

STATIC ARD

CLIMATE & ECOLOGY

Ecology and Climate Change: Ecology and its relevance to man, natural resources, their sustainable management and conservation. Causes of climate change, Green House Gases (GHG), major GHG emitting countries, climate analysis, distinguish between adaptation and mitigation, climate change impact to agriculture and rural livelihood, carbon credit, IPCC, UNFCCC, CoP meetings, funding mechanisms for climate change projects, initiatives by Govt of India, NAPCC, SAPCC, INDC.



Contents

1	Ecology and its relevance to man, natural resources, their sustainable management and conservation	3
2	Relevance of Understanding Ecology	3
3	Components of Ecosystem	3
3.1	Some terms	3
4	Sustainable management & Conservation of natural resources	6
5	Climate change and its causes	7
6	Green House Gas	8
6.1	Agriculture in GHG Emission	9
6.2	Climate Smart Agriculture	10
6.3	Climate Smart Agriculture: Characteristics	10
7	Adaptation vs Mitigation	14
8	Impact of climate change in Agriculture and Rural Livelihood	15
8.1	Impact on Agriculture	15
8.2	Impact on Rural Livelihood:	17
9	Carbon Credit	17
9.1	Carbon Market - Compliance based trading vs Voluntary Trading	17
10	Climate Finance and Funding Mechanism	20
11	NAPCC	22
12	UNFCCC	27
13	SAPCC	35
14	INDC	35

1 Ecology and its relevance to man, natural resources, their sustainable management and conservation

Till now NABARD exam has not gone deep into ecosystem and ecology based question. So we will just see some terminologies in it which may appear in objective questions

- Ecology is the scientific study of interactions among organisms and their environment, including both the living (biotic) and non-living (abiotic) components.
- An ecosystem, on the other hand, is a specific community of living organisms interacting with each other and their physical environment.
- Ecosystems are a subset of ecology. An ecosystem is made up of all of a community's biotic and abiotic components.
- **Sir Arthur George Tansley** coined the term Ecosystem in 1935.
- **Ernst Haeckel, a zoologist**, created the term ecology in 1866

2 Relevance of Understanding Ecology

- **Conservation of Environment:** The proper understanding of ecology helps human being to adopt a balanced and sustainable approach towards development.
- **Resource Allocation:** As per our knowledge resources will be allocated as per basis of demand and supply
- **Energy conservation:** It will help us to avoid over exploitation of energy, as its limited and endless usage will lead to deterioration of ecosystem and species living out here
- **Eco friendliness:** Ecological understanding helps to live with concept of one planet for all

3 Components of Ecosystem

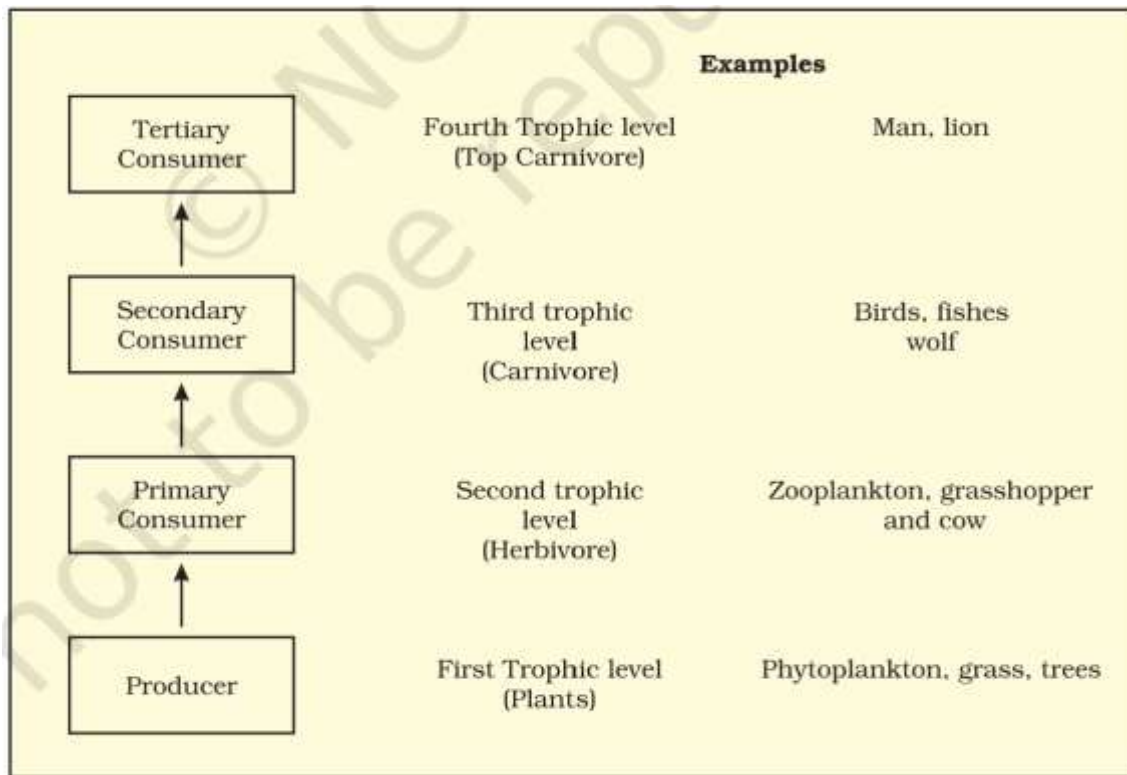
- The components of the ecosystem are seen to function as a unit when you consider the following aspects: **(i) Productivity; (ii) Decomposition; (iii) Energy flow; and (iv) Nutrient cycling.**

3.1 Some terms

- **Primary production** is defined as the amount of biomass or organic matter produced per unit area over a time period by plants during photosynthesis. It is expressed in terms of **weight (gm^{-2}) or energy (kcal m^{-2})**.
- The rate of biomass production is **called productivity**. It is expressed in terms of **$\text{gm}^{-2} \text{ yr}^{-1}$ or (kcal m^{-2}) yr^{-1}** to compare the productivity of different ecosystems.
- It can be divided into **gross primary productivity (GPP)** and **net primary productivity (NPP)**.
- Gross primary productivity of an ecosystem is the rate of production of organic matter during photosynthesis. A considerable amount of GPP is utilised by plants in respiration.
- **Gross primary productivity minus respiration losses (R), is the net primary productivity (NPP). $\text{GPP} - \text{R} = \text{NPP}$** Net primary productivity is the available biomass

for the consumption to heterotrophs (herbivores and decomposers). Secondary productivity is defined as the rate of formation of new organic matter by consumers

- Primary productivity depends on the plant species inhabiting a particular area. It also depends on a variety of environmental factors, availability of nutrients and photosynthetic capacity of plants. Therefore, it varies in different types of ecosystems. **The annual net primary productivity of the whole biosphere is approximately 170 billion tons (dry weight) of organic matter.** Of this, despite occupying about 70 per cent of the surface, the productivity of the oceans are only 55 billion tons. Rest of course, is on land.
- Dead plant remains such as leaves, bark, flowers and dead remains of animals, including fecal matter, constitute detritus, which is the raw material for decomposition
- **Detritivores (e.g., earthworm)** break down detritus into smaller particles. This process is called fragmentation. By the process of leaching, watersoluble inorganic nutrients go down into the soil horizon and get precipitated as unavailable salts. Bacterial and fungal enzymes degrade detritus into simpler inorganic substances. This process is called as **catabolism**.
- It is important to note that all the above steps in decomposition operate simultaneously on the detritus. Humification and mineralisation occur during decomposition in the soil. Humification leads to accumulation of a dark coloured amorphous substance called humus that is highly resistant to microbial action and undergoes decomposition at an extremely slow rate. Being colloidal in nature it serves as a reservoir of nutrients. The humus is further degraded by some microbes and release of inorganic nutrients occur by the process known as **mineralisation**.
- Except for the deep sea hydro-thermal ecosystem, sun is the only source of energy for all ecosystems on Earth. Of the incident solar radiation less than 50 per cent of it is **photosynthetically active radiation (PAR)**.
- We know that plants and photosynthetic bacteria (autotrophs), fix Sun's radiant energy to make food from simple inorganic materials. **Plants capture only 2-10 per cent of the PAR** and this small amount of energy sustains the entire living world.
- Based on the source of their nutrition or food, organisms occupy a specific place in the food chain that is known as their trophic level. **Producers belong to the first trophic level, herbivores (primary consumer) to the second and carnivores (secondary consumer) to the third.**



- The number of trophic levels in the grazing food chain is restricted as the transfer of energy follows **10 per cent law** – **only 10 per cent of the energy** is transferred to each trophic level from the lower trophic level. In nature, it is possible to have so many levels – producer, herbivore, primary carnivore, secondary carnivore in the grazing food chain
- An important characteristic of all communities is that their composition and structure constantly change in response to the changing environmental conditions. This change is orderly and sequential, parallel with the changes in the physical environment. These changes lead finally to a community that is in near equilibrium with the environment and that is called a **climax community**. The gradual and fairly predictable change in the species composition of a given area is called ecological succession. During succession some species colonise an area and their population become more numerous whereas populations of other species decline and even disappear.
- Based on the nature of the habitat – whether it is water (or very wet areas) or it is on very dry areas – succession of plants is called **hydrarch or xerarch, respectively**. **Hydrarch succession** takes place in wet areas and the successional series progress from hydric to the mesic conditions. As against this, xerarch succession takes place in dry areas and the series progress from xeric to mesic conditions. Hence, both hydrarch and xerarch successions lead to medium water conditions (mesic) – neither too dry (xeric) nor too wet (hydric). The species that invade a bare area are called **pioneer species**.
- **Healthy ecosystems** are the base for a wide range of economic, environmental and aesthetic goods and services. The products of ecosystem processes are named as ecosystem services

- **Robert Constanza** and his colleagues have very recently tried to put price tags on nature's life-support services. Researchers have put an average price tag of US \$ 33 trillion a year on these fundamental ecosystems services, which are largely taken for granted because they are free. This is nearly twice the value of the global gross national product GNP which is **(US \$ 18 trillion)**. Out of the total cost of various ecosystem services, the soil formation accounts for about 50 per cent, and contributions of other services like recreation and nutrient cycling, are less than 10 per cent each. The cost of climate regulation and habitat for wildlife are about 6 per cent each.

