



Vivekananda
International
Foundation

REPORT

Climate Change

**Reflections on Issues, Challenges
and the Way Forward**



Report on

Climate Change

Reflections on Issues, Challenges
and the Way Forward



Vivekananda International Foundation
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PREFACE

The Climate Change Expert Group was established at the Vivekananda International Foundation (VIF) in 2022. It comprises of experts from a wide range of fields, including climate and weather systems, the environment, energy, diplomacy and national security. The expert group's mandate was to explore ways in which climate change has manifested in India and how it has affected the country's well-being, national security, foreign policy, contemporary geopolitics and geo-economics. It also aims to provide policy-relevant recommendations in areas pertaining to climate mitigation and adaptation. The Climate Change Expert Group at VIF has organised six meetings to date. The first meeting was held on 8 September 2022, the second on 22 November 2022, the third on 16 January 2023, the fourth on 18 May 2023, the fifth on 7 August 2023 and the sixth on 16 October 2023 respectively.

This report summarises the key outcomes of the six Climate Change Expert Group

meetings that the VIF has organised to date. Policy relevant recommendations are grouped under two broad categories - mitigation and adaptation. The first category deals with issues relevant to India's climate mitigation efforts and its climate diplomacy. It includes Common But Differentiated Responsibilities and Respective Capability (CBDR-RC), per capita emissions and historical cumulative CO₂ emissions, carbon budget, agriculture, coal, lifestyle change, carbon market mechanism, regional trade in clean energy, nuclear power and communication/messaging. The second category deals with issues relevant to India's adaptation efforts. It includes payment for loss and damage, climate resilient infrastructure, a comprehensive flood management plan, monitoring and evaluation of adaptation interventions, multi-disciplinary climate change research institutions, climate models, climate projections, Payment for Ecosystem Services (PES), climate finance, etc.

LIST OF ABBREVIATIONS

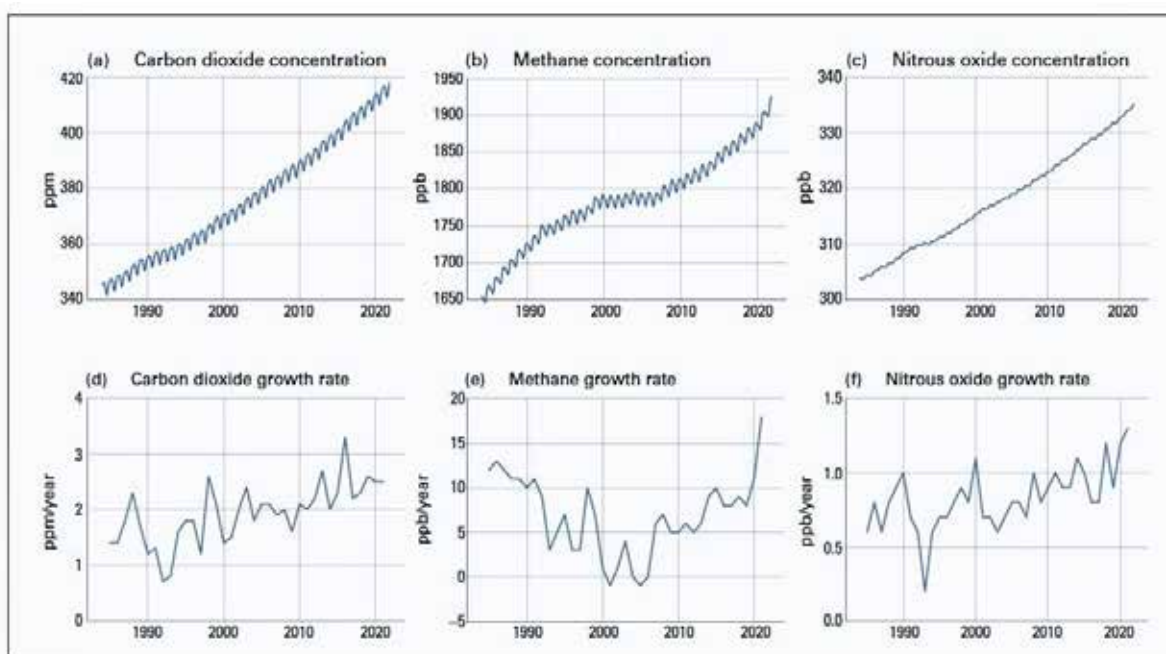
CBAM	Carbon Border Adjustment Mechanism	MoEFCC	Ministry of Environment, Forest and Climate Change
CBDR-RC	Common But Differentiated Responsibilities and Respective Capability	NAFCC	National Adaptation Fund for Climate Change
CCTS	Carbon Credit Trading Scheme	NbS	Nature-based Solution
CDRI	Coalition for Disaster Resilient Infrastructure	NDC	Nationally Determined Contribution
COP	Conference of the Parties	PES	Payment for Ecosystem Services
CSO	Civil Society Organisation	RCP	Representative Concentration Pathway (RCP)
DAE	Department of Atomic Energy	SIDS	Small Island Developing States
EbA	Ecosystem-based Adaptation	SSPs	Shared Socioeconomic Pathways
EU	European Union	ULB	Urban Local Bodies
GCF	Green Climate Fund	UNFCCC	United Nations Framework Convention on Climate Change
GMP	Global Methane Pledge	USA	United States of America
GST	Global Stock Take	UT	Union Territory
IPCC	Intergovernmental Panel on Climate Change	WI	Wetlands International
ISA	International Solar Alliance	WMO	World Meteorological Organisation
ISRO	Indian Space Research Organisation		
LT-LEDS	Long-Term Low Carbon Development Strategy		

INTRODUCTION

Current state of the world's climate

The Earth's average temperature has been rising steadily owing to increased accumulation of greenhouse gases in the atmosphere. While natural variability plays some part, the preponderance of evidence indicates that human activities, particularly emissions of heat-trapping greenhouse gases, are mostly responsible for making our planet warmer. Despite this, anthropogenic greenhouse gas

emissions have shown no signs of abating and continue to increase. For example, atmospheric levels of greenhouse gases have reached new highs in 2021, the latest year for which consolidated global figures are available. Atmospheric concentration of carbon dioxide reached 415.7 parts per million (149% of pre-industrial levels), that of methane reached 1,908 parts per billion (262% of pre-industrial levels) and that of nitrous oxide reached 334.5 parts per billion (124% of pre-industrial levels) respectively.



