CURRENT AFFAIRS PROGRAM
PRE CUM MAINS 2024
DEC 2023: BOOKLET-9
SPECIAL BOOKLET ON CLIMATE CHANGE

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1. PYQ

i. Discuss global warming and mention its effects on the global climate. Explain the control measures to bring the level of greenhouse gases which cause global warming, in the light of Kyoto Protocol, 1997 [Mains 2022, 15 marks, 250 words]

ii. Do you think India will meet 50% of its energy needs from renewable energy by 2030? Justify your answer. How will the shift of subsidies from fossil fuels to renewables help achieve the above objectives? Explain [Mains 2022, 15 marks, 250 words]

iii. Describe the major outcomes of the 26th session of the COP to the UNFCCC. What are the commitments made by India in this conference? [Mains 2021, 15 marks, 250 words]

iv. Explain the purpose of Green Grid Initiative launched at World Leaders Summit of COP26 UNFCCC in Glasgow in Nov 2021. When was this idea first floated in the International Solar Alliance (ISA)? [Mains 2021, 10 marks, 150 words]

v. Assess the impact of global warming on coral life system with examples (Answer in 150 words) (2019) [GS1]

vi. 'Climate change' is a global problem. How India will be affected by climate change? How Himalayan and coastal states of India will be affected by climate change? (2017)

vii. Should the pursuit of carbon credits and clean development mechanisms set up under UNFCCC be maintained even though there has been a massive slide in the value of a carbon credit? Discuss with respect to India's energy needs for economic growth. (200 words) (2014)

2. CLIMATE CHANGE

1) CLIMATE CHANGE, GLOBAL WARMING AND GREENHOUSE GASES

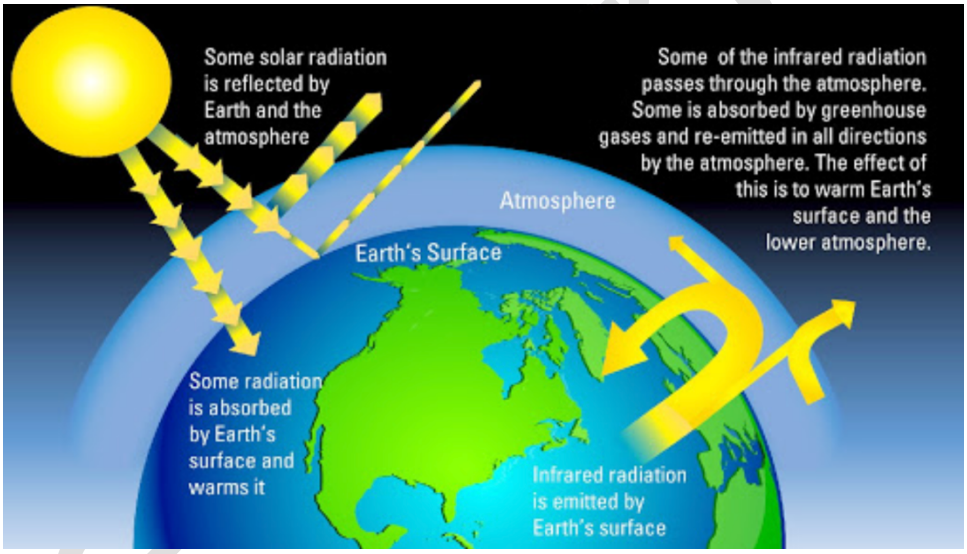
- **Climate:** Long term pattern of weather in a particular area.

- **Global warming** refers to the **long-term increase in earths' average surface temperature** due to the accumulation of greenhouse gases in the atmosphere.

- Gases in the earth's atmosphere that trap heat are known as **Greenhouse gases**. They let sunlight pass through the atmosphere, but they prevent the heat that the sunlight brings from leaving the atmosphere. Greenhouse gases are crucial for survival of life on earth. In the absence of Greenhouse gases, the average temperature on earth would have been -18 degree Celsius instead of the present 15 degree Celsius.

- But the excess of greenhouse gases in the atmosphere is leading to extra warming of the earth's surface **causing Global** Warming and thus **Climate Change**.

- **Green House Effect:**



2) GREENHOUSE GASES – CO2, METHANE, NITROUS OXIDE (N2O), OZONE, FLUORINATED GASES, BLACK CARBON, BROWN CARBON ETC.

A) CO_2

- It is produced by **burning of carbon containing substances,** mostly fuels (Coal, natural gas, oil), Solid waste, trees, other biological materials etc.
- CO_2 is removed from atmosphere when it is absorbed (sequestered) by plants during photosynthesis.
- **Concentration of CO_2 in atmosphere:**
  - » For the first time in history, the atmospheric CO2 level reached **419 parts per million (PPM)**, as measured by the United States' National Oceanic and Atmospheric Administration's Mauna Loa Atmospheric Baseline Observatory in Hawaii.

        - This is nearly 45% above the pre-industrial baseline of **278 PPM** in 1750 accepted by IPCC.
    - » Our **annual CO2 emission** have grown about 70 times since the pre-industrial era reaching nearly **36.4 Gt** in 2019.

B) METHANE

- **Practice Questions:**
    - Discuss the sources, implications, and potential mitigation strategies of methane emissions in the context of global warming and climate change. How can international cooperation play a significant role in addressing this significant environmental concern? [15 marks, 250 words]

- **Introduction:**
    - As per UNEP, Methane is a GHG which is responsible for 30% of the warming since pre-industrial times. Its contribution is 2nd only to carbondioxide.

- **Why special focus on methane is needed in our fight against climate change?**
    - Methane has much higher global warming potential than CO2.
    - IPCC had said that the methane mitigation has the **greatest potential to slow warming** over the next 20 years.
        - A 0.3% reduction per year in methane is equivalent to net-zero for CO2 - there would be no additional warming if this level of reduction is achieved.

- **Methane Emission: Sources:**
    - **Natural Sources**: Wetlands, termites etc.
        - **Wetlands** are the largest source of methane.
    - **Agriculture** - Rice cultivation, animal husbandry etc. generate substantial amount of methane.
    - **Energy Production** (fossil fuel) - Among anthropogenic factors, after Agriculture, it is this sector which contributes to the highest methane production. It is released during the extraction, processing, and transport of fossil fuels, including coal, oil, and natural gas.
    - **Leakage**: For e.g., the ruptures in the underwater Nord stream in Sep 2022 caused the single largest such release of the greenhouse gas.
    - **Landfills** in recent times are also becoming a big source of methane emissions.
    - **Thawing of permafrost** in polar region is also releasing methane. In future, it may become a big source of methane emissions.

- **Steps being taken**:
    - **International Steps**:
        - » **Improving Detection**:
            - UNEP has launched International Methane Emissions observatory - the Methane Alert and Response System (MARS) at COP27. It is focused on scaling up global efforts to detect and act on major emissions sources in a transparent manner and accelerate implementation of the global methane pledge.

- **Global Methane Pledge** announced at COP26
  - » By COP27, 150 countries have joined the initiative lead by USA and EU. They have promised to **cut their methane emission by at least 30%** from 2020 levels by 2030.
  - » **Significance:**
    - Global warming would be **reduced by at least 0.2 degree Celsius by 2050**, if countries deliver according to the pledge.
    - **Health benefits**: Oxidation of methane is responsible for formation of ground-level ozone (smog), which is a harmful air pollutant.
  - » **Why has India not joined the pledge**?
    - India's methane emissions are '**survival emissions**' and not 'luxury' emissions.
      - The two prominent source of methane in India are enteric fermentation and 'paddy cultivation' and any restriction on them would harm small and marginal farmers.
    - Other than harming farmers, it may also reduce agri production. Currently, India is one of the largest producers and exporters of rice.
    - India also argues that 6th IPCC report has highlighted that CO2 is the major global warming gas and this pledge is shifting focus to methane which has a lifetime of only 12 years, whereas CO2 can survive for more than 100 years.

- **India has not joined the global methane pledge**, but it doesn't mean the India is not worried about methane emissions. There are several fronts on which India is working.
  - » National Innovation in Climate Resilient Agriculture (NICRA) project of ICAR has developed several technologies with the potential to mitigate methane emissions.
    - For instance, the **'System of Rice Intensification'** has the potential to enhance rice yield from 36-49% with 22-35% less water than conventional transplanted rice. It also uses less seed, fertilizers, and pesticides.
      - Key steps involve:
        1. Planting young seedlings (less than 15 days old) with only one or two leaves
        2. Planting them singly, spaced widely apart
        3. Maintaining soil moisture at a level that promotes aerobic soil conditions.
        4. Controlling weeds by mechanical means, such as hand weeding or using a rotary hoe
        5. Using organic matter to improve soil fertility.
        6. Applying small amounts of fertilizer at specific stages of plant growth
    - Another technology, '**Direct Seeded Rice**' reduces methane emissions as it does not involve raising nurseries, puddling, and transplanting. Unlike transplanted paddy cultivation, standing water is not mantained in this system.
    - **Harit Dhara**: It is an anti-methanogenic feed supplement developed by ICAR. It can cut down cattle methane emissions by 17-20% and can also result in higher milk production.
    - Under Crop Diversification Program, methane emission is being avoided due to diversion of paddy to alternate crops like pulses, oilseeds, maize, cotton, and agro-forestry.

