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Climate Financing: As an Economic Approach towards Sustainable Environment

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ABSTRACT

A sustainable environment is a result of the efficient use of environmental resources to make them available for future generations. Climate is the most important for biodiversity to survive on the earth. Rapid changes in the behaviour of climate due to the greenhouse effect, soil degradation, and pollution in the air, and water lead to come into effect impacts like EL nino., floods, heat waves, and many more natural hazard. Hence adverse climate economic activities need to be curbed and efficient resource mobilization towards environment-friendly projects including renewable energy needs to be channelized into the Indian economy, which is popularly known as climate financing. , India secured 7th position in the Climate Change Performance Index (CCPI) and in 2023 the rank was 8th. The objectives of this study are to understand the necessity of climate financing for a sustainable environment and to take a glance at India's current stance and status in the Climate Financing Strategy. For that purpose, this research incorporated descriptive methodology to study various data collected from secondary sources and conclude that India is the third-largest greenhouse gas emitter. Annual CO2 emissions have been increasing at a steady rate, but the intensity per GDP ($) is decreasing, while per capita emissions are increasing sharply. India's GDP is expected to decrease by 4.5% by 2030, and this loss may reach 35% by 2100. To address this, budgetary allocation of India follows an increasing trend. Budgetary allocation trends from Rs.64 crores in 2014-15 to Rs. 220 crores in 2024-25 and continuing the same allocation at current F.Y ,ie.2024-25.Apart from budgetary allocation, India has made several environmental commitments, including the Nationally Determined Contribution (NDC) by 2030. However, green investment in India is currently short of its actual needs, ranging from $160 to $288 billion per year for climate actions. In the end, the research suggests effective utilization of FDI in the non-conventional energy sector, blended finance mode for climate projects domestic investment through private-public partnerships, identifying fossil burning propensity zones, and providing renewable energy easily to ensure a more significant reduction in greenhouse gas emissions and ensure a sustainable economy.

Keywords: Climate finance, Sustainable economy, Green India Mission, Green GDP, Sustainable environment.

1. Introduction

The temperature has reached the Laxman Rekha of 1.5ºC above the pre-industrial level and the El Nino effect has also been quite observed adversely on the climate; adverse climate economic activities need to be curbed and efficient resource mobilization towards environment-friendly projects including renewable energy need to be channelized in the Indian economy, which is popularly known as climate financing. The decision regarding climate financing has been taken in the 27th Conference of Parties (COP27) on climate change held in 2022. The definition of climate financing given by the United Nations has three important aspects: (i) type/nature of financing- Local, Domestic/National, and International/Foreign financing; (ii) source of financing- Private/Corporate, Public/Government and Other sources and (iii) Objective- to reduce climate adversity (**The Economic Times, 2023**)[1]. International Financial Corporation[2] has also advised for the blended finance for climate action in India since public finance cannot alone meet the climate goals. It is also estimated an amount of USD 10.1 trillion is required to achieve the target of net zero carbon emission by 2070. In 2024, India secured 7th position in the Climate Change Performance Index (CCPI) and in 2023 the rank was 8th.

The Economic Times (2022)[3] has stated in its article that 716 Lakh crore or $10.1trillion is required in India to achieve the commitment of net zero emission by 2070. The strong increase in GDP in India has driven up the Carbon emission by around 190 million in India in 2023 leading to growth in

[1] https://energy.economictimes.indiatimes.com/blog/how-does-climate-financing-affect-and-aid-the-indian https://energy.economictimes.indiatimes.com/blog/how-does-climate-financing-affect-and-aid-the-indianeconomy/97270719#:~:text=The%20climate%20finance%20initiative%20taken,45%20per%20cent%20by%20203.

[2] https://www.ifc.org/en/insights-reports/2023/blended-finance-for-climate-investments-in-india

[3]https://bfsi.economictimes.indiatimes.com/news/industry/india-needs-rs-162-lakh-crore-green-finance-till-2030-amid-rising-funding-costs/9539 7962

emission rate higher than GDP growth (**The Economic Times, 2023**)[4]. The more the economy is developed from the underdevelopment or developing stage, the more environmental degradation may happen in the form of greenhouse gas emissions and global warming that eventually dilute environmental sustainability. Therefore, economic development should accommodate and take care of environmental quality for the future. For this reason, additional investment in the form of climate financing is the ultimate option in the current scenario.

2. Review of Literature

To understand deeply the different concepts and connotations of the present topic of the study, numerous different past studies are studied and analysed thoroughly and the gist of some of the important research is synthesized below chronologically in tabular form from both Indian and international perspectives.

Table 1: Gist of Past Literature

From Indian Context			
Sl. No.	**Authors**	**Topic of Study**	**Major Findings from the Study**
1.	Goel (2016)	Green Financing	Highlighted opportunities and difficulties facing green financing in the future and also focussed on green banking initiatives of top Indian public and private sector banks. It also asserted the demand for creative financing tools to help the nation achieve SDG 2030 and transition to a zero-carbon policy.
2.	Jha & Bakhshi (2019), Zakari et al. (2021), and Bhatnagar et al.(2022)	Green Financing	Asserted the significance of green finance in advancing sustainable development and acknowledged the beneficial effects of green financing on environmental sustainability in India.
3.	Siby & Teena (2023)	Climate Financse	Analysed India's prospects and challenges related to climate funding through a qualitative approach and suggested that the Indian dream of zero carbon emission and climate-resilient development can be realized through the implication of sound policy implementations and by adopting renewable energy, climate-resilient Sustainable farming, optimization of water use, afforestation to create carbon Sinks and reducing fossil fuel consumption
4.	Das et al. (2023)	Environmental Sustainability	Found that environmental sustainability in India is inversely correlated with the usage of sustainable environmental technologies, raising the prospect of greenwashing. The study does, however, also emphasize how financing for green projects contributes to environmental sustainability.
5.	Bhatia (2023)	Sustainable Development	It is stated that sustainable development requires cooperation from all parties, especially in developing nations like India, and the role of finance from the public and private sectors is also emphasized.
6.	Banik et al. (2023)	Blended Financing	It is ascertained that Blended finance can lower the total cost of capital of the private investor. The regulatory policy of Green investment ought to be more open and accommodating concerning India. It is also cited that green finance products must be appealing to both domestic and foreign investors.
From International Context			
7.	Mamun et al. (2022)	Green Finance	Studied the impact of green finance on decarbonization and asserted that it considerably lowers carbon emissions and has a greater impact on such emissions in developed nations and economies that are vulnerable to climate change.
8.	Fu et al. (2023)	Green Finance and Sustainable Development	The study suggests that to enable the availability of green finance and the integration of carbon-neutral practices, it needs to emphasize strong

