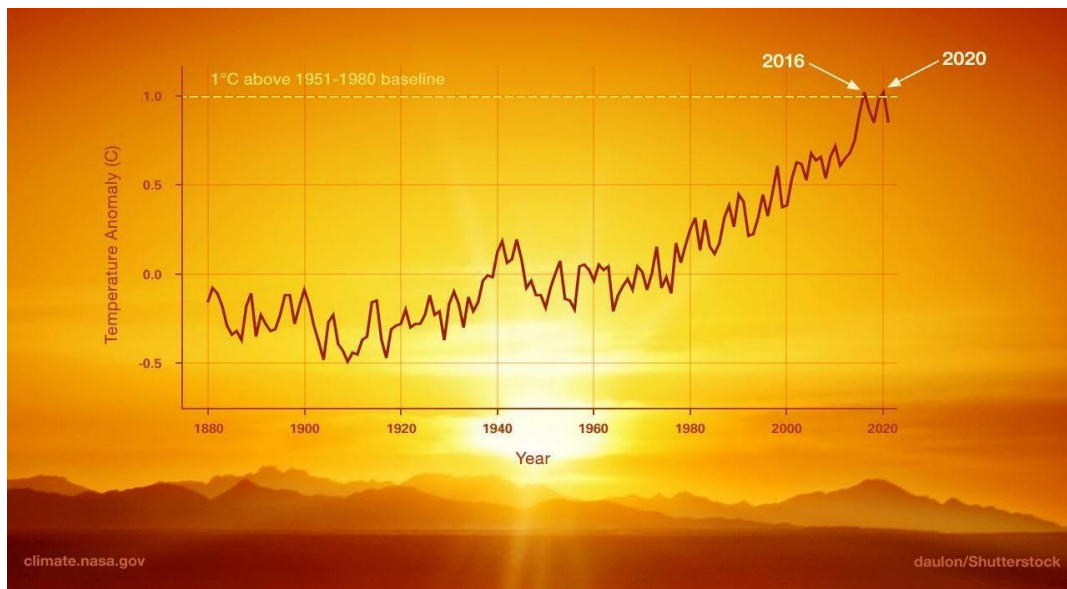


Module 5 Global Warming, Climate change & EIA



Global warming is **the long-term warming of the planet's overall temperature**. Though this warming trend has been going on for a long time, its pace has significantly increased in the last hundred years due to the burning of fossil fuels.

Global Warming is defined as the increase of the average temperature on Earth. As the Earth is getting hotter, disasters like hurricanes, droughts and floods are getting more frequent.

Concept

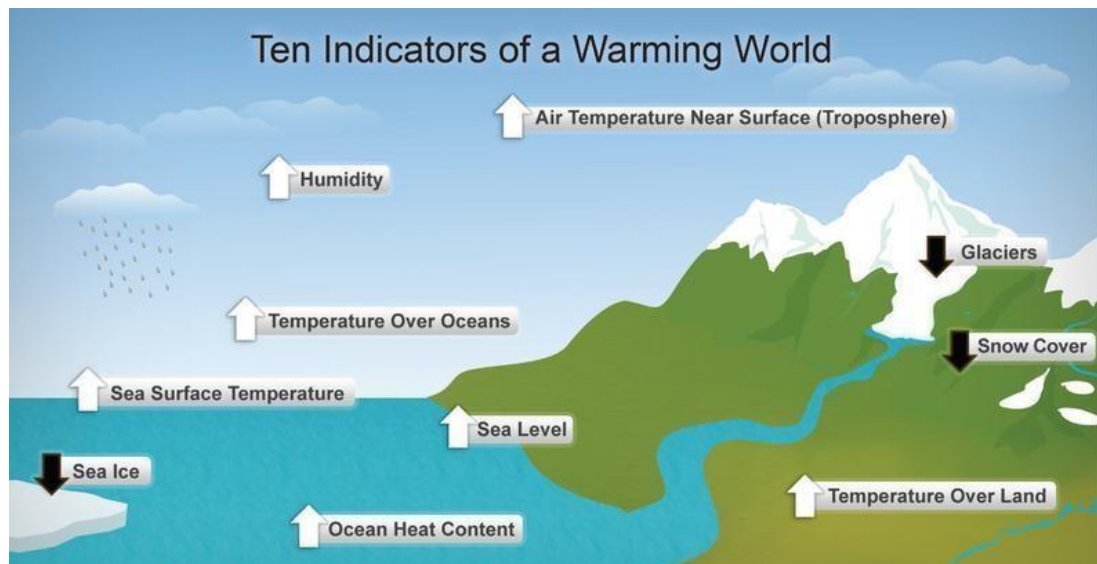
Global warming is the long-term heating of Earth's climate system observed since the pre-industrial period (between 1850 and 1900) due to human activities, primarily fossil fuel burning, which increases heat-trapping greenhouse gas levels in Earth's atmosphere. The term is frequently used interchangeably with the term climate change; though the latter refers to both human- and naturally produced warming and the effects it has on our planet. It is most commonly measured as the average increase in Earth's global surface temperature.

Since the pre-industrial period, human activities are estimated to have increased Earth's global average temperature by about 1 degree Celsius (1.8 degrees Fahrenheit), a number that is currently increasing by 0.2 degrees Celsius (0.36 degrees Fahrenheit) per decade. It is unequivocal that human influence has warmed the atmosphere, ocean, and land.

Indicators of global warming

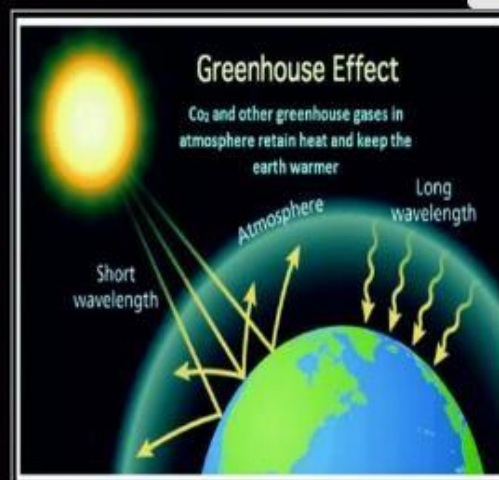
Humans are warming the planet by increasing the greenhouse gases in the atmosphere. Scientists have many lines of evidence that consistently show that the world is getting warmer. These indicators of global warming (see figure below) include

- Rising sea levels
- Increased greenhouse gas levels (see carbon cycle)
- Global mean surface temperature increase
- Glacial retreat
- Extreme weather events
- Ocean acidification
- Ocean heating
- Melting sea ice