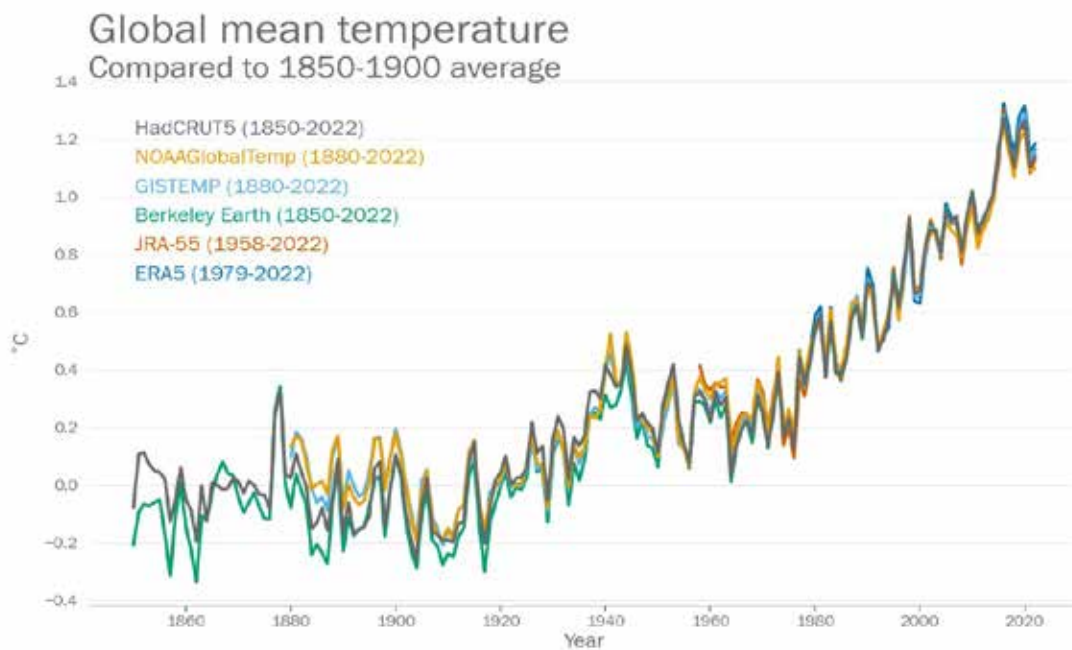
Source: World Meteorological Organization (WMO). 2023.

As a result of the increased accumulation of greenhouse gases, the global mean temperature has reached 1.15°C above the 1850–1900 pre-industrial average in 2022. Also, there is now a 66% likelihood that the annual average near-surface global temperature will reach more than 1.5°C above pre-industrial levels for at least one year between 2023 and 2027. There is also a 98% likelihood that at least one of the next five years, and the five-year period as a whole, will be the warmest on record. This is significant because 1.5°C is considered a critical threshold beyond which the impact of climate change would intensify. While the projected breaching will be temporary, it would represent a marked acceleration of human impact on the global climate system and send the world into

“uncharted territory.” For example, it could exacerbate and supercharge extreme weather events. Extreme weather events such as floods, drought, heat wave, tropical cyclones, etc. are considered the “day-to-day face” of climate change. As global average temperature races towards the 1.5°C, they are certain to occur with increasing frequency and intensity.

Conference of the Parties (COP)

COP is the supreme decision-making body of the United Nations Framework Convention on Climate Change (UNFCCC), an intergovernmental treaty that was signed in 1992 during the United Nations Conference on Environment and Development (also known as the Rio Conference or the Earth Summit)



Source: World meteorological Organization (WMO). 2023



in Brazil. The UNFCCC, which entered into force in 1994, called for stabilising greenhouse gas concentrations “at a level that would prevent dangerous anthropogenic (human induced) interference with the climate system.” The 198 countries that have ratified the convention are called “Parties to the Convention.” The Conference of the Parties, also known as the COP, has been held annually since 1995.

During the 21st Session of the COP (COP21) that was held in Paris in 2015, both developed and developing countries agreed for the first time to limit their greenhouse gas emissions. The resulting Paris Agreement aimed to hold “the increase in the global average temperature to well below 2°C above pre-industrial levels” and pursue efforts “to limit the temperature increase to 1.5°C above pre-industrial levels” by the end of this century. Since then, studies have shown that climate-related risks for natural and human systems are higher for global warming of 1.5 °C than at present, but lower than at 2°C. As a result, governments agreed to focus on the more stringent goal of 1.5°C during COP26 in Glasgow in 2021. Achieving that goal will require

a 45% reduction in global emissions by 2030 compared with 2010 levels. Countries, however, have failed to secure the necessary emission reduction pledges during COP27 that was held in Sharm El-Sheikh in 2022. Thus, the hope of limiting global average temperature to 1.5°C by the end of this century has waned.

COP28, to be held from 30 November to 12 December 2023 in Dubai, the UAE, comes at a decisive moment for international climate action. Temperature records are being repeatedly broken and climate impacts are being felt in the form of unprecedented wildfires, floods, storms and droughts worldwide. India is likely to be fully engaged just as it was during COP27 in 2022 where it had a solid presence. During COP27, the 70-member Indian delegation, was led by Mr. Bhupender Yadav, Union Minister for Environment, Forests and Climate Change (MoEFCC). The delegation made sure that India was well represented during discussions on all 170 agenda items. India’s solid representation was indicative of the country’s faith in multilateralism. It was also indicative of the country’s wish to be a part of the solution to global problems like climate change. As such, India is likely to have a strong presence at COP28 also. Some of the key issues that will be discussed during COP28 are as follow:

1. **Global Stock Take (GST):** The purpose of the GST is to assess the world’s collective progress towards achieving the goals and

purpose of the Paris Agreement and provide guidance to governments on how to strengthen action, support and international cooperation on climate change. The GST takes place every five years. The first one began at COP26 in 2021 and will conclude at COP28. It is clear the world is not on track to meeting the agreement's goals, but the hope is that governments at COP28 will come up with a roadmap to accelerate climate action. It is probable that India will come into the spotlight during COP28 and will be asked to do more. India should leverage its low per capita emissions and limited historical cumulative CO₂ emissions to extract more favorable outcomes for it during the negotiations.

