Report of the Sub-Committee for the Assessment of the Financial Requirements for Implementing India's Nationally Determined Contribution (NDC)

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Department of Economic Affairs, Ministry of Finance, Government of India
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CONTENTS

FOREWORD

On 4th June, 2016, the Executive Committee on Climate Change headed by Principal Secretary to the Hon'ble Prime Minister had issued a Notification for the constitution of Implementation Committee on India's Intended Nationally Determined Contribution (INDC) comprising of relevant Ministries and stakeholders. Under this Committee, Six Sub-Committees for specific areas of work including Sub-Committee on Finance were constituted.

The Sub Committee on Finance, in its functioning, received information/inputs from various Departments/Ministries of the Central and the State Governments and many other organizations. The purpose was to arrive at a range of numbers indicating finance requirements for implementation of NDC. Implementation of these wide-ranging goals forms a pivotal question for India. The vital need of an adequate flow of finance is followed by a careful estimation of the cost requirements to meet the NDC goals as well as by the identification of sources of funds to materialize those costs. It forms an essential pre-requisite for formulation of an effective, efficient and successful implementation strategy.

Amidst growing developmental challenges, India is sustainably managing its natural resources while adhering to the principle of sustainable production and consumption. India has proactively pursued actions on climate change and achieved a reduction in emission intensity of GDP by 21 per cent over the period 2005-2014. However, to fully implement our NDC in a timely manner, India requires enhanced new and additional financial, technological and capacity building support. New and additional financial and technological support to the developing countries is committed under the Paris Agreement needs to be operationalized.

While we were in the final stages of the Report, COVID 19 global Pandemic emerged necessitating a massive disruption of economy due to complete lockdown in March 2020 onwards and the nation is now focused on securing 1.3 billion population from health hazards and providing relief to the impacted population, especially the poor and vulnerable. The urgent need is to mobilize resources to stimulate the economy. Simultaneously, developing countries like India need to provide sharper focus on strengthening adaptation actions and solutions, be it, food systems, health care, water and sanitation and disaster management.

I give my immense thanks to my colleagues on the Sub-Committee for their fullest participation and support in preparing the Report, notwithstanding their heavy and busy commitments in their respective fields of work.

Chairperson, Sub-Committee and Secretary, Department of Economic Affairs

ACKNOWLEDGEMENTS

The writing of this Report has been a challenging task. It was made possible, however, by the sincere and untiring efforts of several experts and officials of the Departments/Ministries concerned. The Committee would like to express profound sense of gratitude to them for their valuable contribution. Several Government institutions provided sustained support, helped us in accessing data, as well as in discussing various issues.

The Sub- Committee appreciates the research work of the Indian Council for Research on International Economic Relations (ICRIER) team and their contribution was valuable for the work of this Report. We acknowledge the contribution from Forest Survey of India to the work of this Report. The assessment of cost to meet carbon sink target couldn't have been made possible without technical information series disseminated in the workshop organized by Forest Survey of India. We would also like to thank Indian Meteorological Department, Reserve Bank of India, Securities Exchange Board of India, Bureau of Energy Efficiency, Asian Development Bank for facilitating the data requirements under the study. We are grateful to the Indian Renewable Energy Development Agency Limited (IREDA), the National Bank for Agriculture and Rural Development (NABARD), the World Bank New Delhi office, the State Bank of India Mumbai head office, the District Rural Development Agency at Leh, the Defense Institute of High Altitude Research, Defense Research and Development Organisation (DRDO) at Leh, the Krishi Vigyan Kendra at Leh, the Ladakh Ecological Development and Environmental Group (LEDeG) for sharing information in their respective domains.

Last but not the least, the support extended by Climate Change Finance Unit, Department of Economic Affairs, Ministry of Finance for the smooth functioning of the Sub- Committee is also appreciated.

Chairperson, Sub-Committee for the Assessment of the Financial Requirements for Implementing India's Nationally Determined Contribution

ABBREVIATIONS

ABS:	Asset Backed Securitization
AD:	Accelerated Depreciation
ADB:	Asian Development Bank
AG:	Aspirational Goals
AIFs:	Alternate Investment Funds
BFSI:	Banking, Financial Services and Insurance
CAMPA:	Compensatory Afforestation Fund Management and Planning Authority
CEA:	Central Electricity Authority
CG:	Current Goals
CGE:	Competitive General Equilibrium
COP:	Conference of Parties
DRDO:	Defence Research and Development Organisation
EBA:	Expenditure Budget Analysis
ECB:	External Commercial Borrowing
ESG:	Environmental Social and Governance
FDI:	Foreign Direct Investment
FSI:	Forest Survey of India
FiT:	Feed-in -Tariffs
FPI:	Foreign Portfolio Investments
GBI:	Generation Based Incentives
GCF:	Green Climate Fund
GGEF:	Green Growth Equity Fund
GST:	Global Stocktake
IDFs:	Infrastructure Debt fund
IFCs:	International Finance Corporation

IMD:	Indian Meteorological Department
IMF:	International Monetary Fund
INDC:	Intended Nationally Determined Contribution
IREDA:	Indian Renewable Energy Development Agency Limited
KP:	Kyoto Protocol
LEDeG:	Ladakh Ecological Development and Environmental Group
LCR:	Low Carbon and Climate Resilient
MDBs:	Multilateral Development Banks
MIGA:	Multilateral Investment Guarantee Agency
MNRE:	Ministry of New and Renewable Energy
MSMEs:	Micro, Small and Medium Enterprises
NABARD:	National Bank for Agriculture and Rural Development
NBFCs:	Non-Banking Financial Companies
NCEF:	National Clean Environment Fund
NDC:	Nationally Determined Contribution
NEP:	National Electricity Plan
NIIFs:	National Investment and Infrastructure Fund
NVG:	National Voluntary Guidelines
PA:	Paris Agreement
PAT:	Perform Achieve and Trade
PE:	Private Equity
RDBs:	Rupee Denominated Bonds
RECs:	Renewable Energy Certificates
RPOs:	Renewable Purchase Obligations
SCBs:	Scheduled Commercial Banks
SDGs:	Sustainable Development Goals
SEBI:	Securities and Exchange Board of India

SERC: State Electricity Regulatory Commissions

TOF: Tree Outside Forest

ToR: Terms of Reference

UNFCCC: United Nations Framework Convention on Climate Change

VCF: Venture Capital Funds

CHAPTER 1: INTRODUCTION

1.1 In several occasions, Hon'ble Prime Minister of India, Shri Narendra Modi has highlighted India's large-scale efforts towards protecting the environment, cleaner development path and sustainable life styles. Considering the importance of issues and the implications in the context of nation's international commitment, the Executive Committee on Climate Change headed by Principal Secretary to the Prime Minister decided to constitute Intended Nationally Determined Contribution (INDC) implementation Committee comprising of relevant Ministries and stakeholders on 4th June, 2016. Subsequently, six Sub-Committees for specific areas of work including Sub-Committee on Finance were constituted.

1.2 The Sub-Committee on Finance on India's Nationally Determined Contribution (NDC) under the chairmanship of Additional Secretary, Department of Economic Affairs commenced its work formally on 3rd August, 2017. The mandate of the Committee has been to arrive at a range of numbers indicating finance requirements for NDC implementation. In February 2018, MoEF&CC had communicated that the work of other Sub-Committees was still in progress and the Sub-Committee on Finance may wait for the outcome of other Sub-Committees. In a meeting chaired by Secretary, Economic Affairs on 28.7.2018 to review the matter, it was decided that Sub-Committee on Finance be reconstituted, in the light of the emerging role of climate finance in the sustainable macro-economic management of the economy, with Secretary, Department of Economic Affairs as the Chair and with participation from relevant Ministries/Departments as well as experts. Accordingly, reconstitution of the Sub-committee on Finance was notified on 26th September 2018.

1.3 The Sub-Committee on Finance held five meetings - on 03.08.2017, 06.10.2017, 28.07.2018, 09.02.2019 and 15.05.2019. Apart from these meetings of the Sub-Committee on Finance, several members of the Committee also held discussions with multiple stakeholders at different points in time over the period August, 2017 to December, 2019.

1.4 Members' List

1.4.1. With a view to outlining a comprehensive agenda for the Assessment of the Financial Requirement for Implementing India's NDC which Government of India must keep in mind, it has been decided to set up a Sub-Committee on Finance to prepare a strategy for implementation of India's NDC with the following composition:

i. Secretary, Department of Economic Affairs - Chairperson
ii. Director General of Forests, MoEF&CC
iii. Joint Secretary (Climate Change), MoEF&CC
iv. Representative of NITI Aayog not below the rank of Joint Secretary
v. Representative of Ministry of Power not below the rank of Joint Secretary
vi. Representative of Ministry of New and Renewable Energy not below the rank of Joint Secretary

vii. Shri. J.M Mauskar, member of the Prime Minister's Council on Climate Change
viii. Shri. R.R. Rashmi, former Special Secretary, MoEF&CC
ix. Dr. Jagdish Kishwan, former DG, ICFRE and Chancellor FRI University
x. Shri. Dipak Dasgupta, Distinguished Fellow, TERI
xi. Dr. Rajat Kathuria, Director and Chief Executive, Indian Council for Research on International Economic Relations (ICRIER)
xii. Adviser (Climate Finance Unit), DEA- Member Secretary

1.5 Terms of Reference (ToR)

1.5.1 The Terms of Reference of the Sub-Committee are as follows:

i. To mobilize domestic and new & additional funds from developed countries to implement the mitigation and adaptation actions in view of the resource required and the resource gap.
ii. Suggest policies and actions needed to generate required resources and manage/ deploy them through appropriate mechanisms/agencies in achieving the goals of NDC.
iii. Mapping and detailing the existing and proposed policies and actions needed to generate required resources and deploy them through appropriate mechanisms to achieve the NDC goals.

1.5.2 The present Report attempts to address the requirement by providing preliminary numbers of cost for mitigation objectives in the NDCs, particularly those pertaining to energy and forestry sectors. It also discusses the approach to be adopted towards the estimation of adaptation numbers. Further, it provides an initial analysis of the available amount of finance coming in the country for climate relevant activities and discusses the various financial instruments available for climate finance mobilization.

1.6 Climate Finance and India's Challenges

1.6.1 The United Nations Framework Convention on Climate Change (UNFCCC) was adopted at the "Rio Earth Summit" in 1992. The UNFCCC mandates that Parties should protect the climate system for the benefit of present and future generations of humankind, on the basis of equity and in accordance with their common but differentiated responsibilities and respective capabilities. Accordingly, the developed country Parties should take the lead in combating climate change and the adverse effects thereof. It also recognized that the developed country Parties and other developed Parties included in Annex II to the Convention shall provide new and additional financial resources to meet the agreed full costs incurred by developing country Parties in advancing the implementation of existing commitments.

1.6.2 At the 15th session of the Conference of Parties (COP-15) in Copenhagen in 2009, climate finance was quantified for developing countries to scale up their mitigation actions and a flow of US$ 100 billion a year by 2020 by the developed countries was mooted. Further, it was decided to set up a dedicated Green Climate Fund (GCF) to provide support to developing countries by assisting them in mitigating climate change and adapting to its impacts. The COP-

17 at Durban in 2011 decided to launch a process to develop a protocol, another legal instrument or an agreed outcome with legal force under the Convention applicable to all Parties. The process was concluded at COP-21 in Paris in December 2015 in which a new Agreement in the shape of a treaty was adopted under UNFCCC to enhance the implementation of the Convention, including its objective. Even at the Paris Climate Conference in 2015, the wide gap between the promised annual climate finance flows of US$100 billion at Copenhagen and the actual climate finance received by developing countries was revealed through a Government of India's Discussion Paper. Analysis of the post Paris Agreement developments suggests a similar story that much more work needs to be done to meet the targets which are contingent on the momentum in international climate finance arena and the Scope, Scale and Speed of climate finance, as pointed out by another Government of India Discussion Paper in 2018. The details of evolution of finance in climate treaties may be seen at Government of India discussion paper "Climate Summit for Enhanced Action: A Financial Perspective from India".

1.6.3 As a measure of mutual reassurances between Parties, INDCs were submitted by different countries and formed one of the primary reasons for successful finalization of Paris Agreement in December, 2015. Hon'ble Prime Minister Narendra Modi stated that there is no better way to celebrate the birthday of Mahatma Gandhi, who lived a life of minimum carbon footprint. Hence, marking the birth anniversary of the Father of the Nation, India's Nationally Determined Contribution (NDC) submitted on October 2, 2015 outlines the post-2020 climate actions India intends to undertake under the Paris Agreement on climate change and India ratified the Paris Agreement on the same date in 2016.

1.6.4 NDC is the bedrock of India's climate actions post 2020. As regards the NDC, the national determination is equally important as commitment part of NDC. India has recognized that its path of development must be one which places adequate emphasis on all the three pillars of sustainable development, namely, economic, social and environmental. Therefore, as far as Indian NDC is concerned, it was not based on any temperature goal but was on a "best effort basis", keeping in mind the development imperatives of the country. India's NDC gives equal weightage to adaptation and mitigation. The country's approach can also be seen in the statement while depositing the instrument of ratification. India stated that- "The Government of India declares its understanding that, as per its national laws; keeping in view its development agenda, particularly the eradication of poverty and provision of basic needs for all its citizens, coupled with its commitment to following the low carbon path to progress, and on the assumption of unencumbered availability of cleaner sources of energy and technologies and financial resources from around the world; and based on a fair and ambitious assessment of global commitment to combating climate change, it is ratifying the Paris Agreement."

1.6.5 Emphasis on climate resilience holds a very important place in India's climate policy framework. Estimates show that around US$ 4.5 trillion worth of investments is required by India till 2040 to develop infrastructure to improve economic growth and community wellbeing. The current trend shows that India can meet around US$ 3.9 trillion infrastructure investment out of US$ 4.5 trillion. The cumulative figure for India's infrastructure investment gap would be around US$ 526 billion by 2040. The large proportion of climate finance flows

in India towards climate friendly investments and actions are from domestic Government budgets. Developing countries like India have myriad development challenges and Government of India has been steadfast in its attempts to achieve economic and social development objectives for its citizens.

1.6.6 Financing for climate actions is high on agenda. Since the inception of multilateral negotiations on climate change, finance played an important role as an enabling factor in ensuring collective efforts at addressing the global problem of climate change. Specifically, Article 4.4 of the UNFCCC mandates that the developed country Parties and other developed Parties included in Annex II shall also assist the developing country Parties that are particularly vulnerable to the adverse effects of climate change in meeting costs of adaptation to those adverse effects. Further, Article 4.5 mandates the developed country Parties and other developed Parties included in Annex II to take all practicable steps to promote, facilitate and finance, as appropriate, the transfer of, or access to, environmentally sound technologies and know-how to other Parties, particularly developing country Parties, to enable them to implement the provisions of the Convention. The Article 4.7 of the UNFCCC makes it very clear- "The extent to which developing country Parties will effectively implement their commitments under the Convention will depend on the effective implementation by developed country Parties of their commitments under the Convention related to financial resources and transfer of technology and will take fully into account that economic and social development and poverty eradication are the first and overriding priorities of the developing country Parties".

1.6.7 Developing countries in their discussions at the UNFCCC, continue to stress public grants and grant-equivalent public financing flows from developed countries as the predominant source, while allowing for some flows of private capital backed formally by concessionary public flows and terms – and counted by their grant equivalent terms. In reality, private sector is likely to invest in areas where returns are high and risks are low. Precisely for this reason, Article 9.3 of the Paris Agreement clearly noted the significant role of public finance. It is therefore essential to explore and finalize innovative instruments to supplement public finance such as interest subsidies, sovereign guarantees, and credit enhancement mechanisms. .

1.6.8 A great deal of stress is also being laid upon the inter-generational equity in regard to the emerging climate actions proposed to be taken by the present generation. However, the imperatives of the intra-generational equity, i.e. eradication of poverty and equitable social and economic development cannot be brushed aside. And for any kind of equity, availability of adequate climate finance to developing countries for their climate actions is essential. The present Scope, Scale and Speed of climate finance are insufficient as the climate finance requirements runs into trillions of Dollars. The much-discussed quantitative commitment is the goal of US$ 100 billion committed by developed countries at Copenhagen in 2009 is a meagre amount in size in contrast to the actual needs assessed for developing countries.

1.6.9 As we take stock of progress in the implementation of major global agreements, financing challenges have emerged as key bottlenecks. The 2019 Financing for Sustainable Development Report, has put forward a set of challenges like high debt risks, strained multilateral system

etc. This situation reconfirms the need for strengthening the existing multilateral regime. Financial innovations can generate progress across the 2030 agenda. New technologies and innovation can improve the functioning of markets. Financial technology (fintech) can enhance access to finance for millions of people. Blended finance, when well-managed, can contribute to strengthening development finance. New instruments strengthened sustainability reporting, and innovative policy solutions can enable a growing number of investors to pursue financial returns with positive sustainable development impact. But financial and sustainability risks do not disappear with innovative forms of financial intermediation— credit risk still needs to be managed, and new technologies give rise to new risks. Non-bank financial institutions and fintech companies are not always well positioned to manage these risks, and neither are regulators who have historically focused on traditional financial services providers. International cooperation is extremely important for financing the transition towards a sustainable global economy. In addition, a recently emerging theme is the incorporation of climate risk in financial decision making. It is also important to ensure that the risk perception of the developing countries is not elevated by incorporating climate disclosures and climate variables in risk management frameworks. The role of public sources of funding would continue to remain critical even for mobilizing and leveraging private capital as amount of public finance acts as a catalyst in attracting and leveraging private capital.

1.6.10 India will endeavor to do its best for its climate actions. The national circumstances demand that the first priority for India is adaptation, being a country highly vulnerable to extreme weather events. Climate change impacts are expected to worsen with the passage of time because of the momentum due to present carbon stock continuing to raise the temperature. Hence, India's adaptation needs will have to be intensified and so the adaptation costs will increase. India is doing adaptation in mission mode. India is doing the promised mitigation actions also in mission mode. However, finance still remains the critical issue as India is stepping up its targets majorly by relying on domestic budgetary resources. The developing countries should get their fair share in the atmospheric resource, respecting the principles of equity and common but differentiated responsibilities.