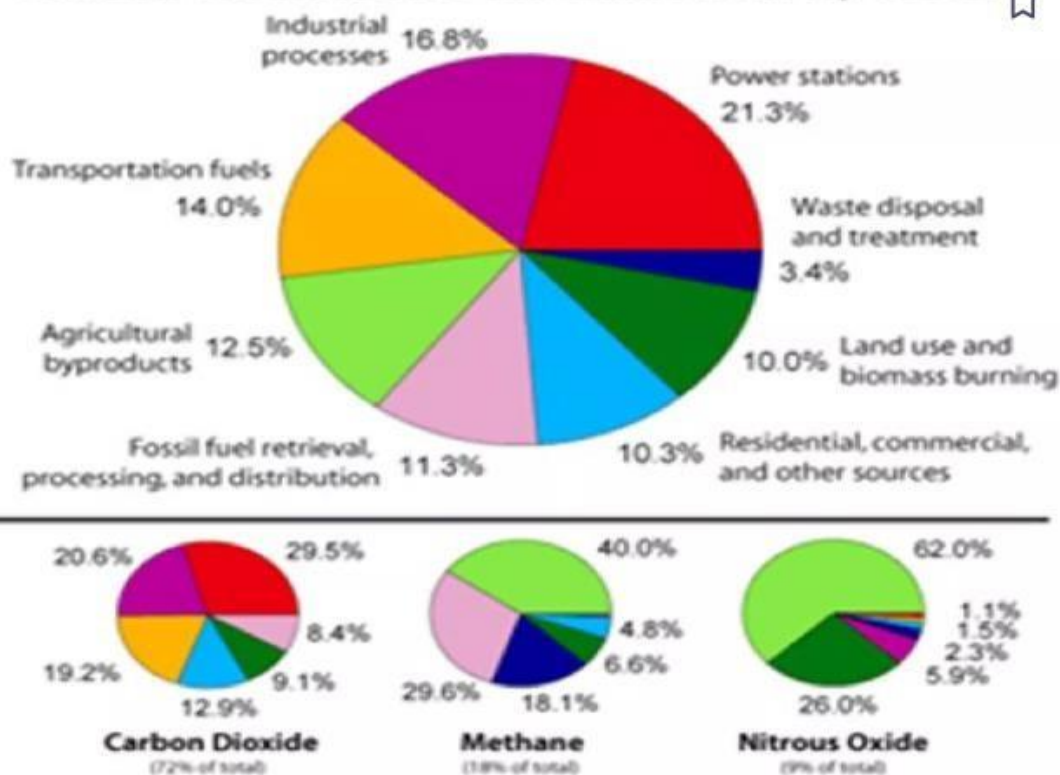


GREENHOUSE EFFECT

The greenhouse effect is a **natural process** that **warms the Earth's surface**. When the Sun's energy reaches the Earth's atmosphere, some of it is reflected back to space and some is absorbed and re-radiated by greenhouse gases. The absorbed energy warms the atmosphere and the surface of the Earth.



Annual Greenhouse Gas Emissions by Sector



Ten Signs of Global Warming

Arctic sea ice extent is diminishing

The area covered by sea ice has been smaller every year for the past 30 years, with an average decrease of 3.2% per decade. The sea ice reaches its lowest cover in September, and then grows again during the winter. Minimum cover in September is decreasing at an even faster rate of 13.4% per decade, with September 2016 seeing cover at a record low.

Exceptionally warm winter temperatures can affect the re-growth, and October 2016 – January 2017 saw the lowest daily extent of sea ice in record, likely due to record warm temperatures in the Arctic. The Arctic Report Card released in December 2016 showed a variety of records, including temperature. The volume of sea ice is also decreasing. And the trend continues in 2017.

Ocean heat content is increasing

The top half-mile of most major ocean waters is getting warmer. The amount of heat absorbed by the oceans has increased significantly over the past two decades. Warmer ocean water damages coral reefs, threatens marine ecosystems, and disrupts global fisheries. A change in ocean heat

content can also alter patterns of ocean circulation, which can have far-reaching effects on global climate conditions, including changes to the outcome and pattern of meteorological events such as tropical storms, and also temperatures in the northern Atlantic region, which are strongly influenced by currents that may be substantially reduced with CO₂ increase in the atmosphere.

Air temperature over ocean is increasing

Just as temperatures over land are getting warmer, so are temperatures over oceans. Warmer air near the ocean surface leads to increased evaporation, and more evaporation means more water vapor in the air. The increased amount of water vapor not only contributes to extra warming, but may feed heavy precipitation events and act as fuel for potential hurricanes, if other conditions are right.

Sea surface temperature is increasing

The surface of the ocean is getting warmer. Water temperatures measured at the surface have been higher during the past three decades than at any other time since measurements began in 1880. From 1901 through 2015, sea surface temperatures rose at an average rate of 0.13°F per decade, and they continue to rise. Warmer sea surface water can severely damage coral reefs, facilitate algal blooms, and together with warmer air temperature over the oceans, can increase the destructive potential of tropical cyclones and hurricanes.

Global sea level is rising

Records show that the sea level has been rising steadily across the globe at a rate of 0.04 to 0.1 inches per year since 1900. The current rate according to NASA is 0.13 in/year, suggesting rise is accelerating. The main reasons for the rise are thermal expansion due to higher sea water temperatures (warmer water expands) and the added water from melting of land ice, such as glaciers.

The impacts of a higher sea level can go from permanently flooded areas (below future sea level) to an increase of seasonal and —nuisance floods, as well as worse (higher) storm surges. Sea level rise also threatens freshwater supplies and ecosystem services such as natural water filtration, as well as human coastal infrastructure.

Humidity is increasing (causing more warming)

Weather stations have recorded higher levels of water vapor in the air and when it is hot out, it feels even hotter. When surface temperature warms (both land and sea surface), it leads to more evaporation, and consequently an increase in atmospheric humidity. Because water vapor is a greenhouse gas, the increase in humidity causes additional warming.

Temperature of the lower atmosphere is increasing

The atmosphere is not warming uniformly. Warming is instead concentrated in the lower layers of the atmosphere, called the troposphere (where we live, where weather occurs, and where planes fly). Rising temperatures in the troposphere evidence the human fingerprint in global warming caused through the release of emissions from burning coal, oil, and natural gas.

Air temperature over land is increasing

Air temperature over land is increasing faster than over the oceans. The excess heat in the atmosphere has been measured by weather stations over land across the globe. The increase in air temperature is not homogeneous throughout the globe – for instance, the Arctic is seeing a faster rate of warming than other areas. The excess heat in the air can be linked to increased frequency of heat waves across the globe, wider distribution of insect pests (e.g., pine beetle in the northwest U.S.), and various health-related issues such as the spread of tropical diseases further north into the U.S.

Snow cover is reduced, and snow is melting earlier

The area covered by snow in the Northern Hemisphere in the spring is getting smaller, not only because there is less snow in some areas and years, but also because snowpacks are melting earlier due to warmer temperatures. People all over the world rely on melting snow to replenish their water supplies, and the earlier melt (and sometimes smaller accumulation) reduces the water availability for these people, threatening their way of life. In the U.S., scientists believe that the reduced snowpack and early melting of snow in the Sierra Nevada was one of the factors behind the long, extreme drought that began affecting California in 2011.

Glaciers are melting

Glaciers are an essential source of water for many places around the world, where people depend on glacial meltwater to replenish their aquifers. Glaciers are retreating at an astonishing pace – three times the ice volume stored in the entirety of the European Alps is lost globally every year. As glaciers melt, water supplies are at risk and there is also the potential for soil destabilization and erosion because glacial waters carve rivers through their melting path.

Melting glaciers also can lead to hazardous conditions such as landslides and avalanches for communities below, who also value glaciers' aesthetic value: the sheer loss of the natural beauty of glaciers majestic sights is culturally significant. The evidence of these changes is clear: Glacier National Park only has 25 of the estimated 150 glaciers that existed there in the 1800's.

//////*****

Causes of Global Warming

Following are the major causes of global warming:

Man-made Causes of Global Warming

Deforestation

Plants are the main source of oxygen. They take in carbon dioxide and release oxygen thereby maintaining environmental balance. Forests are being depleted for many domestic and commercial purposes. This has led to an environmental imbalance, thereby giving rise to global warming.

Use of Vehicles

The use of vehicles, even for a very short distance results in various gaseous emissions. Vehicles burn fossil fuels which emit a large amount of carbon dioxide and other toxins into the atmosphere resulting in a temperature increase.

Chlorofluorocarbon

With the excessive use of air conditioners and refrigerators, humans have been adding CFCs into the environment which affects the atmospheric ozone layer. The ozone layer protects the earth surface from the harmful ultraviolet rays emitted by the sun. The CFCs have led to ozone layer depletion making way for the ultraviolet rays, thereby increasing the temperature of the earth.