[4] https://auto.economictimes.indiatimes.com/news/industry/global-co2-emissions-reach-new-high-in-2023-gdp-growth-weak-monsoon-drove-up-emissions-in-india-iea/108251835

			regulatory frameworks and also found that investors accept lower financial returns in exchange for non-financial benefits in green finance.
9.	Bedendo et al. (2022)	Green Finance and Green Bonds	It suggests that the issuance of green bonds is more likely among large banks and concludes that only banks helping the financial sector in a greater way decarbonize by issuing green bonds.
10.	Pawlowski (2024)	Green Bonds	The study concentrates on the importance of the evolution of the green bond market in financing investment activities in the field of energy transition concerning the financial market of Europe and concludes that the energy sector is responsible for the largest value of green bonds. The range of green debt issuers is gradually becoming more diverse, which highlights the significance of the green bond market in raising money for environmental protection initiatives.

3. Research Gap

Currently, the necessity of conserving the environment sustainability has been felt across all sectors of the economy globally and many researchers, nationally and internationally have identified different areas of climate degradation and its deadly and catastrophic consequences. Few have also focussed on different climate investment measures and mechanisms. After studying different studies, no such studies are found that put emphasis jointly on environment sustainability issues along with climate financing necessity and India's stance on it. The present study endeavors to meet such a gap with a descriptive focus.

4. Relevance and Objective of the Study

The most unpredictable event in today's context is climate change and its related climate risk in every aspect of socio-economic conditions. India is the third largest emitter in the world and is facing severe climate risk potentiality in its growth trajectory. India has made several climate commitments by 2030 and the success of the same is highly dependent on financing possibilities. Therefore, by realizing the highest level of importance of climate risk management from the country's end, it is a very relevant area to identify, investigate, and bring about different aspects and parameters of environmental sustainability and climate financing issues.

Hence, the current study must incorporate the following research objectives:

1. To understand the necessity of climate financing for a sustainable environment;
2. To look into India's current stance and status in Climate Financing Strategy;

5. Research Methodology

The present study is purely descriptive in nature. Secondary data have been used to support the understanding and show the trend of a particular phenomenon. The data have been collected from different websites, magazines, and news articles which are freely available over the internet. To present data, statistical tables, and charts are used in the relevant section of the study. Different documents like Government budgets, RBI reports, and Press releases of Government are also used in the study. Different databases like Statista, World Bank, and others are also used. The period of the study in most of the data presentation is taken from 2014-15 since India took NDC in October 2015. So, data is taken one year ahead of 2015-16 and also as per availability of data.

6. Necessity of Sustainable Environment in India

If we consider only present consumption with high priority, it will be a very detrimental philosophy for the entire human being in the world. The increase in population and reduction in forest cover have changed the expected climate impact on human beings in a rapidly unexpected way thereby inviting a future threat of a hostile environment for living. Such an alarming situation always demands a thoughtful step towards mitigating such an impending danger hanging on the future of all human beings. Urbanization, commercial production, and fulfilment of only current needs at the cost of the environment lead to uncontrolled accumulation of carbon in the environment that invites unpredictable climate volatility. Thus, a sustainable environment impliedly requests for the economy to emphasize green economic activities so that a carbon-neutral economy as well as climate can be established.

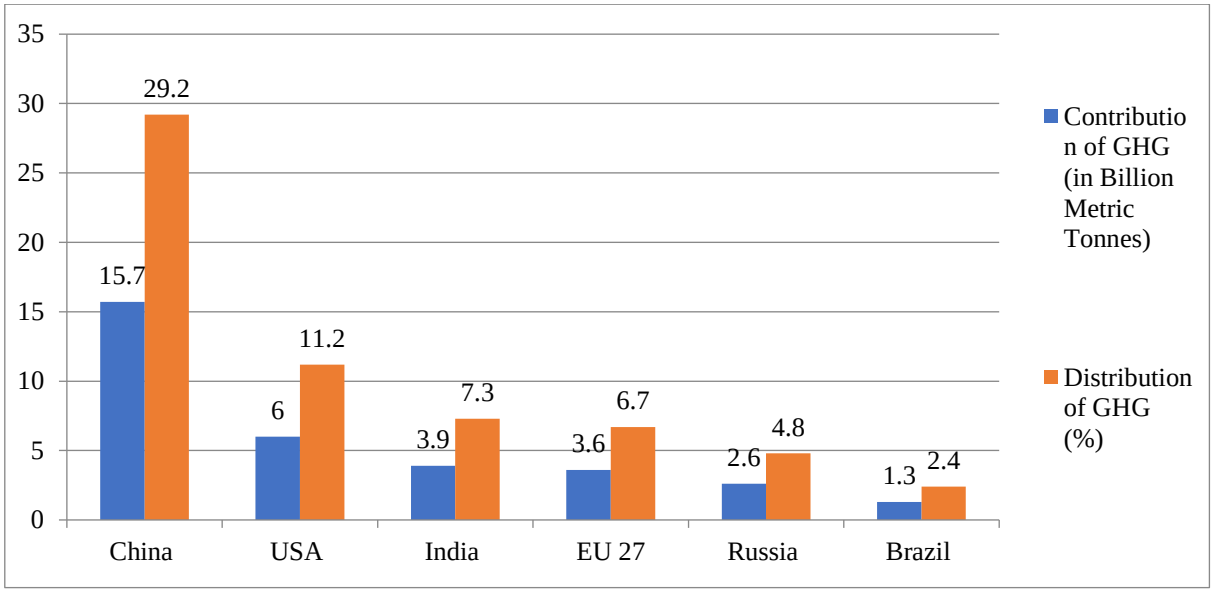
In the last decade, the parameters of a healthy climate and environment in India are continuously declining. The following is a list of some eye-catching events that happened in India that show how our environment gets rude towards our unsustainable consumption patterns having a fatal impact on our ecosystem.

