Available at: <https://www.climatepolicyinitiative.org/publication/landscape-of-green-finance-in-india-2022/>
14. Climate Policy Initiative (CPI). 2021. The Future of Distributed Renewable Energy in India. Available from: <https://www.climatepolicyinitiative.org/publication/the-future-of-distributed-renewable-energy-in-india/>
15. Climate Policy Initiative (CPI). 2020. Accelerating Green Finance in India: Definitions and Beyond. Available at: <https://climatepolicyinitiative.org/wp-content/uploads/2020/07/Accelerating-Green-Finance-in-India-Definitions-and-Beyond.pdf>
16. Climate Policy Initiative (CPI). 2019. From banks to capital markets: Alternative Investment Funds as a potential pathway for refinancing clean energy debt in India. Available from: <https://www.climatepolicyinitiative.org/wp-content/uploads/2019/07/Alternative-Investment-Funds-as-a-Potential-Pathway-for-Refinancing-Clean-Energy-Debt-in-India-1.pdf>
17. Climate Transparency. 2022. Climate Transparency Report: G20 Response to the Energy Crisis: Critical for 1.5°C. Available at: <https://www.climate-transparency.org/g20-climate-performance/g20report2022>
18. Council on Energy, Environment and Water (CEEW). 2023. Greening India's Automotive Sector; EV Policies, Categories and Subnational Trends. Issue Brief. Centre for Energy Finance, Bloomberg Philanthropies. Available at: <https://www.ceew.in/cef/solutions-factory/publications/CEEW-CEF-Greening-Indias-Automotive-Sector.pdf>
19. Council on Energy, Environment and Water (CEEW). 2021a. Mapping India's Climate Vulnerability: A District-Level Assessment. Available at: <https://www.ceew.in/publications/mapping-climate-change-vulnerability-index-of-india-a-district-level-assessment>
20. Council on Energy, Environment and Water (CEEW). 2021b. How have India's RE policies impacted its wind and solar projects? Available from: <https://www.ceew.in/cef/solutions-factory/publications/CEEW-CEF-How-have-India%E2%80%99s-RE-Policies-Impacted-its-Wind-and-Solar-Projects-03Dec21.pdf>
21. Council on Energy, Environment and Water (CEEW). 2020. Financing India's Transition to Electric Vehicles. Centre for Energy Finance. Available at: <https://www.ceew.in/cef/solutions-factory/publications/CEEW-CEF-financing-india-transition-to-electric-vehicles.pdf>
22. Deloitte Economics Institute 2021. India's Turning Point. Available at: <https://www2.deloitte.com/content/dam/Deloitte/in/Documents/about-deloitte/in-india-turning-point-noexp.pdf>
23. Department of Economic Affairs (DEA). 2020. Report of the Sub-Committee for the Assessment of the Financial Requirements for Implementing India's Nationally Determined Contribution. Ministry of Finance, Government of India. Available at: <https://dea.gov.in/sites/default/files/Sub%20Committee%20Report%20Final.pdf>
24. Dhingra, S. and Ghatak, M. 2022. India: the economic impact of COVID-19. Centre for Economic Performance. London School of Economics and Political Science. Paper Number CEPCP619. Available at: <https://cep.lse.ac.uk/pubs/download/cp619.pdf>