Industrial Development

With the advent of industrialization, the temperature of the earth has been increasing rapidly. The harmful emissions from the factories add to the increasing temperature of the earth.

In 2013, the Intergovernmental Panel for Climate Change reported that the increase in the global temperature between 1880 and 2012 has been 0.9 degrees Celsius. The increase is 1.1 degrees Celsius when compared to the pre-industrial mean temperature.

Agriculture

Various farming activities produce carbon dioxide and methane gas. These add to the greenhouse gases in the atmosphere and increase the temperature of the earth.

Overpopulation

An increase in population means more people breathing. This leads to an increase in the level of carbon dioxide, the primary gas causing global warming, in the atmosphere.

Natural Causes of Global Warming

Volcanoes

Volcanoes are one of the largest natural contributors to global warming. The ash and smoke emitted during volcanic eruptions goes out into the atmosphere and affects the climate.

Water Vapour

Water vapour is a kind of greenhouse gas. Due to the increase in the earth's temperature, more water gets evaporated from the water bodies and stays in the atmosphere adding to global warming.

Melting Permafrost

Permafrost is frozen soil that has environmental gases trapped in it for several years and is present below Earth's surface. It is present in glaciers. As the permafrost melts, it releases the gases back into the atmosphere, increasing Earth's temperature.

Forest Blazes

Forest blazes or forest fires emit a large amount of carbon-containing smoke. These gases are released into the atmosphere and increase the earth's temperature resulting in global warming.

Effects of Global Warming

Following are the major effects of global warming:

Rise in Temperature

Global warming has led to an incredible increase in earth's temperature. Since 1880, the earth's temperature has increased by ~ 1 degree. This has resulted in an increase in the melting of glaciers, which have led to an increase in the sea level. This could have devastating effects on coastal regions.

Threats to the Ecosystem

Global warming has affected the coral reefs that can lead to the loss of plant and animal lives. Increase in global temperatures has made the fragility of coral reefs even worse.

Climate Change

Global warming has led to a change in climatic conditions. There are droughts at some places and floods at some. This climatic imbalance is the result of global warming.

Spread of Diseases

Global warming leads to a change in the patterns of heat and humidity. This has led to the movement of mosquitoes that carry and spread diseases.

High Mortality Rates

Due to an increase in floods, tsunamis and other natural calamities, the average death toll usually increases. Also, such events can bring about the spread of diseases that can hamper human life.

Loss of Natural Habitat

A global shift in the climate leads to the loss of habitats of several plants and animals. In this case, the animals need to migrate from their natural habitat and many of them even become extinct. This is yet another major impact of global warming on biodiversity.

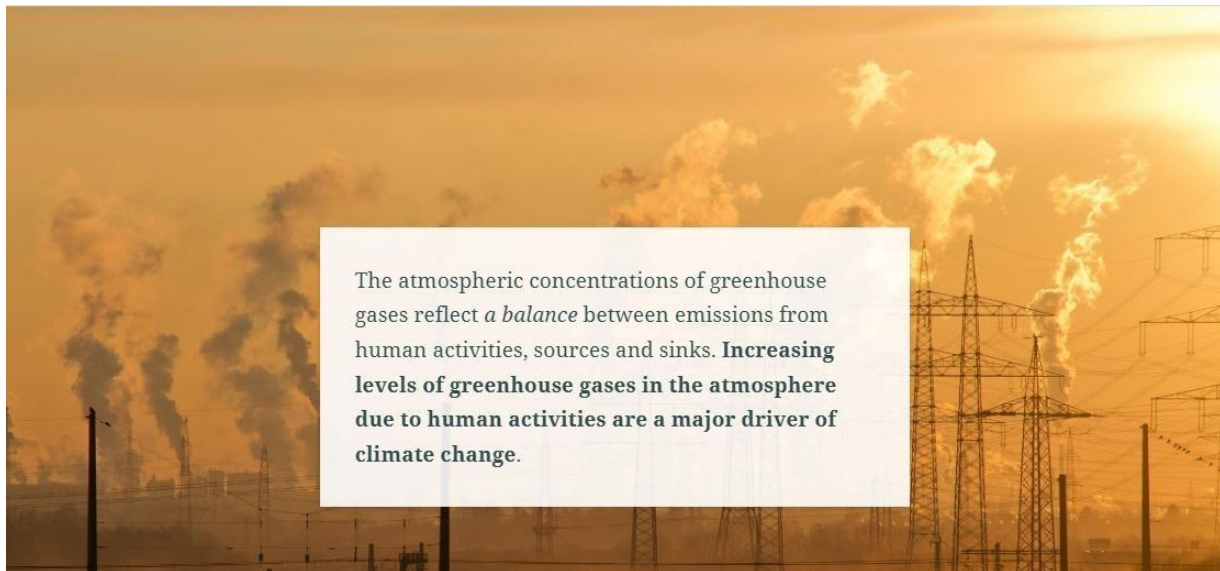
The Global Climate Indicators

The Global Climate Indicators are a set of parameters that describe the changing climate without reducing climate change to only temperature. They comprise key information for the most relevant domains of climate change: temperature and energy, atmospheric composition, ocean and water as well as the cryosphere.

These Global Climate Indicators have been identified by scientists and communication specialists in a discursive process led by GCOS during workshops and scientific panel meetings and have been finally endorsed by WMO. They form the basis of the annual WMO Statement of the State of the Global Climate, which is submitted to the Conference of Parties of the United Nations Framework Convention on Climate Change (UNFCCC). In addition, the Copernicus Climate Change Service (C3S) of the European Commission uses the Indicators implemented the Global Climate Indicators for their annual "European State of the Climate".

These seven headline indicators are complemented by a set of subsidiary indicators that provide additional information and allow a more detailed picture of the changes in the respective domain. It is important to note, that the Global Climate Indicators are not limited to specific datasets or certain storylines.

1. Greenhouse Gases



The atmospheric concentrations of greenhouse gases reflect a balance between emissions from human activities, sources and sinks. Increasing levels of greenhouse gases in the atmosphere due to human activities are a major driver of climate change.

The Big 3- Carbon dioxide (CO₂) is the most commonly addressed greenhouse gas, and its atmospheric concentration is measured by parts per million (ppm). Methane (CH₄) and nitrous oxide (N₂O) are also extraordinarily important for the global climate and are measured by parts per billion (ppb). In 2019, greenhouse gas concentrations reached new highs.