- February 2023 had become the hottest in India since 1901;

- From Jan 2023 to September 2023, India has seen extreme weather events almost every day;
- India has also seen the driest August in 2023 since 1901;
- India has also seen some massive floods due to extreme weather like the Maharashtra Floods in 2005; the Ladakh flood in 2010; the Flash flood that took place in Uttarakhand in 2013 and in 2014, the Jammu and Kashmir flood in;

In the world statistics, India has positioned herself in third position as the largest contributor and distribution of greenhouse gases in 2022.

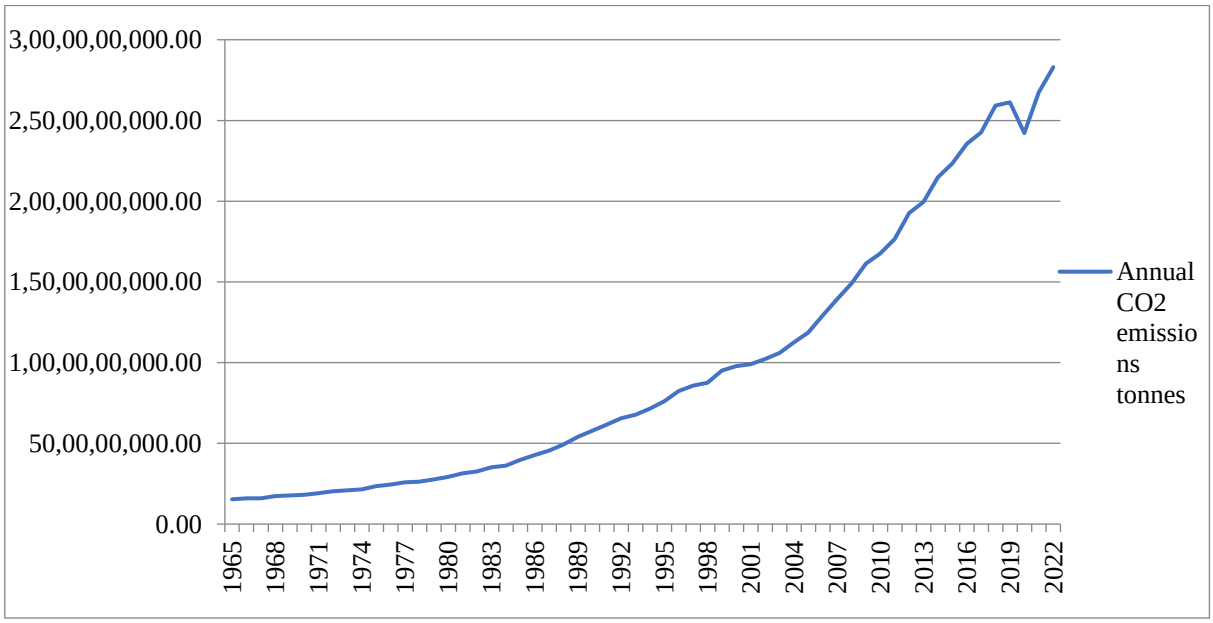
Fig 1: Worldwide Contribution and Distribution of Greenhouse Gases (GHG) in 2022



Source: Statista.com/statistics/1379081/leading-countries-based-on-greenhouse-gas

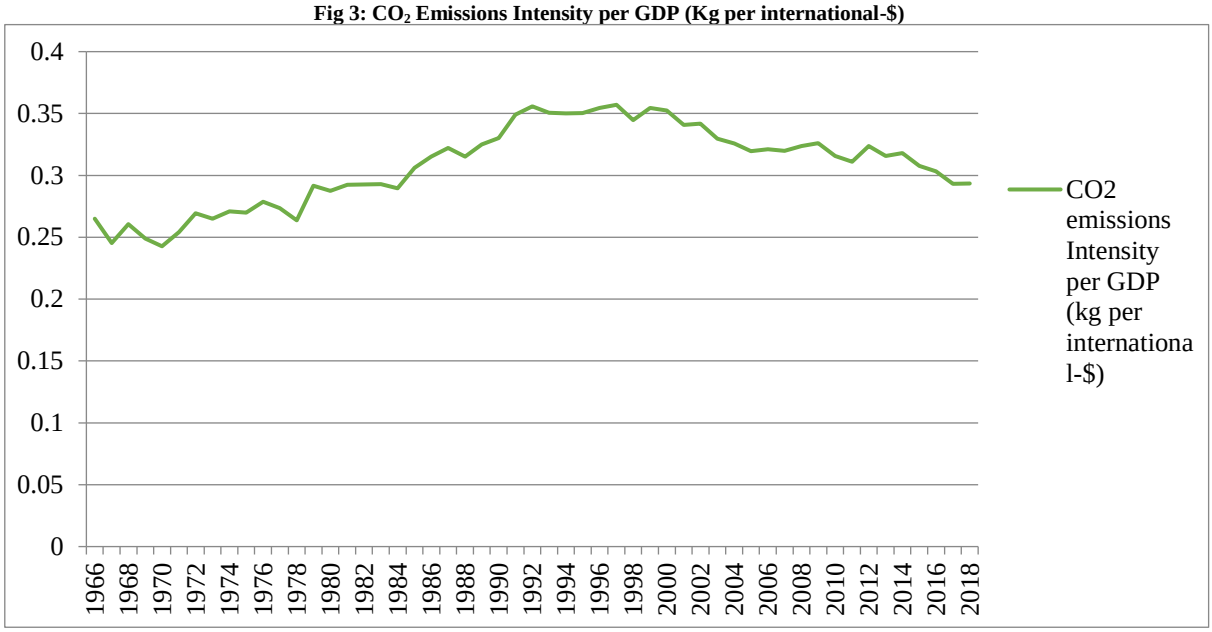
During the last few decades, in India, the emission of CO_2 per year has also increased, and due to this India has become highly vulnerable to frequent climate adverse physical impacts. But during the last two decades, carbon intensity per GDP ($) has a decreasing trend whereas per capita CO_2 emission has an increasing trend.