Q. Which one of the following has the largest population in a food chain? (a) Producers (b) Primary consumers (c) Secondary consumers (d) Decomposers

Q. The second trophic level in a lake is (a) Phytoplankton (b) Zooplankton (c) Benthos (d) Fishes

Q. Secondary producers are (a) Herbivores (b) Producers (c) Carnivores (d) None of the above

Q. What is the percentage of photosynthetically active radiation (PAR) in the incident solar radiation? (a) 100% (b) 50 % (c) 1-5% (d) 2-10%

4 Sustainable management & Conservation of natural resources

- Natural resources are resources that exist without any actions of humankind. This includes all valued characteristics such as commercial and industrial use, aesthetic value, scientific interest and cultural value. Major Natural Resources are • Land • Soil • Water • Natural Vegetation
- **The UN, in 2012, adopted the System of Economic and Environmental Accounting (SEEA). It is the latest internationally accepted framework for NRA**
- The Natural Capital Accounting and Valuation of the Ecosystem Services (NCAVES) Project, funded by the European Union, has been jointly implemented by the United Nations Statistics Division (UNSD), the United Nations Environment Programme (UNEP) and the Secretariat of the Convention of Biological Diversity (CBD).
- India is one of the five countries taking part in this project - the other countries being Brazil, China, South Africa and Mexico.
- It is an umbrella term covering efforts to make use of an accounting framework to provide a systematic way to measure and report on stocks and flows of natural capital.

The five R's Strategy to Save the Environment

Refuse: It means to say 'No' to things that are not required. Refuse to buy products that could harm you and the environment. Deny dispensable plastic convey sacks

Reduce: It aims to be useless. Save electricity by turning off unnecessary lights and fans. Save water by repairing leaky taps. Do not waste food

Recycle: This aims to collect plastic paper and recycle these materials to make valuable items instead of synthesising or separating new plastic, paper, glass, or metal. The initial phase in reusing is the segregation of wastes

Reuse: This is superior to reusing because the most common way of reusing utilises some energy. In the 'reuse' technique, things are utilised over and over

Repurpose: This implies when an item can presently not be utilised for the first reason, consider cautiously, and use it for another practical reason. 'Being in harmony with nature is known to us. It is related to our long-standing practises, customs, arts and crafts, festivals, food, beliefs, rituals, and folklore. Sustainable life has forever been a necessary piece of Indian custom and culture

5 Climate change and its causes

Climate change refers to long-term shifts in temperatures and weather patterns. Such shifts can be natural, due to changes in the sun's activity or large volcanic eruptions. But since the 1800s, human activities have been the main driver of climate change, primarily due to the burning of fossil fuels like coal, oil and gas.

Factors Contributing to Climate Change:

- **Greenhouse Gas Emissions:**
 - Burning fossil fuels (coal, oil, and natural gas) releases carbon dioxide (CO₂) into the atmosphere.
 - Industrial activities, transportation, and deforestation contribute to GHG emissions.
- **Deforestation:**
 - Clearing forests reduces the Earth's capacity to absorb CO₂ through photosynthesis, contributing to increased atmospheric concentrations.
- **Industrialization and Urbanization:**
 - Rapid industrial growth and urbanization lead to increased energy consumption and emissions.
 - Urban heat island effect exacerbates local warming in cities.

Measures to Mitigate Climate Change:

- **Transition to Renewable Energy:**
 - Promote the use of renewable energy sources such as solar, wind, and hydropower to reduce reliance on fossil fuels.
 - Encourage research and development of new technologies for efficient and clean energy production.

- **Forest Conservation and Reforestation:**
 - Implement sustainable forest management practices and promote reforestation efforts to enhance carbon sequestration.
- **Adoption of Sustainable Agriculture:**
 - Encourage climate-resilient farming techniques, agroforestry, and efficient water management practices.
 - Promote organic farming and reduce the use of synthetic fertilizers and pesticides.
- **International Cooperation:**
 - Strengthen global cooperation and agreements such as the Paris Agreement to reduce GHG emissions and promote sustainable development.

6 Green House Gas

What are the Initiatives to Reduce Emissions in India?

- Bharat Stage-IV (BS-IV) to Bharat Stage-VI (BS-VI) emission norms.
- UJALA scheme.
- International Solar Alliance.
- National Action Plan on Climate Change (NAPCC).
- Ethanol Blending in India by 2025.
- India Updated its NDC.

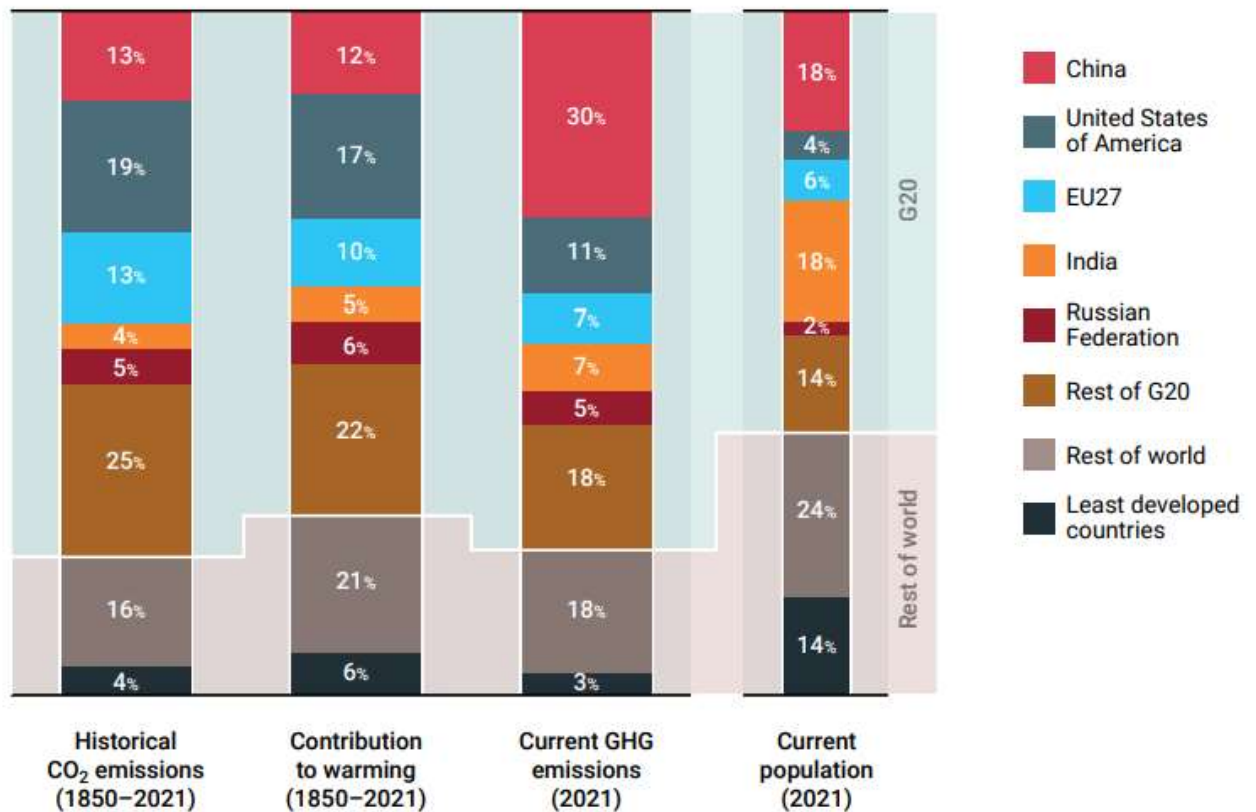
United Nations Environment Programme (UNEP) has released a report titled- the Emissions Gap Report 2023: Broken Record – Temperatures hit new highs, yet world fails to cut emissions (again), stating that urgent Climate Action is crucial to avoid the alarming trajectory of Temperature Rise.

The EGR tracks the gap between where global emissions are heading with current country commitments and where they ought to be to limit warming to 1.5°C.

Trends in GHG Emission

- Greenhouse Gas Emissions (GHG) hit a new record of 57.4 Gigatonnes of Carbon Dioxide Equivalent (GtCO₂e) in 2022, with a 1.2% increase from the previous year.
- Fossil CO₂ emissions account for approximately two thirds of current GHG emissions using 100-year global warming potentials.
- According to multiple datasets, fossil CO₂ emissions grew between 0.8–1.5% in 2022 and were the main contributor to the overall increase in GHG emissions. In 2022, fluorinated gases emissions grew by 5.5%, followed by Methane at 1.8% and nitrous oxide (N₂O) at 0.9%.
- GHG emissions across the G20 also increased by 1.2% in 2022. However, members vary widely in their trends with increases in China, India, Indonesia and the United States of America, but decreases in Brazil, the European Union and the Russian Federation. Collectively, the G20 currently accounts for 76% of global emissions.

Current and historic contributions to climate change
(% share by countries or regions)



6.1 Agriculture in GHG Emission

- In the backdrop of the 2070 carbon neutrality target set by India at the CoP26 in Glasgow, the Union Budget for 2022-23 has listed “climate action” and “energy transition” as one of the four priorities for the Amrit Kaal.
- However, considering that agriculture contributes 73% of the country’s methane emissions, the Budget announcements have been rather limited. Agricultural and allied activities such as rice cultivation, rearing of domestic animals and biomass burning account for 22%-46% of the global methane concentration.
- Agricultural Emissions and Climate Smart Agriculture

What is the Share of Agricultural Emissions?