Carbon dioxide: 410.5 ± 0.2 ppm = 148% of preindustrial levels

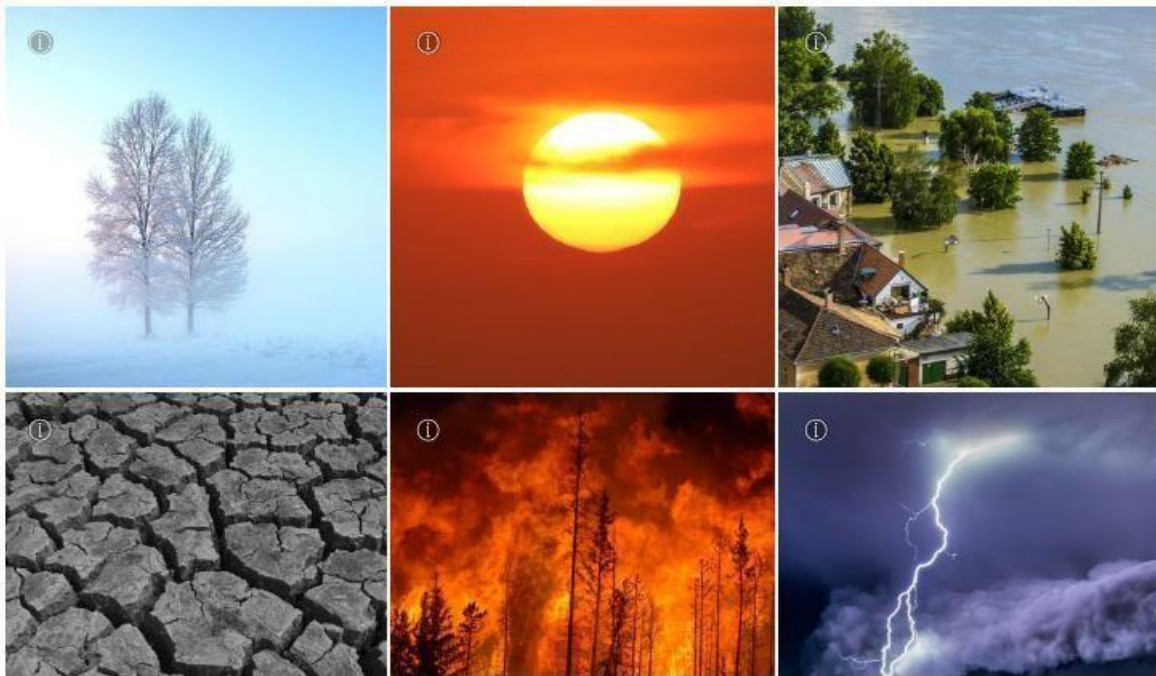
Methane: 1877 ± 2 ppb = 260% of preindustrial levels

Nitrous oxide: 332.0 ± 0.1 ppb = 123% of pre-industrial levels.

Temperature

As greenhouse gas concentrations rise, so does global mean surface temperature (GMST). GMST is measured using a combination of air temperature two meters over land, and sea surface temperature in ocean areas from various databases, typically expressed as an anomaly from a baseline period.

2. Extreme Events

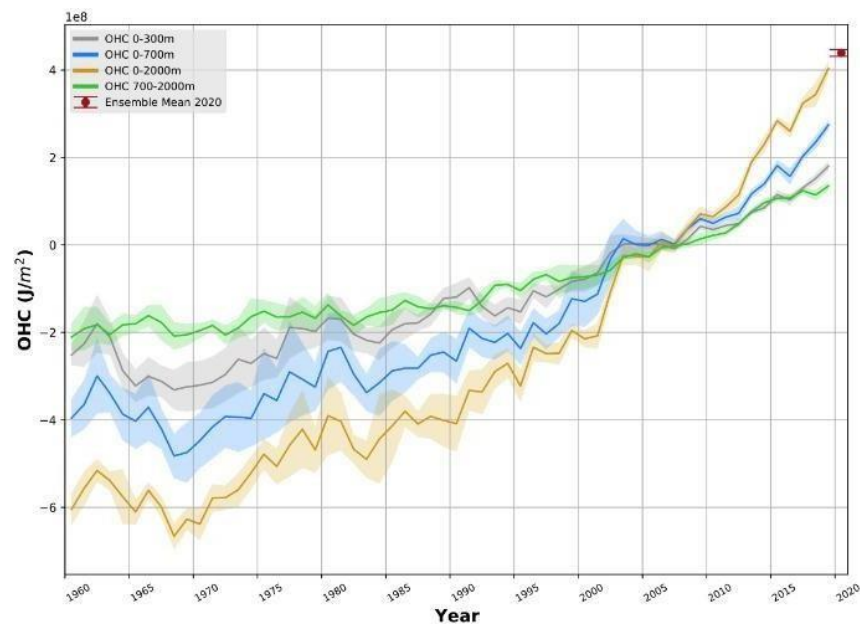


Rising global temperatures have contributed to more frequent and severe extreme weather events around the world, including cold and heat waves, floods, droughts, wildfires and storms.

3. Ocean Heat Content



Around 90% of the excess energy that accumulates in the earth system due to increasing concentrations of greenhouse gases, goes into the ocean.



Ocean Heat Content (OHC) is a measure of this heat accumulation in the Earth system. It is measured at various ocean depths, up to 2000m deep. All data sets agree that ocean warming rates show a particularly strong increase in the past two decades across all depths. In 2019, the

0–2000m depth layer of the global ocean reached a new record high, and a preliminary analysis based on three global data sets suggests that 2020 exceeded that record.

4. *Sea Level Rise*

What's the big deal?



<https://youtu.be/cXzfOpZSmk8>

Globally, sea level has been rising an average of 3.29 (+/- 0.3) mm per year, peaking in 2020. A small decrease in the latter part of 2020 is likely related to La Niña conditions in the tropical Pacific.

5. *Glacial Mass*



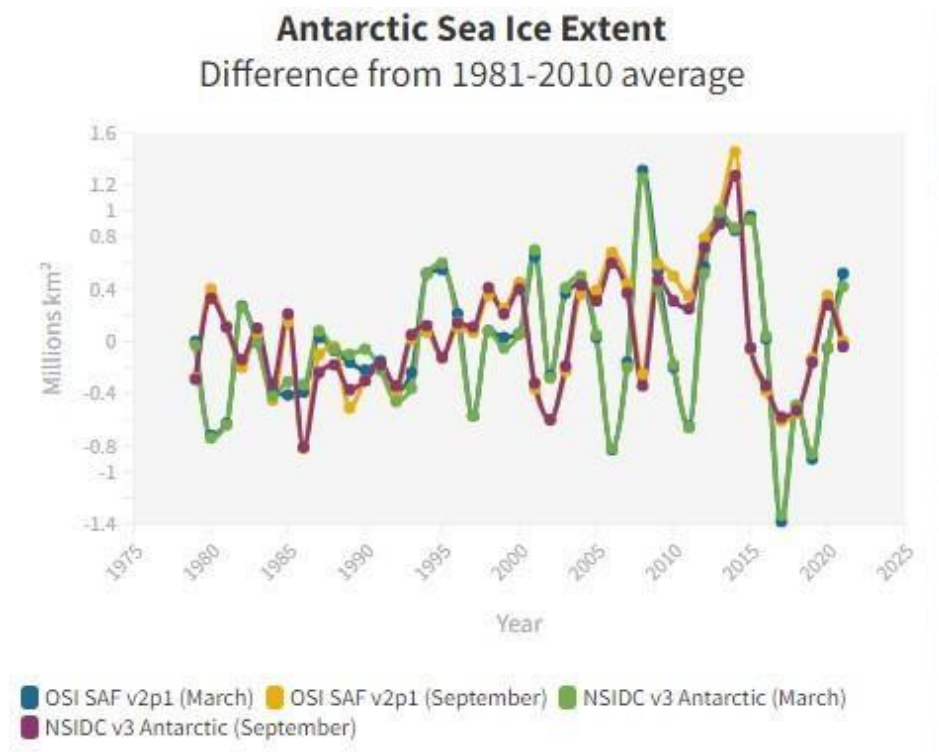
Glaciers, including ice sheets, are distributed across the planet, with concentrations in the high mountain ranges of Asia, and North and South America. As providers of ecosystem services and freshwater supply to millions around the world, glacial loss has significant and direct impacts on both the global climate and sustainable development. Preliminary results for 2020, based on a subset of evaluated glaciers, indicate that glaciers continued to lose mass in the hydrological year 2019/2020. Although, mass balance was slightly less negative, with an estimated ice loss of 0.98

metre water equivalent, there is a clear trend towards accelerating glacier mass loss in the long term. Eight out of the ten most negative mass balance years have been recorded since 2010.

6. Sea Ice Extent



Sea ice extent measures areas covered by an areal ice concentration greater than 15%. It serves as a useful indicator of climate change particularly given how quickly change occurs at the poles and how widespread the repercussions of its cover can be.