25. EY, Indus Law and IVCA. 2022. Electrifying Indian Mobility Report. Available at: <https://induslaw.com/publications/pdf/alerts-2022/Electrifying-Indian-Mobility-Report-July-2022.pdf>
26. Fifteenth Finance Commission (FC). 2021. Finance Commission in COVID Times: Report for 2021–26. New Delhi, India: Fifteenth Finance Commission. Available at: <https://fincomindia.nic.in/ShowContentOne.aspx?id=9&Section=1>
27. Germanwatch. 2021. Global Climate Risk Index 2021. Available at: <https://www.germanwatch.org/en/19777>
28. Government of India (GoI). 2015. India's Intended Nationally Determined Contribution: Working Towards Climate Justice. Available at: <https://www4.unfccc.int/sites/submissions/INDC/Published%20Documents/India/1/INDIA%20INDC%20TO%20UNFCCC.pdf>
29. Hussain, F.I. and Dill, H. 2023. India incorporates green bonds to into its climate finance strategy. World Bank blogs. June 12. Available from: <https://blogs.worldbank.org/en/climatechange/india-incorporates-green-bonds-its-climate-finance-strategy>
30. India Briefing. 2022. ACC Battery Storage Manufacturing in India: Successful PLI Bids. Available at: <https://www.india-briefing.com/news/india-incentives-for-acc-battery-storage-manufacturing-pli-scheme-3-companies-get-approval-22349.html/>
31. India Climate and Energy Dashboard (ICED), NITI Aayog, Government of India. Available from: <https://iced.niti.gov.in/energy/electricity/generation>
32. Indian Infrastructure. 2021. Network Expansion: Key operational metro rail projects across India. Available at: <https://indianinfrastructure.com/2021/09/08/network-expansion-3/>
33. International Energy Agency (IEA). 2021. India Energy Outlook. Available from: [https://iea.blob.core.windows.net/assets/1de6d91e-e23f-4e02-b1fb-51fdd6283b22/India\\_Energy\\_Outlook\\_2021.pdf](https://iea.blob.core.windows.net/assets/1de6d91e-e23f-4e02-b1fb-51fdd6283b22/India_Energy_Outlook_2021.pdf)
34. International Finance Corporation (IFC). 2022. Green Buildings Market Intelligence: India Country Profile. Available at: <https://edgebuildings.com/wp-content/uploads/2022/04/India-Green-Building-Market-Intelligence.pdf>
35. International Finance Corporation (IFC). 2021. India Green building Market Maturity Snapshot 2020. Available at: <https://edgebuildings.com/wp-content/uploads/2023/11/IFC0077-2023-India-Green-Building-Market-Maturity-Sheet.pdf>
36. International Finance Corporation (IFC). 2017. Climate Investment Opportunities in South Asia - An IFC Analysis. Available at: <https://www.ifc.org/en/insights-reports/2017/final-climate-investment-opportunities-in-south-asia-an-ifc-analysis>
37. Invest India and SAREP. 2023. Investment landscape of Indian e-mobility market. Available at: <https://www.bharat-mobility.com/img/pdf/investment-opportunities.pdf>
38. Kapur, A., Irava, V., Pandey, S., & Ranjan, U. 2020. Study of State Finances 2020-21. Working Paper. Accountability Initiative, Centre for Policy Research. Available from: <http://accountabilityindia.in/publication/study-of-state-finances/>



39. Kompas, T., Pham, V. H., and Che, T. N. 2018. The effects of climate change on GDP by country and the global economic gains from complying with the Paris climate accord. *Earth's Future*, 6(8), 1153-1173.
40. Ministry of Housing and Urban Affairs (MoHUA), Government of India. 2021. National Mission on Sustainable Habitat 2021- 2030. Available at: <https://www.ies.gov.in/pdfs/NMSH-2021.pdf>
41. Ministry of New and Renewable Energy (MNRE). 2021. Production Linked Incentive (PLI) Scheme: National Programme on High-Efficiency Solar PV Modules. Available from: <https://mnre.gov.in/production-linked-incentive-pli/>
42. Ministry of New and Renewable Energy (MNRE). 2022. Year-End Review 2022 – Ministry of New and Renewable Energy. Available from: <https://pib.gov.in/PressReleasePage.aspx?PRID=1885147>
43. Ministry of New and Renewable Energy (MNRE). 2023. National Solar Mission Division. Office Memorandum. Available from: <https://cdnbbsr.s3waas.gov.in/s3716e1b8c6cd17b771da77391355749f3/uploads/2023/10/202310051580869443.pdf>
44. Ministry of New and Renewable Energy (MNRE). 2024. Development of Solar Parks and Ultra Mega Solar Power Projects. [accessed 2024 Oct 04]. Available from: <https://mnre.gov.in/development-of-solar-parks-and-ultra-mega-solar-power-projects/>
45. Ministry of Environment, Forest and Climate Change (MoEFCC). 2022. India's long-term low-carbon development strategy. Ministry of Environment, Forest and Climate Change, Government of India. Available at: [https://unfccc.int/sites/default/files/resource/India\\_LTLEDS.pdf](https://unfccc.int/sites/default/files/resource/India_LTLEDS.pdf)
46. Ministry of Environment, Forest and Climate Change (MoEFCC). 2021. India: Third Biennial Update Report to the United Nations Framework Convention on Climate Change. Ministry of Environment, Forest and Climate Change, Government of India. Available at: [https://unfccc.int/sites/default/files/resource/INDIA\\_%20BUR-3\\_20.02.2021\\_High.pdf](https://unfccc.int/sites/default/files/resource/INDIA_%20BUR-3_20.02.2021_High.pdf)
47. National Institute of Urban Affairs (NIUA). 2021. Blog: Energy & Climate Concerns in India's Buildings Sector. Climate Centre for Cities. Available at: <https://niua.in/c-cube/blog/content/energy-climate-concerns-india%E2%80%99s-buildings-sector>
48. NITI Aayog and Rocky Mountain Institute (RMI). 2019 India's Electric Mobility Transformation: Progress to date and future opportunities. Available at: <https://rmi.org/insight/indias-electric-mobility-transformation/>
49. NITI Aayog and Rocky Mountain Institute. 2021. Mobilising Finance for EVs in India: A Toolkit of Solutions to Mitigate Risks and Address Market Barriers. NITI Aayog, Delhi. Rocky Mountain Institute, Boulder, Colorado. Available at:
50. Overseas Development Institute (ODI). 2021. The costs of climate change in India. Available at: <https://odi.org/en/publications/the-costs-of-climate-change-in-india-a-review-of-the-climate-related-risks-facing-india-and-their-economic-and-social-costs/>.
51. Patel, P. and Patel, A. 2021. Use of sustainable green materials in construction of green buildings for sustainable development. *IOP Conf. Ser.: Earth Environ. Sci.* vol 785. Available at: <https://iopscience.iop.org/article/10.1088/1755-1315/785/1/012009>