Fig 2: Annual CO_2 Emission in India (in Tonnes)



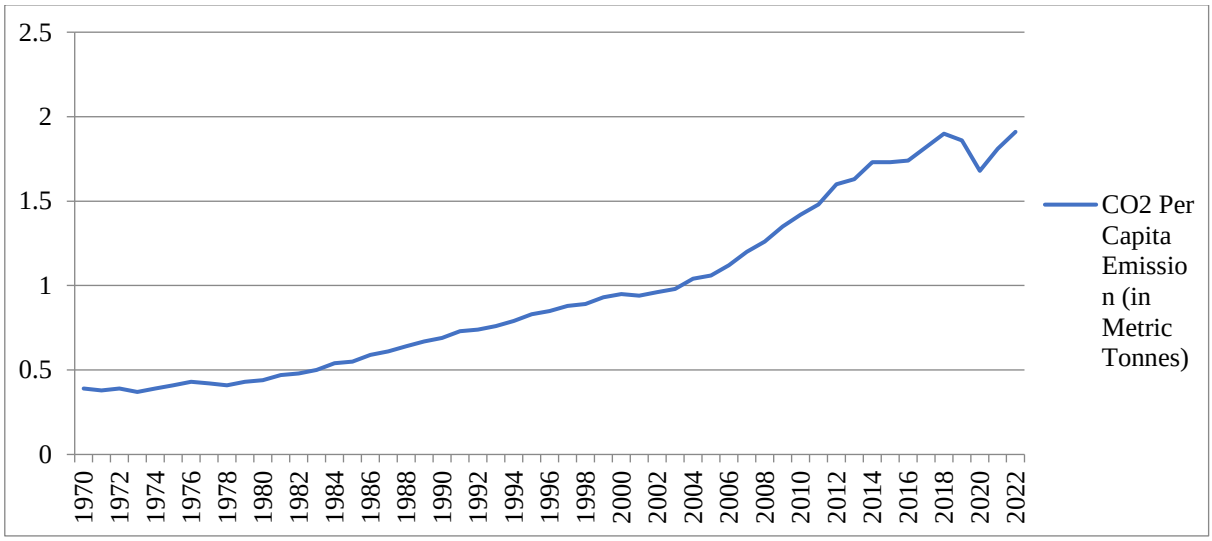
Source: https://ourworldindata.org/grapher/co2-intensity?tab=table

Fig 3: CO_2 Emissions Intensity per GDP (Kg per international-$)



Source: https://ourworldindata.org/grapher/co2-intensity?tab=table

Fig 4: CO_2 per Capita Emission (in Metric Tonnes) in India



Source: https://www.statista.com/statistics/606019/co2-emissions-india/

Indian constitution under article 21- "Right to life' has an inherent right to the people for entitlement to a healthy living environment. Therefore, the state must have performed its duty to provide an environment free from climate vagaries. India has a constitutional mandate for having a sustainable environment for the living of people. Economic growth is highly required in the case of any developing nation; India is the 5th largest economy and has grown in the last quarter of 2023-23 at 8% which is one of the fastest-growing economies in the world. To keep such a growth rate, productivity and efficiency must be higher. However, the adverse climate impacts both productivity and efficiency, and also output due to unpredictable environmental shifts. The trade-off between economic growth and consequent environmental degradation due to such robust economic growth in developing countries like India has been one of the significant international discussion matters in current times (**Lee et al. 2022)**. It is found that productivity is lost due to the propensity of the labour force to be absent on hot days. It is also found in research[5] that every 1% increase in annual temperature may decrease by 2% revenue.

Indian economy must incorporate the idea of Green GDP at the earliest possible otherwise it may have lost a significant portion of its GDP due to global warming impact as mentioned by several reports. **RBI report (2022-23)[6]** has mentioned that up to 4.5% of GDP may be lost due to adverse climate

[5] https://epic.uchicago.in/climate-change-may-decline-output-of-manufacturing-sector-in-india-study

[6]https://rbidocs.rbi.org.in/rdocs/Publications/PDFs/RCF03052023395FAF37181E40188BAD3AFA59BF3907.PDF

impact in India by 2030. **Roy (2021)** has stated in her article that 3 to 10% of India's GDP may be lost annually in 2100. **The Economic Times (2023)**[7] has pointed out that Indian GDP may be lost up to 35% by 2100.

In India, the Government has also worried about the fatal impact of climate adversity mostly on agriculture and the lives of the farmers. It is found through a climate impact assessment through a crop simulation model; the following assessment has come out as per the Ministry of Agriculture & Farmers Welfare:

Table 2: Crop Yield Reduction in 2050 and 2080

Crop Type	% Decrease in 2050	% Decrease in 2080
Rain-fed rice yields	20%	47%
Irrigated rice yields	3.5%	5%
Wheat yield	19.3%	40%
Kharif Maize yields	18%	23%

Source: https://pib.gov.in/PressReleaseIframePage.aspx?PRID=1909206

India has to maintain its different climate commitments not only for climate risk mitigation but also for reducing the negative impact on GDP. A deviation from a sustainable environment through climate conservation commitments may be a danger for the Indian economy in the near future in terms of loss of GDP.

Table 3: A Comparative Analysis of Loss of GDP due to Different Scenarios

Scenarios (Deviations from Baseline in percent)	Impact on GDP (USA)	Impact on GDP (World)	Impact on GDP (India)
Below 2°C in 2030	-1.93	-1.67	-1.91
Below 2°C in 2050	-2.29	-3.02	-3.8
NDC in 2030	-2.59	-2.14	-3.16
NDC in 2050	-5.56	-5.74	-9.08
Current Policies in 2030	-1.55	-1.63	-2.86
Current Policies in 2050	-5.09	-6.05	-9.87

Source: RBI Report (2023) https://rbi.org.in/Scripts/PublicationsView.aspx?id=21769

It is found from the above table that the vulnerability of India's GDP due to climate risk is higher than the World average in all of the scenarios and except for 1st case; it is also higher than the USA. It is also found that the highest loss of GDP may occur in case of deviation from NDC in 2050.

Laidlaw (2023) has highlighted that the climate strategy is taken as a material issue by Indian companies in mitigating climate risk. It is found that 24% of Indian companies, which is more than the global average of 21% of companies, have already made concrete plans to combat the physical impacts of climate change. **Franck (2019)** has stated that an average increase in temperature of 0.04°C per annum, keeping other factors and policy constant, may reduce the global real GDP per capita by 7.22% by 2100.