- **Way Forward:**
  - » **Renewable Energy** Transition: In long run it will reduce dependency on fossil fuels which will reduce emissions of both CO2 and methane.
  - » **Alternate Agricultural practices:**
    - ▫ Improving the effectiveness and yield of rice cultivation methods like System of Rice Intensification and Direct Seeded Rice and encouraging more farmers to adopt these practices.
    - ▫ Crop diversification to reduce dependency on rice.
  - » **Focus on Burp Control**:
    - ▫ Promote anti-methanogenic feed supplement like **Harit Dhara**.
    - ▫ More R&D on alternatives. For e.g. in 2021 EU approved a food supplement, **Bovaer**, saying that it can consistently reduce methane emissions from dairy cows by 30-80%.
  - » **Scientific Waste Management:** Reduce the waste disposal on landfills; ensure installation of landfill gas capture systems etc.; converting organic waste into biogas which can be used for energy etc.
  - » **Leak Detection and Repair**: Regular monitoring and maintenance of oil and gas infrastructure can minimize methane leaks.
  - » **Improved International Cooperation**: Global targets; data sharing, finance mobilization; technology transfers; Improved R&D are some of the methods by which international cooperation can contribute in fighting the challenge of methane.

- **Conclusion**: Addressing methane emissions is critical for mitigating global warming and its associated impacts. A comprehensive approach dealing with fossil fuel sector, agriculture sector and international cooperation will be needed for a more resilient and climate-resilient future.

3) IMPACT OF GLOBAL WARMING/CLIMATE CHANGE

GWG emissions is breaching all the records: As per the AR6, **Emissions of Carbon dioxide, methane and nitrous oxide breached records in 2020.** CO2 Concentration in the atmosphere - at around 419 parts per million - are the highest they have been in 2 million years.

Three factors make carbon budgeting complex:

1. **The pollutants** - primarily GHGs like CO2 and methane - have an extraordinary long life. Thus, historic emissions continue to warm up the planet just like current emissions.
2. GHG emissions are linked to **economic growth**.
3. **Sharing of burden** becomes difficult as the emissions are associated with economic growth.

1. **Rising Temperatures**
   - » As per the AR6 of IPCC, the global temperature has already risen by 1.1 degree C since preindustrial 19th century. This could increase upto 1.5 degree Celsius in less than 20 years (before 2040).
     - **Further,** the **2 degree C warming** is likely to get exceeded by the end of this century unless immediate and deep reductions in greenhouse gas emissions are initiated immediately.
     - **In business-as-usual approach**, or in **worst case scenario**, the temperature rise by the end of this century would exceed **even 4 degree Celsius'**
     - The report is also **'unequivocal'** (i.e., there is almost no doubt) that most of the observed warming of the planet since the late 1800s is caused by human activities.
   - » As per the WMO, the **decade 2010-20 and the five years (2015-20)** were the hottest in the earth's history

2. **Melting of Glaciers and Sea Level Rise -> Submergence of coastal region**
   - » AR6: Sea level rise has tripled compared with 1901-1971. The Antarctic sea ice is the lowest in last 1,00 years.
   - » The temperature of Antarctica rose above 20 degree Celsius for the first time on record.

3. **Heating up of Oceans -> marine heat waves, intense cyclones etc**.
   - » Ocean temperatures are better indicators of global warming as 93% of the excess solar energy trapped by GHG accumulate in the world's oceans

4. **Increasing variability in weather patterns**
   - » **Heat waves and floods** which used to be once-in-a century event are becoming more regular occurrence.
   - » **Weather Disasters** have displaced millions of people this year and **affected rainfall patterns** from India to northern Russia and the Central United states.
   - » **For instance: India saw 13 Deficit Monsoons in 18 years between 2001-18**.

5. **Compounding extremes** (several climate change drivers operating together) are maximizing disaster in India and elsewhere.

» E.g., heavy rainfall, landslides, snow avalanches, and flooding occurring together is an example of compounding event.

6. **Thawing of Permafrost and Arctic Lakes Bubbling Methane**
   » **Introduction**
      ▪ Recent months have seen **thousands of lakes in Arctic Tundra, Alaska and Siberia bubbling** with gases and producing a hiss sound along with bubbles.
   » **Permafrost Thawing producing methane gas**
   » **Warmer temperature increases the thawing of permafrost and release methane to the atmosphere.**
      ▪ But this also means that growing season increases, more plant growth takes place and thus more CO_2 getting absorbed. But overall, the increase in release of GHGs would be much higher.

   » **Presently Arctic is a net carbon sink**
      ▪ **But** soon arctic could become a carbon source, if the earth continues to warm, and a lot of permafrost thaws out. This would start a cycle of releasing more carbon from permafrost thawing and less absorption where the extra carbon in the atmosphere results in increasing warming.

7. **Sea Water** is **26% more acidic** than at the start of the industrial era. This is leading to degradation of marine ecosystem.

8. **Biodiversity Loss**
   » At least **1 million species were at risk** because of the rising CO_2 concentration in the atmosphere and global warming.
      ▪ For instance, a recent study shows that seal pups (IUCN: LC) are finding it tough to survive in the Baltics in the absence of ice. 100s of grey seal pups are dying on the shores of the Baltic Sea in Estonia and Latvia as the Nordic coastline faced winter without ice in decades.

9. **Negative Impact on Food Security, Agriculture and Economy**
   » Variability in rainfall
   » Increased temperature and evaporation of water sources
   » Increased chances of Locust attacks
   » Extreme weather events triggered by climate change costs India $87 billion annually: State of Climate in Asia, 2020 (report by WMO)

10. Climate change has **adversely affected both physical and mental health of people.**
   » Impacts on health is mediated by both through natural and human systems, including economic and social conditions and disruptions.
   » Extreme heat events -> Mortality and morbidity
   » Climate related food borne, and water borne diseases has increased. The incidence of vector borne diseases have also increased due to range expansion and/or increased reproduction of disease vectors.
   » Some **mental health challenges** are associated with increasing temperatures, trauma from weather and climate extreme events, and loss of livelihood and culture. Exposure to wildfire

smoke, atmospheric dust, and aeroallergens have been associated with climate sensitive cardiovascular and respiratory distress.

11. **Achievements of SDG targets** are negatively hindered.
12. **Impact on Cities, Settlements and Infrastructure**
    - » Hot extremes including heatwaves have intensified in cities. This has also aggravated air pollution events and limited functioning of key infrastructure. Infrastructure, including transportation, water, sanitation and energy systems have been compromised by extreme and slow onset of events.

13. **Economic Impact**:
    - » Damages due to variability in weather pattern (e.g. slow on set of Monsoons) and extreme weather events.
    - » Climate exposed sectors like agriculture, forestry, fishery, energy and tourism have been adversely affected. Outdoor labour productivity have gone down
    - » Extreme events like cyclones hinder economic growth in short run too.

14. **Climate Migration**:
    - ▫ **IPCC's 6th AR** says that through displacement and involuntary migration from extreme weather and climate events, climate change has generated and perpetuated vulnerability.
    - ▫ Since 2008, an average of more than 20 million people per year have been displaced by extreme weather events, many of which were exacerbated by climate change.

15. **Shrinking of Stratosphere:**
    - » According to a study published by NASA on June 15, the earth's energy imbalance doubled over the 14-year period between 2005 - 2019, doubling the pace at which the Earth retains heat from 2005. As a result of this **we are already on the brink of losing stratosphere**.

4) IPCC AND ITS REPORTS

A) ABOUT IPCC

- The Intergovernmental Panel on Climate Change (IPCC) is the **UN body** for assessing the science related to climate change. Its job is **to assess already published scientific literature** to update our knowledge of climate change science.
    - ▫ IPCC's Assessment Reports (ARs), which are produced every few years, are the most **comprehensive and widely accepted** scientific evaluations of the state of Earth's climate.
    - ▫ They form the basis for government policies against climate change and provide scientific foundation for the global Climate Change negotiations.
    - ▫ So far, **Six Assessment Reports** have been produced.

- **IPCC** was **set up in 1988** by World Meteorological organization (WMO) and United Nations Environment Program (UNEP) to provide policy makers with regular assessment of the scientific basis of climate change, its impacts and future risks, and options for adaptation and mitigations.

B) WHAT HAVE PREVIOUS REPORTS AR1-AR5 SAID?

- The **first Assessment Report** (1990) noted **that anthropogenic emissions are increasing atmospheric GHGs**. In the business-as-usual scenario, temperature was likely to increase by 2 degree C compared to pre-industrial levels by 2025, and 4 degree C by 2100.
    - The report formed the **basis for the negotiation of the UNFCCC in 1992**, known as the Rio Earth Summit.