2. Global Goal on Adaptation (GGA):

The GGA was established under the Paris Agreement to enhance climate change adaptation by increasing awareness of and funding towards countries' adaptation needs in the context of the 1.5/2°C goal of the Paris Agreement. However, unlike the clear 1.5°C target for global mitigation, adaptation is primarily a local activity and as such, a global target has been challenging to establish. At COP28, efforts will be made to define key elements of the goal, including the methodologies, indicators, metrics and data sources to support the assessment of the overall adaptation progress. Clarity on

GGA will enable governments and relevant organisations to pursue and measure adaptation progress with greater focus, comparability and precision. India should pay close attention to the GGA and must insist that the Payment for Ecosystem Services (PES) be included in it.

3. Climate finance: The provision and mobilisation of climate finance is a key priority for many countries. In 2009, developed countries pledged to mobilise USD 100 billion annually from 2020 and onwards from a range of public and private sources, but that has not yet been achieved. In the meantime, the developing countries' annual adaptation needs have increased. For example, the United Nation's Environment Programme (UNEP) estimated the annual adaptation needs of developing countries at USD 160-340 billion by 2030 and USD 315-565 billion by 2050. As such, at the COP28, governments will continue their negotiations on a new climate finance goal to replace the USD 100 billion commitment. An agreement on this front would be highly beneficial to India. However, the loss and damage component of climate financing that was agreed to during COP27 in Sharm El-Sheikh in 2022 could become a "double-edged sword" for India, as it could be asked to contribute to it. India should resist any attempt to make the country pay for loss and

damage. Instead, it should make the case that it be given funds on account of its low per capita, limited historical emissions and its immense adaptation needs.

- 4. Clean energy:** Commitments to double energy efficiency, triple renewable energy capacity to 11,000 GW globally and double hydrogen production to 180 million tonnes a year by 2030, will be put to governments at COP28 and are expected to be agreed. This is likely to be well-received by India. The country has been among the world's top performers with respect to investment in renewable energy and its deployment. For example, the share of non-fossil fuels in India's electricity generation capacity reached 41.99% by September 2023 on account of increased renewable energy deployment. This is above the 40% that it pledged to achieve by 2030. But renewable energy alone will not be enough to transform India's energy landscape. Alternative energy sources such as green hydrogen and biofuels should also be considered. India should, therefore, make concerted efforts during COP28 to acquire relevant technologies related to alternative energy sources to transform its energy landscape on a much larger scale.

India's commitments and actions

India is committed to be a part of the solution to global problems like climate change. As such,

the country has taken an active part in global climate change processes such as the UNFCCC. Consequently, it is a signatory to global climate treaties such as the 1997 Kyoto Protocol and the 2015 Paris Agreement. As part of its commitment to the Paris Agreement, India submitted its first Nationally Determined Contribution (NDC) to the UNFCCC in October 2015. NDCs are national plans containing targets on emissions cuts, usually pegged to 2030 and some details on how they will be met. They form the heart of the Paris Agreement. India's NDC included eight targets of which three are quantitative targets to be achieved by 2030. They included the following:

1. To reduce the emissions intensity of GDP by **33-35%** by **2030** from 2005 level.
2. To achieve about **40%** 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).
3. To create an additional carbon sink of **2.5 to 3 billion tonnes** of CO₂ equivalent through additional forest and tree cover by **2030**.

India has already achieved most of its quantitative targets ahead of time. For example, it has already reduced the emissions intensity of its economy by 40%. That is well above the 33-

35% that it pledged to achieve by 2030. A key reason for this is the increased deployment of renewable energy and improved energy efficiency among other things. Meanwhile, due to increased deployment of renewable energy, the share of non-fossil fuels in India's electricity generation capacity reached 41.99% by September 2023. Again, this is above the 40% that it pledged to achieve by 2030. Solar in particular has been the key driver of India's renewable energy push. While India has less than 10 MW of solar capacity in 2010, that has increased to 71.78 GW by 2023.

The progress that India has achieved thus far has enabled Prime Minister Narendra Modi to announce a five-fold strategy, or "Panchamarit", to combat climate change during COP26 in

Glasgow in 2021. It included the following targets:

1. To reduce the emissions intensity of GDP by **45%** by **2030** from 2005 level.
2. To achieve about **50%** cumulative electric power installed capacity from non-fossil fuel based energy resources by **2030**.
3. To have **500 GW** non-fossil energy capacities by **2030**.
4. To reduce the total projected carbon emissions by **one billion tonnes** by **2030**.
5. To achieve the target of **net zero** emissions by **2070**.

All India Installed Capacity in MW/GW of Power Stations (As on 30 September 2023).

	Energy sources	Installed capacity	Share in India's total installed electricity capacity
Thermal	Coal	207,045.50 MW/207.04 GW	48.67%
	Gas	25,038.21 MW/25.03 GW	5.88%
	Lignite	6,620 MW/6.62 GW	1.55%
	Diesel	589.20 MW/0.58 GW	0.13%
	Total	239,292.91 MW/239.29 GW	56.25%
Nuclear		7,480 MW/7.48 GW	1.75%
Renewable	Solar	71,780.74 MW/71.78 GW	16.87%
	Hydro	51,832.92 MW/51.83 GW	12.18%
	Wind	44,184.63 MW/44.18 GW	10.38%
	Bio	10,835.27 MW/10.83 GW	2.54%
	Total	178,633.56 MW/178.63 GW	41.99%
All India		425,406.47 MW/425.40 GW	

Source: Central Electricity Authority (CEA), 2023.

India's *Panchamarit* strategy has since been incorporated into the country's "Updated NDC" that it submitted to the UNFCCC in August 2022. India has also submitted its Long-Term Low Carbon Development Strategy (LT-LEDS) to the UNFCCC in November 2022. The strategy outlined the country's vision and actions for achieving a low-carbon and climate-resilient future by 2070. It covers areas such as electricity, transportation, urbanisation, industry, forest, etc. The fact that India has updated its NDC to include more ambitious targets and that it has released its low carbon development strategy is indicative of the country's seriousness about climate change as also its unwavering commitment to do more than its fair share. At the global level, India has been instrumental in establishing the International Solar Alliance (ISA) in 2015. The ISA is an international coalition of more than 120 sun-rich countries lying fully or partially

between the Tropic of Cancer and the Tropic of Capricorn who are seeking to massively ramp up solar energy, thereby helping to bend the global greenhouse emissions curve whilst providing clean and cheap energy. India was also instrumental in establishing the Coalition for Disaster Resilient Infrastructure (CDRI) in 2019. The CDRI is an international coalition of countries, UN agencies, multilateral development banks, the private sector and academic institutions. It aims to build resilience into infrastructure systems to ensure sustainable development. Then in 2023, India helped to launch the Global Biofuel Alliance on the sidelines of the G20 Summit in New Delhi. The alliance aims to accelerate sustainable biofuels deployment to support the global energy transition. These initiatives could play a key role in climate change mitigation and adaptation on a global scale.