Sea-ice extent difference from the 1981-2010 average in the Antarctic for the months with maximum ice cover (September) and minimum ice cover (February). Data from EUMETSAT OSI SAF v2p1 (Lavergne et al., 2019) and NSIDC v3 (Fetterer et al., 2017).

7. Ocean Acidification

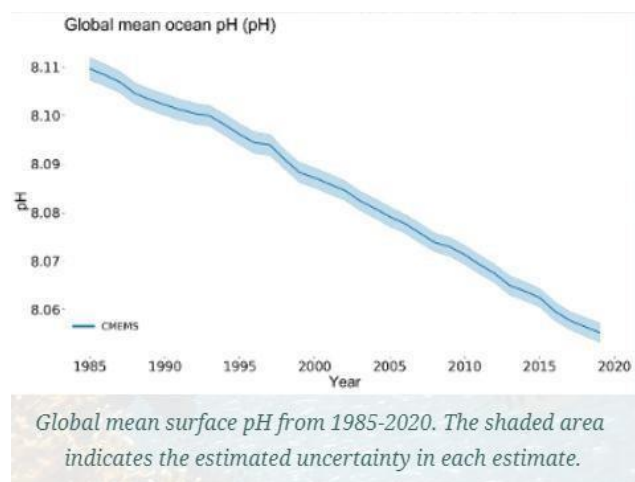


One impact of rising CO₂ concentration is ocean acidification.

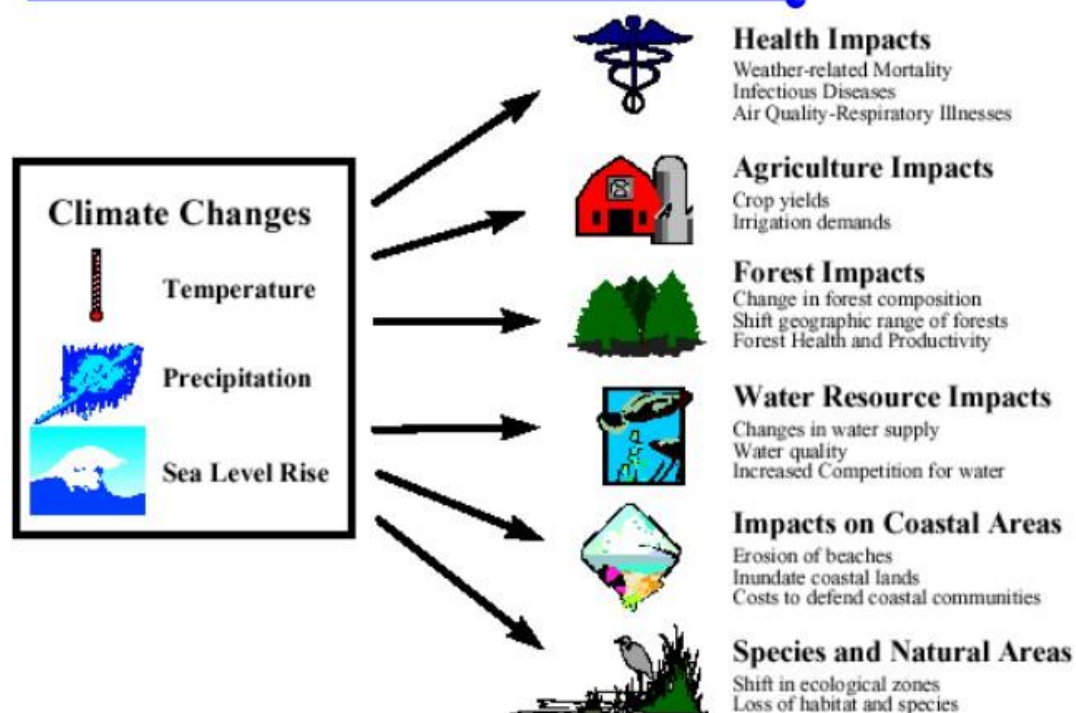
The ocean absorbs around 23% of the annual emissions of anthropogenic CO₂ to the atmosphere, helping to alleviate the impacts of climate change but at a high ecological cost to the ocean.

CO₂ reacts with seawater and increases its acidity. It endangers organisms and ecosystem services, including food security, by endangering fisheries and aquaculture. It also affects coastal protection by weakening coral reefs, which shield the coastline, and tourism.

Global mean ocean pH has been steadily declining:

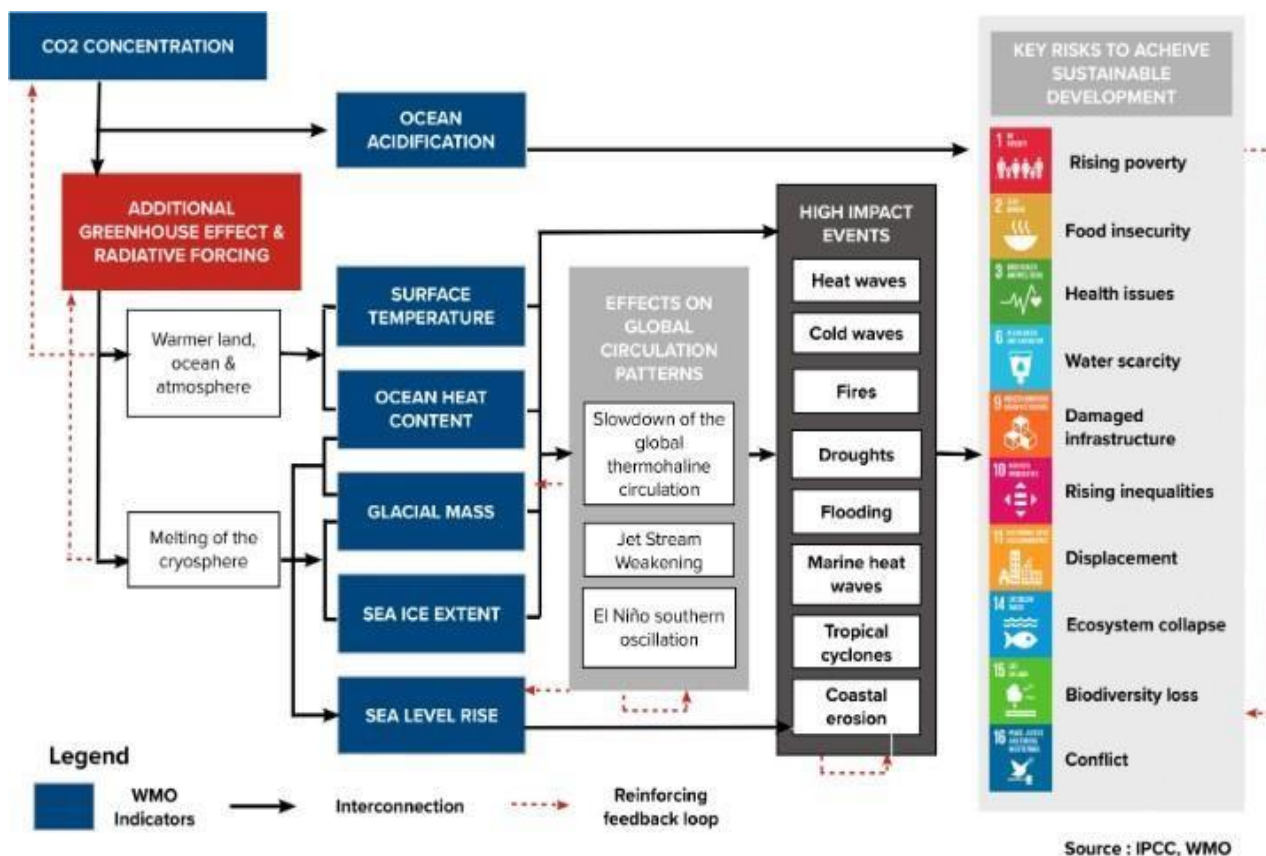


Potential Climate Change Impacts



Risks & Impacts

Rising atmospheric CO₂ concentrations lead to cascading effects via six of the other key climate indicators that perpetuate warming and contribute to high impact events, risking the achievement of the Sustainable Development Goals (SDGs).