- As per the national GHG inventory, the agriculture sector emits 408 MMT (million metric ton) of CO₂ equivalent.
- **Rice cultivation is the third highest source** (17.5%) of GHG emissions in Indian agriculture after enteric fermentation (54.6%) and fertiliser use (19%).
- **Paddy fields are anthropogenic sources of atmospheric nitrous oxide (N₂O) and methane (CH₄)**, which have been reckoned as 273 and 80-83 times more powerful than CO₂ in driving temperature increase in 20 years’ (as per IPCC AR6, 2021).

- The amount of CH₄ emitted from paddy fields of India is 3.396 teragram (1 teragram = 109 kilograms) per year or 71.32 MMT CO₂ equivalent.

Why are the Agricultural Emissions so High?

- The damage is largely a result of the various kinds of subsidies — on urea, canal irrigation and power for irrigation.
- The Minimum Support Prices (MSP) and procurement policies concentrated on a few states and largely on two crops, rice, and wheat has led to their overproduction.
- As of 1 January 2022, the stocks of wheat and rice in the country's central pool were four times higher than the buffer stocking requirement.
- Despite the record distribution of rice in the Public Distribution System (PDS) and exports in 2020-21, the rice stocks with the Food Corporation of India (FCI) are seven times the buffer norms for rice.
- This data not only reflects inefficient use of scarce capital, but also the large amount of greenhouse gases (GHG) embedded in these stocks.

6.2 Climate Smart Agriculture

Climate-smart agriculture is an approach for transforming food and agriculture systems to support sustainable development and safeguard food security under climate change.

CSA comprises three pillars or objectives: (1) sustainably increase agricultural productivity and incomes; (2) adapt and build resilience to climate change; and (3) reduce/remove GHG (greenhouse gases) emissions, where possible."

Dimensions of climate-smart practices include water-smart, weather-smart, energy-smart, and carbon-smart practices.

They improve productivity, deal with land degradation, and improve soil health.

CSA promotes crop diversification, increases water efficiency, and integrates drought-resistant crop types.

6.3 Climate Smart Agriculture: Characteristics

Contrary to conventional agricultural development, CSA systematically integrates climate change into the planning and development of sustainable agricultural systems.

CSA's three primary pillars are interrelated concerns-increased productivity, enhanced resilience and reduced emissions. However, the resultant trade-offs often cannot maximize the pillars simultaneously, only optimize them.

- ❖ CSA maintains ecosystem services: Ecosystems provide the agricultural sector with a number of unpaid services –clean natural water, materials, food, sunlight etc. CSA attempts to ensure the sustainability of these services, preventing their degradation.
- ❖ CSA is not a rigid set of particular practices, technologies or methodologies- it is only a concept amenable to adaptation. It has multiple entry points, ranging from the development of technologies and practices to the elaboration of climate

change models and scenarios, information technology, insurance schemes, value chains and the strengthening of institutional and political enabling environments.

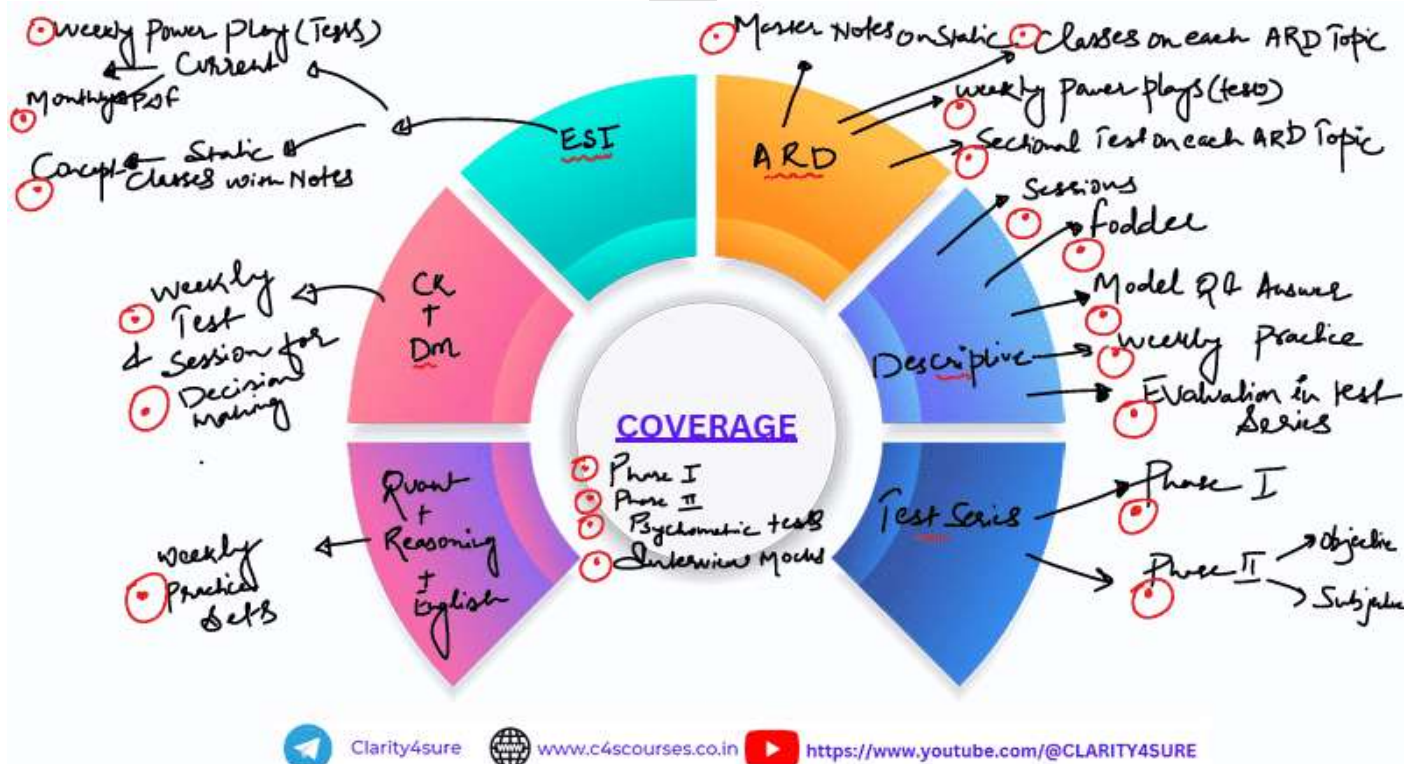
Results for NABARD Grade A 2023 by C4S				
Sl No.	Name	Stream	Have You taken any of the courses offered by Clarity ?	Final Selection
1	Prajakta Liladhar Meshram	Generalist	Yes	Yes
2	ARUN KUMAR BHARTI	Generalist	Yes	Yes
3	PUNITKUMAR NAIKAR	Generalist	Yes	Yes
4	B Lalmuansangi	Generalist	Yes	Yes
5	RAJASEKARAN T	Generalist	Yes	Yes
6	Avinashi Horo	Generalist	Yes	Yes
7	DEVIREDDY NAGA SINDHU	Generalist	Yes	Yes
8	KOMPALA VENKATA RAMESH	Generalist	Yes	Yes
9	RAYUDU SAI PADMINI	Generalist	Yes	Yes
10	Ammana Spandana	Generalist	Yes	Yes
11	DS Khuvei Olyson	Generalist	Yes	Yes
12	NAZI FRAH	Generalist	Yes	Yes
13	Sathish Kumar T	Generalist	Yes	Yes
14	Diwanshi Rana	Generalist	Yes	Yes
15	Ayush Anand	Generalist	Yes	Yes
16	Romi Singh	Generalist	Yes	Yes
17	Arun Manhas	Generalist	Yes	Yes
18	Appaji Pundalik Naik	Generalist	Yes	Yes
19	Darshan GN	Generalist	Yes	Yes
20	Rishabh Verma	Generalist	Yes	Yes
22	Ananya M	Generalist	Yes	Yes
23	Akshay Nair Nambalal	Generalist	Yes	Yes
24	RIYANABEGUM I NAYKAR	Generalist	Yes	Yes
25	SIDDHARTH DUBEY	Generalist	Yes	Yes
26	Suraj Kumar Prajapathi	Generalist	Yes	Yes
27	Shivam dheeran	Generalist	Yes	Yes
28	DOLLY Lalchandani	Generalist	Yes	Yes
29	Pravin	Generalist	Yes	Yes
30	SAURABH SHAM JADHAO	Generalist	Yes	Yes
31	Kunal Atmaram Desale	Generalist	Yes	Yes
32	Thogata Nagaraju	Generalist	Yes	Yes
33	Ranajit Patil	Generalist	Yes	Yes
34	Shubham Bhalchandra Kotkar	Generalist	Yes	Yes
35	Suryanshi Nigam	Generalist	Yes	Yes
36	SOUNDAR RAJAN R	Generalist	Yes	Yes
37	Saurabh Singh	Generalist	Yes	Yes
38	Palla Srinivas	Others	Yes	Yes
39	Nancy Singh	Others	Yes	Yes
40	Haffis Mohammed	Others	Yes	Yes
41	Pramod Raj N R	Generalist	Yes	Yes
42	Surya Prakash.M.S	Others	Yes	Yes
43	Vishal kumar bharti	Generalist	Yes	Yes
44	Kallesh Amaresh Totad			
Telegram: @Clarity4sure Web: www.c4scourses.co.in				
*Total 51 Candidates have responded of their selection who were associated with Clarity in courses; rest names will be added after confirmation				
** The list includes name of candidates who were associated with any one of the course/guidance by CLARITY and they themselves have marked YES in GOOGLE FORM				
***We are not involved in marketing propaganda where a few institutes are picking name of candidates who have just only given mock interview with them and not involved in guidance or course				

Key Government Initiatives on CSA

- National Innovation on Climate Resilient Agriculture (NICRA):** National Innovations in Climate Resilient Agriculture (NICRA) is a network project of the Indian Council of Agricultural Research (ICAR) launched in February, 2011 with an outlay of Rs.350 crores. The project aims to enhance the resilience of Indian agriculture, covering crops, livestock and fisheries to climatic variability and climate change through development and application of improved production and risk management technologies. National Mission on Sustainable Agriculture (NMSA) The Government is implementing the National Action Plan on Climate Change (NAPCC) which

provides the overarching framework for climate actions, through national missions in specific areas.