RECOMMENDATIONS

1. MITIGATION

- 1. India should strongly demand climate justice, the principle of Common But Differentiated Responsibilities and Respective Capability (CBDR-RC) in particular.**

The principle of CBDR-RC, enshrined in Article 3(1) of the 1992 UNFCCC, established that all states are responsible for addressing global environmental destruction and yet not equally responsible. India is of the opinion that while climate change is a universal problem that all countries have an obligation to address, developed countries should take a bigger share of the burden than developing countries as they have historically emitted most of the greenhouse gases. However, the current state of play is that developing countries are expected to meet the same commitments as developed countries despite their lack of financial resources and alternatives. This runs counter to the established fact that developed countries are disproportionately responsible for climate change and they should take a bigger share of the burden than developing

countries. India should continue to champion climate justice, CBDR-RC in particular, as the only realistic and sustainable way to address climate change.

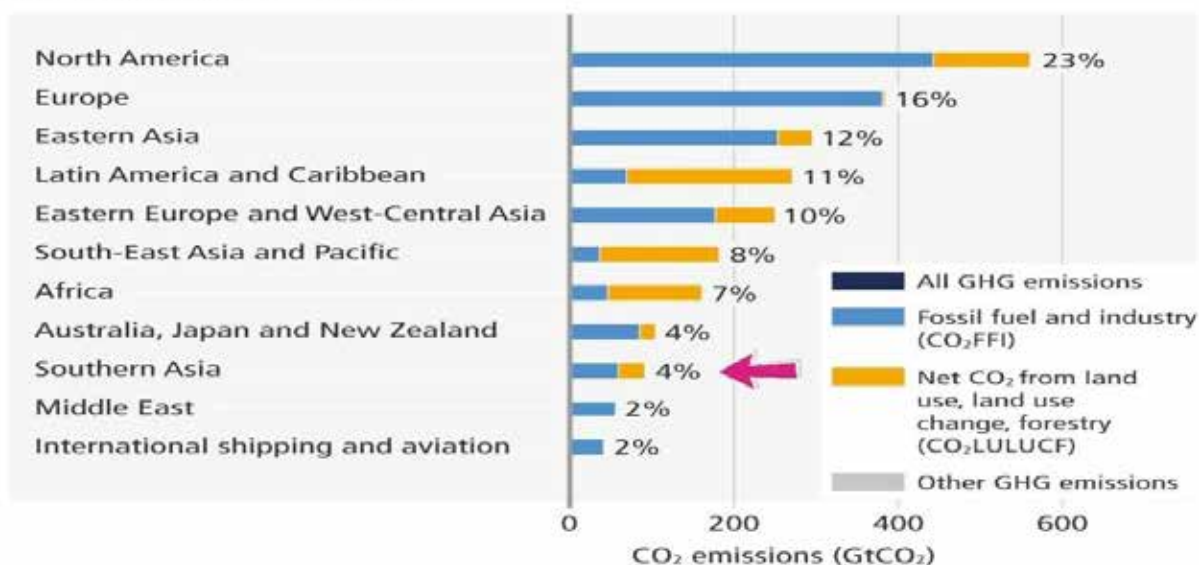
- 2. India should use its low per capita emissions and limited historical cumulative CO₂ emissions as leverages during global climate negotiations.**

Although India is one of the largest emitters of greenhouse gases in the world, it has low per capita emissions and limited historical emissions. As of 2020, the country's per capita emission was 2.4 tCO₂e (tonne carbon dioxide equivalent) against the world average of 6.3 tCO₂e. That was far below that of the USA (14 tCO₂e), Russia (13 tCO₂e), China (9.7 tCO₂e), Brazil and Indonesia (7.5 tCO₂e) and the EU (7.2 tCO₂e). Meanwhile, India's contribution to historical cumulative CO₂ emissions (excluding forestry and other land use) amounted to just three percent between 1850 and 2019. The USA on the other hand accounted for the largest share at 25%. It is followed by the EU (17%), China (13%), and Russia (7%). Historical emissions are important

because CO₂ emissions from hundreds of years ago continue to contribute to the heating of the planet and current warming is determined by cumulative CO₂ emissions over time. India should, therefore, leverage its low per capita emissions and limited historical cumulative CO₂ emissions to extract more favorable outcomes during global climate negotiations.

prevent further warming. The carbon budget is the total amount of carbon that can be emitted to stay below any given limit on global temperatures. The world has already used up 86% of the carbon budget for a 50-50 chance of staying below 1.5°C and, at the current rate of emissions, there is just ten years of budget left. A recent study further observed that only

b. Historical cumulative net anthropogenic CO₂ emissions per region (1850–2019)



Source: Intergovernmental Panel on Climate Change (IPCC). 2022.

3. Carbon budget is a “strategic national resource” and India must vehemently claim its fair share.

As to who is responsible for using up the carbon budget is crucial in the context of climate justice debates. It speaks to the responsibility for dealing with the impact of climate change to date, as well as who ought to do the most to

about 250 billion tonnes of carbon dioxide can now be emitted to avoid CO₂ accumulation in the atmosphere that would raise temperatures by 1.5°C. That is down from 500 billion tonnes just a few years ago and, at current annual rates of greenhouse gas emissions, of about 54 billion tonnes a year over the past decade; it would run out well before the end of this decade. Whereas developed countries have already exhausted

their carbon budget, India has used far less than its fair share due to its low per capita emissions and limited historical cumulative CO₂ emissions. As such, India's emissions can continue to grow as it is a developing country with sustainable development and poverty eradication among its leading priorities. Carbon budget can, therefore, be deemed a "strategic national resource" for India and it must claim its fair share vehemently. At the same time, India should insist that developed countries' must use only their respective fair shares of the global carbon budget and not eat into developing countries' shares.