1.6.11 The constitutional imperatives of the country, people's aspirations, India's sectoral policies, overall macro-economic goals, the broad policy framework, put together, have a bearing on achievement of NDCs. India has strived to ensure that it follows a growth path that delivers sustainable development and protect the environment. India is investing in various schemes aligned with its NDC, like Clean India Mission, National Smart Grid Mission, Atal Mission for Rejuvenation and Urban Transformation, various energy efficiency programmes etc. India's strategies have emphasized on clean and efficient energy system, enhanced energy efficiency in industries, resilient urban infrastructure as well as safe, smart and sustainable green transportation network, planned afforestation and reforestation, renewable energy expansion programmes. Hence, the best effort basis of India's NDC is inherently taking into account the economic development imperatives. India's NDC clearly states – "keeping in view its development agenda, particularly the eradication of poverty coupled with its commitment to following the low carbon path to progress and being sanguine about the unencumbered availability of clean technologies and financial resource from around the world, India

communicates its INDC". It was developed envisaging the availability of international public finance for climate finance, based on the objectives of effective, cooperative and equitable global architecture based on climate justice and the principles of equity and common but differentiated responsibilities and respective capabilities. It also recognizes that poverty eradication is the overriding priority for India. Hence, the implementation of the climate targets is not exclusive of the global and national economic scenario.

1.6.12 The implementation of NDC effectively commences on 1.1.2021. While we are only some months away for implementation of NDC, COVID 19 global outbreak necessitated the country to go into a lockdown from March 2020 onwards as part of the national strategy and inflicted the economy. The primary focus now is on securing the 1.3 billion population from health hazards and providing relief to the impacted population especially the poor and vulnerable. Even Article 4.1 of the Paris Agreement clearly states that, "in order to achieve the long-term temperature goal set out in Article 2, Parties aim to reach global peaking of greenhouse gas emissions as soon as possible, recognizing that peaking will take longer for developing country Parties, and to undertake rapid reductions thereafter in accordance with best available science, so as to achieve a balance between anthropogenic emissions by sources and removals by sinks of greenhouse gases in the second half of this century, on the basis of equity, and in the context of sustainable development and efforts to eradicate poverty." So, developing countries like India have to reallocate scarce resources to restart their economies by reinvesting in public sector health services and providing financial assistance to impacted populations. It is too early to forecast the time and resources that India would be requiring to fight this global pandemic. The urgent need is to mobilize resources to stimulate the economy, which has been elaborated later in the Report.

CHAPTER 2: NDC AND ITS FINANCIAL IMPLICATIONS

2.1 India's NDC is as follows:

- *To put forward and further propagate a healthy and sustainable way of living based on traditions and values of conservation and moderation.*
- *To adopt a climate friendly and a cleaner path than the one followed hitherto by others at corresponding level of economic development.*
- *To reduce the emissions intensity of its GDP by 33 to 35 per cent by 2030 from 2005 level.*
- *To achieve about 40 per cent cumulative electric power installed capacity from non-fossil fuel-based energy resources by 2030 with the help of transfer of technology and low-cost international finance including from Green Climate Fund (GCF).*
- *To create an additional carbon sink of 2.5 to 3 billion tonnes of CO_2 equivalent through additional forest and tree cover by 2030.*
- *To better adapt to climate change by enhancing investments in development programmes in sectors vulnerable to climate change, particularly agriculture, water resources, Himalayan region, coastal regions, health and disaster management.*
- *To mobilize domestic and new & additional funds from developed countries to implement the above mitigation and adaptation actions in view of the resource required and the resource gap.*
- *To build capacities, create domestic framework and international architecture for quick diffusion of cutting-edge climate technology in India and for joint collaborative R&D for such future technologies.*

2.2 Estimation of Financial Requirements

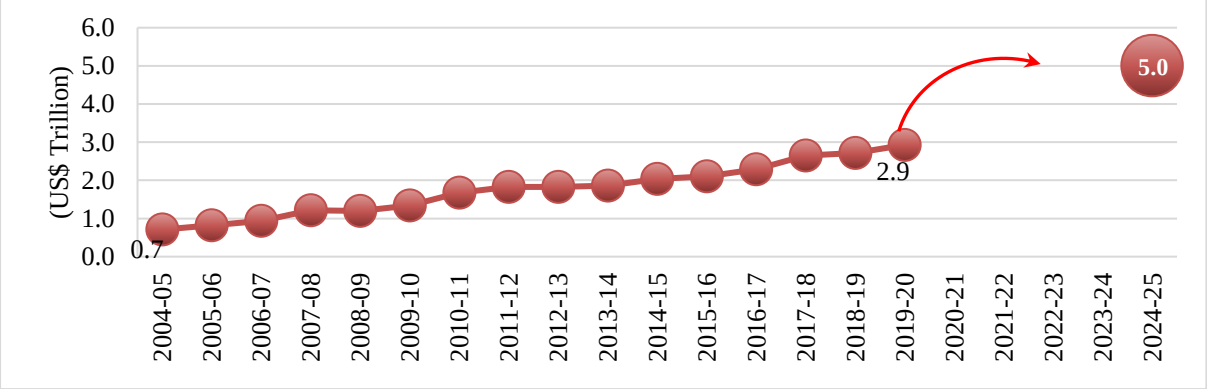
2.2.1 The preliminary financial estimates in NDC document indicate that India would need around US$ 206 billion (at 2014-15 prices) between 2015 and 2030 for implementing adaptation actions in key areas like agriculture, forestry, fisheries infrastructure, water resources and ecosystems. Apart from this, there will be additional investments needed for strengthening resilience and disaster management. NDC further provides the preliminary total estimates for meeting India's climate change actions between now and 2030 which is at US$ 2.5 trillion (at 2014-15 prices). India's NDC clearly states that finance is a critical enabler of climate change action. Hence, a careful estimation of the cost requirements for implementing the NDC and the possible sources for meeting these requirements is an essential pre-requisite. Keeping this in mind, a study has been carried out to address this requirement and the findings of this study provides details of range of numbers of cost for achieving the emission intensity and electricity generation capacity objectives, forestry target and adaptation goals, apart from providing the available amount of finance flows, gaps and discusses the possibility of various financial instruments for mobilization of resources. These are briefly stated as follows:

2.3 Emission Intensity and Generation Capacity

2.3.1 Two among the main quantitative targets in India's NDC are: a) to reduce the emissions intensity of its GDP by 33 to 35 per cent by 2030 from 2005 level and b) achieve about 40 per cent cumulative electric power installed capacity from non-fossil fuel-based energy resources by 2030 with the help of transfer of technology and low-cost international finance. In this regard, this study was conducted to understand the contours of these two targets, their implementation and the financial implications. In fact, there exist several past studies also that have tried to model energy demand and subsequently estimate costs that would be incurred to meet a particular target. There are other model based approaches. In February 2019, the Central Electricity Authority (CEA) had brought out "Draft *Report on Optimal Generation Capacity Mix for 2029-30*", which is briefly explained later in the subsequent chapter. In the present study, costs and emissions have been estimated by using the India Energy Security Scenario (IESS) 2047 tool, developed by NITI Aayog. The energy sector assessment uses the updated IESS V2.2, an energy accounting framework, published by NITI Aayog in 2015 with base year as 2012. The IESS-2047 tool has the capability to customize 17 different parameters across the six different broad energy consuming sectors of the economy. The methodology of the study is listed at Annexure 1.

2.3.2 India, despite its pressing development imperatives, has always accorded a prominent focus to the sustainability aspects in its accelerated economic growth. Hence with the twin action of balancing the NDC targets along with becoming a US$ 5 trillion economy by 2024-25, as laid down by the Hon'ble Prime Minister, India needs to achieve and sustain a real GDP growth rate of 8 per cent. International experience, especially from high-growth East Asian economies, suggests that such growth can only be sustained by a "virtuous cycle" of savings, investment and exports catalyzed and supported by a favorable demographic phase. Hence heeding to the infrastructure deficit represented by different indicators, the pressures of urbanization and industrialization with the imperative of sustainable growth through implementation of NDC targets India faces a formidable and complex challenge in working for economic progress. The Economic Survey 2019-2020 shows the required level of quantum leap that would be needed to achieve the $5 trillion Economy (Figure 1)

Figure 1: India's Goal for $5 trillion Economy



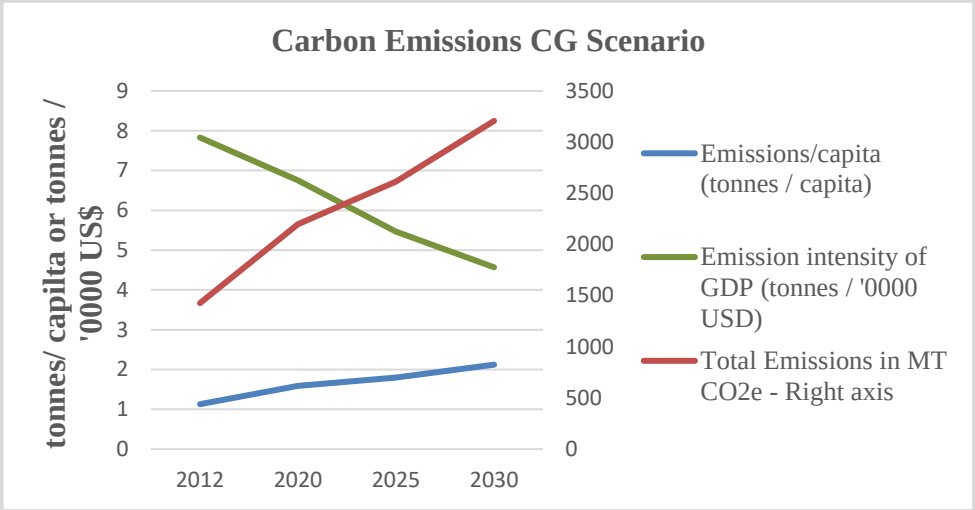
2.3.3 Juxtapose these imperatives with the NDC goals; a robust estimation of costs for the quantifiable mitigation goals is of essence. To estimate the costs for meeting our mitigation goals, scenarios, namely Current Goals (CG) and Aspirational Goals (AG) have been built. The CG scenario is based on the current policies of the Government and voluntary targets declared by the Government at national and international venues. The Business As Usual (BAU) represents the NDC targets whereas; the CG scenario incorporates the NDC target in addition to the other voluntary targets that have been set by the Indian Government at various national and international platforms. The aim was to build a scenario where each of the individual segments are weaved together to assess their impact on NDC target achievement. The National Electricity Plan (NEP) 2018 becomes an important resource for supply side sectors. The NEP 2018 provides projections for future addition of capacities of different technologies. Additionally, some sectors have also been updated to include independent voluntary targets announced by the Government. The CG scenario is built around these levels. For projections beyond declared voluntary targets, the same rate of change as the original IESS model has been used. This study models the AG scenario by incorporating bolder steps towards mitigation goals. All supply side sectors have been upgraded by an extra level above their CG levels. This scenario does not represent real world projections or expectations, but it does give us an insight into benefits of stepping up mitigation actions both in terms of emission reductions and cost-savings. Under the CG scenario, the model suggests a reduction of 58.9 per cent ~ 59 per cent emissions intensity of GDP in constant dollar terms by 2030 over the 2005 levels. For the AG scenario, the estimate is 60.66 per cent ~ 61 per cent. The model suggests a reduction of 49.15 per cent for BAU. It is worth mentioning here that the emission reduction under BAU surpasses the voluntary goal of 33-35 per cent reduction that India has set in its NDC. While the cumulative costs for CG and AG are lower as compared to BAU for 2030, the cumulative costs till 2022 are higher for both the scenarios. This indicates that for the initial years higher investments will be required that will translate into cost savings later on due to the operation of economies of scale.

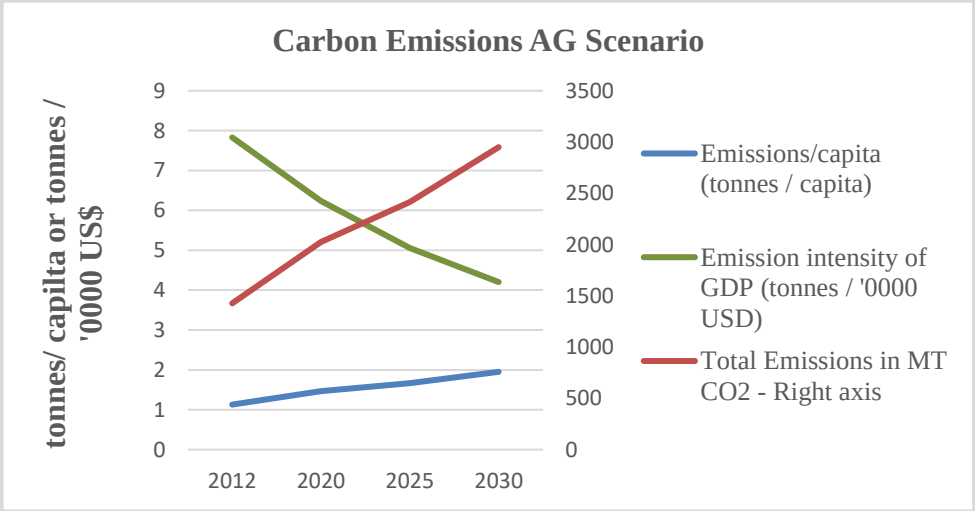
2.4 Emissions

2.4.1 The emission growth rate from energy and industry reveals a significant reduction with higher integration of renewables. Agriculture and Waste management sectors are considered to have constant emissions growth as per the past trends. Emissions calculated by the model focus on the Energy and Industrial Processes sectors. Due to the limitation of the IESS framework, steel and cement sectors have been used as proxies for the entire industrial sector. The general trend has been that if one adds the steel and cement sector emissions and calculates its ratio to the total emissions from the industrial sector, it comes to around 50 per cent. Thus, in order to account for the other industry sub sectors, emissions from Industrial Processes have been doubled.

2.4.2 The trends can be observed as per Figure 2.

Figure 2: Projected emissions trends under the CG and AG Scenario





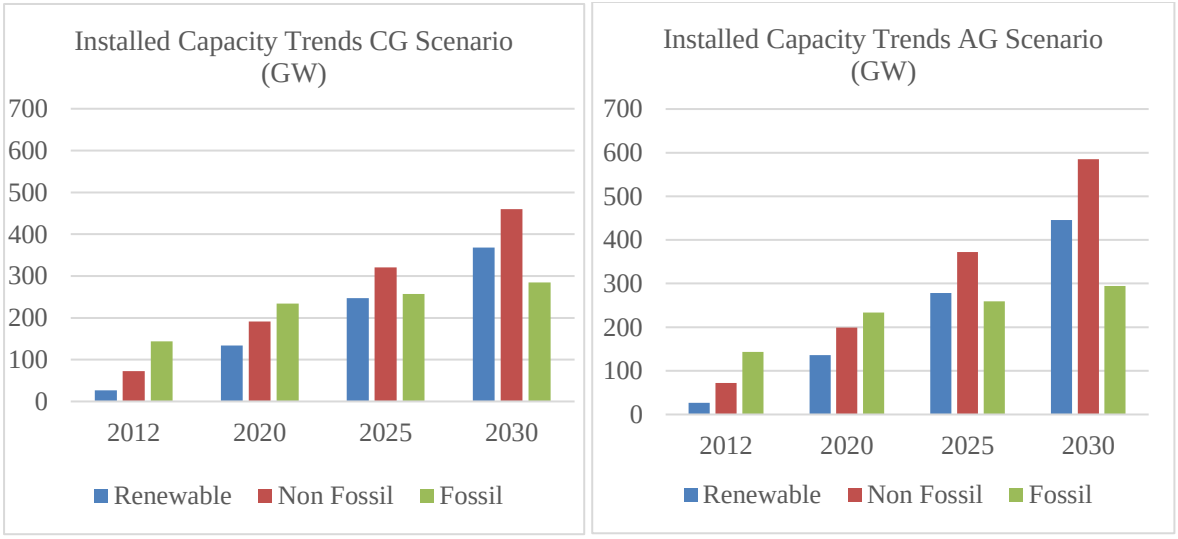
2.5 Installed Capacities

2.5.1 Fossil fuel sources account for only 38 per cent of the total installed capacity under CG. Their share reduces to 33 per cent under AG. This is due to a steep rise in renewables and other non-fossil sources like nuclear and hydro, in addition to stagnation of fossil fuel sources of power (Figure 3). An optimization exercise was conducted by CEA wherein an attempt was made to arrive at the optimal generation mix for meeting demand requirement in 2029-2030. The scenario that was built is comparable to the CG scenario in the present study. According to the results of the CEA study, the likely share of installed capacity by source in 2029-2030 will be as follows: solar (36.1%), wind (16.8%), hydro (8.8%), coal (32.1%), biomass (1.2%) nuclear (2%), gas (2.9%) i.e. fossil fuels contribute 35 per cent, renewable energy sources (RES) 54.1 per cent, hydro 8.8 per cent and nuclear 2 per cent. These numbers are comparable to those conducted in this study as well. The minute differences that exist could possibly be explained

by the inclusion of carbon capture and storage (CCS) and grid balancing under fossil fuels and waste to energy under RES in our analysis

2.5.2 It is important to note here that this report mentions the likely source wise breakup of **total primary energy supply (TPES)** 2030. TPES includes all sources of primary energy that a country has access to after accounting for exports, imports and energy that is extracted from resources. This cannot be compared to the source wise break of electricity generation in 2030 as provided by the CEA study. However, for the purpose of comparison and validity of results, the source wise breakup of the electricity generation under CG scenario in 2030 has been mentioned in **Annexure 2**.These results are in line with the numbers put forward by the CEA study where the breakup is as follows: fossil fuels (52%), RES (36%) and non-fossil fuels (48%)[coal (50%), solar(23%), wind(12%), hydro (8%), nuclear (4%), gas(2%) and biomass (1%).]

Figure 3: Projected Power Sector installed capacity in 2030 under the CG and AG Scenarios



2.5.3 The costs are evaluated based on the capital and operational cost of the technology options selected, based on both the demand and supply side factors. Financing costs have not been incorporated.