7. Inter-linkage between Climate Financing and Sustainable Environment

Climate financing refers to the finance required for climate change adaptation and mitigation action. It is used to meet the Nationally Determined Contributions (NDCs) by the countries. Climate finance is a sub-set of green finance that covers financing for other environmental issues like bio-diversity, conservation, etc. **(The Economic Times, 2023)**[8]. Climate financing includes financing from local, national, and international sources of financing for action taken on climate adaptation. This finance may come from private, public, or alternative sources **(United Nations Climate Change)**[9].

[7] https://economictimes.indiatimes.com/news/economy/indicators/india-may-lose-35-of-gdp-to-climate-change-by-2100-warns-unescap-report/articleshow/104222968.cms?from=mdr

[8] https://energy.economictimes.indiatimes.com/news/renewable/explainer-understanding-the-terminologies-around-sustainable-finance/105848597

[9] https://unfccc.int/topics/introduction-to-climate-finance

The environment has been losing its quality and sustainability due to massive exogenous anthropogenic activities. Environmental degradation is a cause of concern for most developing nations like India since such nations need to upscale their size of GDP without hampering climate and complying with sustainable development goals. The sustainable environment demands decarbonised climate and the elimination of the green-house gas effect. To maintain environmental sustainability, India like other countries has made a long-term commitment of Net zero carbon emission by 2070 towards the climate. For this, India has undertaken eight 'Nationally Determined Contributions (NDC)' to UNFCC on 2nd October 2015, which shows three aspects of India's climate action plan:

Table 4: Nationally Determined Contribution

Aspects	**NDC Sl. No.**	**Climate Action Plan by 2030**
The mission of India's Climate Action Plan	1	Ensuring a Healthy and sustainable way of life leading to a lifestyle for the environment.
	2	Taking climate-friendly as well as cleaner way for economic development.
Target of India's Climate Action Plan	3	Reducing 45% emission intensity of GDP from the 2005 level.
	4	Increasing non-fuel based energy production to 50% of total electric power installed capacity.
	5	Creating a carbon sink that can absorb 2.5 to 3 billion tonnes of CO_2 equivalent.
Means to India's Climate Action Plan	6	Enhancing Investment in development schemes relating to agriculture, water resources, coastal areas, Himalayan region, and disaster management.
	7	Mobilizing both national and international funds in climate risk mitigation.
	8	Building capacity for developing and diffusing cutting-edge climate technology.

Source: Government of India Press Release[10]

Third aspect as indicated above calls for a higher amount of investment required for climate risk mitigation and a sustainable environment. Climate resilient and protective infrastructure and technology need to be used for mitigating climate transitional risk. In this context, it is important to understand that climate change on environment creates two types of risk to the economy: physical climate risk which is associated with severe climate events like catastrophic floods, super-cyclones, draught, etc. leading to huge loss, and transitional climate risk which is associated with potential cost to the society to use climate-friendly infrastructure and technology, to comply with government policies on carbon emission. The cost of transitional risk from climate change is a major cause of concern for the economy since; if economic productive activities are proactively transitioned from high carbon and carbon equivalent intensity to least carbon economy, it may eventually decrease the cost of physical climate risk.

It is also ascertained that an estimated 2.5% of the GDP needs to have a green finance to meet the infrastructure gap that requires for the goal of carbon reduction as enshrined in India's NDC commitment and also stressed on new investment of $ 7.2 to 12.1 trillion by 2050 **(RBI Report, 2023)[11].** It is also noted by the RBI in its report **Policy Options to Mitigate Climate Risks** [12] that the cumulative expenditure that is required in India by 2030 for adapting to climate change is approximately Rs. 85.6 lakh crore (at 2011-12 prices). The following shows the estimated requirement climate finance requirement for India per annum for different climate actions:

Table 5: Estimated Requirement for Green Finance

Sl. No	**Climate Action**	**Requirement (USD)**	**Projected by**
1.	NDC Commitment for 2030	170 billion per year up to 2030	Climate Policy Initiative, 2022
2.	Achieving Net-Zero carbon emission by 2070	160 billion per year	International Energy Agency, 2022
3.	Achieving Net-Zero carbon emission by 2070	202 billion per year	Council on Energy, Environment, and Water-Center for Energy Finance, 2021

[10]https://pib.gov.in/PressReleaseIframePage.aspx?PRID=1987752#:~:text=In%20August%202022%2C%20India%20updated,enhanced%20to%2050%25%20by%202030

[11]https://rbidocs.rbi.org.in/rdocs/Publications/PDFs/03CH_030520236282D892D22944898CA663AB8E6A83C7.PDF

[12] https://www.rbi.org.in/Scripts/PublicationsView.aspx?id=21771

4.	Keeping 1.5° C from 2016-2050	288 billion per year	McCollum et al., 2018

Source: RBI Report on Climate Change and Financial Sector, 2023[11]

It is found according to the report of **Landscape of Green Finance (2022)[13]** in India that in FY 2019-20, it has tracked green finance of Rs. 309000 crore or about USD 44 billion per annum. This amount is less than one-fourth of India's need for climate risk. This report has also shown that India needs approximately 11 lakh crore per year or 162.5 lakh crore between 2015 to 2030 **(The Economic Times, 2022)[14]** and Rs. 716 lakh crores to achieve net zero emissions by 2070.

8. India's Climate Financing Strategy

India is one of the leading countries in meeting its NDCs of 2015. India has completed its two qualitative targets in NDC 2015 as shown in the table:

Table 6: India's NDC 2015 Achievement

NDC 2015 Targets	Target Achieved Date	Outcome
Reducing the Emission Intensity of its GDP by 33-35% by 2030	31st December 2023	33% emission intensity reduced
Achieving 40% of Cumulative Electric capacity from non-fossil fuel	31st October, 2023	Non-Fossil fuel energy possesses 43.81% of the total capacity

Source: Ministry of Environment, Forest and Climate Change[15]

To achieve other climate change adaptation and mitigation actions, different techniques of climate financing have been taken in India that help maintain environmental sustainability with a progressive trend of GDP. Such climate financing techniques or strategies include mainly: Green Bonds, Blended Finance for Climate, Green Credit Programs, Carbon tax and Carbon Credit, Climate Budgeting, etc.

Singh (2017) has mentioned that the source of funds for climate action is channelled through two ways in India: Public finance and Private finance. Public finance includes sources mainly from the Government Budget (union and state), Private and public sector banks, Domestic development financial institutions and Public enterprises and NBFCs. International finance includes sources from International funds, foreign development banks, foreign governments' grants, and FDI. The government budget takes one of the highest portions of entire climate finance in India.