- **The National Mission for Sustainable Agriculture (NMSA)**, one of the Missions under NAPCC, includes programmatic interventions like Soil Health Card, Paramparagat Krishi Vikas Yojana, Mission Organic Value Chain Development for Northeastern Region, Rainfed Area Development, National Bamboo Mission and Sub-mission on Agro-Forestry. The NMSA works through adoption of sustainable development pathway by progressively shifting to environment friendly technologies, adoption of energy efficient equipments, conservation of natural resources, integrated farming, etc. Besides, the NMSA aims at promoting location specific improved agronomic practices through soil health management, enhanced water use efficiency, judicious use of chemicals, crop diversification.



- **The National Adaptation Fund for Climate Change (NAFCC):** The National Adaptation Fund for Climate Change (NAFCC) was established to meet the cost of adaptation to climate change for the State and Union Territories of India that are particularly vulnerable to the adverse effects of climate change. This Scheme was implemented during 2015-16 mainly for supporting concrete adaptation activities dealing with mitigating the adverse effects of global climate change in various sectors including agriculture. Under the NAFCC, various projects have been sanctioned in different states i.e., Punjab, Himachal Pradesh, Odisha, Manipur, Tamil Nadu, Kerala, Mizoram, Chhattisgarh, J&K, Meghalaya, Telangana, Andhra Pradesh etc. Implementing Agency NABARD
- **Climate Smart Village: Climate-smart village (CSV)** is an institutional approach to test, implement, modify and promote CSA at the local level and to enhance farmers' abilities to adapt to climate change. The CSV adopts a portfolio of

interventions to tackle the climate challenges of the agriculture sector that cover the full spectrum of farm activities. Various Consultative Group on International Agricultural Research (CGIAR) centers and national research organisations are putting their concerted efforts into the CSVs in India. CSVs were piloted in two states of India: Karnal district of Haryana state and Vaishali district of Bihar state which later spread into districts of Punjab, Andhra Pradesh and Karnataka.

- **Pradhan Mantri Krishi SinchayeeYojna (PMSKY):** This Scheme was planned and formulated to give more priority on water conservation and its management in agriculture with the vision to extend the area under irrigation from 1 July 2015. The main motto of this Scheme is 'Har Khet Ko Paani' to improve water use efficiency. 'More crop per drop' scheme provide end-to-end solutions in water on source creation, distribution channels and its management.
- **Pradhan Mantri Fasal Bima Yojna (PMFBY):** The Pradhan Mantri Fasal Bima Yojana (PMFBY) introduced in the country from Kharif 2016 season is voluntary for States/UTs as well as for farmers. States/UTs can participate in the scheme keeping in view their risk perception and financial considerations etc. From inception of the scheme till 2020-21 cumulatively 2,938.7 lakh farmer applications for a sum insured of Rs. 10,49,342 crore have been enrolled under the scheme.
- **Soil Health Card Scheme:** This Scheme was launched in February, 2015 to issue soil health cards (SHC) to the farmers providing detailed information on test-based soil nutrient status of their own land along with recommended dose of fertilizers for improving productivity through judicious use of inputs. The Government of India targeted to issue 10.48 crores of SHCs since inception of the Scheme.
- **National Water Mission (NWM):** A Mission was mounted to ensure Integrated Water Resource Management (IWRM) for conserving the water sources and minimizing its wastage, and also to optimize Water Use Efficiency (WUE) by 20 per cent including agriculture sector.
- **Paramparagat Krishi Vikas Yojna (PKVY):** It is an extended component of Soil Health Management (SHM) launched in 2015 under NMSA with the objective of supporting and promoting organic farming through adoption of organic village by cluster approach, which in turn result in improvement of soil health. Biotech-KISAN: It is a scientist-farmer partnership scheme launched in 2017 for agriculture innovation with an objective to connect science laboratories with the farmers to find out innovative solutions and technologies to be applied at farm level. Under this scheme, so far 146 Biotech-KISAN Hubs have been established covering all 15 agroclimatic zones and 110 aspirational districts in the country. The scheme has benefitted over two lakhs farmers so far by increasing their agriculture output and income. Over 200 entrepreneurship have also been developed in rural areas.
- **Neem Coated Urea:** It is a form of urea fertilizer coated with neem extracted material, which acts as a slow releaser of nitrogen reducing the pest and disease infestation ultimately minimizing the usage of chemicals in farming by achieving the overall increase in crop yield.

- **Sub-mission on Agro-forestry:** This Mission was launched during 2016-17 with the objective of planting trees on farm bunds. Agro-forestry has the potential to bring sustainability in agriculture and also achieving the optimum productivity by mitigating the impact of climate change.
- **National Livestock Mission:** This Mission was initiated by the Ministry of Agriculture and Farmers' Welfare and got commenced from 2014-15 focusing mainly on livestock development through sustainable approach ultimately protecting the natural environment, ensuring bio-security, conserving animal bio-diversity and farmers' livelihood.

The Global Methane Pledge was launched at COP (Conference of Parties) 26 in November 2021 to catalyse action to reduce methane emissions. It was led by the United States and the European Union. It has 111 country participants who together are responsible for 45% of global human-caused methane emissions. India, which is not a part of the Global Methane Pledge, is among the top five methane emitters globally. Most emissions can be traced back to agriculture.

Global Methane Tracker

The **International Energy Agency's** Global Methane Tracker 2024 indicates that methane emissions from fuel usage in 2023 were nearly at their highest level on record, representing a slight increase compared to 2022.

What are the Major Highlights of Global Methane Tracker 2024?

- ❖ **Methane Emissions Overview:** In 2023, methane emissions from fossil fuels totaled close to 120 million tonnes (Mt). Bioenergy (largely from biomass use) contributed a further 10 Mt methane emissions. This level has stayed constant since 2019.
- ❖ **Rise of Major Methane Emissions Events:** Major methane emissions events increased by over 50% in 2023 compared to 2022. These events included more than 5 million metric tons of methane emissions from significant fossil fuel leaks globally. One prominent incident was a major well blowout in Kazakhstan that lasted over 200 days.
- ❖ **Top Emitting Countries:** Nearly 70% of methane emissions from fossil fuels come from the top 10 emitting countries. The United States is the largest emitter of methane from oil and gas operations, closely followed by Russia. China is the highest emitter of methane in the coal sector.
- ❖ **Importance of Cutting Methane Emissions:** Cutting methane emissions from fossil fuels by 75% by 2030 is crucial for limiting global warming to 1.5 °C. The IEA estimated that this goal would require about USD 170 billion in spending. This is less than 5% of the income generated by the fossil fuel industry in 2023. Around 40% of emissions from fossil fuels in 2023 could have been avoided at no net cost.

7 Adaptation vs Mitigation

- ❖ Adaptation means anticipating the adverse effects of climate change and taking appropriate action to prevent or minimise the damage they can cause, or taking advantage of opportunities that may arise.
- ❖ Mitigation means making the impacts of climate change less severe by preventing or reducing the emission of greenhouse gases (GHG) into the atmosphere.
- ❖ Adaptation means anticipating the adverse effects of climate change and taking appropriate action to prevent or minimise the damage they can cause, or taking advantage of opportunities that may arise. Examples of adaptation measures

include large-scale infrastructure changes, such as building defenses to protect against sea-level rise, as well behavioral shifts, such as individuals reducing their food waste. In essence, adaptation can be understood as the process of adjusting to the current and future effects of climate change.

- ❖ Mitigation means preventing or reducing the emission of greenhouse gases (GHG) into the atmosphere to make the impacts of climate change less severe. Mitigation is achieved either by reducing the sources of these gases — e.g. by increasing the share of renewable energies, or establishing a cleaner mobility system — or by enhancing the storage of these gases — e.g. by increasing the size of forests. In short, mitigation is a human intervention that reduces the sources of GHG emissions and/or enhances the sinks

Adaptation	Mitigation
Climate change adaptation aims to mitigate the harmful effects of future climatic changes without necessarily stopping the climate change itself.	Mitigation aims to lessen the adverse effects of climate change by actually preventing it or limiting how much it changes.
It involves foreseeing climate change and taking actions or measures to reduce or prevent them.	It mainly involves reducing or removing greenhouse gases from atmosphere.
Measures – Building buffer zones, and flood barriers, developing warning systems, and drought-resistant crops, and using scarce water resources in a better way.	Measures – Using new technologies or energy-efficient old technologies, clean energy sources, carbon sinks, and certain behavioral changes.
They have short-term benefits.	They often have long-term benefits.
It is more region-specific or localized.	It has a global responsibility and is thus not localized.

8 Impact of climate change in Agriculture and Rural Livelihood

8.1 Impact on Agriculture

Changes in Agricultural Productivity: Climate change can make conditions better or worse for growing crops in different regions. For example, changes in temperature, rainfall, and frost-free days are leading to longer growing seasons in almost every state. The climate change impact assessment was carried out using the crop simulation models by incorporating the projected climates of 2050 & 2080. In absence of adoption of adaptation measures, rainfed rice yields in India are projected to reduce by 20% in 2050

and 47% in 2080 scenarios while, irrigated rice yields are projected to reduce by 3.5% in 2050 and 5% in 2080 scenarios. Climate change is projected to reduce wheat yield by 19.3% in 2050 and 40% in 2080 scenarios towards the end of the century with significant spatial and temporal variations. Climate change is projected to reduce the kharif maize yields by 18 and 23% in 2050 and 2080 scenarios, respectively. Climate change reduces crop yields and lower nutrition quality of produce. Extreme events like droughts affect the food and nutrient consumption, and its impact on farmers.