4. India should protect its agricultural sector from global emission reduction plans.

Reducing agricultural emissions, largely methane and nitrous oxide, can play a significant role in climate change mitigation. The majority of emissions from the agricultural sector come from raising livestock with cow burps and manure being the biggest single source. Unsurprisingly, methane has now become a "buzzword" for developed countries and the US and the EU have jointly launched the Global Methane Pledge (GMP) during COP26 in Glasgow in 2021. The pledge is aimed at slashing methane emissions by 30% by 2030. India did not sign onto the pledge due to concerns about its



An Indian farmer

potential implications for its agricultural sector. India's agricultural sector makes up around 13% of the country's GDP. It also engages 44% of its total workforce. Critically, small and marginal farmers account for 86% India's total farmer population. Methane emissions by these farmers are "survival emissions" or subsistence emissions. Methane emissions by developed countries' highly commercialised agricultural sector on the other hand are "luxury emissions." Thus, India has much to lose if its agricultural sector comes under global methane reduction plans such as the GMP. Besides, initiatives such as GMP can be construed as a ploy to divert attention from developed countries' inaction over their excessive CO₂ emissions.

5. India should use its coal reserves judiciously.

Despite increased deployment of clean and renewable energy such as solar power and wind power in India, they are unlikely to meet more



A coal mine in Jharkhand

than 50% of the country's energy requirements at any given time. A key reason for this is that both solar and wind power suffer from intermittency, i.e. they only generate electricity when the sun shines or the wind blows. Besides, India does not have sufficient reserves of critical minerals such as nickel, cobalt, rare earth elements, etc. that are key components of clean energy systems. Consequently, coal will continue to be an integral part of India's energy mix for the foreseeable future. The country should, therefore, make judicious use of its large coal reserves even as it increases deployment of solar and wind power. Doing so would require India to step up coal-related research so that information pertaining to quantity, quality and location of coal reserves in the country can be ascertained accurately.

6. India should increase its nuclear power capacity.

India's ongoing clean energy transition is driven primarily by solar and wind power. As of 30 September 2023, solar power accounted for 16.87% of the country's total installed electricity capacity and wind power accounted for 10.38%. Nuclear, however, is often left out of the clean energy conversation and accounts for just 1.75% of India's total installed electricity capacity as of 30 September 2023. It is unlikely that India will achieve its net zero by 2070 target without nuclear power. There are many benefits to nuclear power. Unlike solar and wind, power, from nuclear power, energy can be generated 24 hours a day and it is not dependent on the weather. Also, nuclear energy produces more electricity on less land than any other clean energy source. A way forward for India is to explore the feasibility of



Kudankulam Nuclear Power Plant (KNPP) in Tamil Nadu

deploying Small Modular Reactors (SMRs). Many of the benefits of SMRs are inherently linked to the nature of their design – small and modular. Given their smaller footprint, SMRs can be sited on locations unsuitable for larger nuclear power plants. Prefabricated SMRs units can be manufactured, shipped and installed on site, making them more affordable than to build than large power reactors, which often are custom designed for a particular location, and sometimes lead to construction delays. SMRs offer savings in cost and construction time, and they can be deployed incrementally to match increasing energy demand.

7. India should emphasize lifestyle change as a solution to climate change.

Lifestyle is a key driver of growth in demands for energy, goods and food, and therefore, greenhouse gas emissions. As such, sustainable lifestyle ought to be brought back to the center of the climate debate. Towards this end, India has pioneered a new movement called Mission LiFE. Announced in 2021, the mission’s aim to instill a healthy and sustainable way of living among Indians based on traditions and values of conservation and moderation. Underpinning this mission is India’s deep-rooted environmental philosophy, that of reverence for nature in particular. Ancient Indian religious texts like the *Vedas*, *Upanishads*, *Puranas*, etc. contain numerous references to the “worship

of the divine in nature”. Examples include the following:

“Do not cut trees because they remove pollution.” (*Rig Veda 6:48:17*).

“Do not disturb the sky and do not pollute the atmosphere.” (*Yajur Veda 5:43*).

Given the deep-rooted reverence for nature, it is unsurprising that India has been able to preserve much of its natural environment and wildlife despite accounting for just 2.5% of the world’s total land area and 16% of its population. For example, the country is home to nearly 6.5% of the world’s known wildlife species, 7.6% of

Animal-based food production contributes to the most emissions

Annual global emissions from the top 10 contributing animal- and plant-based foods



Guardian graphic. Source: Xu, et al., 2021, “Global greenhouse gas emissions from animal-based foods are twice those of plant-based foods”

the world's mammals and 12.6% of the world's bird species. Reverence for nature has also impacted lifestyle choices, including dietary habits. Indian diets have relatively light carbon footprint because the protein element is mostly plant-based. Scientists have estimated that food production causes 35% of planet-warming greenhouse gas emissions. The use of cows, pigs and other animals for food, as well as livestock feed alone is responsible for 57% of all food production emissions. Thus, less meat consumption can be one of the most meaningful changes people can make to curb greenhouse gas emissions, help reduce deforestation and even decrease the risk of pandemic-causing diseases passing from animals to humans. The ongoing environmental and climate crisis have made India's environmental philosophy - reverence for nature, sustainable lifestyle, eating less meat, etc. – more relevant than ever before. It is, therefore, imperative that India mainstream its environmental philosophy through its Mission LiFE initiative both at the national and international level.

8. India should reduce costs of decarbonisation for its industrial sector through a carbon market mechanism.

Carbon markets are trading systems in which carbon credits are sold and bought. Companies or individuals can use carbon markets to compensate for their greenhouse gas emissions by purchasing carbon credits

from entities that remove or reduce greenhouse gas emissions. Carbon markets, therefore, are seen as critical for achieving decarbonisation. However, concerns remain. For example, the EU's proposed Carbon Border Adjustment Mechanism (CBAM), a tax on imported carbon intensive products, is deemed protectionist and potentially risky for export industries. In particular, developing nations in Africa with less economic heft and no systems in place for measuring emissions, could suffer the most from its introduction. India has also announced the setting up of a national carbon market in 2023. It primarily targets high-emitting sectors such as energy, steel and cement. It was hoped that the carbon market would enable India to reduce the emissions intensity of its GDP to 45% from 2005 levels by 2030 and eventually achieve net zero emissions by 2070. However, there is a danger that fixing a carbon price could raise the cost for industry. It is, therefore, imperative that India focus on creating a level playing field for all of its industries and utilise its carbon market to secure the necessary funds and technologies for them.