- The **Second Assessment Report** (1995) revised the projected rise in global temperature to 3 degree C above pre-industrial level by 2100. It was the scientific underpinning for the Kyoto Protocol of 1997.

- The **third Assessment Report** (2001) projected the rise in global temperature to 1.4 to 5.8 degree C by 2100 compared to 1990.

- The **fourth Assessment Report** (2007) said that the GHG emissions increased by 40% between 1970 and 2004 and the atmospheric CO2 was the most in 650,000 years. In the worst case scenario, the global temperature could rise by 4.5 degrees.
    - The report won the 2007 Nobel Peace Prize for IPCC. It was also the scientific input for the 2009 Copenhagen Climate meeting.

- The **fifth Assessment Report** (2014) said that more than 50% of the temperature rise since 1950 is due to human activities. The rise in global temperature by 2100 could be as high as 4.8 degree C from pre-industrial times, and more frequent longer heatwaves were "virtually certain". It formed the scientific basis of the Paris Agreement in 2015.

5) 6TH ASSESSMENT REPORT OF IPCC

- The sixth report was published in **three parts**: - the first in Aug 2021, the second in Feb 2022, and the third in April 2022. These three parts were by three working groups of scientists:

    » **Working Group-1**: Deals with **scientific basis of climate change**
    » **Working Group-2**: Looks at **likely impacts, vulnerabilities, and adaptation issues.**
    » **Working Group-3**: Deals with a**ction that can be taken to combat climate change**

A) THE FIRST REPORT "CLIMATE CHANGE 2021: THE PHYSICAL SCIENCE BASIS" HIGHLIGHTED THE FOLLOWING:

- Climate was changing more rapidly than originally anticipated by climate scientists.
- Rise in **global temperature was direct result of human activities** and there are 'unequivocal evidence' about it.
- Temperature has already rise by 1.1 degrees from the pre-industrial 19th century.
- **Greenhouse gas Emissions:**
    - Emissions of Carbon dioxide, methane and nitrous oxide breached records in 2020.

- CO_2 Concentration in the atmosphere - at around 416 parts per million - are the highest they have been in 2 million years.

- **Impact:**
  - A more intense and frequent heatwaves; increased incident of extreme rainfall; a dangerous rise in sea-levels; prolonged droughts; Melting of glaciers.

B) THE SECOND REPORT: CLIMATE CHANGE 2022: IMPACTS, ADAPTATION, AND VULNERABILITY

- The report recognizes the interdependence of climate, ecosystem, and biodiversity, and human societies and integrates knowledge more strongly across the natural, ecological, social and economic sciences than earlier IPCC reports.
- **Impact of Climate Change** (already discussed)

- **Risk in Near Term (2020-2040)**
  - Global warming, reaching 1.5 degree C in near term, would cause unavoidable increases in multiple climate hazards and present multiple risks to ecosystems and humans.
    - All the current problems would be intensified, and some irreversible damages would occur.
  - Near term actions that limit global warming to close to 1.5 degree C would substantially reduce projected losses and damages related to climate change in human systems and ecosystems, compared to higher warming levels, but cannot eliminate them all.

- **Mid to Long-Term Risks** (2041-2100)
  - Beyond 2040 and depending on the level of global warming, climate change will lead to numerous risks to natural and human systems. For 127 identified key risks, assessed and mid- and long-term impacts are upto multiple times higher than currently observed.

- **Complex Compound and Cascading Risks**
  - Multiple climate hazards will occur simultaneously, and multiple climatic and non-climatic risks will interact, resulting in compounding overall risk and risks cascading across sectors and regions.
- Multiple climate change-induced disasters were likely in the next two decades even if strong action was taken to reduce the emissions of greenhouse gases.

C) THE THIRD REPORT: CLIMATE CHANGE 2022: MITIGATION OF CLIMATE CHANGE

- The report lays out actions that the world can take to stop global temperatures rising beyond certain levels by the end of the century.

- If countries stick to current NDC commitments, it would lead to breach of 1.5 degree C temperature rise.
  - Even the 2-degree Celsius target, in that case, would rely on "rapid acceleration" of climate actions after 2030.

- **Global warming would stabilize if emissions reach net zero**.
  - For 1.5 degree C target, this meant achieving net zero emissions globally in the early 2050s; for 2 degree C, it is in early 2070s.

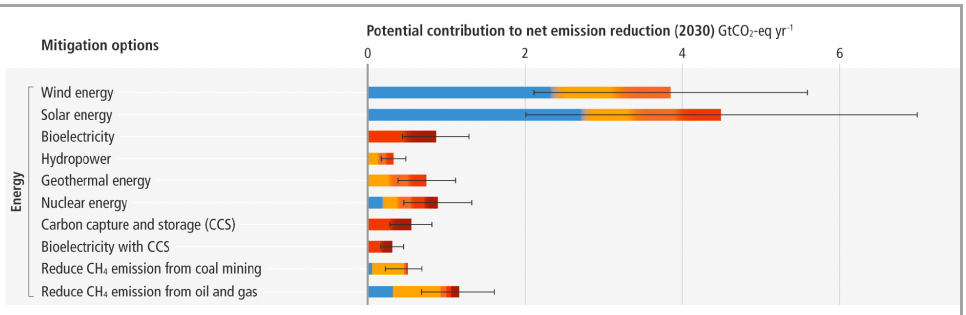
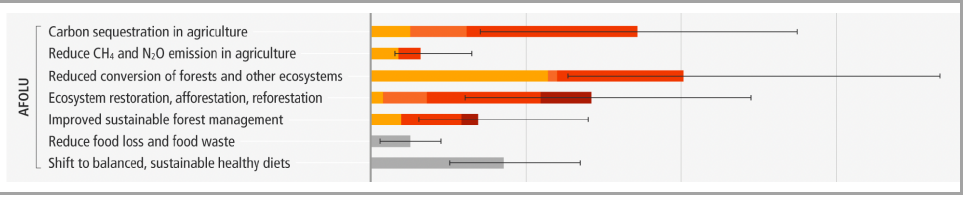
- Even limiting warming to 2 degree C would require greenhouse gas emissions to peak before 2025 at the latest and be reduced by a quarter by 2030.

- **Carbon Inequality remains pervasive** as ever with LDCs emitting only 3.3% of global emissions in 2019.
  - Their average per capita emissions in the period 1990-2019 were only 1.7 tonnes CO2e, compared to global average of 6.9 tCO2e.

- **Abundant and Affordable Solutions exist across sectors including energy, buildings, and transport**, as well as **individual Behavioural changes**.
  - The report has detailed **60 different options and pathways** that can lead to 40-70% reduction in global emissions.
  - It states with high confidence that "**several mitigation options**, notably solar energy, wind energy, electrification of urban systems, urban green infrastructure, energy efficiency, **demand side management**, improved forests - and crop/grassland management and reduced food wastage and loss, are **technically viable**, are becoming increasingly cost effective and are generally supported by the public".

- The per-unit costs of several low emissions technologies have fallen continuously since 2010, however **innovation has lagged in developing countries due to weak enabling conditions**.
  - On a unit costs basis, solar energy has **dropped 85%**, **wind by 55%**, and lithium-ion by 85%.
    - Their deployment and usage has increased multifold since 2010 - 10 times for solar and 100 times for electric vehicles.
  - **Factors**: Higher public spending in R&D; Funding for demonstration and pilot projects; and demand pull instruments such as deployment subsidies to attain scale.

- The report covers **demand side mitigation** and states that it can help reduce emissions by 40-70% by 2050.
- **Individuals can also contribute in other ways:**
  - Putting political pressure on leaders.
- **Many options available now in all sectors are estimated to offer substantial potential to reduce net emissions by 2030**. Relative potential and cost will vary across countries in the longer term compared to 2030.