The effects of climate change on human health

The effects of climate change on human health include direct effects of extreme weather, leading to injury and loss of life as well as indirect effects, such as under nutrition brought on by crop failures or lack of access safe drinking water. Climate change poses a wide range of risks to population health.

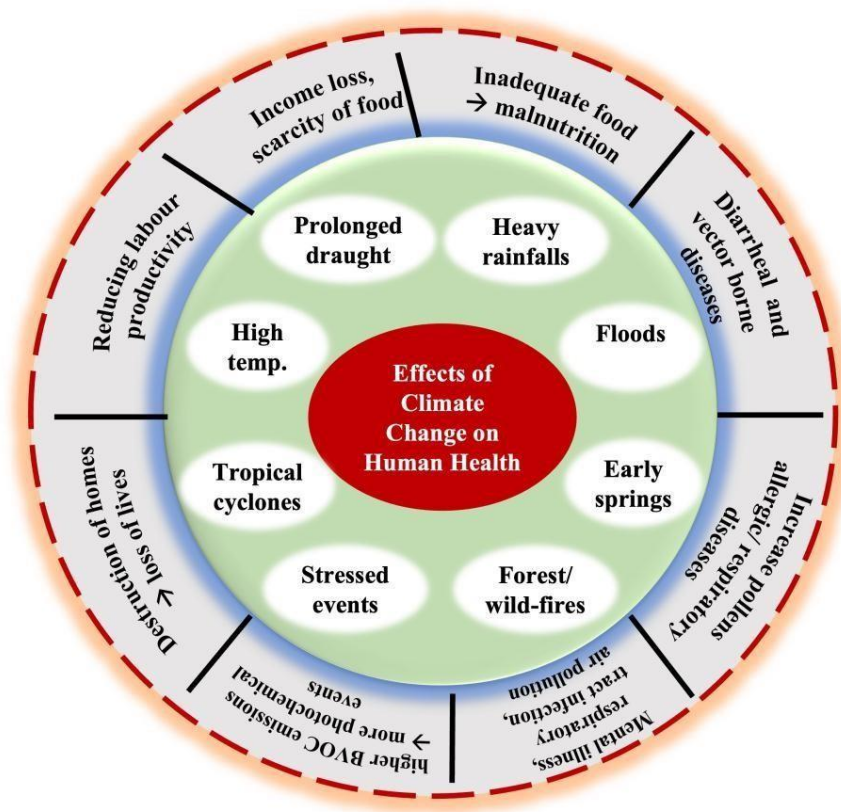
The three main categories of health risks include:

- (i) Direct-acting effects (e.g. due to heat waves, extreme weather disasters),
- (ii) Impacts mediated via climate-related changes in ecological systems and relationships (e.g. crop yields, mosquito ecology, marine productivity), and
- (iii) The more diffuse (indirect) consequences relating to impoverishment, displacement, and mental health problems.

General health impacts

The direct, indirect and social dynamic effects of climate change on health and wellbeing produce the following health impacts: cardiovascular diseases, respiratory diseases, infectious diseases, under nutrition, mental illness, allergies, injuries and poisoning.

Health and health care provision can also be impacted by the collapse of health systems due to climate-induced disasters such as flooding. Therefore, building health systems that are climate resilient is a priority



Mental health impacts

This section is an excerpt from Effects of climate change on mental health

Smoke in Sydney (Australia) from large bushfires (in 2019), affected some people's mental health in a direct way. The likelihood of wildfires is increased by climate change.

The effects of climate change on mental health and well-being can be rather negative, especially for vulnerable populations and those with pre-existing serious mental illness. There are three broad pathways by which these effects can take place: directly, indirectly or via awareness.

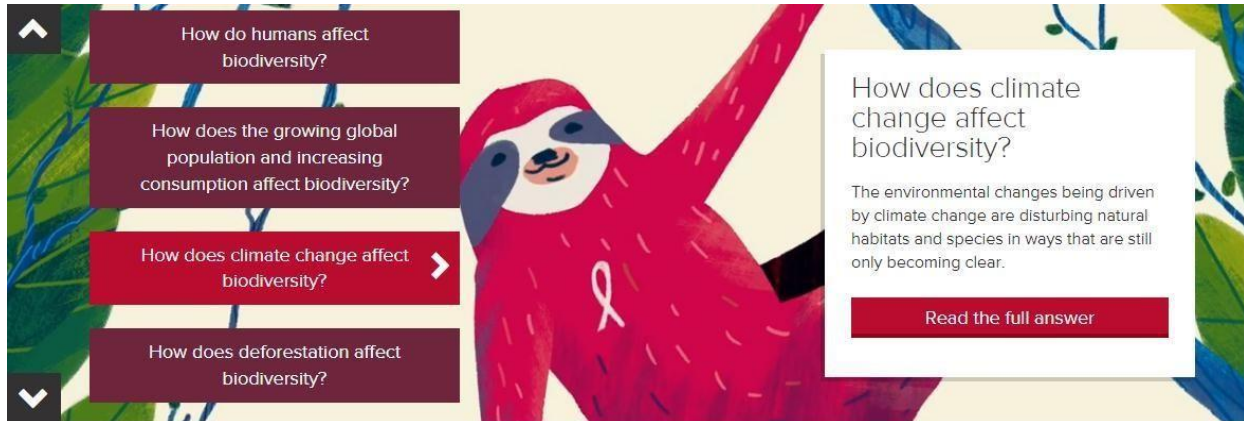
The direct pathway includes stress related conditions being caused by exposure to extreme weather events, such as post-traumatic stress disorder (PTSD). Scientific studies have linked mental health outcomes to several climate-related exposures—heat, humidity, rainfall, drought, wildfires and floods. The indirect pathway can be via disruption to economic and social activities, such as when an area of farmland is less able to produce food. The third pathway can be of mere awareness of the climate change threat, even by individuals who are not otherwise affected by it.

Mental health outcomes have been measured in several studies through indicators such as psychiatric hospital admissions, mortality, self-harm and suicide rates. Vulnerable populations and life stages include people with pre-existing mental illness, Indigenous peoples, children and adolescents.

The emotional responses to the threat of climate change can include eco-anxiety, ecological grief and eco-anger. While unpleasant, such emotions are often not harmful, and can be rational responses to the degradation of the natural world, motivating adaptive action.

Assessing the exact mental health effects of climate change is difficult; increases in heat extremes pose risks to mental health which can manifest themselves in increased mental health-related hospital admissions and suicidality.

Effect of climate change on biodiversity



- The environmental changes being driven by climate change are disturbing natural habitats and species in ways that are still only becoming clear.
- Climate change is affecting ecosystems at multiple scales.
- Individual/species: changes in morphology and behavior, phenology, and range shifts observed
- Ecosystems: shifts in productivity, species interactions, and emergent properties observed
- Together, these changes are impacting ecosystem services and human well-being.
- Natural resource managers need proactive, flexible approaches to deal with changes.