9. India should push for clean energy cooperation in South Asia.

Countries in South Asia are active participants in global multilateral processes aimed at addressing climate change, the UNFCCC in particular, and they have set out national targets for emissions reduction and decarbonisation.

However, there is a lack of collective efforts at the regional level. South Asia has a lot to gain by carving out a regional approach to address climate change through cross-border trade in low-cost, clean and renewable energy among other things. There is currently a wide variation in commercial energy resource endowments and energy demand among countries of the region. Whereas India has substantial renewable energy potential, Sri Lanka and Bangladesh are highly dependent on fossil



A hydropower plant in Bhutan

fuels. Bhutan and Nepal, on the other hand, have abundant hydropower potential, and are surplus electricity producers and willing sellers too. Importing electricity from these countries could help countries like India augment its clean and renewable energy capacity. It would also generate substantial revenues for Bhutan and Nepal. Enhanced cross-border trade in low-cost, clean and renewable energy, therefore, is critical to boost South Asia's development, energy security and climate-resilience.

10. India should communicate its climate actions, both national and international, much more effectively.

India has already achieved most of its quantitative targets that were outlined in its NDC in 2015 ahead of time. For example, the country has already reduced the emissions intensity of its economy by 40%. That is well above the 33-35% that it pledged to achieve by 2030. And due to the accelerated deployment of clean and renewable energy, the share of non-fossil fuels in India's electricity generation capacity have reached 41.99% as of September 2023. This is also above the 40% that it pledged to achieve by 2030. It is, therefore, unsurprising that India was ranked consistently as one of the best performers globally with respect to clean and renewable energy investment and deployment. For example, the 2021 edition of Ernst & Young's biannual Renewable Energy Country Attractiveness Index, or RECAI, ranked India in third place out of 40 countries for the attractiveness of its renewable energy investment and deployment opportunities. Beyond these, India has played a key role in establishing the International Solar Alliance (ISA) and the Coalition for Disaster Resilient Infrastructure (CDRI). These institutions, headquartered in the country, could play an important role in climate change mitigation and adaptation, especially in developing countries. In light of these, India



India's Himalayan hill states like Himachal Pradesh and Uttarakhand were affected severely by extreme rainfall-induced floods and landslides this year.

should effectively communicate its climate actions and achievements during global climate negotiations.

B. ADAPTATION

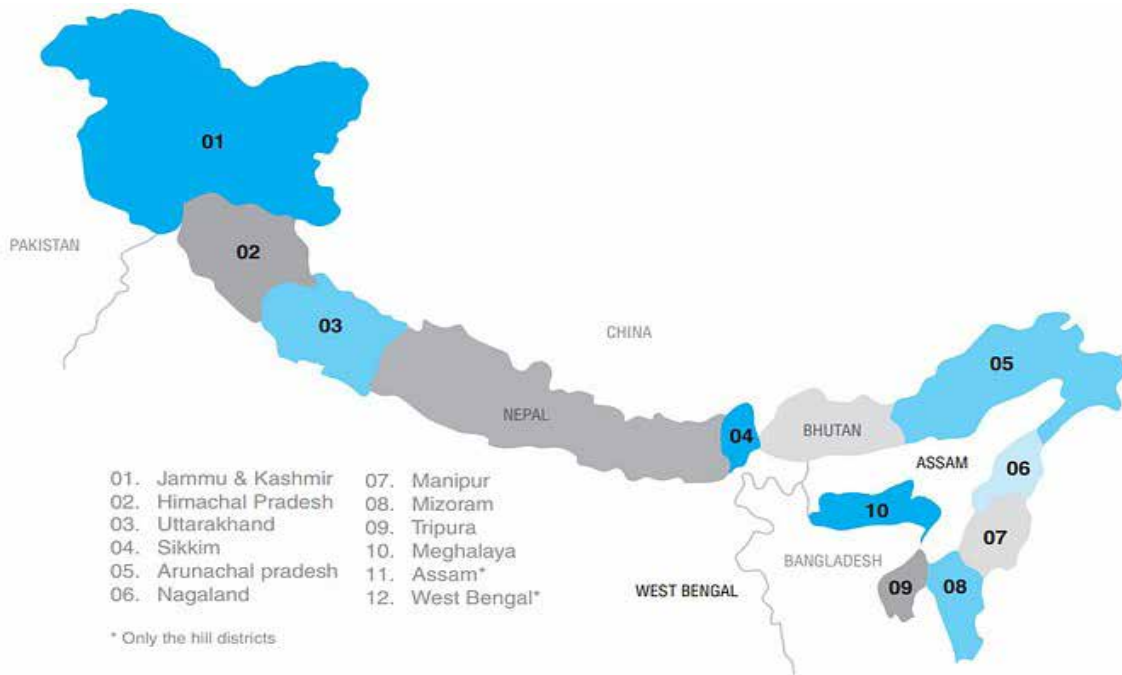
1. India should insist that developed countries pay up for losses and damages incurred by developing countries.

Developed countries owe a debt to developing countries as they are disproportionately responsible for releasing the bulk of all greenhouse gases to date. That has posed significant threats to developing countries, most of whom bear little responsibility for climate change. At the same time, developing countries are less able to deal with damages caused by rising temperatures. Developed countries, however, are still unwilling to pay their debts, both in terms of actual costs of mitigation and adaptation, and also in terms of changing their profligate consumption patterns,

which have contributed significantly to the climate crisis. COP27, held in Egypt in 2022, did produce a historic agreement on loss and damage. However, it will be several years before the fund exists, with the loss and damage agreement setting out only a road-map for resolving lingering questions, including who would oversee the fund, how the money would be dispersed, and to whom. India should insist that developed countries be obligated to pay up for losses and damages incurred by developing countries, including itself.