Energy	
AFOLU (AGRICULTURE, FORESTRY	

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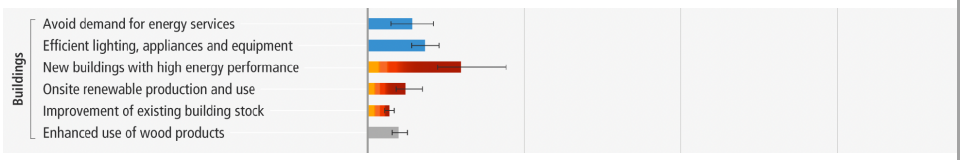
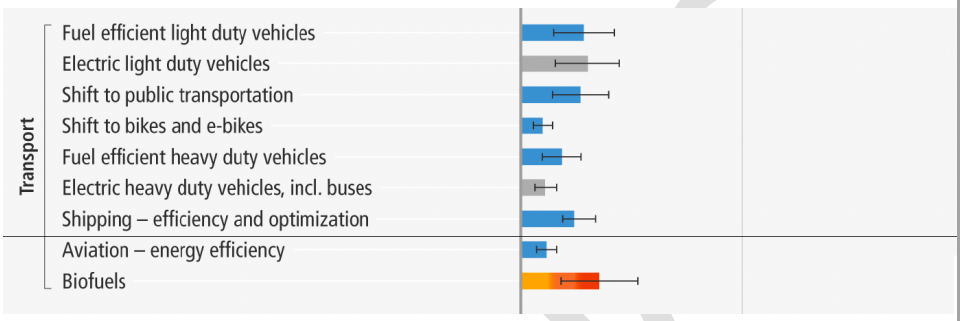
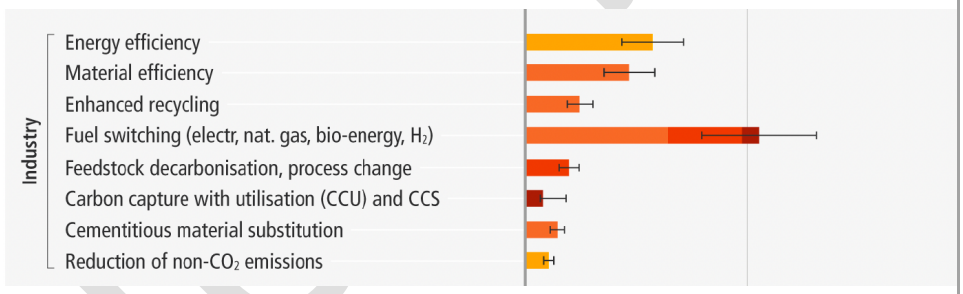
Buildings	
Transport	
Industry	
Other	

- **Implementing these mitigation strategies** would come at a substantial cost. The report estimates that taking the actions to keep temperature below 2 degree C could **reduce global GDP by 1.3% to 2.7% by 2050**, but not doing so has its own costs

- **Climate Finance**:
  - Tracked financial flows were still **falling short** of the levels needed to achieve mitigation goals across all sectors and regions.
  - The **gaps are the widest** for the agriculture, forestry, and other land use (**AFOLU**) sector and for **developing countries**.
  - But, the **global financial system is large enough** and "sufficient global capital and liquidity" exist to close these gaps.

3. UNFCC – FROM PARIS AGREEMENT (COP21) – COP28

1) UNFCCC (UNITED NATION FRAMEWORK CONVENTION ON CLIMATE CHANGE)

- It is one of the three conventions adopted at the Rio Earth Summit (UN summit Conference on Environment and Development (UNCED)) in 1992. Its sister Rio Conventions are the UN Convention on Biological Diversity and the Convention to Combat Desertification.
- This was the first multilateral legal instrument on climate change and **came into force in 1994** after a sufficient number of countries had ratified it.
- **Ultimate Aim** of UNFCC: Prevent dangerous human interference with the climate system by stabilizing greenhouse gas concentration in atmosphere.
- It sets on **non-binding limits** on greenhouse gas emission for individual countries and contain **no enforcement mechanism**.

- **Parties to Convention**
  - **197 parties**
    - All UN member states, Palestine (observer state), Niue and Cook Island (non-member states) and the European Union.
  - **Annex 1 Parties** -> Industrialized OECD countries, Economies in Transition (EIT), EU
  - **Annex 2 Parties** -> OECD members of Annex-1, NO EIT.
    - Provide financial and technical support to EITs and developing countries for mitigating Climate change.
  - **Non-Annex 1 Parties** -> Mostly developing.
  - **Least Developed Countries** (LDCs)

- **Key Significance of UNFCCC** - 1) Recognition of the problem 2) Setting target of stabilizing GHGs 3) Onus on Developed countries 4) Funds and technology transfer to developing countries 5) Regular Reporting -> Keep a tap on the problem.

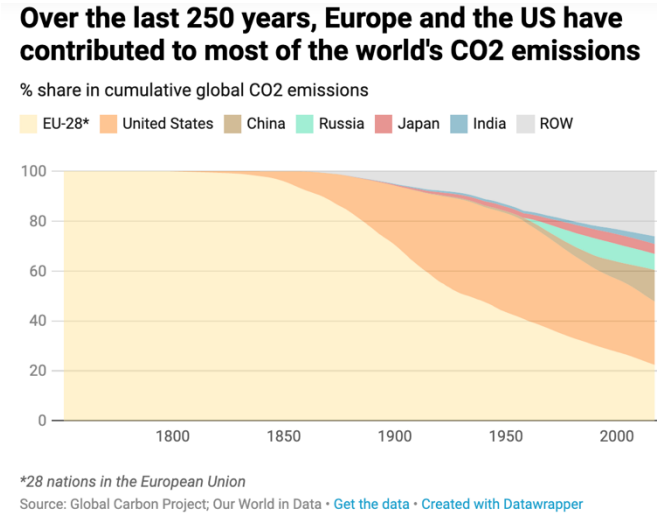
2) KYOTO PROTOCOL (COP-3)

- It was an international agreement to reduce greenhouse gas emissions. It was negotiated under the UNFCCC during a meeting held in Kyoto, Japan, in 1997 and came into force in 2005 (due to complex ratification process)
  - **The first commitment period** was 2008-2012
  - **The second commitment period** beginning **1 Jan 2013 to 2020**.
    - Launched by Doha Amendment (2012)
- The **objectives of KP** included reducing greenhouse gas emissions through enforcement of compliance; promote sustainable development through tech-transfer and investment; and encourage developing countries and private sector to contribute to emission reduction.

- **Parties to Kyoto Protocol**
  - **Annex B:** Nearly identical to Annex - I of the UNFCCC; Agreed for emission reduction.
  - **Non-Annex B Parties:** Countries which are not listed in Annex B of KP.

- **Key Features**
  - The protocol 'operationalized' the UNFCCC. It commits industrialized countries to stabilize greenhouse gas emissions based on the principles of the Convention.

- **Binding Emission targets for 38 industrialized countries and the European Community (Annex 1 Parties)** in its first commitment period.
- **Only bound developed countries - Common But Differentiated Responsibility (CBDR)**



- **Flexible Architecture of KP Regime to meet target.**
  - » **National Measures** and **Market Based Mechanisms**
    - This market-based mechanism allows GHG abatement to start where it is most cost-effective - for e.g. in the developing world.
  - » **3 Components - Carbon Trading, Clean Development Mechanisms and Joint Implementation**
- **Penalties for not meeting the targets**.

- **What happened to Kyoto Protocol?**
  - **Were targets met?**
    - » Most countries didn't meet the targets for emission reduction assigned for the first period of commitment (2008-2012).
    - » So, protocols impact was very small.

- **Kyoto Beyond 2012**
  - **At Doha in 2012, the amendments to Kyoto Protocol for the 2nd commitment period** (the Doha Amendment) were successfully adopted for the period 2012-2020.
    - » **It never entered into force** as the required number of countries didn't deposit their instrument of accession.
    - » But some developed countries started implementing their commitments under the '**opt-in**' **provisions** of the Doha Round.
    - » **Note: India ratified** the second commitment period of Kyoto Protocol in Jan 2017.

3) PARIS AGREEMENT (COP21)

- The Paris **Agreement** and the accompanying COP decisions are focused on enhancing **efforts to mitigate and adapt to climate change beyond 2020**.
  - **a. Long Term Goal:**

- » Limiting global temperature increase well below 2 degrees Celsius, while urging efforts to limit the increase to 1.5 degrees.
- » Two long term emission goals
  - ▫ Peaking of emissions as soon as possible (with a recognition that it will take longer for developing countries)
  - ▫ A goal of Net Green House Gas Neutrality (expressed as "a balance between anthropogenic emissions by sources and removals by sinks") in the second half of this century.

b. Ends the Strict Differentiation between developed and developing countries: Provides for a **framework that commits all countries** to put forward their best efforts against climate change and keep strengthening these efforts.

c. Mitigation - Binding Procedural Commitments -> Preparing, communicating and maintaining NDC; Communicate new progressive NDC every five years.

- » The agreement commits parties to "pursue domestic measures with the aim of achieving the objectives" of its NDC.
- » Doesn't make implementation or achievement of NDCs a binding obligation.

d. Carbon Markets

- Though the agreement avoided any direct reference to the use of market-based approaches, it recognized that the parties may use 'internationally transferred mitigation outcomes' to implement its NDCs.

e. **STOCKTAKE/SUCCESSIVE NDCs**

- To ensure successive improvement in efforts, the agreement provides for **two linked processes**, each on a five-year cycle.
  - **Global Stocktake** to assess collective progress towards the agreement's goals. The first global stocktake took place in 2023.
  - **New NDCs** every five years informed by the outcomes of the global stocktake. Signatories should ensure that the new NDCs are more ambitious than the previous ones.

f. **Finance**

- **Provisions for Support to poor developing countries by Developed countries.**
- **Finance Mobilization goal**
  - The COP decided to extend the $100 billion-a-year goal through 2025, and beyond that, by 2025 COP will set a "new collective quantified goal from a floor of "$100 billion a year".

g. **Adaptation**:

- A major priority for many developing countries was strengthening adaptation efforts under the UNFCCC. The agreement does that by :
  - Establishing a global goal of "enhancing adaptive capacity, strengthening resilience and reducing vulnerability to climate change"
  - Committing enhanced adaptation support for developing countries

- Including a review of adaptation progress, and of the adequacy and effectiveness of adaptation support, in the global stocktake to be undertaken every five years.

h. **Loss and Damage**:
- In a victory to small island countries and other countries highly vulnerable to climate impacts, the agreement includes a **free standing provisions** extending the Warsaw International Mechanism for Loss and Damage
  - The mechanism, established at COP-19 is charged with developing approaches to help vulnerable countries cope with unavoidable impacts, including extreme weather events such as sea-level rise.
  - Potential approaches include **early warning systems** and **Risk insurance**.
- Loss and Damage provision "did not involve or provide a basis for any liability or compensation.