- ❖ Impact to soil and water resource: Climate change is expected to increase the frequency of heavy precipitation in the India, which can harm crops by eroding soil and depleting soil nutrients. Heavy rains can also increase agricultural runoff into oceans, lakes, and streams. This runoff can harm water quality.
- ❖ Health Challenges to Agricultural Workers and Livestock: Agricultural workers face several climate-related health risks. These include exposures to heat and other extreme weather, more pesticide exposure due to expanded pest presence, disease-carrying pests like mosquitos and ticks, and degraded air quality
- ❖ Threat to Food Security
- ❖ Eroding Genetic Diversity
- ❖ Threat to Biological diversity
- ❖ Resurgence of Pest and disease
- ❖ Alteration in monsoon and its affect like flood, heat waves and drought
- ❖ Increased costs for farmers

Measures to mitigate the impact of climate change on Agriculture:

- ❖ Improved Crop Varieties: As climate conditions change, farmers need to adjust their crops accordingly. This includes selecting varieties that are more tolerant of extreme temperatures and droughts. For example, maize varieties in Africa that have been bred specifically for heat tolerance have been shown to offer a yield advantage of up to 10%.
- ❖ Irrigation: A well-managed irrigation system can be a powerful tool for limiting the effects of climate change on agriculture. By decreasing the dependence on rainfall, farmers are able to ensure that their crops are receiving the water they need to thrive, even during periods of prolonged drought.
- ❖ Precision Agriculture: Precision agriculture uses technology to monitor crop growth and soil health in order to make more informed decisions about planting and fertilization. This can help farmers optimize their yields and reduce their environmental impact.
- ❖ Agroforestry: Agroforestry combines traditional agricultural practices with tree cultivation. This helps to reduce soil erosion and increase carbon sequestration, while also providing a source of income for farmers.
- ❖ Water Harvesting: Water harvesting is a simple and effective way to capture rainfall and store it for future use. This can be especially helpful for farmers in areas prone to long periods of drought.

- ❖ **Climate-Smart Agriculture:** Climate-smart agriculture is a set of practices that aim to increase agricultural productivity while also reducing greenhouse gas emissions. This includes practices such as the use of improved crop varieties, efficient irrigation systems, and sustainable land management.

8.2 Impact on Rural Livelihood:

Climate change poses a significant threat to the lives and livelihoods activities (decreasing water supply, effects on livestock rearing and agriculture, reduced productivity, and an increased reliance on external food sources) of the local communities around the world

- ❖ **Structural change**
- ❖ **Rural Migration**
- ❖ **Climate change and variability pose a significant challenge for agricultural and fisherman community worldwide**
- ❖ **Deterioration of allied and agro-based industries**
- ❖ **Deterioration of MSME**
- ❖ **Health Issues and declining productivity**
- ❖ **Declining Labour productivity**
- ❖ **Rising gender gap due to climate change issue**

9 Carbon Credit

What is carbon credit trading?

A single carbon credit represents the removal or avoided emission of one ton of carbon dioxide – or another greenhouse gas like methane of equivalent volume. These credits can be sold at a cost to an entity that can then claim that credit as a reduction in its own carbon emissions. For example, a farmer grows a tree that in theory can remove one ton of carbon dioxide from the atmosphere. The farmer then sells the carbon credit for the tree plantation to a steel company that can then claim that its “net” emissions are its original emissions minus one ton of carbon dioxide.

These credits, measured in tonnes of carbon dioxide-equivalent (CO₂e), then get priced and traded.

9.1 Carbon Market - Compliance based trading vs Voluntary Trading

In compliance-based trading, a governing institution (usually the government), sets a limit on how much carbon per unit output each member of a group can emit e.g. steel companies. If a company emits more than that limit, it is required to purchase carbon credits to bring down its net emissions to within that limit. If a company emits less than the allowed limit, it can sell the remaining allowance as a carbon credit to other companies. This creates a monetary incentive for companies to emit as little as possible.

In voluntary trading, there is no externally imposed limit on carbon emissions. Rather, a company may choose to purchase carbon credits to lower its net emissions, or even achieve net zero emission status, i.e. all carbon emissions are offset by carbon credits, out of choice. This is often because sustainability is a core value for stakeholders including customers, employees, and shareholders.

How does carbon credit trading work in practice?

Carbon credit trade has three stages – create, issue, and trade/retire.

Create

Using the previous example of a farmer planting trees - first, the farmer will plant the tree. Next, the farmer, or the project developer who hired the farmer, will conduct a Baseline Emissions Assessment (BEA), i.e. an assessment of how much carbon is being removed from the atmosphere, and prepare a Project Design Document (PDD) that includes results from the BEA as well as other details about the execution and monitoring of the tree plantation project.

Issue

Then, an independent verifying body will validate the PDD and issue a report that confirms that the project is eligible for carbon credits. The project developer must then submit this report to a standards program that will officially issue the carbon credit and enter it in their records.

Trade/ Retire

The project developer can then decide to sell the carbon credit, for example to a steel company that wants to lower its net emissions. For this, they have to notify the standards program, which in turn will retire the carbon credit in their records, i.e. note that it has been claimed by the steel company and is therefore no longer in circulation.

How much is a carbon credit worth?

While there is significant international momentum around creating a standardized price for a single carbon credit, today the price for a carbon credit is highly variable ranging from a few rupees to a few thousand rupees. As with any other tradeable commodity, the price of a carbon credit comes down to its quality. Quality in this case refers to three key aspects – credibility, durability, and existence of spillover benefits.

Credibility refers to how reliable the source of the carbon credit is. A highly credible carbon credit is one that is verified by a reputable agency, has all the necessary documentation, and can be easily and transparently monitored or proved if needed.

Entities, particularly large publicly listed companies, are willing to pay more for more credible carbon credits to avoid the reputational risk of buying fake or fraudulent carbon credits.

Durability refers to how permanent the carbon credit is. For example, a tree that can in theory remove several tons of carbon dioxide from the atmosphere during its lifetime could die in a forest fire. Other sources of carbon removal such as carbon capture and sequestration (CCUS) are more permanent, and therefore their corresponding carbon credits tend to be more expensive in the open market.

Spillover effects refer to the additional positive social or environmental benefits that can be attributed to the carbon credit. For example, several project developers in India distribute solar cook stoves to rural households to prevent them from using coal or wood-fueled cookstoves. They then sell carbon credits corresponding to the volume of carbon emission avoided from coal/wood fired cookstoves. In addition to emission mitigation, this also has health and welfare benefits for the families that receive the cookstove so a company may be willing to pay more for these credits – out of goodwill or to claim the additional benefits as their corporate social responsibility.

Carbon Credit Trading Scheme, 2023

1. What is the Carbon Credit Trading Scheme, 2023?

The Carbon Credit Trading Scheme, 2023, is a new initiative by the Ministry of Power to regulate and incentivize the reduction of greenhouse gas emissions in India. It involves the issuance and trading of carbon credits to meet emission targets.

2. Who issues the carbon credit certificates?

The carbon credit certificates will be issued by the Bureau of Energy Efficiency (BEE) to entities that surpass their assigned emission reduction targets.

3. How are the obligated entities for the scheme determined?

The Ministry of Power, based on recommendations from the Bureau of Energy Efficiency, notifies entities obligated to comply with the trading scheme.

4. Who sets the emission intensity targets for these entities?

The Ministry of Environment, Forest, and Climate Change sets the emission intensity targets for obligated entities, upon the recommendation of the Ministry of Power.

5. What happens if an entity does not meet its emission targets?

Entities that fail to meet their targets must compensate by purchasing carbon credit certificates.

6. Where will carbon credit certificates be traded?

These certificates will be traded on power exchanges registered with the Central Electricity Regulatory Commission (CERC).

7. What is the role of the Grid Controller of India Limited (GCIL) in this scheme?

GCIL acts as the registry for the scheme, undertaking the registration of entities and maintaining a record of transactions.

8. Who oversees the governance of the carbon market?

A National Steering Committee, chaired by the Power Secretary and comprising representatives from various ministries, oversees the governance and oversight of the carbon market.

Rules for a global carbon market were established at the Glasgow COP26 climate change conference in November 2021, enacting an agreement first laid out at the 2015 Paris Climate Agreement.

The agreed-upon framework, known as Article 6, will comprise a centralised system and a separate bilateral system.

The centralised system is for the public and private sectors, while the bilateral system is designed for countries to trade carbon offset credits, helping them meet their emission targets.

The new rules allow participants to use previous credits created between 2013 and 2020, prompting fears that they could potentially saturate the market and put downward pressure on prices.

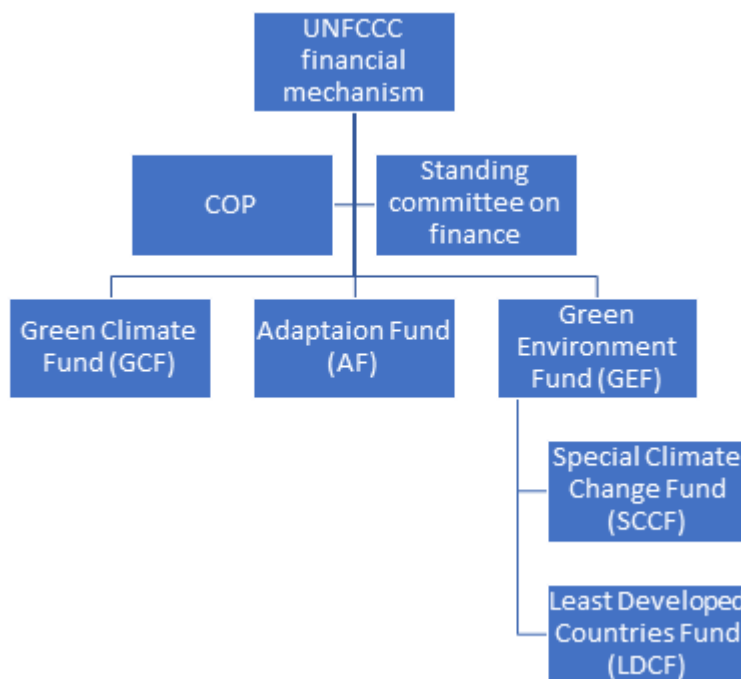
Under the new agreement, those who create carbon credits will deposit 5% of proceeds generated into a fund to help developing countries tackle climate change. Also, 2% of credits will be cancelled to ensure an overall reduction in emissions.