2.6 Results

2.6.1 The model results indicate a reduction in emissions intensity of GDP, in constant dollar terms, of approximately 59 per cent and 61 per cent for CG and AG scenarios respectively, by 2030 over the 2005 levels. The projected cumulative costs incurred in the case of CG were estimated to be approx.**₹ 263.44 trillion (₹26,344,000 Crores)**. The projected cost estimate for AG scenario is to the tune of approx.**₹ 261.73 trillion (₹26,173,000 Crores)** (Table 1). While the cumulative costs for CG and AG are lower as compared to BAU for 2030, the cumulative costs till 2022 are higher for both the scenarios. This indicates that for the initial years higher investments will be required that will translate into cost savings later on due to the operation of economies of scale.

Table 1: Projected Total cumulative cost (capital and operational) of sectoral changes under the CG, AG and BAU scenario (2018-2030) under High GDP Growth Rate

Sectors	CG Cumulative Cost Scenario	AG Cumulative Cost Scenario	BAU Cumulative Cost Scenario
Electricity	1469.11	1930.31	1245.46
Bio-energy	34.15	62.29	25.57
Transport	-62.81	-216.50	158.02
Industry	396.56	257.17	349.29
Buildings	538.33	565.90	447.19
Others	267.49	252.97	274.61
Fossil Fuels**	2851.74	2606.77	3391.15
Total US$ Billion	**5494.58***	**5458.91***	**5891.28**
Total ₹ Trillion@ US$ 2012	**263.44**	**261.73**	**282.48**
Total ₹ Trillion discounted @ 6%	**92.29**	**91.70**	**98.97**

*These are sectoral costs not necessarily additional cost with BAU

**The 2017 cost have been updated only where significant changes were reported, especially in the RE sectors. For the other sectors, the costs have been mostly in line with the original projections of IESS 2.2 and hence not been updated. Only credible capacity and cost reports from government agencies, State / Centre have been taken as reference. The sectoral costs for each of the scenarios have been provided under Annexure 3. These costs are in intervals of 5 years as IESS 2.0 analyses the trajectories in a 5-year cycle (2012, 2017, 2022 … 2047).

2.6.2 The calculations were also carried out for a lower GDP growth rate for the periods 2017-2022, 2022-2027 and 2027-2032. In the case of CG Scenario with lower GDP growth, the model suggests a reduction of 58.6 per cent emission intensity of GDP in constant dollar terms by 2030. A reduction of only 0.33 per cent lower than the CG Scenario with 8 per cent GDP growth was recorded. Similarly, under the AG Scenario, the model allows for a reduction of 60.22 per cent emission intensity of GDP in constant dollar terms by 2030. This forms a reduction of only 0.44 per cent from the estimate with higher GDP growth. The cumulative costs have been shown in Table 2. Given the current macroeconomic situation in the country, this growth rate scenario better represents the figure trajectory for India. The cost estimates generated by the IESS tool include not just the costs accruing from capacity installation but all expenses that will be incurred with the implementation of ambitious government targets across sectors such as housing, rural electrification, reduced oil imports and so on. It also includes annualized cost incidences for any changes in technology on the demand side sectors and energy savings (through energy efficient technology) on the supply side. Thus, given the interlinkages between sectors, the scenario costs represent systematic costs that include direct and indirect expenses that will be incurred due to any given change on the demand or supply side.

Table 2: Projected Total cumulative cost (capital and operational) of sectoral changes under the CG, AG and BAU scenario (2018-2030) under Medium GDP Growth Rate			
Sectors	**CG Cumulative Costs (2018-2030)**	**AG Cumulative Cost Scenario**	**BAU Cumulative Cost Scenario**
Electricity	1446.56	1912.48	1129.043
Bio-energy	34.15	62.29	25.56831
Transport	-87.46	-232.04	115.1282
Industry	369.00	236.28	326.1258
Buildings	465.04	488.96	386.2147
Others	261.70	248.10	273.5767
Fossil Fuels	2633.77	2407.63	3042.27
Total US$ Billion	**5122.76**	**5123.69**	**5297.927**
Total INR Trillion@ US$ 2012	**245.61**	**245.66**	**254.0091**
Total INR Trillion discounted @ 6%	**86.05**	**86.06**	**88.9905**

2.7 Forestry

2.7.1 Another quantitative target in India's NDC is "to create an additional carbon sink of 2.5 to 3 billion tons of CO_2 equivalent through additional forest and tree cover by 2030". The achievement of the target may entail conservation of existing forests, improving quality of existing forests and acquisition of land for creating additional forests. It is among the most ambitious targets on forestry in NDCs by any country. Indeed, the interpretation of the forestry target and defining the forestry target posed a difficult challenge, in particular about the inclusion or exclusion of the options for improvement in the density of existing forest and tree cover because of absence of the mention of a base year, and occurrence of word "additional" twice in the forestry target- once before 'carbon sink', and second before 'forest and tree cover'. The literal interpretation of the target communicated in the NDC will mean that the meeting of the target cannot include forest density improvement (conversion of open forest to moderately dense forest, moderately dense forest to very dense forest and so on). Hence the target may have to be achieved only by adding areas to the existing forest and tree cover majorly by afforestation outside forest area, thus by creating new forests and from sequestration of carbon in increased extent of trees outside forest (TOF) comprising urban forestry, agro forestry, avenue plantation – roads, state highways, national highways and so on including by railways. On the question of year (reference level), the target could have been set keeping reference level of 2005 by assuming that increase in demand of timber by 20 per cent and decrease in consumption of biomass/wood by 75 per cent by the year 2030 will contribute to the enhancement of the carbon sink. The increase in demand for timber will lead to more plantation (and carbon storage in end-use form – furniture, paneling, joinery and lumber, etc.) and decrease in demand of biomass/fuelwood will lead to conservation and enhancement of forest carbon stocks. The target included achievements of CAMPA activities (Compensatory Afforestation Funds), Green India Mission, National Afforestation Programme, Ganga Mission, National Green Highway Mission under National Highway Authority of India and

existing activities of State Forest Departments. But whether the forest enhancement through density improvement in existing forests will be counted toward the target or not remains uncertain.

2.7.2 Existing studies and Forest Survey of India's (FSI) assessment have included the conversion/enhancement of forests in their analysis. In this study report, the information provided in FSI's technical Report is used. The information provided in FSI's technical report is converted to CO_2 equivalent in tonne per hectare per year and costs per hectare per year (assuming 2018 current price). The methodology, assumptions, data and scenarios used are given in **Annexure 4**. The cost will vary greatly depending upon the availability of land for afforestation (Table 3).

Table 3: Cost calculations

	Target Definition	**Land required (in mha)**	**Cost per year in 2018 current prices (in ` Crores)**	**Cost per year in 2011-12 base year prices (in ` Crores)**
	Include forest enhancement options	15.06	4830	3574.34
	Exclude forest enhancement options	9.12	45850	33930.29
BAU	Including 1.9 billion tonnes of existing stocks	4.37	4400	3256.12

2.7.3 The estimates in this report at constant 2012 prices range from ₹ 35.74 billion (₹3,574.34 Crores) to ₹ 339.30 billion (₹33,930.29 Crores) per year depending upon the fact whether forestry improvement options are included or not. The cumulative cost estimates for forestry for the years 2020 and 2030 can easily be worked out at constant 2011-12 prices for any of the three options given in **Table 3** above. The Net Present Value of the cumulative costs for these years using a discount rate of 6 per cent can also be calculated for the three options.

2.7.4 It may be impractical to assume that all land and other resources will be available from the first year of implementation. At least a preparatory period of 2 years may be required to set up mega nurseries, plan movement of planting stock, upgrade monitoring mechanism, identify areas, lands, landscapes and forest areas for plantation and restoration, and mobilize Ministries, Departments, agencies and field staff before the field operations can be executed. Thus, this report also includes a scenario where an equal allocation of land in each forestry option over a period (till target is achieved) is planted. Assuming forestry enhancement options are excluded and FSI's data on land availability is used, it may take around 18 years, *i.e.*, 8 years beyond the present deadline of 2030, to achieve the forestry target.

2.7.5 NDC is the bedrock of India's climate actions post 2020. Keeping this in mind, the committee members pointed out that, perhaps, there is an ambiguity in the interpretation of forestry NDCs targets; therefore, the Government may need to clarify any doubt on the

interpretation of the forestry NDC target. If the text of the NDC is straightforward and unambiguous, the need for having three options for action given in **Table 3** above can be obviated, and only the correct relevant option can be included in the report. This may be done by elaborating and clarifying the text, which will not leave any space for ambiguity and different interpretations.

2.8 Adaptation Needs and financial implications

2.8.1 The NDC document states that the adaptation goal as "…to better adapt to climate change by enhancing investments in development programmes in sectors vulnerable to climate change, particularly agriculture, water resources, Himalayan region, coastal regions, health and disaster management." The NDC document furthermore states that India's expenditure on programmes with critical adaptation components has increased from 1.45 per cent of GDP in 2000-01 to 2.82 per cent during 2009-10. Expenditure on human capabilities and livelihoods viz. poverty alleviation, health improvement and disease control and risk management, constitutes more than 80 per cent of the total expenditure on adaptation in India. Recent assessment reports by the IPCC show the South Asian region to be highly vulnerable to the impacts of climate change. India, being a large part of this region is thus also at risk. There are looming threats of rising temperatures, extreme precipitation events and variable levels, etc. for the region. In fact, India's second biennial update report presented to the UNFCCC observes that "…out of the 36 States and Union Territories in the country, 27 are disaster prone. 12 per cent land is prone to flood and river erosion; of the around 7,500 km coastline, 5,700 km is prone to cyclones; 68 per cent of the cultivable land is vulnerable to drought; hilly areas are at risk from landslides and avalanches; and 15 per cent of the landmass is prone to landslides" (MoEF&CC, 2018). Climate adaptation or more specifically planned adaptation has a key role to play in determining how climate impacts manifest on the ground and how much damage they cause. Being a country highly vulnerable to extreme weather events, climate change impacts are expected to worsen with the passage of time because of the momentum due to present carbon stock continuing to raise the temperature. Hence, India's adaptation needs will have to be intensified.

2.8.2 Planned or anticipatory adaptation would include all Government policies and programmes that incorporate changing climate patterns in its design and attempt to improve resiliency of its people and environment through various strategies. Unplanned or autonomous adaptation is unpredictable in nature and would generally imply private costs being incurred in terms of unanticipated emergency responses or vulnerability reductions. For future estimates of the cost of climate change adaptation, the NDC document notifies a cost of US$ 206 billion (at 2014-15 prices) for implementing adaptation actions. The estimate refers to the timeframe of 2015 to 2030 and includes cost for adaptation action in agriculture, forestry, fisheries, infrastructure, water resources, health and ecosystems. Also mentioned in the NDC document is the damage cost estimate of 1.8 per cent of GDP for India by 2050. This has been taken from an Asian Development Bank (ADB) study of the South Asian Region. Using a Competitive General Equilibrium (CGE) model, the study estimated the impact on the sectors such as - agriculture, terrestrial ecosystems, water, marine and coastal resources, health, and energy.

2.8.3 As a starting point of adaptation financing assessment, the programme costs of policies that contribute to the achievement of various SDG goals was estimated and aggregated. For this, the mapping of Central Sector Schemes with the 17 SDGs by NITI Aayog in SDG India Index Baseline Report [NITI Aayog, 2018] was done. In particular, every scheme in the mapped document was picked up to match with the expenditure budgets of the concerned Department/Ministry to finally pick up the total 'Actual 2017-18' spending from the Union Budget 2019-20. For this analysis, however, full scheme amounts were included with no exclusions, in comparison to the expenditure budget analysis. The said analysis spanned over 46 Ministries/Departments, to arrive at an estimate of ₹ 660,372.03 Crores (or 3.86 per cent of GDP).

2.8.4 Specific SDGs were selected based on their contribution to improving resilience. Tabulating the total expenditure on such projects, a figure of ₹ 326,393.56 Crores (or 1.9 per cent of GDP) was arrived at. A recent report by the Task Force on National Infrastructure Pipeline under the Ministry of Finance, estimates that a total of ₹13,63,530 Crores would be spent on infrastructure in 2020-21. From the sectoral point of view, the coverage of the estimate is vast as it encompasses all facets of infrastructure- urban, rural, digital, social, agricultural as well as industrial. It goes on to calculate that given the current pipeline of projects, there would be a sharp increase in investments till 2022 and then a gradual tapering by FY2025. The annual expenditure in the last year of assessment, i.e. 2025-26 would be around ₹11,05,896 Crores**.** The estimation of future spending, literature on infrastructure needs assessment to calculate the expenditure required for adaptation till 2030 is borrowed. State level data for key SDG indicators, sectoral expenditure and other state variables such as SDP, population, urbanisation, etc. were used for the econometric analysis. The details are presented in Annexure 5.

2.9 Results

2.9.1 The financial needs for meeting these SDGs have been taken to represent the need for financing to 'adapt to climate change'. Table 4 provides the cumulative total expenditures, calculated at 2012 constant prices for 2020 and 2030. In addition, the present discounted values of these costs were also calculated.

Table 4: Cumulative Total Expenditure (in ₹ million)

Year	Cumulative Total Expenditure at 2011-12 prices	Discounted @ 6%
2020	28,947,942	19,912,504
2030	85,602,168	46,509,941

2.9.2 The cumulative costs in 2012 base prices was estimated to stand at approx. **₹ 85.6 trillion (₹8,560,000 Crores)** in 2030 for this sector.

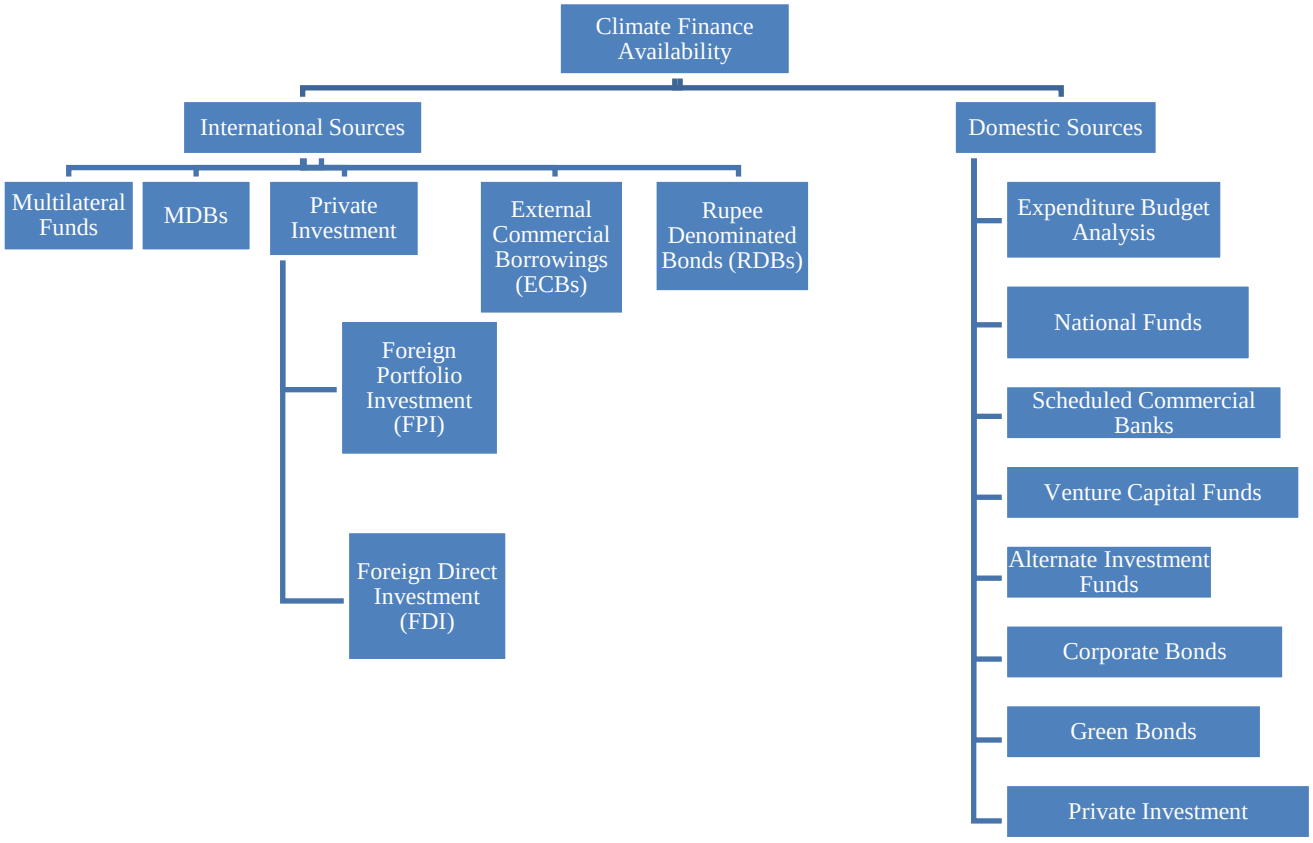
2.10 Currently Available Finance

2.10.1 To effectively and efficiently achieve NDC commitments, finance and technology are the two pivotal enablers. Climate finance forms an essential part of any climate change

deliberations. Various sources of financing have been an integral part of discussions to ensure an adequate availability of finance, particularly to the developing set of countries for effective management and implementation of climate action goals. In this regard, the report also undertook an availability assessment to understand the amount of climate relevant finance flows currently available in the country. This in turn would help to understand not just the currently available climate finance amount, but also assist to get an idea of the future provision of resources from these different sources.

2.10.2 Figure 4 illustrates the different sources that have been looked at in the study for the availability analysis. For international sources, the study covers multilateral funds, multilateral development banks (MDBs), external commercial borrowings (ECBs), rupee denominated bonds (RDBs), foreign direct investment (FDI) and foreign portfolio assessment (FPI). On the other hand, the coverage of domestic sources includes expenditure budget analysis (EBA), national funds, scheduled commercial banks (SCBs), non-banking financial company (NBFC), venture capital funds (VCFs), alternate investment funds (AIFs), corporate bonds, green bonds and domestic private investments.