- **When Paris Agreement of COP 21 entered into force**
  - » It required approval of atleast **55 countries accounting for atleast 55 percent of greenhouse gas emission.**
  - » It came into force on **Nov 4, 2016** (a month after required number of ratification).

- **Analysis: Positives**
  - » **PARIS Agreement** was a major breakthrough whose significance could be understood from the fact that with **150 Presidents and Prime Ministers,** it was the largest ever single day gathering of heads of state surpassing even the UN summits.
  - » **It turned the corner** after the **failure of Kyoto Protocol** and inability to reach an agreement in previous COPs. It represented a change in global attitude and recognized that climate change is a global problem which should be dealt immediately.
  - » The agreement is **more Comprehensive than Kyoto protocol** which was limited to assigning greenhouse gas emission targets for a group of developed countries.
  - » **Regular stock take** would increase the chances of world community rectifying its targets to prevent climate crisis.
  - » **Best Compromise possible**: Developed countries ensured climate action would be joint responsibility of every nation unlike Kyoto Protocol; Developing countries were able to take heart by the fact that all important principle of differentiation - has been retained, even though in diluted from; Island nations and least developed countries were happy to force the rest of the world to acknowledge the need to take a 1.5 degree path instead of the 2 degree it is more comfortable with.

- **Analysis: Negatives/Limitations**
  - » **NDCs** are not ambitious enough and the world is moving towards missing the goal of limiting the temperature rise to 1.5 degree celsius.
  - » **Non-Binding nature** raises a question on effectiveness of the implementation.
  - » **Frequent reviews** by stocktaking may be challenging to achieve as it is difficult to generate a Paris like consensus regularly.
  - » **Exit Clause is also problematic:** A country can exit from the agreement with one year's notice after three years have passed from the time a country ratifies the Agreement.

- Given the fractured politics in many countries withdrawal of any major emitter would lead to rapid unraveling of the agreement. (for e.g. the US had withdrawn from the agreement)

» **Financing in real terms have come down when various data shows need for increase**

» **Even after eight years of the deal**, by 2023, a lot of work still needs to be done about market mechanism; increasing funding; and making NDCs more ambitious.

A) INDIA'S UPDATED NDC UNDER PARIS AGREEMENT (AUG 2022)

- India submitted its INDC on 2nd Oct 2015.
- The NDC submitted in Aug 2022 is India's first NDC under the Paris Agreement. The Article 4, paragraph 9 of the Paris Agreement provides that each Party shall communicate **a nationally determined contribution every five years** in accordance with the decision of COP21.
- So, in Aug 2022, India communicated an update to its first NDC submitted earlier on Oct 2, 2015 for the period upto 2030, as under:
    - To put forward and further propagate a **healthy and sustainable way of living** based on traditions and values of conservation and moderation, including through a mass movement for **'LIFE'– 'Lifestyle for Environment'** as a key to combating climate change [UPDATED].
    - To adopt a **climate friendly and a cleaner path** than the one followed hitherto by others at corresponding level of economic development.
    - To **reduce Emissions Intensity of its GDP by 45 percent by 2030**, from 2005 level [UPDATED].
    - To achieve about **50 percent 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) [UPDATED].
    - To create an **additional carbon sink of 2.5 to 3 billion tonnes of CO2 equivalen**t through additional forest and tree cover by 2030.
    - To better **adapt to climate change by enhancing investments in development programmes i**n sectors vulnerable to climate change, particularly agriculture, water resources, Himalayan region, coastal regions, health and disaster management.
    - To **mobilize domestic and new & additional funds from developed countries to implement the above mitigation and adaptation actions** in view of the resource required and the resource gap.
    - To **build capacities, create domestic framework and international architecture for quick diffusion of cutting edge climate technology** in India and for joint collaborative R&D for such future technologies.
- This update to India's existing NDC is a step towards our long-term goal of reaching net-zero by 2070.

B) INDIA'S LONG TERM LOW EMISSION DEVELOPMENT STRATEGY (LT-LED STRATEGY) (NOV 2022)

- **Why in news?**
    - India on Nov 14, 2022, announced its long-term strategy to transition to a "low emissions" pathway at the UNFCCC COP.

- **Details**

- LT-LED is a requirement emanating from the 2015 Paris Agreement whereby countries must explain how they will transition their economies beyond achieving near-term NDC targets, and work towards the larger climate objective of cutting emissions by 45% by 2030 and achieve net zero around 2050. This is what scientists say, offers the best chance of keeping temperature rise below 1.5 degree C. So far, no country is on track towards such a pathway.

- While 195 countries, signatories to the UN Climate agreements, were obliged to submit the long-term document by 2022, only 57 countries (to which India is the latest addition) have done so.
- **Highlight of India's Long Term Strategy:**
  - **i.** **Nuclear Power Capacity** - It will be increased at least 3 fold in the next decade.
  - **ii.** India will focus on **increasing the proportion of ethanol in petrol** - with ethanol blending to reach 20% by 2025 and a strong shift to **public transport** for passenger and freight traffic.
  - **iii.** India would also become an **international hub of producing green hydrogen**.
  - **iv.** India will also focus on **energy efficiency** by the Perform, Achieve and Trade (PAT) scheme; increasing electrification; enhancing material efficiency; and recycling and ways to reduce emissions.
  - **v.** The country is also on track to achieve the NDC commitment of **2.5 to 3 billion** tonnes of additional carbon sequestration in forest and tree cover by 2030.
  - **vi.** The emphasis is on ensuring energy security, energy access and employment, while keeping focus on our vision of Atmanirbhar Bharat.

4) THE CONTINUING UNFCCC NEGOTIATION

- **The Continuing UNFCC Negotiations:**
  - After the COP-21 - Paris Agreement, the negotiations have continued. COP-22 (Marrakech Summit, 2016), COP-23 (Bonn Summit, 2017), COP-24 (Katowice Summit, 2018), COP-25 (Madrid Summit, 2019), COP-26 (Glasgow, 2021);

A) COP 26 (GLASGOW PACT) - KEY OUTCOMES: 2021

- **Mitigation:**
  - » It asked countries to strengthen their 2030 climate action plan or NDCs by 2022.
  - » First clear recognition of the need to move away from fossil fuels -> it called for "phase down of coal" and "phase out of inefficient fossil fuel subsidies".

- **Adaptation:**
  - » Asked developed countries to atleast double the money being provided for adaption by 2025 from the 2019 levels.
  - » It created a **two year work program** to define a goal on adaptation.

- **Paris Rule Book has been finalized.**
  - » 'Transparency Framework' was completed - it included reporting rules and formats for emissions, progress on pledges and financial contributions.
  - » Carbon Market provisions have been finalized [a major achievement of COP26].

- **Credit generated from earlier periods**, including through Clean Development Mechanism were transferred to the Paris Agreement but only since 2013. This will allow developing countries to meet its first NDC targets.
- On the **issue of double counting**, it has been decided that a country that generates a credit will decide whether to authorize it for sale to other nations or to count towards their climate targets. The emission cuts will be **counted only once**.

- **Various Positive "Parallel Outcomes"** (not part of the official COP26 negotiations)
  - » **India's announcement of a Panchamitra**
  - » **Plurilateral Agreement on Methane Reduction** among 100 countries is crucial. (Note: India is not a member)
  - » **Plurilateral Agreement to reverse deforestation** among another group of 100 countries. (Note: India didn't join the group due to concerns over a clause on possible trade measures related to forest products).
  - » **COP26 Transport Declaration** -> 100% transition to emission less (electric vehicles) cars by 2040.
    - This has also been signed by over 30 countries.
  - » **Glasgow Financial Alliance for Net Zero (Gfanz):** 450 of the world's banks and other financial institutions have pledged to report annually on the carbon emissions linked to the projects they lend to.
    - They also plan to lend trillions of dollars in green finance - while committing to net zero emission across the board by 2050.

- **Problems that remained:**
  - » Funding
  - » L&D
  - » Didn't specifically raise emission reduction targets.

B) COP-27 (SHARM EL SHEIKH, EGYPT)

- **Quotes:**
  - » The **UN Secretary General had declared at the start of the conference,** "*We are on a highway to climate hell with foot still on the accelerator*".