- There are signs that rising temperatures are affecting biodiversity, while changing rainfall patterns, extreme weather events, and ocean acidification are putting pressure on species already threatened by other human activities.
- Rising global temperatures also have the potential to alter ecosystems over longer periods by changing what can grow and live within them. There is already evidence to suggest that reductions in water vapour in the atmosphere since the 1990s has resulted in 59% of vegetated areas showing pronounced browning and reduced growth rates worldwide.
- Rising temperatures in the oceans affect marine organisms. Corals are particularly vulnerable to rising temperatures and ocean acidification can make it harder for shellfish and corals in the upper ocean to form shells and hard skeletons. We have also seen changes in occurrence of marine algae blooms.
- Despite the threats posed by climate change to biodiversity, we also know that natural habitats play an important role in regulating climate and can help to absorb and store carbon. Mangroves are significant sinks for carbon and the Amazon is one of the most biologically diverse places on the planet and is an enormous store of carbon – up to 100 billion tons, although a recent study has suggested the Amazon may now be emitting more carbon than it absorbs. Safeguarding these natural carbon sinks from further damage is an important part of limiting climate change.

EIA: Environment Impact Assessment

Environment Impact Assessment or EIA can be defined as the study to predict the effect of a proposed activity/project on the environment. A decision making tool, EIA compares various alternatives for a project and seeks to identify the one which represents the best combination of economic and environmental costs and benefits.

Regulations in India

On 27 January 1994, the Union Ministry of Environment and Forests (MEF), Government of India, under the Environmental (Protection) Act 1986, promulgated an EIA notification making Environmental Clearance (EC) mandatory for expansion or modernization of any activity or for setting up new projects listed in Schedule 1 of the notification. Since then there have been 12 amendments made in the EIA notification of 1994.

The MoEF recently notified new EIA legislation in September 2006. The notification makes it mandatory for various projects such as mining, thermal power plants, river valley, infrastructure (road, highway, ports, harbors and airports) and industries including very small electroplating or foundry units to get environment clearance. However, unlike the EIA Notification of 1994, the new legislation has put the onus of clearing projects on the state government depending on the size/capacity of the project.

Certain activities permissible under the Coastal Regulation Zone Act, 1991 also require similar clearance. Additionally, donor agencies operating in India like the World Bank and the ADB have a different set of requirements for giving environmental clearance to projects that are funded by them.

Status of EIA in India

Salient Features of 2006 Amendments to EIA Notification

Environment Impact Assessment Notification of 2006 has decentralized the environmental clearance projects by categorizing the developmental projects in two categories, i.e Category A (national level appraisal) and Category B (state level appraisal).

Category A projects are appraised at national level by Impact Assessment Agency (IAA) and the Expert Appraisal Committee (EAC) and Category B projects are appraised at state level.

State Level Environment Impact Assessment Authority (SEIAA) and State Level Expert Appraisal Committee (SEAC) are constituted to provide clearance to Category B process.

After 2006 Amendment the EIA cycle comprises of four stages:

- Screening
- Scoping
- Public hearing
- Appraisal

Category A projects require mandatory environmental clearance and thus they do not undergo the screening process.

Category B projects undergoes screening process and they are classified into two types.

Category B1 projects (Mandatorily requires EIA).

Category B2 projects (Do not require EIA).

Thus, Category A projects and Category B, projects undergo the complete EIA process whereas Category B2 projects are excluded from complete EIA process.

Environmental Impact Assessment (EIA): Draft 2020

The Ministry of Environment, Forest and Climate Change (MoEF&CC) has published the draft Environment Impact Assessment (EIA) Notification 2020, with the intention of replacing the existing EIA Notification, 2006 under the Environment (Protection) Act, 1986. The Key Proposals of the 2020 Draft include:

Reduced Time for Public Hearings: One of the major steps of the EIA Mechanism is the public participation. The 2020 draft proposes to reduce the notice period for public hearings from 30 days to 20 days.

However, the MoEFCC has claimed it to be —in tune with the times, given the growth of internet and mobile telephony.

Exemption of Projects: Furthermore, by classifying a number of projects into A, B1 and B2, a host of projects are exempted from public scrutiny.

Category B2 projects do not require mandatory Environment Clearance (EC), unlike the Category A and B1 projects.

Exempted Projects: The projects under this exempted category include:

- Offshore and onshore oil, gas and shale exploration.
- Hydroelectric projects up to 25 MW.
- Irrigation projects between 2,000 and 10,000 hectares of command area.
- Small and medium cement plants.
- Acids other than phosphoric or ammonia, sulphuric acid.
- MSMEs in dye and dye intermediates, bulk drugs, synthetic rubbers, medium-sized paint units.
- All inland waterway projects and expansion or widening of highways between 25 km and 100 km with defined parameters.
- These include roads that cut through forests and dredging of major rivers.
- Aerial ropeways in ecologically sensitive areas.
- Specified building construction and area development projects; built-up area up to 1,50,000 sq. m.

Post-clearance compliance: It implies that once a project gets approved by the concerned authority, the proponent projects are required to adhere to certain rules laid down in the EIA report in order to ensure that no further environmental damages take place.

Annual Submission of Reports: The new draft EIA, proposes the submission of compliance reports annually whereas as per the 2006 notification, the compliance report was to be submitted every six months.

Environmental experts are of the view that allowing a longer period for filling the compliance report will give an opportunity to project proponents to hide disastrous consequences, which could go unnoticed.

Report Prepared Solely by Project Proponents: Meanwhile, submission of the compliance report will be solely prepared by the project proponents itself, which, without oversight and review, may lead to inaccurate information submitted on the project.

No Public Reporting for Non-Compliance: The EIA Notification 2020 excludes reporting of violations and non-compliance by the public.

Instead, the government will take cognisance of reports only from the violator-promoter, government authority, Appraisal Committee or Regulatory Authority.

Post-facto Clearance: Another major proposal in the draft 2020 is granting ‘post-facto clearance’ where a project that has been operating without environmental clearance, can be regularised or allowed to apply for clearance.

The judiciary has held, as in the case of *Alembic Pharmaceutical vs. Rohit Prajapati* in April 2020 that —environment law cannot countenance the notion of an ex post facto clearance.¶

Penalty for Firms: Firms found violating the terms of their establishment, if they have to get the clearance, however, will have to pay a penalty

List of projects needing environmental clearance under EIA notifications

Mining , extraction of natural resources and power generation (for a specified production capacity)

Mining of Minerals

Offshore and Onshore oil and gas exploration, development & production

River Valley Projects

Thermal Power Plants

Nuclear Power Projects and Processing of Nuclear Fuel

Primary Processing

Coal Washeries

Mineral beneficiation

Materials Production

Metallurgical industries

Cement Plants

Materials Processing

Petroleum refining industry

Coke oven plants

Asbestos milling and asbestos based products

Chlor-alkali industry

Soda ash industry

Leather/skin/hide processing industry

Manufacturing/ Fabrication

Chemical Fertilisers

Pesticide industry and pesticide specific intermediates

Petro-chemical complexes

Man made fibres manufacturing

Petrochemical based processing

Synthetic organic chemicals industry

Integrated paint industry

Pulp and Paper industry

Sugar industry

Service Sectors

Oil and gas transportation pipe line

Isolated storage and handling of hazardous chemicals

Physical Infrastructure including Environmental Services

Airports

All ship breaking yards including ship breaking units

Industrial estates/parks/complexes/areas, Export Processing Zones, and Special Economic Zones,

Bio-tech Parks, Leather complexes.

Common hazardous waste treatment , storage and disposal facilities

Ports , Harbours, break waters, and dredging

Highways

Aerial ropeways

Common Effluent Treatment Plants

Common Municipal Solid Waste Management Facility

Building/Construction projects/Area Development Projects and Townships

Building and Construction projects Townships and Area Development Projects

Category A projects requires clearance from the Central Government in the Ministry of Environment and Forest (MoEF) on the recommendations of an Expert Appraisal Committee (EAC)

Category B projects excluding those which fulfill the General Conditions (GC) stipulated in the Schedule, will require prior environmental clearance from the State/Union territory Environment Impact Assessment Authority (SEIAA) . In the absence of a duly constituted SEIAA or SEAC, a Category 'B' project shall be considered at the Central Level as a Category B project.