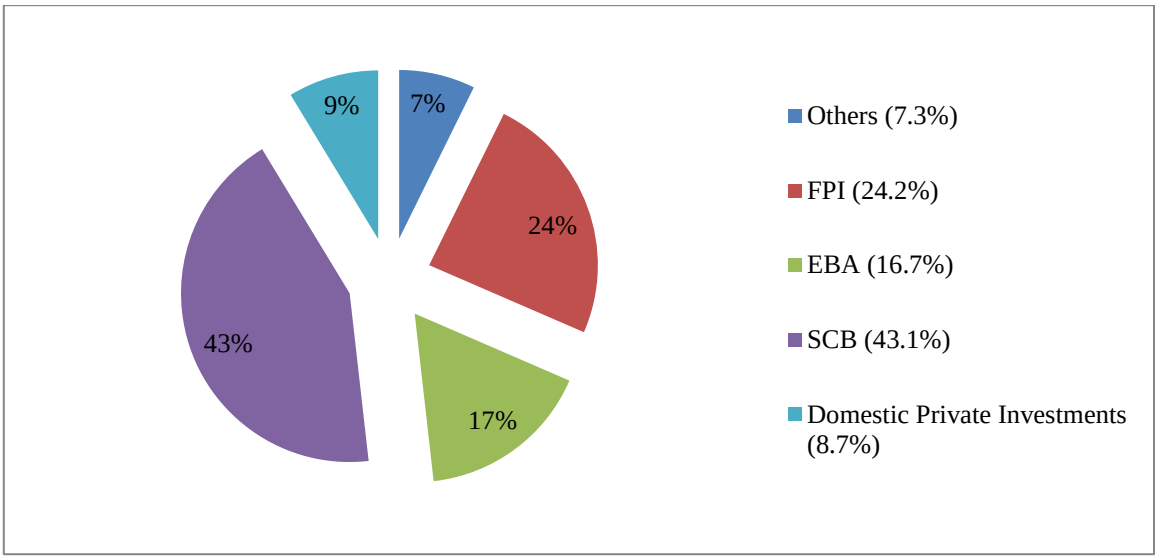
Figure 4: Climate relevant finance availability assessment: Coverage



2.10.3 As per the revised availability numbers at constant 2011-12 prices, the analysis shows the total finance availability is estimated to stand at ₹ 29.064 trillion (₹2,906,425 Crores), with the share of international and domestic finance at ₹ 9.026 trillion (₹902,652 Crores) and ₹ 20.037 trillion (₹2,003,773 Crores), respectively. As can be observed, the domestic spending on climate-oriented expenditure is much higher than the 'approved' finance coming in from most of the international sources. It needs to be mentioned that this total estimate included the individual estimates of multilateral funds, MDB finance from the joint MDB reports, ECB, RDB, FDI, FPI, expenditure budget analysis, national funds, Scheduled Commercial Banks (SCBs), green bonds, and domestic private investments only. The estimates for NBFCs, VCFs, AIF, and corporate bonds were not included as a part of this total estimate due to the difficulty of fixing climate relevance. They were instead utilized to establish growth rates to predict the future pattern of possible climate finance originating from these sources.

2.10.4 Figure 5 highlights the source wise share of the total availability estimate. As can be observed, the major shares are formed by credit outstanding to climate-oriented sectors by the SCBs, FPI asset under custody, EBA and domestic private sector investments. Credit outstanding by scheduled commercial banks in turn forms the gigantic share of the pie, highlighting the crucial role of the banking sector in the climate finance landscape. Again, it is vital to note that among the major shareholders the domestic sector sources hold a higher share. This highlights the high dependence on domestic resources along with the vital need to lay stress on increasing the international share of climate finance.

Figure 5: Total Availability Assessment: Source wise share (%)



Note: 'Others' includes the following sources, Multilateral Funds; MDB; ECB; RDB; FDI; National Funds; Green Bonds.

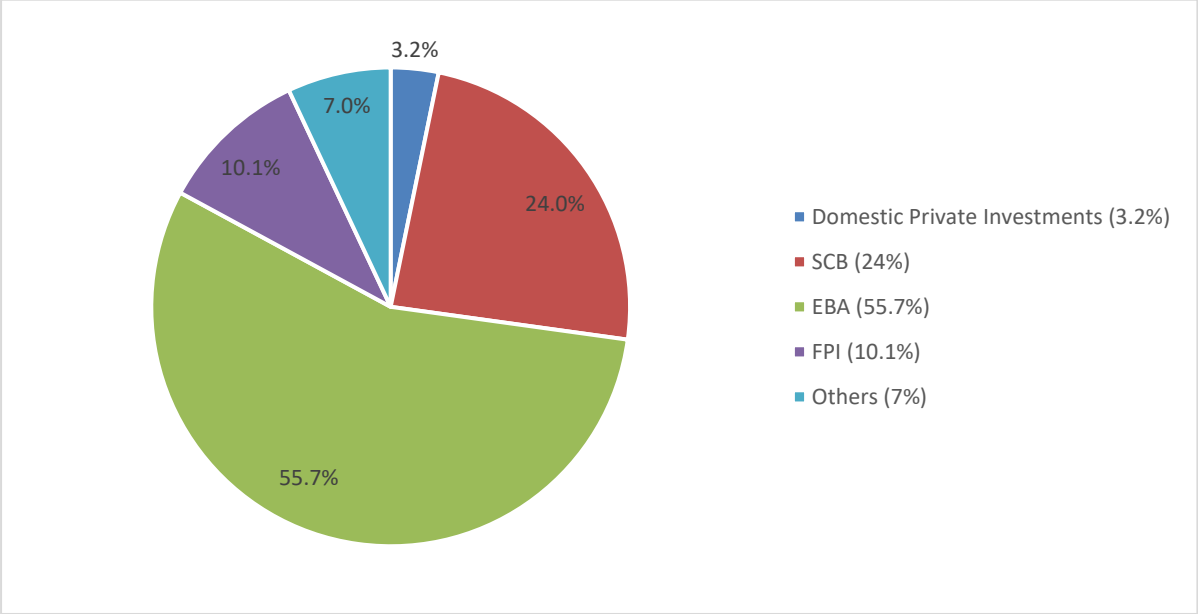
2.11 Future Predictability

2.11.1 The total availability numbers were further utilized to make an attempt to forecast the future availability of climate finance. As the availability assessment numbers were spread across years, the total numbers were averaged down to obtain an annual estimate for 2011-12.

The year 2011-12 was chosen to represent the annual average year as it forms the base year of calculations. This average estimate stands at**₹ 8711.47 billion**. This in turn makes a **6.6 per cent share of 2017-18 GDP at current market prices**. The GDP estimate used here was also deflated to the 2011-12 base as the average estimate has been obtained using numbers at 2011-12 constant prices.

2.11.2 Similar to Figure 5 for total availability, the source-wise contribution of annual availability has also been computed. It should be noted that the total availability figure was calculated from various sources with data pertaining to multiple years. For example, while data collated from the budget expenditure analysis was an annual figure, the data for credit outstanding by SCBs was for six years. Thus, the source-wise contribution of annual availability gives a more accurate estimate of climate finance available at any given point of time. Figure 6 presents the details of these aforementioned contributions. It can be clearly seen here that government budget is the single largest source of climate finance for India.

Figure 6: Annual Availability Assessment: Source wise share (%)



Note: 'Others' includes the following sources, Multilateral Funds; MDB; ECB; RDB; FDI; National Funds; Green Bonds.

2.12 Gap Assessment

2.12.1 The allocation of public finances has been observed to follow an increasing rate over the years and with climate change gaining larger traction, future allocations and priorities could translate to a higher available amount. This could translate to higher pressure on the banking sector to increase their sustainable lending. Given the majority of current availability of climate finance stems from domestic sources, the available share in the future can be expected to grow from the public sector side. An increase in public financing, in turn, serves as a catalyst for private investors to diversify risks and enter the climate change arena. Further with an increasing stress on sustainable responsibilities and priorities in the corporate sector, the role of private sector can be expected to go up. International flows from MDBs, FDI, FPI etc. are

known to be greatly influenced by GDP growth rates and general macroeconomic environment in the country and thus can be expected to direct greater finance flows in the future.

2.12.2 The IESS 2047 tool that was used to estimate the costs for the energy sector uses 2012 as the base year. For the purpose of maintaining internal consistency across mitigation, forestry and adaptation sectors, it was required that all cost and availability numbers be calculated at the same base year prices. Given the variability in the data on finance availability numbers, all availability estimates were converted from their respective years to base year prices of 2012. On this basis, future finance availability is assumed to grow at the estimated share of the current finance availability of GDP, i.e. at 6.6 per cent. The estimates for 2020 and 2030 for medium/low growth scenario are picked up to be utilized as cumulative finance availability numbers for the gap assessment. Further, to obtain their present values in accordance to base year 2012, these estimates were discounted at the rate of 6 per cent. The discounted numbers are utilized for the gap assessment, which are presented in Table 5.

Table 5: Cumulative Finance Availability Estimates

Year	Amount (₹ billion)	Discounted Present Value @ 6% (₹ billion)
2020	35995.48	22584.01
2030	182668.56	63996.79

2.12.3 Similarly, the estimated cumulative costs under the three sectors, namely energy, adaptation and forestry have been utilized for the gap assessment. After converting the data across all sectors to a common base year, the cumulative cost estimates for energy, forestry and adaptation sectors was summed up for the years of 2020 and 2030, and the sum was then discounted at the rate of 6 per cent to arrive at their present values in 2012. The discounted numbers are utilized for the gap assessment. These can be seen in Table 6.

Table 6: Cumulative Costs

Year	Sector	Amount (₹ billion at 2011-12 prices)	Discounted Present Value @ 6% (₹ billion)
2020	Energy	64015.57	
	Adaptation	28947.94	
	Forestry	573.25	
	Total	**93536.76**	**58686.12**
2030	Energy	245610.82	
	Adaptation	85602.17	
	Forestry	7555.83	
	Total	**338768.82**	**118685.55**

2.12.4 Here, the energy cost represents the base changed cumulative cost under the 'current goals' scenario for medium/low growth rate of GDP. The *current goals* scenario was chosen over the *aspirational goal* scenario with a view that it is crucial to first understand the extent

of financing gaps which will need to be facilitated under the current stream of work, with the additional measures coming in at later stages. The forestry estimate represents the base changed cumulative costs under case 8, as discussed to be a viable choice under the forestry section. Finally, the adaptation cost represents the base changed cumulative evaluation for the total expenditure in the particular years under assessment here. Given the variability in the data on finance availability numbers, all availability estimates were converted from their respective years to base year prices of 2012. The total availability numbers were further utilized to forecast the future availability of climate finance. As the availability assessment numbers were spread across years, the total numbers were averaged down to obtain an annual estimate for 2011-12. The year 2011-12 was chosen to represent the annual average year as it forms the base year of calculations. This average estimate stands at ₹ 8711.47 billion. This, in turn, makes a 6.6 per cent share of 2017-18 GDP at 2011-12 constant prices. The GDP numbers are then extrapolated to obtain annual estimates from 2017-2030. Keeping finance availability fixed at 6.6 per cent, the share of finance available for each year is then estimated, to eventually calculate the cumulative finance availability shares for the years 2020 and 2030.With both, the estimated cumulative finance availability as well as the cumulative cost the gap between the two is obtained to stand at ₹ 36102.11 billion or about US$ 752.99 billion in 2020 and ₹ 54688.76 billion or about US$ 1140.66 billion in 2030.

CHAPTER 3: POSSIBLE OPTIONS FOR GAP COVERAGE: EXPLORING FINANCIAL INSTRUMENTS

3.1 The analysis in the above sections points out that availability of finance is the key pillar in enabling climate actions. This brings to the forefront the understanding of 3 essential "S" s of climate finance- Scope, Scale and Speed for global cooperative action on climate change. The gap estimates highlight the huge amount of finance that needs to be mobilized from both domestic and international sources. For a developing country, the amount of developmental expenditure will also seek an increase in the share of total domestic expenditure thereby increasing pressure on the available domestic sources of finance. The Paris Agreement will have to be implemented by the international community reflecting equity and the principle of Common but Differentiated Responsibilities. India has recognised its responsibility towards implementing climate actions while improving efficiency of the economy and its engines of growth. Increasing climate finance will invariably mean enhanced international cooperation. Global action on climate change can only be ensured through a timely and adequate amount of international public climate finance availability, sourced from efficient and innovative instruments by developed countries, and urgently address the gross finance gap which exists for successful implementation of NDCs.

3.2 Private sector investments, in particular, have been known to form a smaller share of the total finance flowing in. One of the key reasons is the high investment risks both, real and perceived. These risks serve as barriers to the entry of new investors, or sometimes even serve as hindrance for innovative mechanisms to set in place. In order to obtain adequate financing, climate change projects need to attract typically two classes of investors, namely commercial and institutional investors. The two types of investors in turn have different appetite of risks. The commercial investors like banks, private equity firms etc. generally have shorter time horizons and are willing to invest in projects with comparably more risk with high tenures. On the other hand, institutional investors like insurance companies, pensions, hedge funds etc. have a lower risk profile and thus prefer projects with stable long-term cash flows to match to the long-term liabilities.

3.3 With different type of risks and different risk appetites of investors in the market for finance, various sets or combination of financial instruments are required to combat the challenges they put across to the investors. There is a need to not only recognize the existing set of instruments and examine their applicability and availability but also identify newer and innovative mechanisms that could be introduced in the climate financing arena. Traditional financial instruments include concessional and non-concessional loans, grants and energy trading. However, there is a need to explore new categories of financial instruments such as Debt Swaps, Credit Enhancements, Insurance, Green Bonds, Sovereign Bonds, Rupee Denominated Bonds, Municipal Bonds, Corporate Bonds, Priority Sector Lending, Green Banks, Infrastructure Debt fund (IDFs), Crowd Funding, Asset Backed Securitization (ABS), Blended Financing and Venture Capital. These categories of financial instruments are explained in Annexure 6.

3.4 A few instruments that have been in operation over the years and can therefore be grouped under the category of financially viable investments, in particular, energy, forestry and adaptation sectors. These instruments can help in devising an effective mechanism for raising climate relevant finance in the different sustainable sectors, which are briefly stated below:

3.4.1 Renewable Energy Certificates (REC)

RECs were identified to help states in meeting their respective Renewable Purchase Obligations (RPO), by bridging the gap between renewable energy availability and the requirements that certain entities had to fulfill in order to meet their RPOs. The rise in the number of registered projects, transactions, value of RECs etc., has proven to be a positive signal for attracting further investments in this sector. Through this market-based instrument, renewable energy generators have the option of selling the power generated locally to DISCOMs or open access consumers. As of 31st March 2018, about 905 renewable energy generators have been registered, having a capacity of 3948 MW. Transactions to the tune of Rs. 6000 crores have been carried out via Power Exchanges.

3.4.2 Perform Achieve Trade (PAT)

It aimed at accelerating and incentivizing energy efficiency in the industrial sector. Certified energy savings can be traded through this market-based mechanism. With the completion of the first PAT cycle in 2015, energy savings of 8.67 Mtoe were made (30 per cent more than the target of 6.88 Mtoe). The cycle helped in reducing 31 million tonnes of CO_2 and contributed towards avoiding 5635 MW of generation. At present, PAT III is in force and a target of energy savings to the tune of 1.06 Mtoe has been set, to be achieved at the end of this cycle in 2019-20.

3.4.3 The Clean Environment Cess

In 2010, the Government had launched the National Clean Energy Fund (NCEF) (now known as National Environment Fund), whereby it introduced a clean energy cess in the country. The cess, renamed as the Clean Environment Cess in 2016 is a central Government-level excise tax on all domestic and imported coal, lignite, and peat. The tax rate has been gradually increasing and has had the following structure, as demonstrated in table 7. The cess has supported numerous objectives such as financing and promotion of clean energy technologies, funding of clean energy and environmental research, reducing the dependence on fossil fuels etc. However, with the introduction of Goods and Services Tax (GST) in 2017, the environment cess like many other cesses, was subsumed under the GST. It thus does not hold a separate identity now, but included under the GST rates.

Table 7: Tax Structure of Clean Environment Cess

	Rate (in ` per tCO_{2e})
2010	` 50/metric tonne of coal
2014	` 100/metric tonne of coal
2015	` 200/metric tonne of coal
2016	` 400/ metric tonne of coal

3.4.4 Excise duty on Petrol and Diesel

An implicit carbon tax, in the form of an excise duty on petrol and diesel has been effective in India. In 2014, with the prices of crude oil coming down, the subsidies on petroleum products were removed by the country and the said duty was put into place. The measure stood out, as India moved from a carbon subsidization regime to one of significant carbon taxation regime—from a negative price to a positive price on carbon emissions. India has made petrol and diesel subject to high level of taxes in the form of excise duties and value added taxes. The tax rate on fossil fuels has been gradually increasing over the years.

3.4.5 Accelerated Depreciation (AD)

Accelerated Depreciation (AD) was introduced in 1994 with applicability across all renewable energy technologies. While maintaining accounts, depreciation is deducted before the taxable profits are calculated, thereby reducing the tax burden on the entity in question. AD augments depreciation on assets during the early years of an asset's life and provides the owner an avenue to reduce the proportion of taxable income. Being a tax saving instrument, AD is not a mechanism that provides financial assistance, rather, it offers post tax benefits to the investor. In addition, the Government does not incur any direct costs for this scheme, except the indirect costs in terms of tax revenue forgone during the initial project years.

3.4.6 Generation Based Incentives (GBI)

For wind energy, power producers not availing accelerated depreciation are eligible to receive ₹ 0.50 per unit of electricity supplied to the grid, with a cap of ₹ 1 Crores per MW, for a period of 4 months up to a maximum of 10 years. The GBI scheme was also extended to solar energy projects. The scheme had been discontinued in 2017, however, GBI is being provided to projects that have been commissioned prior to 31st March 2017. As of April 2017, disbursements of ` 805.56 Crores were made in this sector. The scheme had been discontinued in 2017, however, GBI is being provided to projects that have been commissioned prior to 31st March 2017.

3.4.7 Feed in Tariffs (FiT)

Feed in Tariff is an instrument that was designed to facilitate acceleration in investment in the renewable energy sector. The provision allows a producer to sell electricity generated from renewables, in exchange for guaranteed returns at pre-determined prices, thereby sheltering producers from inherent risks. FiTs help in reducing revenue risks related to investments in renewable energy. The tariffs are set by the respective State Electricity Regulatory Commissions (SERC) for different renewable sources. Solar tariffs in the country have reduced from ` 10.95 kWh in 2010 to ` 4.34. kWh in 2016. A similar decline has also been witnessed in the case of wind energy with the tariff reaching ` 2.43 per kWh in 2017. The decline in case of both solar and wind tariffs has been largely driven by the declining cost of equipment and the introduction of the competitive bidding paradigm that has increasingly replaced Feed in Tariffs (FiTs). While solar power has had a longer track record under competitive bidding, it was introduced for wind energy only in 2017.