- **Key Highlights**:
  - » Nod for establishment of **Loss and Damage Fund**.
  - » **Estimates of Financial Requirements -> COP27 agreement** for the first time, quantified the financial needs for climate action. It said about US$ 4 trillion had to be invested in the renewable energy sector every year till 2030 if the 2050 target of net zero was to be achieved.

C) COP28: DUBAI, UAE (30TH NOV 2023 – 12TH DEC 2023)

- **Practice Question:**
  - "The COP28 Declaration has left almost all the problems where they were before" Elaborate [10 marks, 150 words]

- The meeting reviewed the Progress of commitment made by 197 countries under the Paris Agreement to mitigate the razing global warming.

- **Outcome**: **Dubai Consensus**:
    - Negotiators adopt resolution **titled "Dubai Consensus"**; the text reflects a compromise between developed and developing countries on emissions.

- **Highlights of Global Stocktake (GST)**:
    - The GST text echoed the GST input findings that **1.5 degree target would require** "**deep, rapid and sustained" reduction in global emissions of 43% by 2030 and 60% by 2035** from the 2019 levels and **eventually reaching net zero by 2050**.

    - **Fossil Fuel Phase-out**:
        - Fossil fuels was the most hotly contested issued of the COP28; It was first time that fossil fuel was at the centre of discussion at UNFCCC COP.

        - **Outcome**:
            - COP28 agreement has called upon countries to **contribute towards "transitioning away"** from fossil fuels and **phase down of unabated coal power** so as to **achieve net zero by 2050**.
        - **Criticisms:**
            - No timelines
            - Not using the phrase "fossil fuel phase-out" and instead the use of "transitioning away".
            - While calling for phase down of "unabated coal power, the door was left open for "low-carbon fuels", "low emission" technologies, "low-carbon hydrogen" - all terms with very loose definitions.

    - **Tripling global renewable energy capacity by 2030** (from 3400 GW today to 11000 GW) and **doubling of global average rate of energy efficiency improvements by 2030**.
        - COP28 calls the member countries to achieve these two targets which have the potential to avoid emissions of about 7 billion tonnes of carbondioxide equivalent between now and 2030.
        - **Tripling is a global** targets for renewables is not incumbent on every country individually. It is not thus clear how this tripling will be achieved.
        - This is the only outcome that contribute to additional emission reduction between now and 2030.

    - **Accelerating and substantially reducing non-carbon-dioxide emissions globally**, including in particular methane emissions by 2030.
        - **Criticisms**: No target mentioned
        - **Note**: A group of about 100 countries at Glasgow (in 2021) had made a voluntary commitment to reduce methane emissions by 30% by 2030.

    - **Reduction of emission from road transport** on a range of pathways, including through development of infrastructure and rapid deployment of zero-and low-emission vehicles;

- **Phase down of inefficient fuel subsidies** that don't address energy poverty or just transition, as soon as possible.

- **Operationalization of L&D Fund**:
  - **Background**: A decision to set up a Loss and Damage Fund had been taken last year in Sharm el-Shaikh (COP27) but it had not been created, and no money had been promised.

- **COP28 operationalized the fund** and several countries have already made commitments worth around $800 million by the end of the conference.
  - COP28 decided that the fund will be serviced by new, dedicated and independent **secretariat**. It will be supervised and governed by the Board.
  - The fund is accountable to and functions under the guidance of the CoP serving as the meeting of the Parties to Paris Agreement (CMA).
- **This is the most significant outcome for vulnerable countries** as L&D fund is meant to provide financial help to countries trying to recover from climate-induced disasters.

- **Santiago network** has also decided to avert, minimize, and address loss and damage to catalyze the technical assistance of relevant organizations, bodies, networks and experts for the implementation of relevant approaches associated with climate change impacts.

> **Santiago Network**: At COP25, the parties to UNFCCC decided to set up a Santiago network as part of Warsaw International Mechanism (WIM) for loss and damages. It is aimed to organize the technical assistance of relevant organizations for the implementation of relevant approaches in developing countries that are particularly vulnerable to adverse impacts of climate change.

- **Global Goal on Adaptation (GGA)**:
  - **Background**: COP26 at Glasgow had decided to set up a two-year work program to define the contours of adaptation framework.
    - Adaptation hasn't received enough attention and the entire focus of various agreements have been on mitigation. But, developing countries have been arguing for a global framework for adaptation.
    - The two year work program resulted in identification of some common adaptation goals like reduction in climate-induced water scarcity, attaining climate-resilience in food and agricultural production, supplies and distribution and resilience against climate induced health impacts.
  - The COP28 retains calls for a doubling in adaptation finance and plans for assessment and monitoring of adaptation needs in the coming year.
    - An explicit 2030 date has been integrated into the text for targets on water security, ecosystem restoration, health.

- **Issue of Climate Finance Target**s will be reviewed in next COP:
  - Currently, the $100 billion goal hasn't yet been met (although it appears on track this year) and is far short of what is needed.
  - **COP28 saw an agreement to draft a post 2025 finance target ahead of COP29**. This is a step forward, but details will only be hammered next year.

- **COP28 Declaration on Climate Change and Health**
  - This is the first ever move to commit action and finance to combat the health impact of climate change.
  - The COP28 Presidency and the WHO together issued the 'COP28 UAE Declaration on Climate and Health'.
    - It's signatories aim to accelerate action to protect public health and communities from negative and growing climate impacts and strengthen healthcare systems to cope with the effects of extreme heat, air pollution, infectious and zoonotic diseases and environmental risk factors.

- **Other Related Outcomes**:
  - A group of **22 countries** signed a **declaration to triple nuclear energy capacity** between 2020 and 2050, in order to reduce dependence on oil, gas, and coal.
  - **G7 countries** have announced to phase out coal by 2030 and have urged G20 countries to also agree on it.
  - India and Sweden co-launched Phase II of the Leadership Group for Industry Transition (LeadIT 2.0) for the period 2024-26 at COP-28. They also launched the Industry Transition Platform, which will connect the governments, industries, technology providers, researchers, and think tanks of the two countries.
  - **Green Industrialization Initiative**: African leaders came together on the third day of COP28 to launch the initiative. The GII is set to accelerate green growth of industries in Africa and attract finances and investment opportunities.

- **Limitations/Criticisms**:
  - **Countries failed to adopt rules to set up global carbon market**: Civil society has hailed the move as parties didn't agree to adopt weak rules for carbon markets.
  - **Climate Finance** issue is still pending and would be taken up in COP25.
  - **No timelines for fossil fuel transitioning**: The text related to fossil fuel transitioning is weak, in-adequate and with loopholes.
  - **NDCs** remain far away from achieving Net Zero by 2050.
  - **Net Zero by 2050** target is expected to bring pressure on China and India whose net zero targets are for 2060 and 2070 respectively.
  - **Major Decisions** have not been integrated with agendas like '**Common but differentiated responsibilities**'.

5) NET ZERO

- **Details**
  - Achieving a global balance between emissions and removal of greenhouse gases to and from the atmosphere is called **net zero** (or no net emissions). The Paris agreement targets this to be achieved somewhere in the second half of this century, but the earlier this happens, the greater the chances of keeping global warming below 2-degree C.

» Electricity and heat are responsible for 25% of global GHGs. The **International Energy Agency** envisages that in a net-zero world, almost 90% of electricity could come from renewable sources, mostly solar and wind, with nuclear power making up most of the rest.

- **Achieving Net Zero:**
  - » **Focus on 2030 goal first**:
    - IPCC's AR6 emphasized that to keep temperature rise within 1.5 degree C, global emissions should be reduced by 45% from 2010 levels by 2030, on the way to net zero by 2050.
    - But the UN NDC report says that as per the current NDCs, the global emission is expected to increase by 16.3% in 2030 (compared to 2010 levels).
  - » **Energy Conservation and Efficiency:** Global emissions show that energy is the biggest emitter (73.2%) including its use in transport, industry, and building. Therefore, energy efficiency can play a crucial role in achieving net zero.
    - Targeted consumer education and behavioral change would also be important here.
  - » **Renewable Energy:** Gradually phasing out thermal energy (coal, petrol, gas etc.) and increase the capacity of renewables with improved grid infrastructure, smart grids, etc.
    - **Insure against Renewable Droughts** through other sources like **Nuclear Energy**.
  - » **Transport Sector:** Accelerated transition to e-mobility and non-motorized transport is required.
  - » **Create Offset:** Inspite of all the efforts, humans would still produce some billions of tonnes of emissions by mid-century. This will have to be balanced by removals to achieve net zero. Offset can be in the form of afforestation, increasing soil organic carbon, and **advanced carbon sequestration techniques**.
  - » **Enhancement in Funding:** The Promised funding from developed to developing countries need to be delivered.
  - » **More R&D in advanced technology** like low and zero emission technologies across all sectors. There is also a need of innovation for renewable integration, power to x-storage, and conversion and reconversion pathways. Moreover, carbon-removal technologies need to be focused upon.
  - » **CBDR should not be ignored**: Developed countries should achieve net zero earlier and few extra decades should be available to developing countries.