In international funding, GEF and GCF are the two major funding systems that focus on climate action projects in climate-vulnerable countries. Both of them are financial mechanisms under UN Framework Convention on Climate Change (UNFCCC). Global Environment Facility (GEF) Fund is the largest global contributor of financial flows to India, funded 97 projects in India till 2017 amounting to USD 816.47 million.

Table 7: Active Project Portfolio under GEF Funding in India

Project Type	Number of Projects	Total Financing
National	40	$347,462,649
Regional/Global	17	$108,431,112

Source: https://www.thegef.org/projects-operations/country-profiles/india

Table 8: GEF Funding in India

Period of Funding	GEF Funding	Allocated (USD)	Utilized (USD)	% of Fund Utilised
2006-10	GEF 4	7,60,00,000	7,49,76,990	98.65
2010-14	GEF 5	9,37,50,000	9,33,90,028	99.62

[13] https://www.climatepolicyinitiative.org/publication/landscape-of-green-finance-in-india-2022/#:~:text=Green%20finance%20flows%20must%20increase,Net%2DZero%20emissions%20by%202070.

[14] https://economictimes.indiatimes.com/industry/renewables/indias-annual-green-finance-is-just-one-fourth-of-its-needs-finds-study/articleshow/93486753. cms?from=mdr%20.

[15] https://pib.gov.in/PressReleaseIframePage.aspx?PRID=1987752#:~:text=In%20August%202022%2C%20India%20updated,enhanced%20to%2050%25%20by%202030.

2014-18	GEF 6	8,78,76,737	5,90,80,068	67.23
2018-22	GEF 7	4,72,37,955	3,61,07,775	76.44
2022-26	GEF 8	4,16,54,229	1,24,99,997	30.01

Source: https://www.thegef.org/projects-operations/country-profiles/india

The above table shows that the allocation of GEF funding is increasing from GEF4 to GEF 6 but the percentage of fund utilization has decreased from 98.65% to 67.4%.

The Green Climate Fund (GCF) is a financial mechanism that facilitates and promotes developing countries, vulnerable to climate risk, in taking climate action projects that make a paradigm shift to low carbon emission and climate resilient development **(NABARD)[16].** GCF focuses on both climate mitigation and adaptation. Currently, GCF has funded 10 projects in India amounting to USD 566.8 million.

Table 9: GCF Funded Projects in India

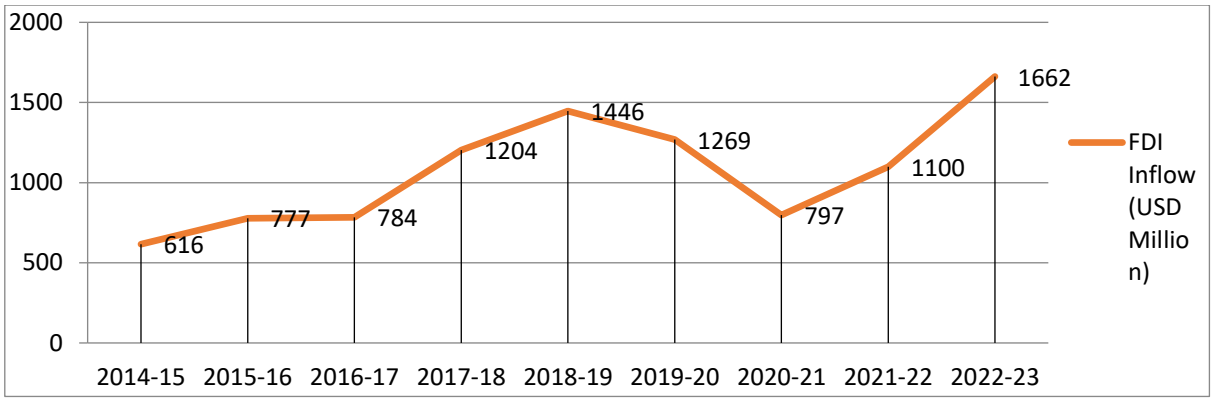
Sl. No.	**Name of Projects**	**GCF Financing (USD)**	**Instrument of Financing**	**Size of Project**	**% of GCF Financing**	**Theme of Financing**	**Tonnes of Emissions Avoided**
1	Avaana Sustainability Fund	2,45,00,000	Equity	Small	20.4	Cross-cutting	4.7 Million
2	Project GAIA	15,25,00,000	Equity	Large	10.3	Cross-cutting	30.6 Million
3	The Green Guarantee Company (GGC)	4,05,00,000	Equity	Large	11.2	Cross-cutting	74.6 Million
4	Climate Investor Two (CI2)	14,50,00,000	Grant	Large	16.5	Cross-cutting	44.7 Million
5	India E-Mobility Financing Program	20,00,00,000	Equity	Large	13.4	Mitigation	9.5 Million
6	Green Growth Equity Fund	13,25,00,000 45,00,000	Equity Grant	Large	14.5	Mitigation	452.0 Million
7	Climate Investor One	10,00,00,000	Grant	Large	12.2	Mitigation	53.7 Million
8	Enhancing climate resilience of India's, coastal communities	4,34,18,606	Grant	Medium	33.3	Cross-cutting	3.7 Million
9	Line of Credit for Solar rooftop segment for commercial, industrial and residential housing sectors	10,00,00,000	Loan	Medium	40	Mitigation	8.2 Million
10	Ground Water Recharge and Solar Micro Irrigation to Ensure Food Security and Enhance Resilience in Vulnerable Tribal Areas of Odisha	3,43,57,000	Grant	Medium	20.7	Adaptation	16.0 Million

Source: https://www.greenclimate.fund/countries/india

It is found from the above table that out of the total 10 projects, 5 projects have both features of project adaptation and mitigation i.e. cross-cutting projects. From projects 2 to 7, i.e. 6 numbers of projects, the range of GCF investment on total project value ranges from 10.3% to 16.5%, and the highest investment i.e. 40% is found in project 9 the project of which is mitigation in nature.