However, there is no 'official' carbon market established, and the global community is still discussing the rules that will govern such trade.

10 Climate Finance and Funding Mechanism

- ❖ Climate finance refers to local, national or transnational financing—drawn from public, private and alternative sources of financing—that seeks to support mitigation and adaptation actions that will address climate change.

- ❖ Climate finance is needed for mitigation, because large-scale investments are required to significantly reduce emissions.
- ❖ It is equally important for adaptation, as significant financial resources are needed to adapt to the adverse effects and reduce the impacts of a changing climate.
- ❖ **Climate Finance & UNFCCC** - To facilitate the provision of climate finance, the United Nations Framework Convention on Climate Change (UNFCCC) has established the financial mechanism to provide financial resources to developing country Parties.
- ❖ **The Adaptation Fund under Kyoto Protocol:** It aims to finance concrete projects and programmes that help vulnerable communities in developing countries that are Parties to the Kyoto Protocol to adapt to climate change.
- ❖ **Green Climate Fund:** It is the financial mechanism of the UNFCCC, established in 2010. India has been pushing for rich countries to meet their Paris Accord climate finance commitment of USD 100 billion per year.
- ❖ **Global Environment Fund (GEF):** GEF has served as an operating entity of the financial mechanism since the Convention came into force in 1994. It is a private equity fund focused on seeking long term financial returns by investments in clean energy under climate change.
- ❖ GEF also maintains two additional funds, the Special Climate Change Fund (SCCF) and the Least Developed Countries Fund (LDCF).



Climate Financing in India:

National Adaptation Fund for Climate Change (NAFCC): It was established in 2015 to meet the cost of adaptation to climate change for the State and Union Territories of India that are particularly vulnerable to the adverse effects of climate change.

National Clean Energy Fund:

- ❖ The Fund was created to promote clean energy, funded through an initial carbon tax on use of coal by industries.
- ❖ Governed by an Inter-Ministerial Group with the Finance Secretary as the Chairman.
- ❖ Its mandate is to fund research and development of innovative clean energy technology in the fossil and non fossil fuel based sectors.

National Adaptation Fund:

- ❖ The fund was established in 2014 with a corpus of Rs. 100 crore with the aim of bridging the gap between the need and the available funds.
- ❖ The fund is operated under the Ministry of Environment, Forests and Climate Change (MoEF&CC).

Principles of Climate Finance

Polluter Pays:

- ❖ The 'polluters pays' principle is the commonly accepted practice according to which those who produce pollution should bear the costs of managing it to prevent damage to human health or the environment.
- ❖ This principle underpins most of the regulation of pollution affecting land, water and air formally known as the 1992 Rio Declaration.
- ❖ It has also been applied more specifically to emissions of greenhouse gases which cause climate change.

Common but Differentiated Responsibility and Respective Capability (CBDR-RC):

- ❖ CBDR-RC is a principle within the UNFCCC. It acknowledges the different capabilities and differing responsibilities of individual countries in addressing climate change.

Additionality:

- ❖ Climate finance should be additional to existing commitments to avoid the diversion of funding for development needs to climate change actions.
- ❖ This includes use of public climate finance and investments by the private sector.

Adequacy & Precaution:

- ❖ In order to take precautionary measures to prevent or minimise the causes of climate change as a stated goal under UNFCCC, the level of funding needs to be sufficient to keep a global temperature within limits as possible.
- ❖ A better level of adequacy might be increased in the national estimates of the needed **climate funds, this will help build planned investments with respect to INDC.**

Predictability:

- ❖ Climate finance must be predictable to ensure sustained flow of climate finance.
- ❖ It can be done through multi-year, medium-term funding cycles (3 – 5 years).
- ❖ This allows for an adequate investment program to scale up the country's national adaptation and mitigation priorities.

11 NAPCC

What it is?

The National Action Plan on Climate Change (NAPCC) was released by the Prime Minister on 30th June 2008. It outlines a national strategy that aims to enable the country to adapt to climate change and enhance the ecological sustainability of India's development path. It stresses that maintaining a high growth rate is essential for increasing living standards of the vast majority of people of India and reducing their vulnerability to the impacts of climate change. There are eight –National Missions which form the core of the National Action Plan. They focus on promoting understanding of climate change, adaptation and mitigation, energy efficiency and natural resource conservation.

What are the missions that come under the National Action Plan for Climate Change?

There are eight National Missions⁵ on climate change: 1. National Solar Mission 2. National Mission for Enhanced Energy Efficiency 3. National Mission on Sustainable Habitat 4. National Water Mission 5. National Mission for Sustaining the Himalayan Eco-system 6. National Mission for a Green India 7. National Mission for Sustainable Agriculture 8. National Mission on Strategic Knowledge for Climate Change.

What are the principles of this plan?

The Principles of NAPCC⁶ are: • Protecting the poor through an inclusive and sustainable development strategy, sensitive to climate change • Achieving national growth and poverty alleviation objectives while ensuring ecological sustainability • Efficient and cost-effective strategies for end-use demand-side management • Extensive and accelerated deployment of appropriate technologies for adaptation and mitigation • New and innovative market, regulatory, and voluntary mechanisms for sustainable development • Effective implementation through unique linkages – with civil society, LGUs, and public-private partnerships

Missions

Jawaharlal Nehru National Solar Mission: Aims to establish India as a global leader in solar energy by creating the policy conditions for its deployment across the country.

- Under: Ministry of New and Renewable Energy
- The initial target of NSM was to install 280 GW solar power by 2022. This was upscaled to 100 GW in early 2015.
- Immediate Aim: Focus on setting up an enabling environment for solar technology penetration in the country both at a centralized and decentralized level.
- Also reduce the cost of Solar Power Generation in the country through
- Long term policy
- Large Scale deployment goals
- Aggressive R&D- Tie local research with international efforts
- Domestic production of critical raw materials, components, and products, as a result, to achieve grid tariff by 2022.

National Mission for Enhanced Energy Efficiency: Aims to strengthen the market for energy efficiency by creating a conducive regulatory and policy regime and has envisaged fostering innovative and sustainable business models for the energy efficiency sector.

- Under: Ministry of Power
- Based on the Energy Conservation Act, 2001.
- NMEEE consists of four initiatives to enhance energy efficiency in energy-intensive industries:
- Perform, Achieve and Trade (PAT): Assigns targets to energy-intensive industries and also allots energy saving certificates (Escerts). These certificates are tradable amongst the candidates who have either breached their targets or remained unsuccessful in achieving them.
- Market Transformation for Energy Efficiency (MTEE) promotes the use and adoption of energy-efficient equipment.
- Energy Efficiency Financing Platform (EEFP) encourages financial institutions and investors to support energy efficiency initiatives.
- Framework for Energy Efficient Economic Development (FEEED) promotes energy-efficient initiatives by hedging against investment risks.
- In order to hedge the financial institutions providing loans for the energy efficiency projects against credit risks, the Bureau of Energy Efficiency has also institutionalised two funds namely “Partial Risk Guarantee Fund for Energy Efficiency” and “Venture Capital Fund for Energy Efficiency”. Both these funds have been launched under “Framework for Energy Efficient Economic Development” component of the NMEEE.

NMEEE calls for:

- Mandating specific energy consumption decreases in large energy consuming industries and creating a framework to certify excess energy savings along with market based mechanisms to trade these savings.
- Innovative measures to make energy efficient appliances/products in certain sectors more affordable.
- Creation of mechanisms to help finance demand side management pro-programmes by capturing future energy savings and enabling public-private-partnerships for this.
- Developing fiscal measures to promote energy efficiency such as tax incentives for including differential taxation on energy efficient certified appliances.

National Mission on Sustainable Habitat:

- Under Ministry of Urban Development
- Objectives:
- To reduce the energy consumption and hence the risk of climate change due to the urban settlement pattern.

- The mission envisages a shift to Energy Conservation Building Code (ECBC) in the design of new commercial buildings as well as solid and liquid waste management.
- The mission also covers under its ambit, the water resource management as well as drinking water management.
- One of the most important plan under the mission is to pave the way for a shift to public transport.
- The research and development is an important component of the mission to promote the wastewater use and sewage utilisation along with waste management.

The aim of the Mission is to make habitats more sustainable through a threefold approach that includes:

- Improvements in energy efficiency of buildings in residential and commercial sector
- Management of Municipal Solid Waste (MSW)
- Promote urban public transport

4 flagship missions or programmes of the Ministry of Urban Development

- Atal Mission on Rejuvenation and Urban Transformation (AMRUT) – Focus is on:
 - Water supply
 - Sewerage and septage management
 - Stormwater drainage to reduce flooding
 - Non-motorized urban transport, an example would be cycling.
 - Green space/parks
- Swachh Bharat Mission
- Smart Cities Mission: To promote cities that provide core infrastructure and give a decent quality of life to its citizens, a clean and sustainable environment and application of Smart Solutions.
- Urban Transport Programme

National Water Mission: A comprehensive programme for equitable distribution of water across the country as well as for enhancing the capacity-building process for the management of over-exploited blocs.

- Under: Ministry of Water Resources, River Development and Ganga Rejuvenation
- Focused upon tackling the issues related to water availability and pollution which is owed to global warming and climate change.
- The mission promotes research and development
- Timely review of National Water Policy is also proposed.
- The mission while promoting the traditional water conservation system, also promotes the expeditious implementation of multipurpose water projects. It has a target of increasing water use efficiency by 20%.
- The convergence of various water conservation schemes for a better outcome and implementation of water resource management programs via the MNREGA route with the participation of the elected representatives of the over-exploited water blocs is central theme of the mission.