2. India's should ensure climate change resilience of infrastructure in its Himalayan states.

India's Himalayan mountain range stretches across 13 states/Union Territories (UTs), including Arunachal Pradesh, Assam, Himachal Pradesh, Jammu & Kashmir, Ladakh, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim, Tripura, Uttarakhand and West Bengal. These states and UTs are prone to a large number of hazards, including floods, landslides, wildfires, earthquakes, etc. Of these, flood is the most common and destructive hazard type. The disastrous flooding that struck large parts of northern India this year, Himachal Pradesh and Uttarakhand in particular, as well as Sikkim, underlined the acute vulnerability of India's Himalayan states. The unprecedented



India's Himalayan states are highly vulnerable to climate change-induced extreme weather events.

floods and landslides have washed away or destroyed a number of houses and critical public infrastructure such as roads and bridges. India should, therefore, ensure the climate change resilience of infrastructure in its Himalayan states so that they can withstand the impact of future floods and landslides better.

3. India should institute comprehensive flood management plan.

A comprehensive flood management plan may include, among other things, flood hazard assessment and mapping to identify areas at risk of flooding. Flood hazard assessments and maps typically look at the expected extent and depth of flooding in a given location, based on various scenarios. These measures can help increase

awareness of the likelihood of flooding among the public, local authorities and other organisations and it can help them take appropriate actions. As it is, India lacks comprehensive and up-to-date flood hazard assessments and maps. It also lacks a national flood recovery program that could help in disaster recovery and long-term flood resilience planning. India should aim to institute a comprehensive flood management plan by integrating flood hazard assessments and mapping and national flood recovery program.

4. India should strengthen monitoring and evaluation mechanisms of its climate change adaptation interventions.

Effective monitoring and evaluation of projects during their development is critical as

it can enable project managers and stakeholders to make sure that they are being implemented as planned. It can also allow stakeholders to identify issues, risks and deviations from the project plan. Equally important is the need for post-project monitoring and evaluation. This can help stakeholders ascertain the impact of a given project post implementation. There is currently a lack of effective monitoring and evaluation of adaptation projects in India. For example, adaptation projects implemented under the National Adaptation Fund for Climate Change (NAFCC) often fall short of achieving the desired results due to weak monitoring and evaluation. It is imperative that India strengthen its monitoring and evaluation mechanisms of its climate change adaptation interventions so that desired results can be achieved in a timely and cost-effective manner.

5. India should institute strong multi-disciplinary climate change research institutions.

Solutions to climate change problems require complex syntheses of ideas from a vast set of disciplines, including science, engineering, social science and the humanities. Strong multi-disciplinary research can contribute new knowledge systems that can offer deeper and broader insights to address climate change. There is, however, a dearth of such cross-cutting multi-disciplinary research on climate change in

India. India should, therefore, aim to institute a multi-disciplinary climate research institution, or network of institutions, so that appropriate solutions can be arrived at. It is also important to undertake a comparative analysis of the policy landscape, including legislative frameworks, policy instruments and financing mechanisms of other countries', developed ones in particular. That would enable Indian policy makers to identify best practices and main challenges, as well as key factors influencing the progress of national mitigation and adaptation in those countries'. A research institution that critically analyses the climate policies of other countries, therefore, is essential.

6. India should aim to develop its own climate models.

Climate models and greenhouse gas emission scenarios are computer programs that simulate weather patterns over time. Scientists use climate models to predict how the climate might change in the future, especially as human actions, like adding greenhouse gases to the atmosphere, change the basic conditions of our planet. India currently does not have its own climate models and relies on those developed by organisations such as the IPCC, including the Representative Concentration Pathway (RCP) and the Shared Socioeconomic Pathways (SSPs). But these models do not necessarily reflect and preserve the principles of equity and the developing

countries' rights to development while charting decarbonisation pathways. As such, they could end up restricting fossil fuel consumption, growth and development in developing countries. Using the IPCC's climate models and greenhouse gas emission scenarios as the benchmark, or reference for negotiations was ill-advised, as it could lead to highly unequal regional outcomes. Also, given that the IPCC's greenhouse gas emission scenarios allowed for the continuance of developed countries' profligate lifestyles, which really is the main driver of climate change, all talks about limiting global average temperature to 1.5°C, or even 2°C, may no longer make sense. India should make concerted efforts to develop climate models that best reflect her reality, by utilising its vast pool of young scientific talent.

7. India should prepare its adaptation plans based on future climate projections.

It has been projected that rising global average temperature will make India's monsoon system stronger, more violent and unpredictable. In fact, India has already experienced a three percent increase in rainfall and that has led to more extreme floods and landslides in some parts of the country. In the light of this, India should develop its adaptation plans based on future climate projections. While climate projections are not completely devoid of uncertainty; projections for the next one or two decades, are fairly credible. Among the things that India can

do to adapt to changing rainfall patterns is to build climate resilient infrastructure in its most vulnerable regions. That may include drainage systems with a capacity to handle greater volume of storm water. Also, the build quality of roads, buildings, bridges, electricity systems, etc. should be improved so that they can withstand flooding and landslides better. Furthermore, extreme weather vulnerability assessments that are based on credible scientific findings should be conducted on a regular basis. That would require effective climate models that simulate weather patterns over time.

8. India should revise its adaptation plans to account for “unforeseen impacts” and Payment for Ecosystem Services (PES).

Climate change models are fairly accurate in predicting global temperature rise, but they have not been as accurate in predicting its potential impact. Given this, India should revise its adaptation plans by incorporating probable “unforeseen impacts.” Beyond this, India's adaptation plans should take into account PES, a type of market-based instrument that is increasingly used to finance nature conservation. It allows for the translation of ecosystem services that ecosystems provide for free into financial incentives for their conservation, targeted at local actors who own or manage the natural resources. Carbon markets, i.e. trading systems in which carbon credits are sold and bought, are one

such PES instrument. Companies or individuals can use carbon markets to compensate for their greenhouse gas emissions by purchasing carbon credits from entities that remove or reduce emissions. India has recently approved the formation of its first domestic regulated carbon market. That could incentivise vulnerable communities in the country to conserve nature while enhancing their income levels.

9. India should establish credible financial framework for adaptation.

India's National Adaptation Fund for Climate Change (NAFCC), established in 2015, aims to finance concrete adaptation projects and programmes in states and Union Territories (UTs) that are particularly vulnerable to the adverse effects of climate change. Between 2015-2019, the NAFCC has allocated Rs. 847.5 crore for 30 projects. However, the NAFCC has been hobbled by financial constraints and this has limited the overall effectiveness of the adaptation projects it has financed. For example, reports indicated that grants released under the NAFCC fell from Rs. 350 crore in 2015-2016 to Rs. 27.76 crore in 2022-2023. Thus, the amount that India currently spends on adaptation under the NAFCC is nearly not enough to secure the country from the ravages of climate change. It is critical that India institute a solid and credible financial framework for adaptation.