3.4.8 Private Equity

The National Investment and Infrastructure Fund of India (NIIF), in partnership with the Government of United Kingdom, launched the Green Growth Equity Fund (GGEF) in 2018. It is an investment fund that is registered with SEBI. The Indian and UK Governments plan to initially invest £120 million each. GGEF is directed towards raising funds through international investors for the purpose of investing in clean energy, transportation etc. Proceeds from the fund are expected to be invested in renewable energy, clean technologies like electric mobility, waste management etc.

3.4.9 Credit Enhancement

Credit Enhancement Guarantee Scheme was launched by IREDA in 2017 for supporting the issuances of green bonds. The aim was to ease the way for renewable energy companies for refinancing their debt. In addition, the scheme also sought to attract additional investors to widen the bond market through improved bond ratings. It also acts as a partial credit guarantee up to 25 per cent of the issue, that can be availed after payment of a certain amount as fees, by grid connected wind and solar project developers.

3.4.10 Partial Risk Guarantee Fund

The rules pertaining to Partial Risk Guarantee Fund for Energy Efficiency were introduced by Bureau of Energy Efficiency in 2016, with the aim of creating bankable energy efficient projects. The Fund represents a risk sharing mechanism, which partially covers the risks associated with the project. The initial coverage of the Fund was limited to Government buildings and municipalities, and later was extended to MSMEs as well. As a part of a Word Bank initiative, Small Industries and Development Bank of India (SIDBI) launched a scheme for providing partial guarantees to energy efficiency projects, of 75 per cent of the loan amount, with a cap of ₹ 15 Crores.

However, there are some sectors that are in need of investments that may be financially unviable at present and therefore require monetary assistance. The Micro, Small and Medium Enterprises (MSMEs) exhibit a strong potential to contribute towards a low carbon pathway. However, the sector is relatively less energy efficient due to the limited financial support that they receive. The cost of batteries for storing electricity is extremely high at present. Thus, generating electricity via solar plants with battery backup, will raise the cost of generation. (Kuldeep, et, al 2016). Given the intermittent nature of renewables and the need to shift away from fossil fuel sources, storage of electricity becomes crucial. Funds to acquire such storage batteries may be provided via provisioning of concessional loans.

3.4.10 Some financial instruments to meet the forestry target may include the following (Table 8):

Table 8: Financial Instruments for Forestry				
Instrument	**Type/Modality**	**Viability – Remarks**	**Financial Support Requirement**	**Policies and Programmes**
Finance Commission	Devolution of Funds from Centre to State – Linked to performance	Viable in short term – In long term it will increase burden on central Government	From public accounts. Needs support in form of market-based mechanism such as payment for ecosystem services	Programmes and framework to promote full cost pricing to include services provided by natural resources such as forests.
CAMPA	Polluter's pay principle - Ecotax	Viable at present – The achievement of target inherently depends on the conservation of existing forests. Increasing volume of CAMPA funds signifies increasing forest land diversion. Thus, a constant flow of the fund will be contradictory to the objective of financing initiatives to meet target.	None	It is important to earmark the fund as special fund for compensatory afforestation.
Green India Mission, National Afforestation Programme, Namami Gange, MNREGA and other Government initiatives	Public finance	Viable	None	Better convergence with other related schemes and clear mechanisms for regular monitoring, reporting and verifying (MRV) of targets.
REDD+ (Green Climate Fund)	Performance linked grant – International	Viable	None	Mechanism to ensure benefit of community is needed. Lack of clarity over identification of beneficiaries

Funds for plantation in agencies – Railways, National Highway Authority of India, CSR and private sector engagement	Public funds and private funds	Unviable due to low volume and uncertainty of regular flow of funds	Public private partnership to fulfill mutual environmental regulation may ensure regular flow of funds	The focus should be on forest ecosystem instead of plantation. It is possible that injudicious plantation may end up exacerbating the environment and ecosystems.
Performance trading:	Public funds from one State Government to another	Unviable due to lack of clarity on apportioning of target among States and unavailability of trading platform or market	Unclear	It is important to apportion target among States at the earliest and explore innovative options such as performance trading between States.

3.5 Instruments for Adaptation Sector

3.5.1 In terms of sources, Government and other domestic institutions were the main providers of adaptation finance. Governmental programme-based grants are the most important source for adaptation. The current risk and return profiles of many of the social sector projects dictates them being taken up by Government finances. While such projects might not find private takers, once set up these projects will lead to considerable positive externalities that might crowd-in private investment later in projects down the supply chain. As climate induced variability in temperature and precipitation patterns as well as natural disasters will play havoc with how infrastructure and other assets perform, such tools would help counter these impending impacts. Some of the innovative instruments that are being discussed are:

- Risk transfer and risk pooling including index-based systems.
- Catastrophe risk insurance
- Climate bonds – debt instruments to raise finance for risk reduction and adaptation projects. However, needs more efforts towards certification and standardization so that the investor is informed and protected.
- Catastrophe bonds – to provide immediate liquidity after disaster contingent on the country maintaining a satisfactory disaster risk management programme

3.6 Carbon Market Instruments: Voluntary Carbon Trading Platform

3.6.1 Carbon pricing is essentially an instrument that ties the external costs of greenhouse gas (GHG) emissions, i.e. the cost of emissions that the public pays for, such as damage to crops, health care costs etc., to their sources through a pricing mechanism, usually in the form of a price on the carbon dioxide (CO_2) emitted. It has gained worldwide popularity as a method to implement the 'polluters pay principle'. There are two main types of prevalent carbon pricing mechanisms:

a) Emission Trading Systems (ETS) –This is further classified into two types:

- Cap-and-trade system that caps the total level of GHG emissions and allows those industries with low emissions to sell their extra allowances to larger emitters. Such a supply and demand system for emission allowances establishes a market price for GHG emissions.
- Baseline-and-credit systems where baseline emissions levels are defined for individual regulated entities and credits are issued to entities that have reduced their emissions below this level. These credits can be sold to other entities exceeding their baseline emission levels.

b) Carbon tax – A carbon tax, on the other hand, directly sets a price on carbon by defining a tax rate on the carbon content of fossil fuels i.e. a price per ton of carbon dioxide equivalent (tCO2e). It is different from an ETS as the emission reduction outcome of a carbon tax is not pre-defined, but the carbon price is.

3.6.2 Other mechanisms include Offset mechanism, Result Based Climate Finance (RBCF), and Internal carbon pricing. India does not have a de jure but a de facto carbon tax. This basically means that there is no formal policy on taxing carbon emissions, but there are taxes and duties that effectively amount to a carbon tax, namely the Clean Environment Cess and the Excise duty on Petrol and Diesel. An initiation of a Voluntary Carbon Trading Platform can perhaps help to raise further financing through willing industries and international partners. In fact, India launched the world's first particulate trading system in Gujarat (Surat) in 2019, through a large-scale pilot project. This project is expected to cut down on emissions and possibly provide best practices for its replication in the case of other forms of emissions.

3.6.3 Theoretically, carbon pricing offers various benefits to different stakeholders in the economy. For governments, it serves as an instrument of climate policy as well as a source of revenue, reducing budgetary constraints. For businesses, internal carbon pricing helps to evaluate the impact of mandatory carbon prices on their operations and to identify potential climate risks and revenue opportunities. Finally, for long-term investors carbon pricing facilitates the analysis of potential impact of climate change policies on their investment portfolios, allowing them to reassess investment strategies and reallocate capital toward low-carbon or climate-resilient activities. These benefits also highlight the vital hold carbon rates have on the economic growth of a country. They have the capability to influence growth rates and may prove detrimental if not planned properly taking into account the national

circumstances, resource endowments and rate of growth and stage of development of the economy.

3.6.4 Reducing and managing risk is a recurrent theme for the design of many of the above-mentioned instruments. The analysis in the above sections has shown that India is majorly relying on domestic budgetary resources for its climate actions. The country strives to channel valuable yet limited resources and domestic imperatives of sustainable macroeconomic management face continuous constraints. Hence international climate finance remains a critical issue for stepping its NDC implementation post 2020. The means of implementation pledged by the international community has to witness sufficient momentum for effectively implementing NDCs of developing countries. It is all the more important to note that Post COVID pandemic situation, the whole structure may need to be revisited and the entire implementation and its timelines and low carbon scenario may require to be readjusted as and when the situations are conducive.

CHAPTER 4: SUMMING UP

4.1 The implementation of NDC effectively commences on 1.1.2021. Recognizing the fact that a careful estimation of the cost requirements for implementing the NDC and the possible sources for meeting these requirements is an essential pre-requisite, a study has been done which provides a range of numbers for achieving the emission intensity and electricity generation capacity objectives, forestry target and adaptation goals, apart from providing the available amount of finance flows, gaps and discusses the possibility of various financial instruments for mobilization of resources.

4.2 Using the IESS 2047 tool, developed by NITI Aayog, the model results indicate a reduction in emissions intensity of GDP, in constant dollar terms, of approximately 59 per cent and 61 per cent for CG and AG scenarios respectively, by 2030 over the 2005 levels under medium GDP growth. As per the factual statistics narrated in the previous sections, the cumulative costs in the case of CG were estimated to be approx.₹ 245.61 trillion (₹ 24,561,082 Crores). The cumulative cost estimates for forestry for the years of 2020 and 2030 are ₹573.25 billion (approx.₹57,325 Crores) and ₹7555.83 billion (approx.₹755,583 Crores) respectively at constant 2012 prices depending upon the fact whether forestry improvement options are included or not. The cumulative costs in 2012 base prices was estimated to stand at approx. ₹ 85.6 trillion (₹8,560,000 Crores) in 2030 for adaptation.

4.3 The financial requirement figures for energy, adaptation and forestry sectors together amounts to around ₹58.68 trillion (₹5,868,612 Crores) in 2020 and ₹118.685 trillion (₹11,868,555 Crores) in 2030. The total finance availability estimates to stand at ₹29.064 trillion (₹2,906,425 Crores), with the share of international and domestic finance at ₹ 9.02 trillion (₹902,652 Crores) and ₹ 20.037 trillion (₹2,003,773 Crores), respectively. However, the estimated cumulative finance availability as well as the cumulative cost, the gap between the two is obtained to stand at ₹ 36.102 trillion (₹3,610,211 Crores) in 2020 and ₹ 54.688 trillion (₹5,468,876 Crores) in 2030.

4.4 Given the gap between finance availability and finance requirements, implementation of wide-ranging NDC goals presents a major challenge for the developing countries as the finance is the critical enabler in ramping up these actions. India will endeavor to do its best for its climate actions. The national circumstances demand that the first priority for India is adaptation, being a country highly vulnerable to extreme weather events. Climate change impacts are expected to worsen with the passage of time because of the momentum due to present carbon stock continuing to raise the temperature. Hence, India's adaptation needs will have to be intensified and so the adaptation costs will increase. In short, enhancement of climate actions in the Indian context means more adaptation actions which would further require more resources to enable these actions. India is doing adaptation in mission mode. Hence it is very much essential that the resource distribution should also follow the prudent path based on the circumstances and priorities. India's adaptation actions warrant for intensive domestic

resources, while the mitigation actions would be a better playing field for the international finance flows.

4.5 Hence, an integrated approach at the domestic and international front for implementation to achieve the required resources is essential to unlock co-benefits for the achievement of sustainable development. Given the finite nature of resources at the domestic level, world needs to do much more than what they are currently committed to because the current promises are not enough. So, there is an important urge that all the developed countries must fulfill their prior commitments. In this respect, developed countries should enhance their support to developing countries for actions related to adaptation and mitigation. This must be done through adequate provision of finance, technology transfer, and capacity building to facilitate the effective implementation of the Convention and its Paris Agreement.

4.6 There is an increasing recognition that the climate and economic policies should align with each other to the extent possible to move towards the path of sustainability. Since no development is possible without a sound financial system supporting it, the spotlight is now on aligning the financial system with sustainable development. India developed a concept of National Voluntary Guidelines (NVG) for adoption by the corporate sector in India which have been mandated by the Securities and Exchange Board of India (SEBI) for adoption by the listed Indian companies including banks. This is enhancing the Environmental Social and Governance (ESG) capabilities of businesses. To generate the concept of responsible financing and create training capacity in the financial institutions, guidelines on 'National Voluntary Guidelines for Responsible Financing' have been established. India is one of the fastest-growing green bond markets in Asia. So, it aspires and commits to implement its already promised climate actions and do equally well or better in comparison to economies with similar levels of development.

4.7 In the context of COVID 19 global outbreak impacting India and the subsequent country wide lock down measures taken, the economic uncertainties are expected to remain high. The report highlights the rising enormous challenge to financing availability is imminent. However, this COVID 19 will definitely trigger the financial requirement and it will be difficult to estimate actual requirement at this stage of uncertainty. This assessment may be done at the global stocktaking stage later. However, it is certain that public financing availability for climate mitigation finance will be hit hardest, as will private domestic banking financing, so that the sum-total gap in financing to implement the NDC post-COVID may well be orders of magnitude now higher, especially for mitigation. This pandemic may leave India with no room left to do additional mitigation finance and the existing gap will be even more constrained, barring new ways of meeting the financing challenge. According to International Monetary Fund (IMF) 'World Uncertainty Index' the uncertainty around the coronavirus is much higher than the past outbreaks.

4.8 The year 2020 was supposed to be the year by which developed country Parties were to fulfill the goal of mobilizing jointly US$ 100 billion. This was to be an important milestone in the discourse of international climate efforts. This essential component in the climate negotiations need to be adhered to by developed countries to bring balance to the Paris

architecture. However, this global pandemic has led to the postponement of the COP 26 which has implications on the financial negotiations. Developing country Parties requested the Madrid Climate Change Conference (COP 25) to mandate the Standing Committee on Finance (SCF) to compile a synthesis report on the attainment of the finance goal of US$ 100 billion per year by 2020. This would have provided a valuable input into the process of setting a new long-term collective goal on finance by 2025 and giving an important signal in building momentum to enhance ambition beyond 2020. With COP 26 postponed until 2021, securing a synthesis report, or any other evidence-based work to inform the post-2025 goal, recedes even further into the future, as does the start date for meaningful negotiations on the new goal. The postponement of COP 26 to 2021 means that the initiation of the deliberations will be delayed further. The less time there is for in-depth negotiations, based on a technical analysis rather than a political assessment of needs of developing countries, the more difficult it will be for developing countries to speak on the actual needs.

4.9 Since India is going through an unprecedented crisis, its priorities would focus aggressively on poverty eradication, job creation, building up a strong and resilient health infrastructure and so on. The uncertainties of economy arising out of these dire situations will also have a severe bearing upon the climate actions especially the NDC commitments. The nation is now focused on securing 1.3 billion population from health hazards and providing relief to the impacted population, especially the poor and vulnerable. The urgent need is to mobilize resources to stimulate the economy. Simultaneously, developing countries like India need to provide sharper focus on strengthening adaptation actions and solutions as never before, be it., food systems, health care, water and sanitation and disaster management. The immediate urgency and the near- and medium-term human, economic and social impact of COVID 19 on developing countries - e.g. economic recession, - will mean that to recover, developing countries have to reallocate scarce resources to restart their economies by reinvesting in public sector health services and providing financial assistance to impacted populations.

4.10 ADB has estimated that COVID-19 outbreak could cost the Indian economy between US$ 387 million and US$ 29.9 billion in personal consumption losses alone. According to a report published by FICCI on the impact of COVID 19 on Indian Economy, "a significant 53 per cent of Indian businesses indicate the marked impact of the Coronavirus pandemic on business operations even at early stages." It is expected that many more firm estimates will follow in the coming months.

4.11 While addressing climate change will continue to be an important challenge, it is worthy to note that Post COVID pandemic situation, the whole structure may need to be revisited. Even before the COVID pandemic, India has been maintaining the position that India's NDC is based on the ' best effort basis' and would require enabling finance and technology for both mitigation and adaptation objectives. India will endeavor to do its best for its climate actions. India is doing the promised mitigation and adaptation actions in mission mode. India’s seriousness is also evident from the fact that Union Health Minister Dr Harsh Vardhan has taken the charge of the World Health Organization’s (WHO) Executive Board at a time when countries are fighting and grappling with the Covid-19 pandemic.

4.12 However, finance still remains the critical issue. Despite the various climate finance decisions, there are attempts by some developed country Parties to shrug off even their modest past responsibilities. Yes, for ambitions to be set high; finance should be an integral part of it. Only then, climate justice can be delivered to the poorer countries. Denying the developing countries, their fair share in the atmospheric resource goes against all tenets of equity and the well-established principle of common but differentiated responsibilities. Moreover, the international climate community has not been able to come out with any concrete outcome on the market-based instruments i.e. the Article 6 of Paris Agreement and the Paris Rule Book is yet to be fully formulated addressing the finance and technological needs of the developing countries. Further, the oil price fluctuations which we are witnessing may lead us to rely more on our domestic coal resources, which can have implications on GHG emissions.

4.13 In view of all the above, the implementation of Indian NDC with effect from 1.1.2021 may be on the following lines:

4.13.1 For the short-term, the Union Budget announcement 2020-21 clearly articulated that India will initiate implementation of its NDC, which comprises adaptation to climate change, mitigation of climate change and also build knowledge system that would inform and support the national action for ecologically sustainable development. Given the nature of climate actions, these will be executed in various sectors across the economy and will be implemented by various Departments/ Ministries concerned through the normal budgetary process with the participatory support from all the stakeholders including State Governments.

4.13.2 For the medium-term, i.e., the budget plus scenario, the timeline may be considered as 2023-24, just before the Global Stocktake (GST) envisaged under the Paris Agreement. This would give India a better sense of the trajectory of the finance generation and clarity for the implementation, especially from the international finance and accordingly consider the mid-term assessment of its actions and suitably recalibrate through re-examination of its actions.