- **Conclusion:**
  - » Net zero will be achieved in three decades if driven by clear policies, supported by technology development, and delivered through massive financial mobilization.

6) INDIA'S DECISION TO ACHIEVE NET ZERO BY 2070: CRITICAL ANALYSIS

- At COP26, PM Modi has proposed a **fivefold strategy** for India to play its part in helping the world get closer to 1.5 degrees Celsius. India's '**Panchamrita'** promises include:
  - » India will get its **non-fossil energy capacity** to **500 GW** by 2030.
    - This is a 50 GW increase from its existing target.
  - » India will meet 50% of its energy requirements till 2030 with renewable energy.
  - » India will reduce its projected carbon emission by one billion tonnes by 2030.
  - » India will reduce the carbon intensity of its economy by 45% by 2030.
  - » India will achieve net zero by 2070.

- **India's demand from developed countries:**
  - » In the spirit of **climate justice**, the developed countries should be providing **at least $1 trillion** in climate finance to assist the developing countries and those most vulnerable.

- **Analysis:**
  - This is a **very positive move** as India had resisted any net zero target in the run up to the COP26. This announcement is expected to put India on a **firm path towards decarbonization**.
  - This announcement also keeps in mind the **Common but Differentiated Responsibilities and Respective Capabilities (CBDR-RC).**
    - India's net zero comes in 2070 and NDC is subject to funding from developed countries
  - **India is contributing more than its share**: Despite a 2070 net zero year for India, India's cumulative emissions between 1900-2100 would be lower than the US, China or EU.
  - **India continues to show international leadership** - It has launched the Infrastructure for Resilient Island States - an initiative under the coalition for Disaster Resilient Infrastructure to support vulnerable island countries. India has also launched Green Grids Initiative in partnership with UK to tap into renewable energy resources everywhere.

- **Critics of shifting to a Net Zero target**
  - **Over-appropriation of global carbon budget** by a few.
    - Countries which have higher emissions presently are taking more advantages of the environment.
    - The campaign to achieve net zero by 2050 is designed to achieve Paris goals by the "lowest cost" methods, **foregoing equity and climate justice**.
  - **Wasn't mandated by Paris Agreement**.
  - **India is anyways a small contributor** - Our emissions are 4.37% of the world's share (with 18% population).

Critics of Sustainability of India's Net Zero Strategy

- India's plan to increase dependence on **hydro projects and nuclear energy** will create displacement, deforestation, hazardous radiation etc.
- Solar and Wind Energy is also focused on **Mega energy parks** which may cause displacements.

Way Forward:

- **Identify short-term and medium-term targets** to achieve the long-term goals.
- **Areas of GHG Reduction:**
  - **Decarbonizing India's Energy Sector -** Replace fossils with renewables; Improve efficiency of existing fossil fuel using sectors; Remove unavoidable carbon release through Carbon Sequestration.
  - **Green Transformation of Mobility**:
    - Shift in modal mix from road to rail and fuel diversification approach to encourage sustainable fuels (biofuels, CNG, LNG) in short term.
    - Electrification in medium term.
    - Hydrogen based heavy mobility in the long term.
  - **Radical Decarbonization of Industrial sector** including steel, cement, chemicals and fertilizers.
    - Accelerate circular economy; efficiency improvement; electrification of heat; carbon capture and low carbon fuels such as biomass and hydrogen.

- **Green Building, Infrastructure and Cities**: India's top 25 cities contribute to 15% of its estimated GHG emissions.
    - Rethink urban planning with a focus on transit oriented urban development and an emphasis on low-carbon buildings and infrastructure construction.
- **Agriculture**: Agriculture sector is the largest contributor to nitrous oxide (N_2O) and Methane (CH_4).
    - A national campaign to empower, educate and enable more than 100 million farmers in adopting precision agriculture, sustainable animal husbandry, and green energy.

- **Integrate emission reduction with Climate Adaptation**
    - Strengthen a suit of social protection program, especially for people facing rural distress.
    - Invest in disaster preparedness.
- **Corporate India** has a vital role to complement government efforts. The goals of 21st century India Inc should be to foster innovative and inclusive green development.
- **Strengthening State Capacity** can help the country move from reactive decision making to proactive planning and execution. A **Low-Carbon Development Commission** supported by the overarching framework of a climate law, could play this role.

Conclusion:

- Through its announcement of 'Net-Zero' target, India has silenced its critics. Now, its time to follow through on these commitments with transparent and credible action. This would allow India to demonstrate genuine climate leadership for the rest of the developing world, and secure a better, greener future for its citizens.

7) MECHANISMS AND ISSUES WITH CLIMATE FUNDING

- **Introduction**
    - » Money has been central to many a fight at the Climate Change negotiations. UNFCCC as part of its CBDR principle requires developed countries to provide financial assistance to developing nations in their fight against the climate change.
    - » **Globally**, there are two funding mechanisms - **The Green Climate Fund** and the **Global Environment Facility.**

- **Green Climate Fund (GCF)**
    - » Established at COP-16 in 2010, it is the financial mechanism for UNFCCC under article 10. It is regarded as the chief instrument for the fulfillment of developed world's annual support of $100 billion annually till 2025.
    - » **COP-21 held at Paris** also decided that **GCF shall serve the Paris Agreement**.

- **Global Environment Facility (GEF)**
    - » Created at Rio Earth Summit in 1992 to help tackle planet's most important environmental problems.
    - **What has it done so far? / What does GEF do?**
        - » GEF also serves as financial mechanism for the following conventions:
            - CBD
            - UNFCCC
            - UNCCD

- Stockholm Convention on Persistent Organic Pollutants (POPs)
- Minamata Convention on Mercury
- It also supports implementation of Montreal Protocol on substances that deplete the ozone layer in countries with economies in transition.

- **Current Funding Situation**:
  - **Requirement: As per COP27** (Sharm el-Sheikh agreement), the global transition to a low-carbon economy would likely require about US$ 4-6 trillion every year till 2050. This is 5% of the global GDP.
    - The cumulative requirement of developing countries, just for implementing their climate action plans, was **about US$ 6 trillion between now and 2030**.
  - **Availability:**
    - The $100 billion amount, that the developed countries have promised is the only money in play right now. And of this only around US$50-80 billion per year is being mobilized. This indicates that the **fund available in less than 10% of what is required.**

- **Key Problems of current climate funding are:**
  - **Requisite finance** hasn't been mobilized.
  - **Funding bias in favour of climate change mitigation activities**. This bias is there because mitigation efforts are easily visible in short run and returns from adaptation efforts will be visible after long time.
    - For e.g., if we adapt by moving away from coasts, the benefit of this adaptation efforts would be visible much later.
  - **Developing world** in itself cannot fight the climate crisis as they are still struggling for finance for their development needs.
  - **A number of countries** are unable to access global finance. Present rules and regulations of global financial systems, make it difficult for many countries to access international finance, particularly those with political instabilities
  - **Lack of transparency** is leading to problems of double counting and green washing.

- **Way Forward:**
  - **Availability and Access** are two main dimensions to the problem of climate finance.
  - **Increasing Availability:**
    - **Developed countries** need to increase their contribution.
      - But, even if this happens, this won't be able to fulfill the requirement of around $6 trillion needed annually.
    - **Mobilize resources from private sector**: Businesses and Corporations need to invest money into green projects.
      - In climate finance thus far, private investment have lagged behind public money. Barely 30% of current financial flows are coming from private sources.
    - **Creation of right environment for investments in green project** -> Private sector will not invest unless they are reasonably sure of healthy returns.
      - Here, international financial institutions should engage with governments, central banks, commercial banks etc. to incentivize climate friendly investments and discouraging, or even penalizing, dirty investments.
    - **Carbon Tax** - Common citizens will have to contribute to the bulk of the additional financial resources.

- **Increasing Access:** There is a need to simply lending mechanisms and overhaul credit rating systems.
- **Increased Transparency**:
  - Climate finance flows through a maze of channel - bilateral, regional, multilateral. It is in the form of grants, concessionary loans, debt, equity, carbon credit, and more. As a result, there are widely different opinion on the quantum of climate finance currently being mobilized. This needs to be addressed.

- **Conclusion**
  - » Though, more money is flowing in green economy than a few years ago, but the pace of increase is nowhere adequate. When it comes to climate change, **along with money, it is the time which is in short supply.**

8) GEO-ENGINEERING, CARBON CAPTURE AND STORAGE (CCS) AND CARBONDIOXIDE REMOVAL (CDR) TECHNOLOGIES

- **Introduction:**
  - » **Definition:** Geo-engineering is a theoretical concept which aims to modify and cool environment to defeat the global warming. It may involve reduction of Sunlight reaching earth or absorption of CO2 to reduce global warming (Carbon Capture Technologies).
  - » Since the global community is looking for a Net Zero target by 2050, the Geo-engineering technologies are expected to play a key role in this.