10. India should take advantage of adaptation and mitigation-related opportunities.

An increasing number of venture capital firms are now funding the development of innovative climate technologies that can produce sustainable and profitable economic outcomes. Venture capital is a form of private equity and a type of financing that investors provide to startup companies and small businesses that are believed to have long-term growth potential. According to one estimate, climate-related private-market equity investments reached USD 196 billion in 2022. Much of the focus is on technologies that have the most potential to cut emissions. India should aim to attract a higher level of venture capital to finance its mitigation and adaptation efforts. Also, the World Bank has now taken bold new steps to increase its lending capacity. A significant portion of the bank's lending would be in support of climate-related projects. Given this, India should foster an enabling environment for climate tech innovation so that it can attract more investment and funding from venture capital firms and the World Bank.

11. India should be critical of "Nature-based Solutions (NbS)" as proposed by developed countries.

Developed countries have advocated for NbS as a measure to reduce climate risks to people, biodiversity and ecosystem services, and to treat

it on par with Ecosystem-based Adaptation (EbA). Developing countries, on the other hand, have been uncomfortable with “nature” being expressed as a “solution” to climate change when the focus should really be on urgently reducing greenhouse gas emissions. In fact, there are concerns that NbS could become a diversionary tactic for developed countries for see it as a cheap alternative to cutting fossil fuel emissions. While NbS has immense benefits, they cannot replace any of the deep commitments to decarbonise the economy. Also, companies, financial institutions and other organisations could use NbS as a means of greenwashing and to help meet profit objectives. Given this, India should not allow itself to be nudged into adopting NbS by developed countries. It should instead adopt it based on its domestic requirements and needs.

12. India should consider Ecosystem-based Adaptation (EbA) as a key tool for climate change mitigation and adaptation.

EbA refers to the strategy of using nature as a defence against climate impacts. It involves the conservation, sustainable management and restoration of ecosystems, such as forests, grasslands, wetlands, mangroves, or coral reefs, to reduce the harmful impact of climate hazards, including shifting patterns or levels of rainfall, changes in maximum and minimum temperatures, stronger storms, and increasingly variable climatic conditions. EbA measures can

be implemented on their own, or in combination with engineered approaches (such as the construction of water reservoirs or dykes), hybrid measures (such as artificial reefs) and approaches that strengthen the capacities of individuals and institutions to address climate risks (such as the introduction of early warning systems). Though primarily an adaptation approach, EbA can also contribute to climate change mitigation by reducing emissions that transpire from habitat loss and ecosystem degradation.

- **Restore wetlands.**

Wetlands are critical in the fight against climate change. They are significant carbon sink with coastal wetlands such as mangroves storing carbon up to 55 times faster than tropical rainforests. Wetlands are also vital for adaptation. They act as sponges that ameliorate droughts by storing water and releasing it to maintain river flows long after the rains cease. They also protect against floods and wildfires. According to Wetlands International (WI), India currently has around 220,000 big wetlands and 550,000 smaller ones. However, the country’s wetlands are at risk of rapidly declining in quantity and quality. In fact, nearly two out of every five wetlands in the country have lost their natural existence in the last 30 years, while 40% of water bodies have lost quality for survival of aquatic animals. The preservation of wetlands should be India’s



Yamuna Biodiversity Park in Delhi



Mangrove forest in West Bengal

top priority, as it can help deliver both climate change mitigation and adaptation while also supporting other ecosystem services.

- **Restore mangrove forests.**

Coastal ecosystems such as mangroves sequester and store more carbon per unit area than forests. They also support fisheries and biodiversity, and strengthen the ability of coastal communities to withstand sea level rise, tropical cyclones and storm surges. Hence, coastal communities can really benefit from the protection of mangroves. According to the *India State of Forest Report (FSR) 2021*, a biennial report of the Ministry of Environment, Forests and Climate Change (MoEFCC), India has a total mangrove cover of 4,992 square kilometers. That represented an increase of 17 square kilometers over 2019. However, the report also noted that India has lost 40% of its mangrove cover during

the last century due to the conversion of mangrove habitat to agriculture, aquaculture, tourism and urban development. Restoring mangrove forests should be a top priority for India as it can help deliver both climate change mitigation and adaptation while also supporting other ecosystem services.

13. India should use population density as a key metric for determining climate change vulnerability.

India has come under increasing pressure from Small Island Developing States (SIDS) to contribute funds to deal with loss and damage. SIDS include some of the smallest and most remote states in the world and they have long suffered from catastrophic cyclones, increasing water salinity, sustained droughts, loss of low-lying islands to sea level rise, etc. Although India is sympathetic to the plight of the SIDS,

the country has argued that developed countries should take the responsibility of providing support to them, as they are historically responsible for climate change. Meanwhile, India itself is among the most vulnerable countries in the world to climate change. Given the sheer number of vulnerable people in the country, India should make a case for considering population density and not just geographical location, as a key metric for determining climate change vulnerability.

14. India should empower municipalities and CSOs to lead the fight against climate change.

Cities have accounted for over 70% of carbon emissions worldwide. As such, Urban Local Bodies (ULBs), or municipalities, are best suited to be the key driver in the implementation of mitigation and adaptation measures. The Constitution (Seventy Fourth Amendment) Act, 1992, which came into effect on 1 June 1993, has already provided constitutional status to ULBs in India. The Act also urged state legislatures to enact laws and give powers to ULBs to function as institutions of self-governance.

The Twelfth Schedule of the Constitution has further enumerated 18 specific functions to be devolved to ULBs. It included, among other things, urban planning; planning of land-use and construction of buildings; roads and bridges; urban forestry, protection of the environment and promotion of ecological aspects; etc. These functions have relevance for climate change mitigation and adaptation. CSOs are also well-suited to create adaptive capacities within communities across India. While the active participation of enlightened and empowered citizens, communities and other stakeholders, CSOs have been recognised as necessary for the successful implementation of India's climate change adaptation plans, as a framework for their meaningful engagement is lacking. Enlisting the active cooperation of CSOs, communities, local institutions, etc. and building up their capacities and empowering them as active participants in decision making processes are a foundational precondition for efficient and effective adaptation measures.

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