[16] https://www.nabard.org/content1.aspx?id=584&catid=8&mid=8

Fig 5: FDI Inflow in India towards Non-Conventional Energy (in USD Million)

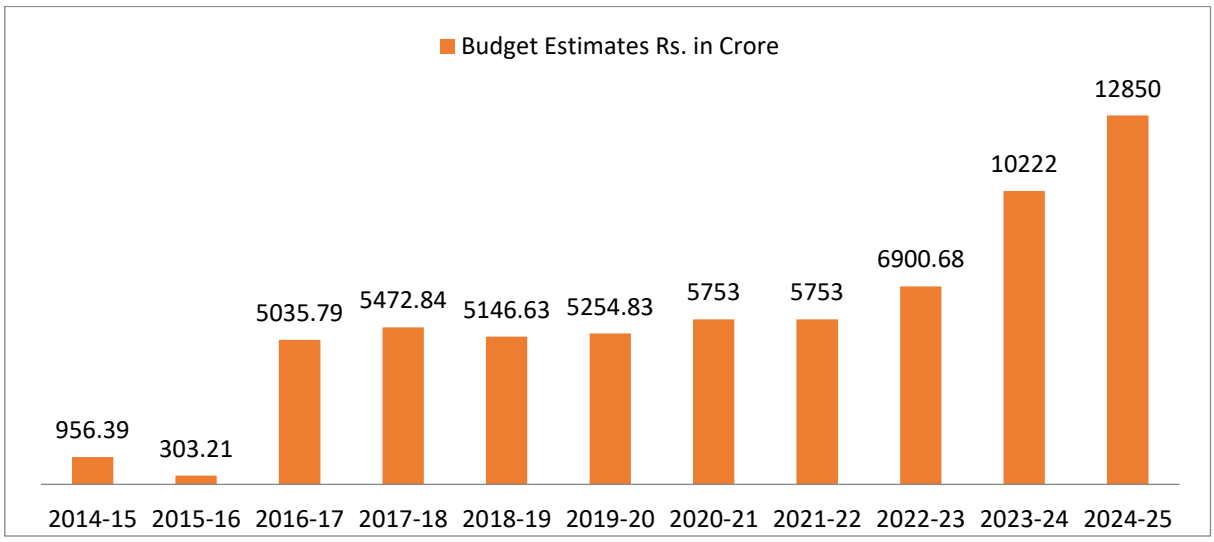


Source: Srinivasan et al. (2023)

India has also seen an overall increasing trend in FDI flow to non-conventional energy which is an integral part of climate risk mitigation strategy. The highest FDI of USD 1446 million was received in 2018-19 for non-conventional energy. Thereafter, it decreased till 2020-21 and reached USD 797 million and again increased to USD 1662 million in 2022-23.

The union budget of India has also given a bold policy focus through the allocation of a significant portion of the fund to different climate action schemes. The Union's budget 2020-21 has explicitly stated that various departments or ministries will execute climate actions through the normal budgetary process (**Ministry of Environment, Forest and Climate Change, 2023)**[17]. The 2022-23 Union's budget is considered a climate budget since this budget has provided a path to achieving global and national climate targets. Indian budget has focussed considerably on climate adaptation and mitigation measures and policies and for that, allocation for budgetary grants are also made. The Budget 2023-24 in India has placed a green economy as one of the top five priorities and includes many schemes and policies like green farming, green energy, green transport, green fuel, green building, and also some prominent missions like sustainable habitat, solar mission, sustaining Himalayan ecosystems, Green India etc[16]. So far as climate change and green economy are concerned, the most important segments of the union budget are (i) New and Renewable Energy and (ii) Environment, Forest, and Climate Change. These two ministries include schemes that are concerned with climate action in India.

Fig 6: Budget Allocation for New and Renewable Energy

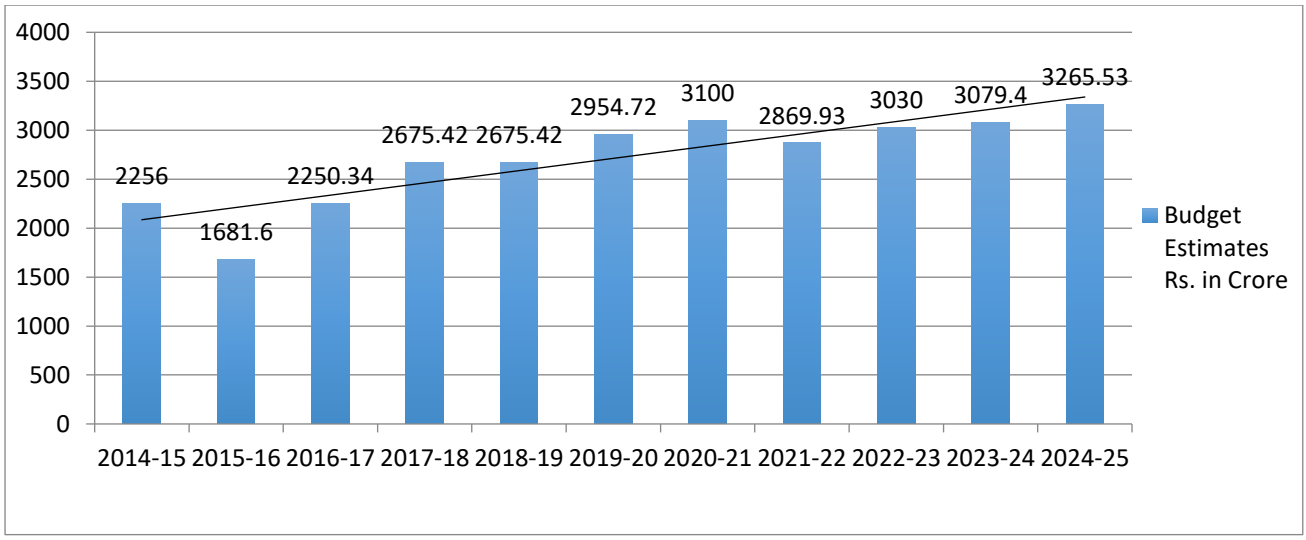


Source: Compiled by authors from Budget Documents

Budgetary allocation has also risen for new and renewable energy as per the budgetary documents as shown in Fig 1. It is observed that there is a good jump in budget allocation from 2014-15 to 2016-17 leading to a 426.54% increase in 2016-17 than 2014-15. There is almost constant budget allocation from 2016-17 to 2021-22 leading to only a 14.24 % increase in 2021-22 than 2016-17. It is also to be noted that again a jump in budget allocation was observed from 2022-23 to 2024-25 leading to an 86.21% increase from 2024-25 to 2022-23.