- **Reduction of sunlight reaching Earth:**
  1. **Stratospheric Aerosol Injection:** Injecting the atmosphere with Sulphur/ Hydrogen Sulphide (copies volcanic effect and scatters sunlight).
  2. **Putting Large Mirrors in Space -** reduce the amount of sunlight reaching earth.
  3. Using Wind-Powered Motors to **whiten the cloud** -> by spraying water into the sky -> reflect solar radiation.

- **Carbon Capture and Storage (CCS)** (Or Carbon Capture Utilization and Storage (CCUS)) refers to technologies that can capture CO2, at a source of emissions before it is released into atmosphere.
  - The process starts with capture of CO2 which undergoes a compression process to from a dense fluid. This eases the transport and storage of the captured CO2.
  - This dense fluid is transported via pipelines and then injected into the underground storage facilities. It can also be used as a raw material in other industrial processes such as bicarbonates.

- **CDR** takes the form of both natural means like afforestation or reforestation, and technologies like direct air capture where machines mimic trees by absorbing CO2 from their surrounding and storing it underground.
  - **E.g. Fake Trees** containing compounds which can react with CO_2 to absorb it and store it in solid from.

- **Other Carbon Capture Technologies**
  i. **Ocean Iron Fertilization:** Seeding the Sea with Iron
     - Phytoplankton prefer iron and flourish in its presence, thus absorbing a lot of CO_2.

- **How significant is the role of CCS and CDR** in achieving net-zero by 2050?
  - » In IPCC AR6, there is no pathway to 1.5 degrees C that doesn't use CDR.

- **Limitations/Problems with these CCS and Geoengineering method**:
  - » **CCS and CDR** are still technologies under development **without demonstrated feasibility** at large scale despite decades of development.
    - It also suffers from **other challenges** like high energy requirements; high cost; challenges in the transport and long term storage of carbon.
  - » **CDR** methods like afforestation, reforestation, **Bioenergy with Carbon Capture and Storage (BECCS)** are constrained by their **need of land**. It may aso hamper food and water security.
  - » **Ocean Iron Fertilization:** The Convention of Biological Diversity has already imposed a de facto moratorium based on precautionary principle. It could result in eutrophication, which may adversely affect the ocean ecosystem.
  - » **Stratospheric Aerosol Injection** is also highly controversial as this could have unintended effects on global and regional climates.
  - » Further, there are concerns related to **fairness, equity, and justice** in the adoption of geo-engineering technologies as most of the R&D is dominated by North American and Western Euro.

- So far, there has been very little progress on these technologies and most of the R&D is dominated by North American and Western European Nations. Emerging economies like China and India have also begun to look into these options more seriously.
  - » CCS is **absent from INDCs of most of the countries**, indicating that most of the countries have not yet accepted it as promising technology.

- **Why very little progress? -** Lake of policy support and spending on R&D.
- **Situation of CCS in India - Not much progress**
  - » Some industries, especially steel and cement have been proactively pursuing CCS as part of their emission reduction ambitions. In Sep 2020, an '**Industry Charter**' for near zero emissions by 2050 was agreed to by six Indian companies that will explore different decarbonization measures including carbon sequestration.
  - » **Government initiatives:** The DST has established a nation wide program on CO2 storage research and in Aug 2020, made a call for proposals to support CCS research, development, pilot and demonstration projects. This is part of the accelerating CCS technologies (ACT) initiative, for which India has committed one million Euros to support Indian participants.

- **Geopolitics of Geoengineering:**

  Since, developed countries dominate the R&D and discussions on futuristic governance framework, there are concerns about the representation of positions of developing and underdeveloped countries.
  - It could widen north-south divide, by dividing the world into haves and havenots.
  - Then there are concerns about potential militarization of these technologies.

- **Way forward**

» **Improved policy support**
» **Learn from successful implementation of technology in industrialized countries.** Increased collaboration with global industries.
» **Strengthen international geo-engineering governance:**
  - Future use of geo-engineering should take into consideration the core principles of UNFCCC like common but differentiated responsibilities.
  - The international governance should introduce accountability, oversight and transparency into the use of geo-engineering in future. The governance framework should be inclusive in approach.

4. EFFORTS BY INDIA TO FIGHT CLIMATE CHANGE

1) NATIONAL ACTION PLAN ON CLIMATE CHANGE

- Launched in 2008
- Consist of 8 submissions – National Solar Mission, National Mission on Enhanced Energy Efficiency; National Mission on Sustainable Habitat; National Water Mission; National Mission on Sustainable Himalayan Ecosystem; the National Mission on Strategic Knowledge for Climate Change; National Mission for Green India; National Mission for Sustainable Agriculture.

2) UPDATED NDC TO UNFCCC

3) LONG TERM-LOW EMISSION DEVELOPMENT STRATEGY

4) MISSION LIFE

- **Details about Mission LiFE**
  - It was first proposed by PM Modi at **COP 26 of UNFCCC** in Nov 2021. It is envisioned as **an India led global mass movement** that will **nudge individual and collective action to protect and preserve the environmen**t.
    - PM Modi has underlined that Mission LiFE **makes the fight against climate change democratic,** in which everyone can contribute with their respective capacities.
    - It emboldens the spirit of the P3 Model: **Pro Planet People**.
    - It functions on the basic principles of '**Lifestyle of the planet, for the planet and by the planet**'.
  - At the launch, PM Modi also highlighted that the concept of **'Reduce, Reuse and Recycle' and circular economy**; and mentioned that it has been part of the Indian Lifestyle for thousands of years.
  - LiFE also resonates with **climate justice** -> it highlights enhanced obligations for those in developed countries and supports climate adaptation and mitigation for those most affected and yet least responsible.

- NITI aayog will curate and incubate Mission Life in the first year, and it will subsequently be implemented by MoEF&CC.
- It is a five-year program.

- **Significance:**
    - According to UNEP, **more than 2/3rd of the GHG emissions can be attributed to household consumption and lifestyles** -> therefore the urgent cuts to global emissions we need can only be achieved through widespread adoption of greener consumption habits.
    - Life recognizes that **small individual actions can tip the balance in the planet's favor**.
        - Actions such as **saving energy at home**; **cycling and using public transport** instead of driving; **eating more plant-based foods and wasting less**; and **leveraging our position as customers and employees to demand climate-based friendly choices**.
    - Many of the goals of LiFE can be achieved by deploying 'nudges', gentle persuasion technique to encourage positive Behaviour.
        - The UNEP employs proven nudging techniques:
            - Discouraging Food waste by offering smaller plates in cafeterias.
            - encouraging recycling by making bin lids eye-catching;
            - and encouraging cycling by creating cycle paths

- **Note: Other Recent global initiatives launched/initiated by India:**
    - Panchamrita Targets announced by Mr Modi at COP26
    - International Solar Alliance
    - The Coalition for Disaster Resilient Infrastructure

5) SCALING UP EFFORTS TO MOBILIZE GREEN FUND

- Though the Paris Agreement provides for mobilization of resources from developed countries, the process has been very slow.
- Thus, **India has scaled up its efforts towards greater mobilization of private capital to meet its ambitious climate action goals**.
- **Green Bonds** are financial instruments that generate proceeds for investment in **environmentally sustainable and climate suitable projects**.
    - Developed countries such as UK, France, Germany etc have been using Green bonds to raise billions of dollars of sovereign green debts.

- **In India**, as per **SEBI's data** between 2017 and Sep 2022, 15 Indian corporates have issued green bonds of value **of Rs 4,539 crores**. Most of this is related to renewable energy generation.

- **Union Budget 2022-23** announced the issuance of **Sovereign Green Bonds**.
    - The final sovereign green bond framework of India has been issued.
    - The Green Financing working committee has also been set up to oversee and validate key decisions on the issuance of Sovereign green bonds.
        - The committee has the mandate to select the projects for allocation of proceeds, do a time-bound review of the allocation and carry out annual reporting along with an impact assessment of the proceeds from sovereign green bonds issued.

    - The RBI also regularly notifies indicative calendar for the issuance of sovereign Green Bonds (SGrB)

- The **security-wise allocation would include 5 year and 10 year SGrBs** for **₹4,000 crore each for both auctions**.
    - **Five per cent** of the notified amount of sale has been **reserved for retail investors** as specified under the 'Scheme for Non-competitive Bidding Facility in the auction of Government of India Dated Securities and Treasury Bills'.
    - The SGrBs will be designated as specified securities under the 'Fully Accessible Route' for investment in Government Securities by **non-residents**.
    - Over time, the SGrBs would provide a pricing reference for private sector entities in India for their domestic borrowings through Environment, Social, and Governance (ESG) bonds.
    - Thus, the issuance of SGrBs would help in creating an ecosystem which fosters a greater flow of capital into green projects and entities undertaking such projects.

6) OTHER STEPS TO PROMOTE RENEWABLE ENERGY AND ENERGY EFFICIENCY