4.13.3 As far as the long-term pathway is concerned, it is the path of sustainable development. Given the imperatives of economic growth, India will be in a position to better evaluate and shape the NDC implementation once the clarity emerges from global stocktake, mobilization trajectory of the international public finances through the New Collective Goals of Finance under the Paris Agreement as well as a much required and desired assessment of the $100 billion a year target set for the developed Country parties. A focus on building up disaster resiliency and resilient infrastructure also needs to be addressed as the country should aim to have high reduction in economic losses from climate-related events and natural disasters across sectors. Further, India launched the Coalition for Disaster Resilient Infrastructure (CDRI) on the sidelines of UN Secretary General's Climate Action Summit in September, 2019. CDRI will focus on developing resilience in ecological infrastructure, social infrastructure with a concerted emphasis on health and education, and economic infrastructure with special attention to transportation, telecommunications, energy, and water.

4.14 Lastly, the COVID Pandemic and also the possible low spiral on the economy, the entire implementation and its timelines and low carbon scenario may require to be revisited and

readjusted as and when the situations are conducive. Climate, growth recovery, jobs, infrastructure investment, energy sector investment, sustainable development, and higher international financing and domestic resources may all need to converge much more closely post-COVID. Now, there is an urgent need that the global community to start preparing, rather than talk about a climate financing gap only.

4.15 As the Paris Agreement clearly states that "The Agreement will be implemented to reflect equity and the principle of common but differentiated responsibilities and respective capabilities, in the light of different national circumstances." In this context, effectively addressing 3 "S" s of climate finance- Scope, Scale and Speed is necessary for having a realistic hope of achieving the objectives of the Convention and its Paris Agreement.

4.16 Covid-19 and the consequent lockdown reemphasize that equity is key to any vision of sustainable development, let alone climate action. And this means equity across the nations, equity within a nation, and equity within the generations and across the generations. Sustainable solution to Covid-19, or for that matter any global challenge like climate change, has to be equitable and should not disproportionately burden the poor of the world. So, International community has to comprehend these realities and international cooperation has to play a critical role to address the climate change issue especially on developing countries like India.

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Annexure 1: Emissions

Methodology used for the study for Emission Intensity and Generation Capacity

The energy sector assessment uses the updated IESS V2.2, an energy accounting framework, published by NITI Aayog in 2015 with base year as 2012. The IESS-2047 tool has the capability to customize 17 different parameters across the six different broad energy consuming sectors of the economy. One can simulate the reduction in energy demand over the projection period and can compare it with the business-as-usual scenario so that the benefits of an intervention can be quantified in terms of energy requirement. The different possibilities programmed in IESS depend not only on individual actions, but also on mindful public-policy decisions targeting efficient systems. The original model contains data from 2012.

The simple, yet robust model of IESS with open nature of the modeling exercise makes it the best option to undertake the study, in view of limited time and resources. The data on capacities, costs, and efficiencies is updated along with the targets, to be able to arrive at a latest estimate of cost required for India to fulfill NDC contribution.

The overall modeling process works with more than 15 sectors, both from demand and supply side which need to be balanced from each cycle. The sectors covered in the IESS 2.2 include:

Table 9: Sectors covered in IESS 2.2

Energy Supply side	Energy Demand Side	Economic
Gas Power Stations	Residential	GDP
Coal power stations	Commercial	Population
Carbon Capture Storage (CCS)	Industry (7 sectors)	Temperature Stress
Back up electricity by diesel	Cement sector	Storage of captured CO2
Nuclear power	Fertilizer sector	
Hydro Power Generation	Aluminum sector	
Solar PV	Iron and Steel sector	
Solar CSP	Pulp n Paper sector	
Onshore Wind	Textile sector	
Offshore Wind	Chlor Alkali sector	
Small Hydro	Domestic passenger transport	
Distributed Solar PV	Domestic freight	
Solar Water Heater	Domestic Cooking	
Biomass Based Electricity& Biogas	Agriculture energy use	
First & Second Generation Bio Fuels	Telecom	
Advanced / Algae Bio Fuels		
Waste to Electricity		
Electricity Balancing Requirement		
Electricity imports & exports		
T&D Losses		
Storage, demand shifting		
H2 Production for Transport and Telecom		
Domestic Gas Production		
Domestic Coal Production		
Domestic Oil Production		
Fossil fuel Imports		

Keeping the basic framework of IESS 2.0, the 2017 actuals have been updated for the macroeconomic actuals including the population and GDP for India. However, future growth projections for 2017 onwards have been retained from the original model in most cases. The projections were changed in sectors where projections issued by Government of India were available to represent 'Current Goals' (CG) scenario.

Basic Assumptions of the Model:

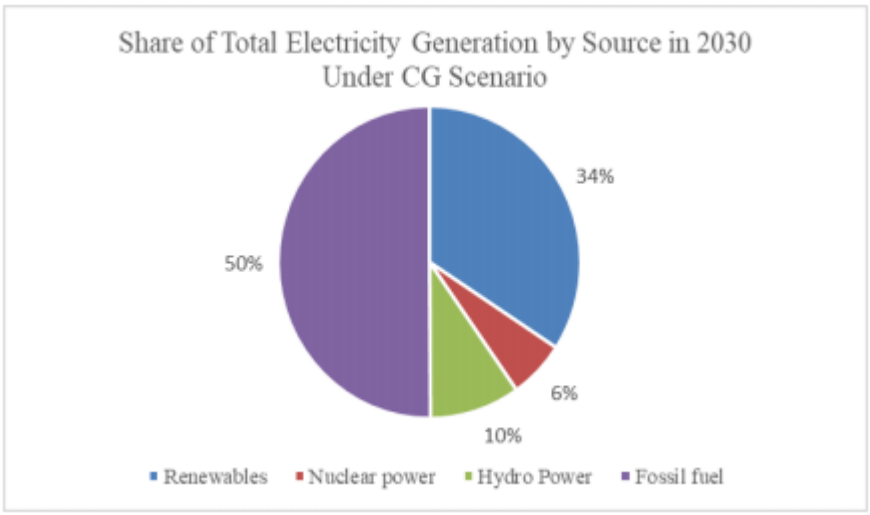
- India's GDP data was calculated according to constant ` 2011-12 prices for the model using data from Ministry of Statistics and Program Implementation. For comparison purposes GDP was also calculated at constant US$ 2012 prices.
- Estimates for population and other macroeconomic indicators were taken from the World Bank and Food and Agricultural Organization of United Nations database.
- The data for renewable energy installation and benchmark costs was obtained from official documents of Ministry of New and Renewable Energy and Central Electricity Authority.
- The latest data for biomass & bio fuels was added from relevant policy statement releases & National Biomass Survey.
- The nuclear power sector was updated with the help of Department of Atomic Energy (DEC) press releases, and answers to parliamentary questions.
- Other power sector data was included as per National Electricity Plan 2018
- The data on Fossil fuel sources added from Petroleum Planning and Analysis Cell and Coal India Limited.
- Energy efficiency numbers obtained from Bureau of Energy Efficiency for residential, commercial, agriculture and cooking sectors have been incorporated.

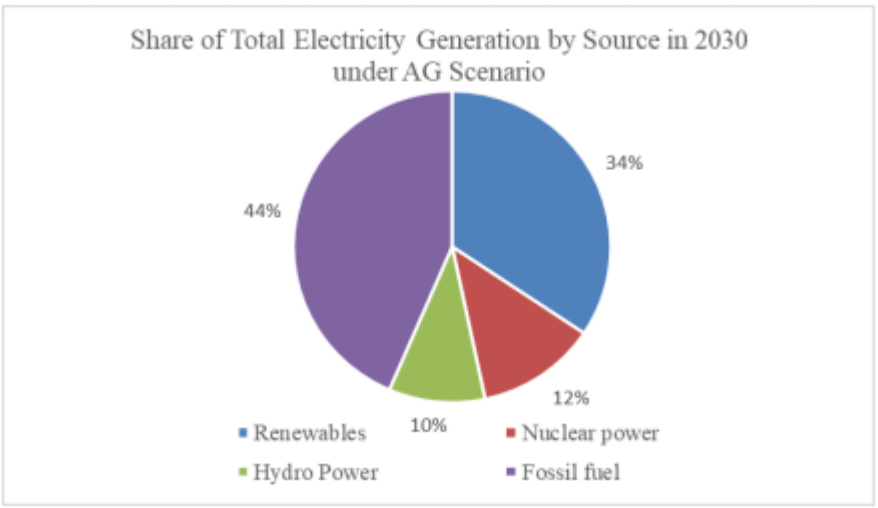
Limitations

The current partial analysis comprises of energy supply side with some demand sectors. Carbon intensity of GDP has a natural de-growth which is supported by higher renewable energy and efficiency improvements. However, this may not be considered as a complete assessment as energy demand sectors have not been completed and the scenarios presented above may change by large amounts.

Annexure 2: Source wise Breakup of Electricity Generation in 2030 under CG and AG Scenario

Figure 7: Source wise Breakup of Electricity Generation in 2030 under CG and AG Scenario





Annexure 3: Sectoral costs for Emissions Intensity of GDP

Table 10: BAU Scenario					
Description	**Category**	**2017**	**2022**	**2027**	**2032**
Gas thermal	Electricity	1.883159	1.797127	1.888413	2.453918
Coal Thermal	Electricity	22.99508	14.82091	16.10923	20.98199
CCS	Electricity	0	0	1.213604	1.232245
Balancing Coal Thermal	Electricity	0	14.24711	22.56938	20.63042
Diesel Back up	Electricity	0	0	0	0
Nuclear	Electricity	4.521947	4.420789	3.696101	2.198024
Hydro	Electricity	6.085633	14.29133	6.410254	6.85616
Grid Solar PV	Electricity	3.530403	3.095732	4.508559	5.974439
Grid Solar Thermal	Electricity	0.574846	1.259959	1.442619	2.007979
Wind Onshore	Electricity	4.253452	3.322125	3.520269	4.378023
Wind Offshore	Electricity	0	0.409323	0.41193	0.41558
Small Hydro	Electricity	0.610995	1.714519	1.507094	1.447963
Distributed Solar PV	Electricity	0.199581	0.867335	1.070318	1.848876
Solar Water Heater	Buildings	0.131047	0.182043	0.195715	0.193569
Bioenergy to Electricity	Electricity	6.567559	8.924989	12.51058	15.01177
Biofuels	Bioenergy	0.202247	0.560649	1.404783	1.78648
Waste to Energy	Bioenergy	0.189673	0.378936	0.764139	1.555445
Electricity imports	Electricity	0.191976	0.639921	1.279841	1.919762
Transmission and Distribution	Electricity	9.020756	12.07169	15.96018	20.87705
Storage and Demand Shifting	Electricity	1.957967	4.017863	3.222362	0.550105
Hydrogen Production	Electricity	0.081129	0.168183	0.246565	0.307667
Appliance efficiency-Residential Buildings	Buildings	11.74183	19.28357	29.52659	43.16543
Insulation-Residential Buildings	Buildings	0.009384	0.03379	0.120755	0.316671
Appliance efficiency-Commercial Buildings	Buildings	2.637252	3.547539	5.116641	7.74318
Insulation-Commercial buildings	Buildings	0.06676	0.114258	0.212728	0.42022
Cement Sector Efficiency	Industry	0.489673	0.413074	0.409611	0.398404
Steel Sector Efficiency	Industry	0.915694	1.360809	0.758423	0.962067
Other Sectors efficiency	Industry	21.96191	22.45774	25.35663	30.47469
Passenger Transport	Transport	2.285683	5.900715	11.14096	17.93624
Freight Transport	Transport	0.245703	0.694935	1.486183	2.700526
Cooking	Others	1.112055	0.998394	1.18843	0.716836
Agriculture Pumps	Others	5.900601	8.295334	10.8088	11.86125
Tractors	Others	3.653498	4.937582	5.56976	16.47162
Telecom	Others	1.51056	1.722116	2.212382	2.932193
Domestic gas	Fossil Fuels	5.527911	11.98965	12.02761	16.40691
Domestic Coal	Fossil Fuels	13.28012	17.5009	18.53194	18.57705
Domestic Oil	Fossil Fuels	29.65579	32.27632	28.5136	29.72464
Oil Transfers	Fossil Fuels	6.762461	8.830764	11.3149	14.06749
Gas Transfers	Fossil Fuels	3.764	4.531055	5.901746	6.962276
Imported Gas	Fossil Fuels	5.750585	5.860644	8.746177	10.56117

Imported Coal	Fossil Fuels	18.67879	20.25324	41.19391	71.68008
Imported Oil	Fossil Fuels	70.0523	101.1501	138.9761	183.0729

Table 11: CG Scenario

Description	Category	2017	2022	2027	2032
Gas thermal	Electricity	1.883159	0.919993	0.894075	1.662385
Coal Thermal	Electricity	24.59376	15.27212	16.57632	21.95151
CCS	Electricity	0	0	1.213604	1.232245
Balancing Coal Thermal	Electricity	0	0.904966	0	0
Diesel Back up	Electricity	0	0	0	0
Nuclear	Electricity	4.521947	4.420789	15.59666	8.584824
Hydro	Electricity	6.085633	8.230307	11.5103	11.76296
Grid Solar PV	Electricity	3.530403	13.59847	9.36031	12.29309
Grid Solar Thermal	Electricity	0.574846	1.259959	1.442619	2.007979
Wind Onshore	Electricity	4.253452	8.015576	11.80515	13.92112
Wind Offshore	Electricity	0	2.455939	5.654396	9.579727
Small Hydro	Electricity	0.610995	0.589597	1.553886	1.939954
Distributed Solar PV	Electricity	0.199581	11.31789	6.53604	8.765754
Solar Water Heater	Buildings	0.131047	0.182043	0.195715	0.193569
Bioenergy to Electricity	Electricity	6.493176	9.644497	13.467	16.47542
Biofuels	Bioenergy	0.300015	0.785959	1.991609	3.293184
Waste to Energy	Bioenergy	0.189673	0.378936	0.764139	1.555445
Electricity imports	Electricity	0.153581	0.71108	3.07162	3.839524
Transmission and Distribution	Electricity	9.043053	11.90384	15.24582	19.68212
Storage and Demand Shifting	Electricity	2.565392	3.543078	4.554205	0.472035
Hydrogen Production	Electricity	0.251607	0.543512	0.845047	1.102696
Appliance efficiency-Residential Buildings	Buildings	15.62307	24.23403	35.65312	55.0853
Insulation-Residential Buildings	Buildings	0.009384	0.03379	0.120755	0.316671
Appliance efficiency-Commercial Buildings	Buildings	2.637252	3.547539	5.116641	7.74318
Insulation-Commercial buildings	Buildings	0.06676	0.114258	0.212728	0.42022
Cement Sector Efficiency	Industry	0.751903	0.47519	0.553312	0.667323
Steel Sector Efficiency	Industry	1.130984	1.730177	2.352127	3.58631
Other Sectors efficiency	Industry	23.39501	24.76761	27.27679	32.67558
Passenger Transport	Transport	-1.66087	-4.51805	-8.78101	-14.619
Freight Transport	Transport	1.011234	1.977425	3.525349	6.676733
Cooking	Others	1.37218	1.274799	1.30843	0.807887
Agriculture Pumps	Others	6.075747	8.268975	10.40472	10.9626
Tractors	Others	3.641877	4.862652	5.458739	15.45485
Telecom	Others	1.510116	1.711075	2.16249	2.852339
Domestic gas	Fossil Fuels	5.527911	11.98965	12.02761	16.40691
Domestic Coal	Fossil Fuels	13.28012	17.5009	18.53194	18.57705
Domestic Oil	Fossil Fuels	29.65579	32.27632	28.5136	29.72464
Oil Transfers	Fossil Fuels	6.52635	8.165262	9.996585	12.10947
Gas Transfers	Fossil Fuels	3.901616	4.611545	6.173281	7.47287

Imported Gas	Fossil Fuels	5.993082	5.979567	9.179039	11.40245
Imported Coal	Fossil Fuels	17.23907	8.700927	14.41535	28.39118
Imported Oil	Fossil Fuels	67.18941	92.73213	121.5024	156.002

Table 12: AG Scenario

Description	Category	2017	2022	2027	2032
Gas thermal	Electricity	1.883159	0.919993	0.894075	1.662385
Coal Thermal	Electricity	23.20395	15.36633	17.06311	22.96626
CCS	Electricity	0	1.202519	4.653108	11.21984
Balancing Coal Thermal	Electricity	0	0	0	0
Diesel Back up	Electricity	0	0	0	0
Nuclear	Electricity	4.521947	4.420789	35.80188	36.32194
Hydro	Electricity	6.085633	14.29133	12.934	16.73887
Grid Solar PV	Electricity	3.530403	13.59847	14.67634	18.37068
Grid Solar Thermal	Electricity	0.574846	1.259959	1.442619	2.007979
Wind Onshore	Electricity	4.253452	8.015576	14.44359	18.07484
Wind Offshore	Electricity	0	4.093232	8.09782	12.04505
Small Hydro	Electricity	0.610995	0.966662	1.607834	2.201639
Distributed Solar PV	Electricity	0.199581	11.31789	9.80679	10.5228
Solar Water Heater	Buildings	0.131047	0.182043	0.195715	0.193569
Bioenergy to Electricity	Electricity	6.648931	10.65295	15.15378	19.16532
Biofuels	Bioenergy	0.417861	1.183916	4.476665	7.867228
Waste to Energy	Bioenergy	0.189673	0.378936	0.764139	1.555445
Electricity imports	Electricity	0.153581	0.853296	3.685943	4.607429
Transmission and Distribution	Electricity	8.328608	11.24919	14.37608	18.49686
Storage and Demand Shifting	Electricity	4.995093	8.035725	6.000776	-0.57131
Hydrogen Production	Electricity	0.362607	0.775047	1.187154	1.53374
Appliance efficiency-Residential Buildings	Buildings	16.10685	25.76877	37.46645	58.69432
Insulation-Residential Buildings	Buildings	0.009384	0.03379	0.120755	0.316671
Appliance efficiency-Commercial Buildings	Buildings	2.637252	3.547539	5.116641	7.74318
Insulation-Commercial buildings	Buildings	0.06676	0.114258	0.212728	0.42022
Cement Sector Efficiency	Industry	0.89106	0.609333	0.72784	0.901425
Steel Sector Efficiency	Industry	2.16627	3.205563	4.103001	5.747554
Other Sectors efficiency	Industry	46.05657	8.057563	15.78274	24.93158
Passenger Transport	Transport	-3.58068	-9.64509	-18.5083	-30.2338
Freight Transport	Transport	0.577108	0.690858	1.007147	2.159841
Cooking	Others	1.818784	1.285196	1.542719	0.874444
Agriculture Pumps	Others	5.873864	7.613909	9.467318	9.749167
Tractors	Others	3.6285	4.777513	5.333249	14.35824
Telecom	Others	1.510116	1.711075	2.16249	2.852339
Domestic gas	Fossil Fuels	5.527911	11.98965	12.02761	16.40691
Domestic Coal	Fossil Fuels	13.28012	17.5009	18.53194	18.57705
Domestic Oil	Fossil Fuels	29.65579	32.27632	28.5136	29.72464
Oil Transfers	Fossil Fuels	5.983612	7.358694	8.901833	10.4811

Gas Transfers	Fossil Fuels	3.70922	4.463185	6.096667	7.444003
Imported Gas	Fossil Fuels	5.625811	5.697658	9.009772	11.30209
Imported Coal	Fossil Fuels	13.20076	4.959315	11.65179	27.32253
Imported Oil	Fossil Fuels	60.60862	82.52978	106.9919	133.4986

Annexure 4: Forestry

Explanatory Note on methodology, assumptions, data and scenarios used in the study on forestry target

Forestry target in NDC is *"To create an additional carbon sink of 2.5 to 3 billion tonnes of CO_2 equivalent through additional forest and tree cover by 2030"*
The ways of defining the target include:

i) Including 1.9 billion tonnes of CO_2 sequestration:
Target: 600 million tonne of CO_2 (BAU).

ii) Excluding 1.9 billion tonnes of CO_2 sequestration:
Including conservationand improvement of existing forest:
Target: Additional 2.5 billion tonnes of CO_2 equivalent (meant as range 2.5 - 3 billion tonnes wherever mentioned).