[17] https://pib.gov.in/PressReleaseIframePage.aspx?PRID=1944365

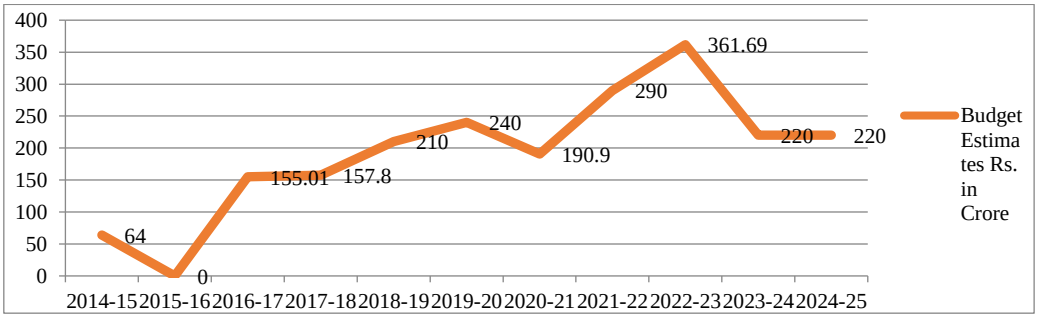
Fig 7: **Budget Allocation for Environment, Forest and Climate Change**



Source: Compiled by authors from Budget Documents

From the above Fig 2, it is observed that there is no constant increase in budget allocation per year from 2014-15 to 2024-25 but the total budget outlay from 2014-15 to 2024-25 has increased from Rs. 2256 Crore to Rs. 3265.53 Crore. 2020-21 and 2024-25 have been found with higher amounts of total budget allocation for the Environment, Forest, and Climate Change.

Fig 8: **Budget Allocation for Green India Mission**



Source: Compiled by authors from Budget Documents

It is seen from the above Fig 3 that budget allocation for the Green India mission is rising from 2015-16 to 2022-23. There is highest allocation took place in 2022-23 for Rs. 361.69 Crore and thereafter, allocation was fixed and decreased to Rs. 220 Crore.

In India, for climate finance, another financing strategy called blended finance is also gaining attention currently. The term blended finance refers to the financing strategy for a project that involves private capital seeking a market rate of return and public or philanthropic capital seeking environmental goods with concessional returns **(Global Impact Investing Network)**[18]. Blended finance is an innovative approach towards inviting private finance for climate adaptation and mitigation projects. CPI report 2022 has also suggested that green financing in India is lower than 1/4th of the total needs of climate financing. Against this backdrop, the Goa government has recently announced to setting up the blended finance facility with the help of the World Bank that helps in accessing and mobilizing finance for low-carbon and climate resilient projects (**The Economic Times, 2024**)[19].

Another strategic step in climate financing projects taken by India is the issuance of sovereign green bonds which will be announced on 1st February 2022. The proceeds of such issuance can be invested in public sector projects for reducing carbon intensity. India issued its first sovereign green bonds of Rs. 80 billion (equivalent to $ 980 million on 25th January 2023 and on 9th February 2023 second announcement of the green bond of Rs. 80 billion (equivalent to $ 968 million) was made. 84% of the total green bond market is comprised of Private sectors and the left 16% is issued by the Government sector in which sovereign green bonds account for only 9% **(Hussain and Dill, 2023)**.

[18] https://thegiin.org/blended-finance-working-group/?gad_source=1&gclid=EAIaIQobChMI55nJ_u-HhgMVVoRLBR1N4Q9VEAMYASAAEgLHKPD_BwE

[19] https://economictimes.indiatimes.com/news/india/goa-govt-world-bank-collaborate-for-blended-finance-facility-for-climate-resilience/articleshow/107846009.cms?from=mdr

9. Concluding Remarks

India is one of the fastest growing countries in terms of GDP in the world economy, and must keep such growth with adequate climate adaptation and mitigation strategy. India is considered an adverse climate-vulnerable country that has seen many life-threatening climate adverse events during last decades and ranked a third position in Greenhouse house emission worldwide. Annual CO_2 emission in India has been increasing constantly with the sharp rate of increase during last decade from 2004 to 2022 but CO_2 emission intensity per GDP ($) was decreasing in trend whereas CO_2 per capita emission is increasing sharply. Due to catastrophic impact of climate change, India is going to evidence the major reduction in crop yield as well as GDP up to 4.5% by 2030 as per RBI report and such loss of GDP may go up to 35% by 2100.

To reduce the climate impact and vulnerability, India has taken several environmental commitments including Nationally Determined Contribution (NDC) by 2030 and on the contrary, it is ascertained that green investment in India is short of its actual needs which is ranging from $160 to $288 billion per year for different climate actions as per different reports. Different strategies have been adopted to increase the funding for climate projects and schemes in India. FDI inflows in non-conventional energy have also been increasing 2020-21 to 2022-23 due to its 100% automatic permissibility. Union budget has also made a strong move through allocation towards different climate mitigation and adaptation projects and schemes. Budget allocation to New and Renewable Energy has been increasing from Rs. 956.39 crore in 2014-15 to Rs. 12850 crore in 2024-25 and during this period the sharp increase budget allocation is observed from 2021-22 to 2024-25. Budget allocation to Environment, Forest and Climate Change has also increased from Rs. 2256 crore in 2014-15 to Rs. 3265.53 crore in 2024-25. Budget allocation to Green India Mission has also increased from Rs. 64 crore in 2014-15 to Rs. 220 crore in 2024-25 but during last two years from 2023-24 to 2024-25 allocation remains same of Rs. 220 crore. In this backdrop, the focus on blended finance mode for climate projects is required but progressive steps in this regards by government is very trivial although an important financing avenue through sovereign green bonds has been initiated by the government but it takes only 9% of entire green bond market in India.

Although India has bold measures to curb the negative impact of climate change and successfully satisfied the NDC 2015 measures well ahead of time, but a close and more dapper steps need to be ensured in regards to reduction of absolute amount of GHG and more number of international dialogue need to be attended for greater amount of international climate finance. Domestic investment through private-public partnership needs to be channelized and used for climate projects. Fossils burning propensity zones must be identified and renewable energy must easily be provided. Financial benefit rewards to individual may be initiated for encouraging more climate resilient activities.

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