- The program has focused on decentralised approach which is reflected in its plan of “basin level” integrated water resource management and sensitization of the urban local youths. The National Water Mission also has an identified goal of putting a comprehensive water resource database in the public domain. The onus of implementation lies on the Ministry of Jal Shakti.

National Mission for Sustaining Himalayan Ecosystem:

- Under: Department of Science and Technology.
- Created to protect the Himalayan ecosystem.
- Mandate: To evolve measures to sustain and safeguard the Himalayan glaciers, mountain ecosystems, biodiversity and wildlife conservation & protection.

Green India Mission

- Under Ministry of Environment, Forest and Climate Change
- GIM puts —greening in the context of climate change adaptation and mitigation. Greening is meant to enhance ecosystem services such as carbon sequestration and storage (in forests and other ecosystems), hydrological services and biodiversity; as well as other provisioning services such as fuel, fodder, small timber and non-timber forest products (NTFPs).
- The Mission aims at responding to climate change by a combination of adaptation and mitigation measures, which would help:
 - Enhancing carbon sinks in sustainably managed forests and other ecosystems
 - Adaptation of vulnerable species/ecosystems to the changing climate
 - Adaptation of forest-dependent communities

The objectives of the Mission are:

- Increased forest/tree cover on 5 m ha of forest/non-forest lands and improved quality of forest cover on another 5 m ha (a total of 10 m ha)
- Improved ecosystem services including biodiversity, hydrological services and carbon sequestration as a result of treatment of 10 m ha
- Increased forest-based livelihood income of about 3 million households living in and around the forests
- Enhanced annual CO₂ sequestration by 50 to 60 million tonnes in the year 2020

National Mission for Sustainable Agriculture: Seeks to transform Indian agriculture into a climate-resilient production system through suitable adaptation and mitigation measures in domains of both crops and animal husbandry.

- Under: Ministry of Agriculture
- To achieve objective to fight against climate change, NMSA have the following multi-pronged strategy:
 - Promoting integrated farming system covering crops, livestock & fishery, plantation and pasture based composite farming for enhancing livelihood opportunities,

ensuring food security and minimizing risks from crop failure through supplementary/ residual production systems;

- Popularizing resource conservation technologies (both on-farm and off-farm) and introducing practices that will support mitigation efforts in times of extreme climatic events or disasters like prolonged dry spells, floods etc.
- Promoting effective management of available water resources and enhancing water use efficiency through application of technologies coupled with demand and supply side management solutions;
- Involving knowledge institutions and professionals in developing climate change adaptation and mitigation strategies for specific agro climatic situations and promoting them through appropriate farming systems.

National Mission on Strategic Knowledge for Climate Change

- Under: Department of Science and Technology
- Seeks to build a vibrant and dynamic knowledge system that would inform and support national action for responding effectively to the objective of ecologically sustainable development
- This Mission strives to work with the global community in research and technology development and collaboration through a variety of mechanisms and, in addition, will also have its own research agenda supported by a network of dedicated climate change-related institutions and universities and a Climate Research Fund.
- The Mission will also encourage private sector initiatives for developing innovative technologies for adaptation and mitigation.

12 UNFCCC

The UNFCCC secretariat (UN Climate Change) is the United Nations entity tasked with supporting the global response to the threat of climate change. UNFCCC stands for United Nations Framework Convention on Climate Change.

Where did it Originate?

- The UNFCCC, signed in 1992 at the United Nations Conference on Environment and Development also known as the Earth Summit, the Rio Summit or the Rio Conference
- The UNFCCC entered into force on March 21, 1994.
- The Convention has near universal membership (197 Parties) and is the parent treaty of the 2015 Paris Agreement.
- The original secretariat was in Geneva. Since 1996, the secretariat has been located in Bonn, Germany.

What is the Objective of UNFCCC?

According to Article 2, the Convention's ultimate objective is “to achieve, stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system”.

This objective is qualified in that it “should be achieved within a time frame sufficient to allow ecosystems to adapt naturally to climate change, to ensure that food production is not threatened and to enable economic development to proceed in a sustainable manner”.

What are UNFCCC's Institutional Arrangements?

The Conference of the Parties (COP)

Article 7.2 defines the COP as the “supreme body” of the Convention, as it is its highest decision-making authority. The climate change process revolves around the annual sessions of the COP.

COP President and Bureau

The office of the COP President normally rotates among the five United Nations regional groups. The President is usually the environment minister of his or her home country. S/he is elected by acclamation immediately after the opening of a COP session. Their role is to facilitate the work of the COP and promote agreements among Parties.

The work of the COP and each subsidiary body is guided by an elected Bureau. To ensure continuity, it serves not only during sessions, but between sessions as well.

Subsidiary Bodies (SBs)

The Convention establishes two permanent subsidiary bodies (SBs), namely the Subsidiary Body for Scientific and Technological Advice (SBSTA), by Article 9, and the Subsidiary Body for Implementation (SBI), by Article 10. These bodies advise the COP.

The SBSTA's task is to provide the COP “with timely advice on scientific and technological matters relating to the Convention”.

The SBI's task is to assist the COP “in the assessment and review of the effective implementation of the Convention”

The Secretariat

The secretariat, also known as the Climate Change Secretariat, services the COP, the SBs, the Bureau and other bodies established by the COP.

Other Bodies

Other bodies have been set up by the COP to undertake specific tasks. These bodies report back to the COP when they complete their work

COP 1 established two ad hoc groups to conduct negotiations on specific issues.

COP 11 established the “Dialogue” to exchange experiences and analyse strategic approaches for long-term cooperative action to address climate change.

Timeline of Important Events

1979	First World Climate Conference (WCC)
1988	IPCC established
1990	In November IPCC and second WCC call for global treaty on climate change and in December UN General Assembly Negotiations on a Framework Convention Begin.
1992	The text of the United Nations Framework Convention on Climate Change is adopted at the United Nations Headquarters in New York.
1994	UNFCCC enters into force
1995	COP 1 (Berlin, Germany)
1996	August <ul style="list-style-type: none">The UNFCCC secretariat relocates from Geneva to its current home in Bonn(Germany), paving the way for the city to become an international sustainability hub and home to 18 UN organizations.
1997	COP 3 (Kyoto, Japan) <ul style="list-style-type: none">Kyoto Protocol adopted- The Protocol legally binds developed countries to emission reduction targets.
1998	Buenos Aires Plan of Action
2001	COP 6-2(second part of 6th COP) <ul style="list-style-type: none">The COP 6-2 took place from 16 to 27 July 2001 in Bonn, Germany.A major breakthrough is achieved at the second part of the sixth Conference of the Parties meeting in Bonn, with governments reaching a broad political agreement on the operational rulebook for the 1997 Kyoto Protocol.
2001	COP 7 (Marrakesh, Morocco) <ul style="list-style-type: none">Resulted in the Marrakesh Accords, setting the stage for ratification of the Kyoto Protocol. This formalized the agreement on operational rules for International Emissions Trading, the Clean Development Mechanism and Joint Implementation along with a compliance regime and accounting

	procedures.
2002	COP 8 (New Delhi, India) Delhi Declaration. The Delhi Declaration focuses on the development needs of the poorest countries and the need for technology transfer for mitigating climate change.
2005	(February 16) Entry of Kyoto Protocol into force with the Russian Federation ratification to the Kyoto Protocol, sealing its entry into force.
2005	COP11/CMP1 (December) <ul style="list-style-type: none"> The first Meeting of the Parties to the Kyoto Protocol (MOP 1) takes place in Montreal.
2006	In January the Clean Development Mechanism, a key mechanism under the Kyoto Protocol, opens for business. <ul style="list-style-type: none"> The CDM is one of the Flexible Mechanisms defined in the Kyoto Protocol that provides for emissions reduction projects which generate Certified Emission Reduction units (CERs) which may be traded in emissions trading schemes.
2007	COP13 <ul style="list-style-type: none"> Parties agreed on the Bali Road Map and Bali action plan, which charted the way towards a post-2012 outcome. The Plan has five main categories: shared vision, mitigation, adaptation, technology and financing.
2008	COP 14, Poznan (Poland) <ul style="list-style-type: none"> The launch of the Adaptation Fund under the Kyoto Protocol and The Poznan Strategic Programme on Technology Transfer.
2009	COP15 (Copenhagen) <ul style="list-style-type: none"> Copenhagen Accord drafted. Developed countries pledge up to USD 30 billion in fast-start finance for the period 2010-2012.
2010	COP 16 (Cancun) <ul style="list-style-type: none"> Resulted in the Cancun Agreements, a comprehensive package by governments to assist developing nations in dealing with climate change. The Green Climate Fund, the Technology Mechanism and the Cancun Adaptation Framework are established.
2011	COP 17 (Durban) <ul style="list-style-type: none"> Governments commit to a new universal climate change agreement by 2015 for the period beyond 2020.(Resulted in the Paris Agreement of 2015)
2012	COP18/CMP8 (Doha) <ul style="list-style-type: none"> The Doha Amendment to the Kyoto Protocol is adopted. COP18 also launched a second commitment period of the Kyoto Protocol.
2013	COP19/CMP9 (Warsaw)