The study defined the target assuming 2005 as baseline. Several scenarios have been discussed for target, both with conservation/enhancement and new additional forests and tree cover and without it. An additional case is also presented that includes scheduled plantation to meet the target without any binding on time as all other cases assume that all resources are available in Year 1 (2021) and carbon is sequestered from 2021 to 2030. But it is highly likely and this assumption may not hold true. In other words, the report includes a scenario where the total land available is planted in equal proportion every year till target is reached.

Table 13: Different Cases based on interpretation of target and land availability

S.No.	Cases	Description	Remark
1	I	Additional 2.5 Billion tCO_2 equivalent with 100% land allocations – including forestry enhancement options	Availability of total land (75.8 mha) is not a practical assumption.
2	II	Additional 2.5 Billion tCO_2 equivalent in FSI's Scenario I – including forestry enhancement options	Land available in Scenario I – 34.6 mha
3	III	Additional 2.5 Billion tCO_2 equivalent in FSI's Scenario II – including forestry enhancement options	Land available in Scenario II – 45.2 mha
4	IV	Additional 2.5 Billion tCO_2 equivalent in FSI's Scenario III – including forestry enhancement options	Land available in Scenario III – 55.8 mha
5	V	Additional 2.5 Billion tCO_2 equivalent not including forest enhancement/improvement (hence x1=x2= 0) with 100% land allocations	Qualifies for both additional conditions

6	VI	Additional 2.5 Billion tCO_2 equivalent not including forest enhancement/improvement (hence x1=x2= 0) in FSI's Scenario I	Qualifies for both additional conditions –target is not met
7	VII	Additional 2.5 Billion tCO_2 equivalent not including forest enhancement/improvement (hence x1=x2= 0) in FSI's Scenario II	Qualifies for both additional conditions–target is not met
8	VIII	Additional 2.5 Billion tCO_2 equivalent not including forest enhancement/improvement (hence x1=x2= 0) in FSI's Scenario III	Qualifies for both additional conditions
9	IX	Additional 2.5 Billion tCO_2 equivalent not including forest enhancement/improvement (hence x1=x2= 0) in FSI's Scenario III – Equal proportion of land planted every year	More practical option of scheduled plantation. Total land available is afforested over a period of years.

Data and Scenarios

Following are the forestry options and scenarios for land allocation defined in the technical information series by FSI:

Table 14: Forestry Options and Land Allocation

Forestry Option	Total Land(ha)	Scenario I	Scenario II	Scenario III
Restoration of Impaired forest	13700000	50%	60%	70%
Restoration of Open forest	18900000	10%	20%	30%
Afforestation on wasteland	12500000	10%	20%	30%
Agroforestry	13700000	10%	15%	20%
Green Corridor	1400000	30%	40%	50%
Plantations along roads	2890000	20%	30%	40%
Plantations along railways	70000	10%	20%	30%
Plantations of railway sidings	10000	100%	100%	100%
Plantations along Rivers and Canals	390000	10%	20%	30%

Urban Green Spaces	12200000	2.5%	5.0%	7.5%
Total Land in (mha)	75.76 mha	34.59 mha	45.21 mha	55.83 mha

Methodology

The methodology focuses on identifying allocation of land for different forestry options to optimize (minimize) the cost. The cost is estimated by following a linear programming model. The objective function is the total cost of achieving the target. Target is one of the constraints in the model where the resultant carbon sink from optimized allocation of land to forestry options must be greater than or equal to 2.5 billion tonne of CO2 equivalent. Other constraints are on land available for each forestry option based upon FSI scenarios on land allocation for each option.

Assumptions

The calculation of cost to meet the forest target is based on the following assumptions:
– The rate of carbon accumulation is assumed constant and linear over the entire period.

– The availability of land, cost and carbon accumulation rates are provided by Forest Survey of India.

– Total land required is available from first year of implementation. This assumption is important as it gives plantation 10 years to sequester carbon. The same assumption is also made by FSI in their assessment (Technical information series page no. 29).

– Preparation – nursery, planting stock, human resource etc. – are available from the first year.

– The entire plantation takes place in the first year.

– While the growth in each year will vary in forests and plantations, average growth over a period of ten years has been assumed as provided by FSI.

Limitations

The calculations are limited due to the following constraints:

– No business as usual scenario due to lack of data on carbon stocks to estimate trend and forecast.

– No clear assumption on mortality rate/ survival rate.

– Inclusion of Biomass/Fuelwood demand to estimate actual carbon sink.

Results

Excluding 1.9 billion tonnes of existing CO_2 sequestration

Table 15: Land and Cost Estimates for different cases		
Cases →	**5**	**8**
Total Land	18536461.2	9125911.006
Total Cost	1.76771E+11	4.5855E+11
Target Achieved	**250000000**	**250000000**
Land (mha)	**18.54**	**9.13**
Cost `/Year (Current prices as provided by FSI)	**17670 Crores**	**45850 Crores**

The achievement is only possible in 5th (100 per cent allocation) and 8th (Scenario III) case. The results are reported here on per year basis, that is, constant average accumulation of 250 million tonne of CO_2 equivalent per year will result in achievement of target of 2.5 billion tonne of CO_2 equivalent in 10 years from 2021-2030. While the growth in each year will vary in forests and plantations, average growth over a period of ten years has been assumed which is equal to the rates of accumulations provided by the FSI. The costs are also per year.

Including 1.9 billion tonne of CO_2

In this case the remaining target that needs to be achieved during the implementation period will be 600 million tonne of CO_2 equivalent. As per FSI's assessment with 2005 as the baseline, the target is achieved in business as usual scenario. Calculation of finance for 600 million tonne of remaining target is based on FSI's assessment for cost.

Table 16: Cost Estimates for different scenarios									
Land Scenarios	**Scenario I**			**Scenario II**			**Scenario III**		
	CO_2 (in billion tonne)	Land Required (in mha)	Cost (in lakh Crores INR)	CO_2 (in billion tonne)	Land Required (in mha)	Cost (in lakh Crores INR)	CO_2 (in billion tonne)	Land Required (in mha)	Cost (in lakh Crores INR)
Target as estimated by FSI (base year 2005)	1.63	12.73	1.14	2.51	18.71	1.92	3.39	24.69	2.46

Calculation for 1 billion tonne	1.00	7.81	0.70	1.00	7.45	0.76	1.00	7.28	0.73
Calculation for 600 million tonne (including 1.9 billion tonne)	0.60	4.69	0.42	0.60	4.47	0.46	0.60	4.37	0.44

Two cases provide the financial requirement of meeting the target. Both of these are explained in the table below:

Table 17: Optimum cases for cost

Case	Target Definition	Land Required	Cost per year in 2018 current prices (in Crores)	Cost per year in 2011-12 base year prices (in Crores)
1	Include forest enhancement options	15.06 mha	4830	3574.34
8	Exclude forest enhancement options	9.12 mha	45850	33930.29
BAU	Including 1.9 billion tonne (Taking Scenario III where least land is required)	4.37 mha	4400	3256.12

Assuming a discount rate of 6 per cent per annum and for a period of 10 years, the total cost for these options in US$ 2012 exchange rate will be **16.6 billion US$, 157.6 billion US$ and 15.12 billion US$ for cases 1, 8 and BAU respectively**.

Annexure 5: Adaptation

Key concepts and methodological overview

Using the NAPCC and NDC documents as base, it can be stated that adaptation programmes broadly span eight areas - (1) crop improvement and research; (2) drought proofing and flood control; (3) forest conservation; (4) poverty alleviation and livelihoods preservation; (5) rural education and infrastructure; (6) health; (7) risk financing; and (8) disaster management. It can thus be seen that through direct and indirect interactions these sectors have a huge impact on the achievement of SDGs and provision of basic needs (food, health, water supply and sanitation, etc.) In a recent report, IPCC (2018) discusses the synergies between climate resilience and the achievement of SDGs. While SDG 13 (take action to combat climate change and its impacts) is directly related to climate adaptation, there is literature to prove that with the achievement of SDG 1 (No poverty) and SDG 4 (quality education), climate resilience and adaptation capabilities as a whole improve. In addition, there are a number of specific climate impacts that could be addressed concomitant to SDG targets.

In fact, identifying the linkage between adaptation, SDGs and basic needs is central to the analysis conducted for calculating financial needs. As Table 18 also shows there are large overlaps between the three concepts. The table also defines the broad contours of the analysis coverage i.e. the sectors that have been chosen and the aspects that have been valued.

It is noteworthy that the progression from one concept to the other is quite straightforward in the case of three sectors -agriculture, water, health. However, it becomes complex when the expenditure trajectories of the three sectors - Himalayan region, coastal regions, and disaster management, are investigated. For the current context, we have focused on the climate risks of inadequate water supply and livability impacts of climate change on these regions. Therefore, programmes related to SDGs 11 and 6 have been evaluated as well as the basic needs for housing, water supply and sanitation. Two aspects have additionally been looked at that are not specifically mentioned in the NDC document but have a significant role to play in determining how climate change impacts would manifest i.e. poverty alleviation and quality education.

Table 18: Linkages between the NDC commitments, SDGs and Basic Needs

NDC sectors	Climate impacts	SDGs	Basic Needs
Water resources	Water scarcity	SDG 6 (Water availability to all)	Potable water
Agriculture,	Food systems	SDG 2 (end hunger, food security)	Food and nutrition
Health	Health Impacts	SDG 3 (ensure healthy lives)	Health services
Himalayan region	Water scarcity, impact on livability and quality of life	SDG11 (cities and human settlements safe and resilient)	Housing
Coastal regions		SDG 6 (Water availability to all)	Water supply and sanitation
Disaster management	Disasters	Part of SDG1 (No Poverty)	Safety from disasters, relief in case of disasters
Overarching variables	Education	SDG 4 (Quality Education) – affects overall adaptation capability	Education
	Income/poverty	SDG 1(No Poverty) – affects overall adaptation capability	Poverty alleviation

Estimation of current spending

As a starting point of adaptation financing assessment, the programme costs of policies that contribute to the achievement of various SDG goals was estimated and aggregated. For this, the mapping of Central sector Schemes with the 17 SDGs by NITI Aayog in SDG India Index Baseline Report [NITI Aayog, 2018] was done. In particular, every scheme in the mapped document was picked up to match with the expenditure budgets of the concerned department/ministry to finally pick up the total 'Actual 2017-18' spending from the Union budget 2019-20. This was used for estimating an approximate of the actual domestic spending in 2017-18 on the SDG goals. For this analysis however, full scheme amounts were included with no exclusions, in comparison to the expenditure budget analysis. The said analysis spanned over 46 ministries, to arrive at an estimate of ` 660372.03 Crores (or 3.86 per cent of GDP).

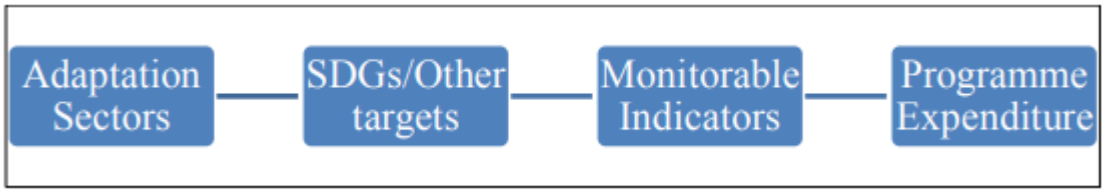
Specific SDGs were selected based on their contribution to improving resilience. Since the SDG-CSS mapping was already done as part of Step 1, this step gave us key policies/programmes that had a climate adaptation dimension. Tabulating the total expenditure on such projects, a figure of ` 326393.56 Crores (or 1.9 per cent of GDP) was arrived at. Comparing this number against the 2.7 per cent figure derived under the expenditure budget analysis, which collates all adaptation expenditure, it can be said that this is smaller. This is because SDGs pertain to specific areas and are a subset of the larger number of areas that adaptation programmes take care of.

Estimation of future spending

As shown in figure 8, the analysis for future spending requirement is done in a series of steps. The mapping of adaptation sectors and SDG targets has already been explained in a previous

section. In the current section, the methodology linking of targets with programme expenditure is discussed.

Figure 8: Framework Design Flow Chart



In the first step, data on state-wise total expenditure for six categories was compiled – water supply and sanitation, housing, agriculture, health, education, poverty alleviation and disaster management. The data was compiled from state budgets and thus comprises of state allocation as well as allocation under centrally sponsored schemes. It needs mentioning here that specific budget heads were selected for the analysis as being the key for enhancing adaptation capabilities. Unlike the Expenditure Budget Analysis (EBA), the state budget allocation was more aggregated and thus selection of just the adaptation related components was difficult. For our purpose the classification of expenditure streams given in various state budgets was as follows:

Table 19: Classification of Expenditure Heads in State Budgets

Expenditure Group	Expenditure Heads in State Budgets
Water supply and sanitation	Development Social Service: Water Supply and Sanitation
Housing	Development Social Service: Housing
Food security	Development Economic Service: Crop Husbandry; Development Economic Service: Soil and Water Conservation; Development Economic Service: Animal Husbandry; Development Economic Service: Dairy Development; Development Economic Service: Fisheries; Development Economic Service: Forestry and Wild Life; Development Economic Service: Plantations; Development Economic Service: Food Storage and Warehousing; Development Economic Service: Agricultural Research and Education
Health	Development Social Service: Medical and Public Health
Education	Development Social Service: Education, Sports, Art and Culture
Poverty alleviation	Development Social Service: Social Security and Welfare; Development Economic Service: Rural Development
Disaster management	Development Social Service: Urban Development; Development Social Service: Relief on account of Natural Calamities Development Economic Service: Flood Control

This data was compiled to get state expenditure streams from 1990 onwards for different adaptation categories.

In the second step, we collated other state level variables that served both as dependent variable (infrastructure stock) and independent variables for the econometric modelling. For each of the six sectors mentioned above, separate models were built. For the estimation of future spending requirement and meeting targets, we borrow from the literature on infrastructure needs assessment to calculate the expenditure required for adaptation till 2030. State level data for key SDG indicators, sectoral expenditure and other state variables such as SDP, population, urbanisation, etc. were used for the econometric analysis.

The flow of investment is used to calculate the investment stock and the stock is thereupon forecasted based on dependent variables such as GDP, population, etc. The forecasted level of infrastructure stock is then used to calculate the infrastructure expenditure needed every year.

The main driving force for increased expenditure till 2030 is population and GDP growth. This has been used to model the expenditure requirements for specific sectors in a 'current policy' scenario.

Modelling framework

The analysis concentrates on the creation of infrastructure that provides the relevant social and economic services related to adaptation. Assuming that these services contribute to consumer as well as producer demand, GDP/SDP as well as composition of GDP/SDP has an important role to play in determining allocation of funds in budgets. Also, as infrastructure typically has a long lifespan, looking only at the flow of expenditure in recent years to understand the current state of provision is misleading. It is thus necessary to look both at the accumulated stock of infrastructure as well as annual addition to it.

Step 1: Building a model linking stock with the flow of infrastructure investment. This model is built using the simple identity which reads as: expenditure stock every year is a sum of investment made every year and the existing level of infrastructure stock from the previous year.

This can be represented as follows:

$Invstock_t = invt + Invstock_{t-1}$, which can be rewritten as

$Invt = Invstock_t - Invstock_{t-1}$

However, for some models the exact infrastructure stock variable at a state level was either not available or not available for multiple periods of time. In all such cases proxies for infrastructure stock have been taken.

In the second step, the model estimates the future demand for infrastructure such that it can provide services required for the six sectors in question. Current data on infrastructure stock in this case is modeled as a function of previous values of infrastructure stock, price of infrastructure, GDP share from agriculture and industry, and technology levels. Thus,

$I = F(It{-}1,\ Y,\ PI\ ,\ Yag,\ Yind,\ U,\ Pop,\ stateandtimedummies, A)$ As information on technological change or actual real prices of infrastructure services are hard to come by at a

state level, it is possible to use time dummies and country fixed effects as proxies. Additionally, the country fixed effect combined with the time dummy allows us to capture the price variable as well.

It is noteworthy that the objective of the model building exercise is to obtain the best fit possible and the highest explanation power of the model. Thus, lagged value of the infrastructure stock variable as well as annual flow of infrastructure expenditure is also added to the model.

In the third step, infrastructure stock is related with SDG outcomes of different states after controlling for various governance quality variables and efficiency.

$$SDGit = F(Invstockit, Gov, eff)$$

The list of SDG indicators and infrastructure stock variables chosen for each of the sectoral models is provided in table 20 below.