52. Press Information Bureau (PIB). 2024. Union Budget 2024-25: India's Next Generation Reforms and Strategic Policies. Ministry of Finance. Government of India. Available at: <https://pib.gov.in/PressReleaseFramePage.aspx?PRID=2036499>
53. Press Information Bureau (PIB). 2023a. Increased allocation of funds under NDRF/SDRF. Government of India: New Delhi. August 2023. Available at: <https://pib.gov.in/PressReleasePage.aspx?PRID=1947134>
54. Press Information Bureau (PIB). 2023b. India achieves two targets of Nationally Determined Contribution well ahead of the time. Ministry of Environment Forest and Climate Change, Government of India. December 18. Available at: <https://pib.gov.in/PressReleaseFramePage.aspx?PRID=1987752>
55. Press Information Bureau (PIB). 2022a. India geared for Energy Transition and Climate Action. Ministry of Information and Broadcasting, Government of India. February 25. Available at: <https://static.pib.gov.in/WriteReadData/specificdocs/documents/2022/feb/doc202222519401.pdf#:~:text=The%20provisions%20relating%20to%20climate%20in%20the%20Union%20Budget>
56. Press Information Bureau (PIB). 2022b. Union Minister for Finance and Corporate Affairs Smt. Nirmala Sitharaman to launch Single Nodal Agency (SNA) Dashboard during the Iconic Week Celebrations of Azadi Ka Amrit Mahotsav celebrations of Ministry of Finance. Ministry of Finance, Government of India. June 6. Available at: <https://pib.gov.in/PressReleaseFramePage.aspx?PRID=1831645#:~:text=The%20SNA%20Dashboard%20forms%20part%20of%20a%20major%20public%20financial;%20https://economictimes.indiatimes.com/news/economy/policy/sna-dashboard-tracking-the-states-contribution-spending-under-css/articleshow/92045966.cms?from=mdr>
57. Press Information Bureau (PIB). 2022c. India has Taken Lead to raise the issue of Climate Finance at International Forums. Government of India: New Delhi. 28 July 2022. Available at: <https://pib.gov.in/PressReleasePage.aspx?PRID=1845822>
58. Press Information Bureau (PIB). 2021. Year-End- Review of Ministry of Heavy Industries - 2021. Ministry of Heavy Industries, Government of India. December 21. Available at: <https://pib.gov.in/pressreleasepage.aspx?prid=1784161>
59. Reserve Bank of India (RBI). 2024. Draft Disclosure framework on Climate-related Financial Risks, 2024. Available at: <https://www.fidcindia.org.in/wp-content/uploads/2019/06/RBI-DRAFT-CLIMATE-RELATED-FINANCIAL-RISKS-28-02-24.pdf>
60. Reserve Bank of India (RBI). 2023. Report on Currency and Finance 2022-23; Towards a Greener Cleaner India. Available at: <https://rbidocs.rbi.org.in/rdocs/Publications/PDFs/RCF03052023395FAF37181E40188BAD3AFA59BF3907.PDF>
61. Reserve Bank of India (RBI). 2022. TABLE 139: Exchange rate of the Indian Rupee vis-à-vis the SDR, US dollar, Pound Sterling, d. m. / Euro and Japanese Yen (Financial Year - Annual Average and End-year Rates). Available at: [https://rbidocs.rbi.org.in/rdocs/Publications/PDFs/139T\\_150920239F9F69A1FEF44CD59F7736A2B52A3BCE.PDF](https://rbidocs.rbi.org.in/rdocs/Publications/PDFs/139T_150920239F9F69A1FEF44CD59F7736A2B52A3BCE.PDF)
62. Shakti Sustainable Energy Foundation (SSEF). 2022. Climate Finance. Available at: <https://shaktifoundation.in/climate-finance/>

63. Takyar, S. 2023. Price trends: Solar and wind power costs and tariffs. RenewableWatch. April 25. Available from: <https://renewablewatch.in/2023/04/25/price-trends-solar-and-wind-power-costs-and-tariffs/>
64. United Nations Environment Programme (UNEP). 2016. Definitions and Concepts: Background Note. Inquiry Working Paper 16/13. United Nations Environment Program. Available at: <https://www.unep.org/resources/report/definitions-and-concepts-background-note-inquiry-working-paper-1613>
65. World Green Building Council. 2021. Blog: The growth of a greener India. Available at: <https://worldgbc.org/article/the-growth-of-a-greener-india/#:~:text=We%20have%20demonstrated%20that%20constructing,substantial%20reduction%20in%20operational%20costs.>

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