	<ul style="list-style-type: none"> ▪ Key decisions adopted include: <ul style="list-style-type: none"> ○ Further advancing the Green Climate Fund and Long-Term Finance, ○ The Warsaw Framework for REDD Plus and the Warsaw International Mechanism for Loss and Damage.
2015	<p>COP 21 (Paris)</p> <ul style="list-style-type: none"> ▪ Paris Agreement adopted. It aims: <ul style="list-style-type: none"> ○ To keep global temperatures "well below" 2.0C (3.6F) above pre-industrial times and "endeavor to limit" them even more, to 1.5C ○ Rich countries should help poorer nations by providing "climate finance" to adapt to climate change and switch to renewable energy. ○ The agreement requires rich nations to maintain a \$100bn a year funding pledge beyond 2020.
2016	<p>COP22 (Marrakech)</p> <ul style="list-style-type: none"> ▪ A crucial outcome of the Marrakech climate conference was <ul style="list-style-type: none"> ○ To move forward on writing the rule book of the Paris Agreement. ○ Launched the Marrakech Partnership for Climate Action.
2017	<p>COP23, Bonn (Germany)</p> <ul style="list-style-type: none"> ▪ Countries continued to negotiate the finer details of how the agreement will work from 2020 onwards. ▪ First set of negotiations since the US, under the presidency of Donald Trump, announced its intention earlier this year to withdraw from the Paris deal. ▪ It was the first COP to be hosted by a small-island developing state with Fiji taking up the presidency, even though it was being held in Bonn.
2018	<p>COP 24, Katowice (Poland)</p> <ul style="list-style-type: none"> ▪ It finalized a "rulebook" to operationalise the 2015 Paris Agreement. ▪ The rulebook covers climate financing facilities and the actions to be taken as per Nationally Determined Contributions (NDC).
2019	<p>COP25, Madrid (Spain)</p> <ul style="list-style-type: none"> ▪ There were no concrete plans regarding the growing climatic urgency.
2021	<p>COP 26, Glasgow (UK)</p> <ul style="list-style-type: none"> ▪ New Global and Country Targets: The Glasgow Summit has urged countries to consider strengthening their 2030 targets by COP27 to be held in Egypt. ▪ The summit targeted global warming not to exceed +1.5°C and got about 140 countries to announce target dates for bringing emissions down to net

	<p>zero.</p> <ul style="list-style-type: none"> India has also joined the consensus and announced its net-zero target of 2070. India also suggested a middle path calling for a "phase-down" of coal-based power. A potentially important development which emerged out of COP26 (but outside the COP process) is the Glasgow Breakthrough Agenda endorsed by 42 countries (including India). Also, a mechanism is being put in place to achieve the target of climate financing USD 100 billion by 2023.
2022	<p>COP 27 Sharm El Sheikh, Egypt</p> <ul style="list-style-type: none"> To be held from 6 to 18 November 2022
2023	<p>The 2023 United Nations Climate Change Conference or Conference of the Parties of the UNFCCC, more commonly known as COP28, was the 28th United Nations Climate Change conference, held from 30 November to 13 December at Expo City, Dubai, United Arab Emirates.</p> <p><u>The 'global stocktake'</u> is considered the central outcome of COP 28 – as it contains every element that was under negotiation and can now be used by countries to develop stronger climate action plans due by February 2025.</p>
2024	<p>The 2024 United Nations Climate Change Conference or Conference of the Parties of the UNFCCC, more commonly known as COP29, will be the 29th United Nations Climate Change conference. COP29 will be held in Baku, Azerbaijan. Mukhtar Babayev will preside COP29.</p>
2025	<p>The 2025 UN Climate Change Conference (UNFCCC COP 30) will convene in November 2025 in Brazil.</p>

Important outcomes of COP 28

Highlights	Description
Loss and Damage (L&D) Fund	<p>COP28 countries <u>agreed to launch the Loss and Damage (L&D) fund</u>, hosted by the <u>World Bank for four years</u>, aligning with <u>UNFCCC and the Paris Agreement</u>. All developing countries are eligible, and contributions are <u>voluntary</u>, with a specific percentage earmarked for <u>Least Developed Countries and Small Island Developing States</u>.</p>
Global Stock take	<p>COP28 released the <u>fifth iteration of the Global Stocktake (GST)</u>, adopting eight steps to limit global <u>temperature rise to 1.5 degrees C</u>. These steps include:</p> <ol style="list-style-type: none"> <u>Tripling renewable energy</u> capacity by 2030 (to at least 11,000 GW by 2030) and <u>collectively double</u> the global energy efficiency improvements

	<p>from <u>around 2% to over 4%</u> every year until 2030.</p> <p>2. Phase-down of <u>unabated coal power</u></p> <p>3. Accelerating efforts globally towards <u>net zero by around mid-century</u></p> <p>4. <u>Accelerating zero and low emissions</u> technologies e.g., Nuclear, CCUS, Hydrogen</p> <p>5. <u>Transitioning away from fossil fuels</u> in energy systems, in a just, orderly and equitable manner, so as to achieve net zero by 2050</p> <p>6. <u>Reducing non-CO2 emissions</u> e.g., methane emissions globally by 2030</p> <p>7. Emissions reductions <u>from road transport</u></p> <p>8. Phasing out of inefficient <u>fossil fuel subsidies</u></p> <p>The text maintains <u>continuity with COP26</u>, balancing global aspirations while recognizing diverse energy needs</p>
	<p>What is Global Stocktake?</p> <p>Global stocktake is a <u>process for countries to see where they're collectively making progress</u> towards meeting the goals of the Paris Agreement. As per the Paris Agreement (2015), it was decided that <u>countries would assess their progress for the first time in 2023</u> and, then, every five years.</p> <p>It noted that there is a <u>need to cut 43% of GHG emissions</u> by 2030, compared to 2019 levels and countries are off-track in meeting their climate goals.</p>
Global Cooling Pledge	66 national signatories committed to a <u>68% reduction in cooling-related emissions by 2050</u>
Climate Finance	<p>UNCTAD estimates that <u>developed nations owe developing countries \$500 billion in 2025</u> under the <u>New Collective Quantified Goal (NCQG)</u> for climate finance, confirmed in the Paris Agreement.</p> <p>The goal, starting <u>at \$100 billion annually</u>, allocates \$250 billion for mitigation, \$100 billion for adaptation, and \$150 billion for loss and damage.</p> <p>With the <u>current \$100 billion goal unmet</u>, developing countries face debt distress.</p>
Global Goal on Adaptation (GGA) framework	Draft text introduced to <u>enhance climate change adaptation</u> like Climate-Induced Water Scarcity Reduction, Climate-resilient food and Agriculture Production and Strengthening Resilience Against Climate-Related Health Impacts
Triple Nuclear	The text calls <u>to triple global nuclear energy capacity by 2050</u>

Energy	
Powering Past Coal Alliance (PPCA)	PPCA, a coalition involving <u>governments, businesses, and organizations</u> , focuses on transitioning from unabated coal power to clean energy. At COP28, PPCA welcomed <u>new national and subnational governments</u> , advocating for cleaner energy alternatives. <u>India is not part of PPCA</u> as it has not committed to phasing out of coal.
Coal Transition Accelerator	Introduced for <u>knowledge-sharing and financial support</u> in transitioning from coal.
Coalition for High Ambition Multilevel Partnership (CHAMP)	65 national governments signed commitments for <u>enhanced cooperation with subnational governments</u> in climate strategies.
Buildings Breakthrough Initiative	The goal of the Buildings Breakthrough Initiative is to <u>make near-zero emissions and resilient buildings the new normal by 2030</u> . The initiative is <u>co-led by France and the Kingdom of Morocco</u> , coordinated under the umbrella of UNEP, and hosted by the <u>Global Alliance for Buildings and Construction</u> (Global ABC)

India's Stance:

India expressed dissatisfaction, particularly opposing methane emission mandates. India highlights the necessity of using coal for developmental needs and emphasizes adherence to nationally determined contributions (NDCs).

Initiatives India opposes for climate action:

- **Coal phase-out:** Despite commitments to expand non-fossil fuel and renewable energy, India stands firm on not phasing out coal-generated electricity in the near term.
- **Global Methane Pledge:** Because of worries about the potential effects on agriculture and the supply of electricity, the nation has continuously opposed international initiatives of the Global Methane Pledge.
- **Global Renewables and Energy Efficiency Pledge:** India did not join the "Global Renewables and Energy Efficiency Pledge" at COP28, emphasizing its own climate equity concept that addresses unequal burdens on nations.
- **Loss and Damage Fund:** Citing historical responsibility and objecting to the World Bank's temporary management of the fund, China and India both refuse to contribute to the Loss and Damage Fund.

India's climate action initiatives during the COP28 summit:

- **Global River Cities Alliance (GRCA):** led by the National Mission for Clean Ganga (NMCG) under the Ministry of Jal Shakti, was launched at COP28.

- It is a unique alliance covering 275+ global river cities in 11 countries, international funding agencies and knowledge management partners and is the first of its kind in the world.
- The launch of GRCA signifies a momentous step in global efforts toward river conservation and sustainable water management.

Green Credit Initiative: The Initiative aims to create a global trade forum facilitating the exchange of innovative environmental programmes and instruments.

- The Green Credit Initiative, launched at COP28, aligns with Mission LiFE which aims to minimise per capita carbon footprint by promoting mindful utilisation instead of wasteful consumption.

LeadIT 2.0: launched at COP 28, focuses on co-development and transfer of low-carbon technology and financial assistance to emerging economies.

Green Development Pact: it provides pathways for nations in their journey towards achieving energy, climate, environment and disaster resilience-related objectives.

- Green Development Pact includes key ambitions such as tripling of global renewable capacity by 2030.

13 SAPCC

State Action Plan on Climate Change (SAPCC):

- Encourages all states and union territories to prepare their own SAPCCs based on their specific needs and priorities
- SAPCCs outline strategies and actions for addressing climate change at the sub-national level
- Aligned with the objectives of the NAPCC and the NDC

14 INDC

INDCs are the primary means for governments to communicate internationally the steps they will take to address climate change in their own countries. INDCs reflect each country's ambition for reducing emissions, taking into account its domestic circumstances and capabilities.

In August 2022, India updated its NDC according to which target to reduce emissions intensity of its GDP has been enhanced to **45 percent by 2030 from 2005 level, and the target on cumulative electric power installed capacity from non-fossil fuel-based energy resources has been enhanced to 50% by 2030**