Table 20: Key Outcome Indicators and Infrastructure Stock Indicators used

Basic Needs	Outcome Indicator/SDG Indicator*	Input Indicator/Infrastructure Stock
Education	Enrollment Rate	Number of schools
Health	Malaria, Diarrhea incidence	Number of hospital beds
Poverty alleviation	Poverty rate	Average man-days under MNREGA
Food	Yield per hectare	Area irrigated
Housing	Population living in slums	Number of households with 'pucca' construction
Water supply and sanitation	Share of households with access to clean drinking water	Area irrigated
Disaster management	Not modeled	

*Indicators were selected from the SDG National Indicator Framework prepared by MoSPI

Accounting for Disaster Relief and Management

Unlike the other adaptation sections, expenditure on disaster relief and management was not econometrically modeled. Referring back to table 18, expenditure on disaster management has been taken as the sum of urban development, flood management and disaster relief. This has been done to account for both planned (urban development, flood management) as well as

unplanned climate expenditure (disaster relief). Viewed from a different angle, this can also be seen as expenditure to manage slow onset and sudden onset climate impacts.

The econometric model building done till now looked at the natural growth of the economy and predicted what level of infrastructure expenditure would need to be incurred in the future. In the case of estimating disaster management needs, a separate model is required that would both, forecast the probability of occurrence of a natural disaster as well as using a damage cost function, estimate the need for ameliorative expenditure. To build such a model, downscaled results for climate parameters from climate models are required and damage costs estimated from changing temperature and precipitation patterns are needed. This has not been done as a part of the current exercise.

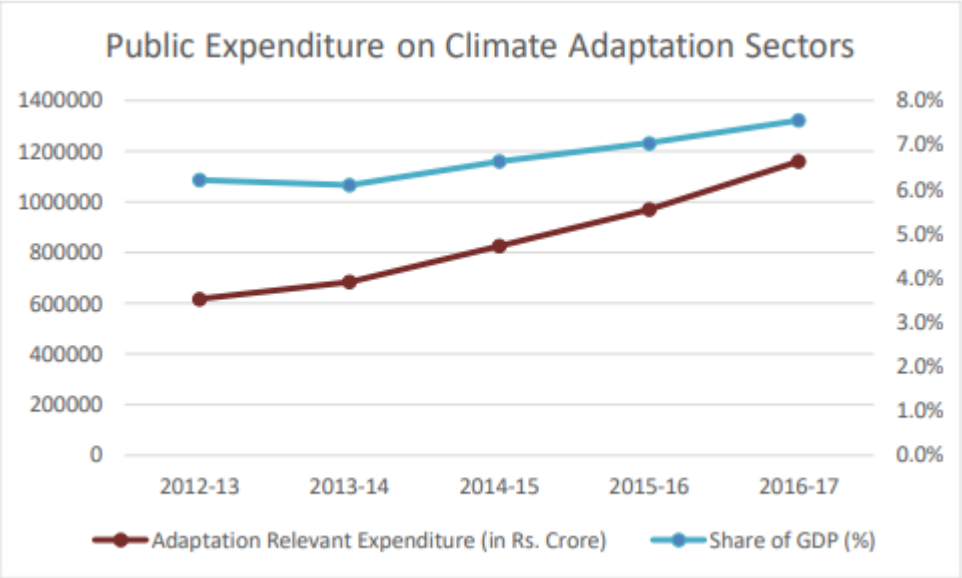
We use a simpler alternative to account for spending on disaster management. Taking the period from 2012-13 to 2016-17 as the base case, the average expenditure on disaster related activity as a share of GDP (i.e. 1.4 per cent) was estimated. Assuming this share to continue to be the same overtime, the increase in absolute amount of spending was calculated based on the growth in GDP forecasted. While this assumption does not cover natural calamities and the costs that might be incurred as a result, it accounts for the growth in disaster preparedness that would occur a natural corollary to growth.

State level expenditure on social sectors

Aggregating the state level expenditure on various adaptation relevant programmes and policies, (see table 19 for reference) we derived the total expenditure every year by states on adaptation. Note that this state-level total expenditure is higher than the calculation made earlier (estimate of current spending) as it includes both the state allocation as well expenditure under central schemes. While the trends show that the amount has been increasing in recent years, even when the figure is rationalized as a share of GDP, it has been growing. For the year 2016-17, the latest year that was included while creating the baseline dataset, the figure was 7.6 per cent of GDP.

The point that needs to be reiterated at this stage is that this number is an upper limit to the amount actually going in for adaptation (Figure 9). There are a number of overlaps between developmental expenditure and expenditure for climate resiliency. As state-level information in not available at such a detailed level that enables us to differentiate project-wise between the two, overall expenditure on a particular sector is taken.

Figure 9: Adaptation relevant expenditure and its share in GDP



Results

As has been mentioned earlier, six different nested models were run that incorporated the relationship between infrastructure investment, stock of infrastructure and outcomes achieved.

21below shows the modelling forecasts for each of the six sectors selected. It is interesting that while the sectoral trajectories of investment requirements are different, we get a model where the investment requirements increase absolutely over the period.

Table 21: Results from the sectoral models (in ` million)

Year	Exp_Education	Exp_Health	Exp_Poverty	Exp_food	Exp_water	Exp_housing	Exp_disaster	Total_expenditure	Total Expenditure at 2011-12 prices	Discounted @ 6%
2017-18	3611835	1090584	1216313	1211556	711656	263333	1745486	**9850764**	7594713	5675212
2020-21	3719999	943743	1180205	1156284	685306	261568	2237009	**10184113**	6859181	4303535
2025-26	3816535	660596	1140897	997926	612947	258396	3286900	**10774197**	5734733	2688667
2030-31	3780095	272818	1117164	746904	497803	254606	4829534	**11498924**	4836874	1694569

Annexure 6: New categories of financial instruments

New categories of financial instruments and also on the potential of upcoming instruments for mobilizing higher climate finance in the near future.

1. Debt Swaps

According to the OECD definition, debt swaps refer to the exchange of debt in the form of a loan or of securities other than shares, for a new debt contract (a debt-debt swap) or the exchange of debt for equity shares (a debt-equity swap). Environment related debt swaps are known to focus on conservation and other 'green' projects and climate change programs. Bilateral debt is the usual choice for executing debt swaps given the political constraints around multilateral swaps.

2. Credit enhancements

To deal with the prevalent issue of risk in the sustainable sector, a credit enhancement through different channels such as guarantees serves as a risk reduction technique to improve the credit profile of a structured financial product or transactions. It reduces the overall credit risk of debt, pushing the credit rating and lowering the interest rate thereby making the project more attractive to private investors. Guarantee instruments are essentially commitments in which a guarantor undertakes to fulfill the obligations of a borrower to a lender in the event of non-performance or default of its obligations by the borrower, in exchange for a fee. There exist partial or full guarantees. Guarantees can assume resource, regulatory, off-taker credit, or perceived technology risks that prevent private sector investments. Different types of guarantees include performance guarantees, credit guarantees, regulatory guarantees etc.In India, IIFCL launched a dedicated scheme known as "Credit Enhancement Scheme" for funding feasible infrastructure projects with project bond tenors above 5 years. The scheme addresses various challenges in the banking sector such as asset liability mismatch, capital adequacy etc. and is expected to help infrastructure projects to reduce the cost of debt (Yes Bank, 2018).

3. Insurance

Disaster related climate change typically requires risk prevention and risk transfer mechanism combinations. Post disaster expenditure is mostly dealt with by reallocating budgetary resources or through loans and grants assistance coming in from the international community. Insurance instruments can help individuals, communities, businesses, organizations and Governments to cope with extreme weather events by supporting resilience and adaptation activities through the release of post-event payouts in exchange for regular premium payments. They can also provide co-benefits for risk reduction and adaptation (ODI, 2018).

4. Green bonds

The UNFCCC Standing Committee on Finance at its 2018 forum, while discussing climate architecture lays stress on the effective utilization of green bonds as an avenue of facilitating green finance. They highlight green bonds as an instrument that can be utilized by both public and private intuitions to scale up the mobilization of climate finance by attracting investments at scale, including from large investment banks, institutional investors and pension funds.

A green bond is similar to a normal bond with the only difference that the issuer of a green bond categorically states that the capital will be raised to fund 'green' projects, which typically includes those relating to renewable energy, emission reductions etc. The Indian green bond market saw its first issuance in 2015 and has grown significantly since then. The issuer base has expanded with private banks such as Yes bank as well as public sector entities like IREDA being involved. Bond proceeds have usually been used to finance utility scale renewables, energy efficient buildings and large-scale transport infrastructure

5. Sovereign Bonds

A sovereign bond is a specific debt instrument issued by the Government that can be denominated in both foreign and domestic currency. Similar to other type of bonds, these also promise to pay the buyer a certain amount of interest for a stipulated number of years and repay the face value on maturity. They have a rating associated with them which essentially signals the credit worthiness.

Sovereign bonds have been utilized for raising sustainability funds around the world. Poland was the first ever nation to issue a green sovereign bond in 2016. It raised finance for different climate projects in the field of renewable energy, green transportation etc. In 2017, France witnessed the issue of largest green sovereign bond with the longest tenure of 22 years. These bonds thus represent a strong case for utilization by India to facilitate the climate financing needs (Yes Bank, 2018).

6. Rupee Denominated Bonds

RDBs, as discussed previously under the availability assessment make a strong candidate to raise 'green' money. The analysis here showed that the major sector garnering a dominant share raised through the instrument is formed by the energy sector, but RDBs are capable of facilitating other sectors like infrastructure, MSMEs etc. as well. The short-term loan problem in the infrastructure sector can also be addressed through long term RDBs. RDBs are capable of offsetting exchange rate risks and thus stimulate private investments in sustainable sectors. The offshore category of RDB called Masala Bonds, in turn also provides global investors to overcome foreign exchange administrative risks, complex registration processes etc. and invest in high quality emerging markets (Yes Bank, 2018).

7. Municipal Bonds

Municipal bonds represent another bond category with potential for raising sustainable financing. These bonds specifically cater to the urban infrastructure. In March 2015, SEBI

allowed municipal bodies to issue debt securities that could be listed. The set of SEBI regulations also put in place disclosure rules for these bonds and thus could facilitate the listing of privately placed municipal bonds (UNEP, 2016). These bond issuances have been observed to gain momentum as well. In 2017, Pune Municipal Corporation raised US$ 27 million (₹ 200 Crores) by issuing 10-year municipal bonds, while in February 2018, the Greater Hyderabad Municipal Corporation raised US$ 27 million (₹ 200 Crores) through municipal bonds to help fund the Government's strategic road development plan (YES Bank, 2018).

8. Corporate Bonds

As discussed previously under the availability assessment, corporate bonds provide a channel for utilization of private sector investments for climate related activities or actions. These are standardized securities that finance the balance sheets of corporations. They can be issued in public markets or even placed privately. Publicly traded infrastructure companies and utilities have been observed to be the primary issuers of such debt. The advantage of corporate bonds lies in the fact that instead of bearing the risks of an individual project, they bear the risk of the issuing corporate entity. The credit-worthiness is thus determined by an issuer's general ability to service the debt, making them less risky than project bonds. Plain vanilla corporate bonds have a broad appeal to institutional (such as pension funds and insurance companies) and retail investors alike. They form the core holdings in most investment portfolios. In turn, a strong banking industry and liquid capital markets are the required pre-requisite for a well-functioning corporate bond market (OECD, 2015).

9. Priority Sector Lending

Reserve Bank of India issued regulations and guidelines to define directed lending to specified sectors and influence interest rates, exposure limits, security and other conditions for lending by banks. Renewable energy also forms a part of the included list of sectors. As per the regulation, 40% of the net credit of banks should be lent out to the priority sectors including agriculture, energy, MSMEs etc. While priority sector lending could play an important role in channeling green finance, it has not yet picked up pace. One of the reasons could be due to the clubbing of renewable energy within the larger 'energy' ambit, resulting in a significant flow into the non-renewable energy sector. Given the magnitude of the exposure of the power sector to bank loans, it becomes a difficult affair to mobilize additional loans through the priority sector lending route (Sarangi, 2018).

10. Green Banks

Green Investment banks (GIBs) are institutions that are publicly funded and finance renewable energy, energy efficiency, and other clean infrastructure projects. They serve as a catalyst, channeling private financing for low carbon technologies, through various financial tools such as long term and low interest loans, revolving loan funds, insurance products, green bonds, and low cost public investments. With debates regarding the amount of climate financing available for climate mitigation and adaptation, these banks may serve as a source of additional funding, reducing the heavy reliance on international funding, as well as providing other added benefits.

GIBs facilitate the merging of public and private finances, thus accelerating investments for clean energy. They play the crucial role of familiarizing the financial sector with Low Carbon and Climate Resilient (LCR) investments and linking it with international capital sources to widen the pool of funds available for clean energy. These banks are designed to facilitate local investment, whilst sourcing private capital. Another added benefit provided by GIBs is the function of combining small scale clean energy projects. These entities recognize the fact that it is difficult for small units to access finance due to the high risk and scattered nature, thereby rendering them as unattractive for private capital. Thus, green banks directly aggregate these kinds of loans to achieve scale and diversity of risk. They have the potential to reduce lending rates and offer flexible finance to match the needs of renewable energy financing.

11. Infrastructure Debt fund (IDFs)

IDFs are investment vehicles for channelizing investment into the infrastructure sector. They are sponsored by commercial banks and NBFCs in India in which domestic/offshore institutional investors, specially insurance and pension funds can invest through units and bonds issued by the IDFs. They serve as an innovative financing instrument for renewable energy financing in India. The current regulatory regime allows such funds to be lent to PPP projects. According to Sarangi (2018), IDFs are yet to make an impact in the country, and cites the problem of availability of well-performing projects to result in much less use of this instrument in the renewable energy space in India. A substantial line of climate change project portfolios serves as a credibility factor for investors.

12. Crowd funding

Crowd funding is a decentralized funding mechanism whereby funds are mobilized from a large number of small private investors to reach the desired amount. This method of financing can be a favorable way to raise resources for renewable energy projects. In India, the medium has been used in the field of rural electrification. Bettervest —a German crowd funding platform has been investing in 'MeraGao Power' and 'Boond Engineering'—initiatives to energize rural India through renewable (Sarangi, 2018).

13. Asset backed securitization (ABS)

Securitization is a process of transforming a pool of financial assets like mortgages etc. into tradable financial instruments that can mobilize institutional capital. A 'green' securitization is when cash flows come from low carbon assets. Asset Backed Securitization allows funding for assets secured on the strength of the cash flows earned by the assets themselves. This allows capital markets to open up to mortgages, agricultural, distributed renewable energy assets etc. that have reliable income flows. ABS deals have been seen to grow despite a shallow bond market and thus the segment presents opportunities for diversification of green issuances into new sectors (ORF Special Report, 2019).

14. Blended Financing

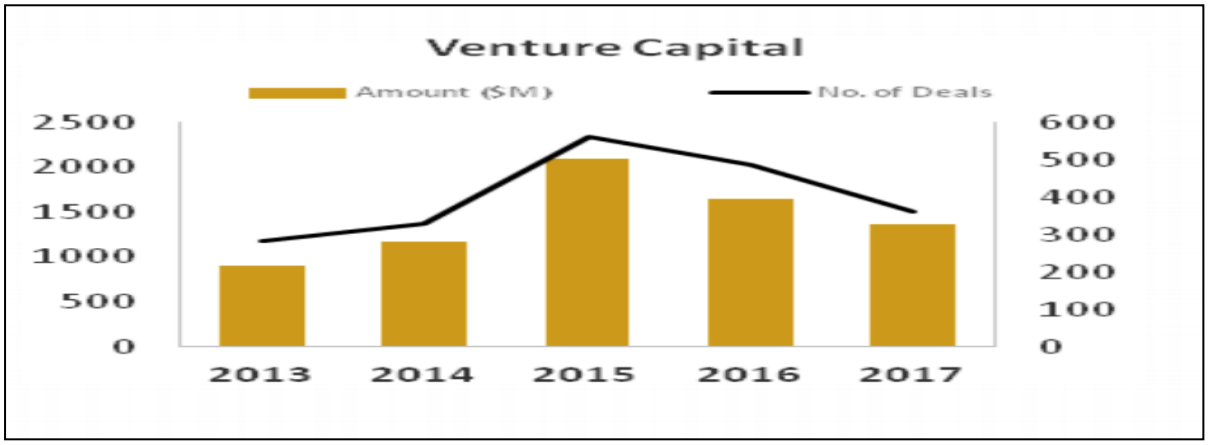
Blended finance can help overcome risk in climate finance architecture by bringing together development finance from public sources and private resources to de-risk sustainability related

investments in focus areas like healthcare, education and infrastructure. This in turn makes the climate change project more attractive and increases the role of private sector in sustainable financing. With an increasing need of climate finance mobilization, more MDBs are also recognizing the role of blended financing. Some of the entities have started tapping the opportunity. Some examples include the World Bank Group's Multilateral Investment Guarantee Agency (MIGA) which has been focused on using blended finance as well as the International Finance Corporation (IFC) that has had a project on Managed Co-Lending Program for infrastructure where three third-party institutional investors together invested US$ 1.5 billion (ORF Special Report, 2019).

15. Venture Capital

VCFs or VCs as discussed previously under the availability assessment, form a private equity (PE) financing medium that provides the ability to raise funding, particularly for entrepreneurs or small companies. They are known to invest in high risk profiles, making the PE market represent a huge potential source for flow of climate finance. According to research firm Venture Intelligence *India Private Equity Trend Report 2018,* India recorded a total PE investment of US$ 23.8 billion with 591 deals in 2017, of which VCs contributed US$ 1363 million with 362 deals. However, the report highlights that while overall PE investments have been increasing in total, the share of VCs in by stage investments have been going down in the country, as can be observed in Figure 10.

Figure 10: Venture Capital investments, by amount and no. of deals



Source: India Private Equity Trend Report 2018, Venture Intelligence

The potential of PE however, cannot be underestimated. As per the report, an industry wise analysis shows the possibility of climate financing finding its space in this market. The report highlights that with respect to total PE investments in the country, while IT sector attracted the dominant share of this amount, it was followed by the Banking, Financial Services and Insurance sector with a considerable 19 per cent. In addition to insurance, climate orientation also found its presence with the energy and the health sector attracting 6 and 5 per cent shares respectively.

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