Case study of hydro power/ thermal power projects

Hydro Power Project Classification

Hydro power projects are generally categorized in two segments i.e. small and large hydro. In India, hydro projects up to 25 MW station capacities have been categorized as Small Hydro Power (SHP) projects. While Ministry of Power, Government of India is responsible for large hydro projects, the mandate for the subject small hydro power (up to 25 MW) is given to Ministry of New and Renewable Energy.

We are taking a look at some of the interesting case studies of Hydro power producers in India. In our forthcoming edition we will try and collaborate more on Hydro power projects.

1. *Case study: Teesta III, 1200 MW, Sikkim a project by ANDRITZ Hydro Pvt. Ltd , Neelav Samrat De, General Manager – Market Management*



Athena Power, an IPP, was granted the developer license to develop Teesta III located in Sikkim on a BOOT basis for a period of 35 years. A SPV was created namely as Teesta Urja to undertake this project with a gross head of 800 meters.

About the project:

ANDRITZ Hydro was entrusted with the responsibility to provide the electro-mechanical equipment of the plant in October 2007, which has 6 Pelton units of 200 MW output each. The 6 units were commissioned in succession by April 2017 and connected to the grid successfully.

Challenges faced:

One of the biggest challenges faced was the transportation of heavy consignments in an extremely hostile terrain which was a mammoth task.

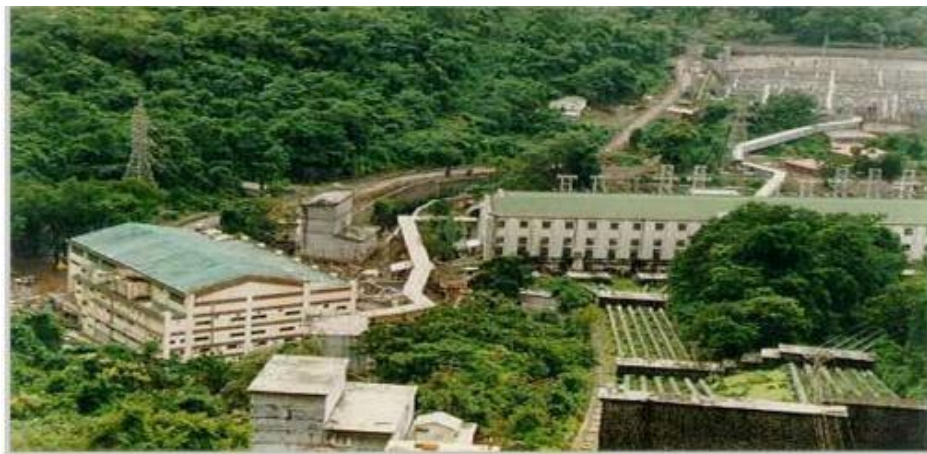
Another set-back faced during construction was the massive earthquake that struck in September 2011. The epicentre of this destructive earthquake was the project site itself. Due to this, the construction schedule initially for 46 months was revised, setting the milestones behind. Loss of life took its toll during the construction of this project during the earthquake.

Following the earthquake, another incident occurred which involved the collapse of one of bridges on the main road to the project site. The collapse of the bridge impeded the transportation of heavy consignments for a further period of another 23 months.

Current capacity:

The run-of-river hydropower plant will generate 5,269 GWh of electricity annually, dependable for 90% of the year. It feeds 1200 MW of power to the grid currently.

2. Case Study : Bhira Hydroelectric Project by Tata Power Company Limited. Commissioning and Operational Experiences of 150MW Bhira Pumped Storage Unit. Mr Ashwini kumar Patil, Head – Hydros.



About the project:

Bhira Hydroelectric Project is the third hydropower plant installed by The Tata Power Company Ltd. in 1927. Bhira is a small village located about 150 km from Mumbai, in Maharashtra. The

Bhira power station with 6 x 25 MW (150 MW) generating units (double overhang Pelton turbines) and 150MW Pumped Storage Unit. The Bhira Pumped Storage Unit was the single largest such unit in India when commissioned in 1995.

Tata Power has successfully commissioned a 10kW micro-hydro project at Bhira in 2014. The low-head, micro-hydro turbine installed in the tailrace of the 150MW Bhira hydro power station utilises the existing flow rate available to generate energy.

The challenges faced that makes this one of a unique project.

Commissioning and Operational Experiences of 150MW Bhira Pumped Storage Unit. It consists of two parts namely BPSU

Commissioning and Pumping Criteria. First part gives various technical details related to stability of the machine at speed-no-load and method to improve the same. The second part covers operational experiences gained related to pumping operation.

The current capacity of this power plant is 150 MW

Case Study: Purulia Pumped Storage Plant Hydro Plant in India by Toshiba India Private Limited (TIPL). Tomohiko Okada, Managing Director.



About the Project.

Purulia Pumped Storage Plant is one of the most prestigious Hydro Plants in India. The key benefit of the system is to support balancing of load.

Challenges in Hydro Project.

In context to challenges in any Hydro Project, execution depends on lot of factors like geology, topography, hydrology and accessibility to project area.

Difficult terrain, hostile weather coupled with lack of adequate Transmission & Distribution (T&D) system, adversely affects developments of Hydroelectric Projects (HEPs).

Land acquisition, environmental clearance and litigations may also result in delays and consequent cost overruns.

Besides, the lack of a compulsory hydropower purchase obligation impacts the signing of long-term PPAs and financial closure for projects.

Current Capacity of the plant Purulia PSPP (West Bengal), 4 x 225MW (2008)

Case Study: Ambhuthirtha Power Plant, Jog also known as MGHE TRS Mahatma Gandhi Hydro Electric Tail Race Scheme Project by Soham Renewable Energy. Mr. Sanjith Sadananda Shetty, Vice Chairman and Managing Director.



Mahatma Gandhi Hydro Electric Tail Race Scheme Project.

About the Project.

Soham takes pride in the fact that this small hydro project at Jog falls is the first of its kind in India to be registered under the United Nations for Framework convention on Climate Change (UNFCCC). Situated near one of the Asia's largest, waterfalls, the project is a 22 MW hydropower plant commissioned in 2007. This landmark project is considered by many to be a benchmark for all such future endeavors. It was the first to take initiative and trade its CERs with Japan's second largest energy utility firm. The success of this project has allowed Soham to initiate plans aimed at further enhancing and upgrading the scope of the plant's operations. But along with success there were definite challenges.

The challenges faced that makes this one of a unique project.

- **Flash Flood:** Often during monsoon season severe storms and torrential rainfall have resulted in record flooding on several streams in the jog region. Flash flooding has twice caused extensive damage to power house and plant infrastructure and washed away the road also. Fortunately, the flash flooding caused only material damage around the hydroelectric project. The damage was primarily associated with surface erosion, scour and inundation. However, the flooding presented challenges in accessing and operating the plant and repair work had to be undertaken at war footing
- **Gradual Sedimentation** Hydropower reservoir typically requires water level to be kept at minimum design level to store as much energy as possible for daily hydro power generation as well as to prevent any spillage at dam. However, as the reservoir storage volume is lost due to sedimentation, energy output from plant is affected, reservoir gradually losses capability to contain large flood inflows and control release of flood discharge through the spillway is Inevitable.
- **Trash Removal:** Here is a small case study at Jog fall plant where-in we have been able to successfully improve our operational effectiveness. Operational effectiveness includes efficiency but is not limited to only efficiency. The trash from waste such as cut down trees and weeds clogged the trash rack leading to reduction in power. Operation and maintenance problems associated with trash control facilities often cost a lot each year in form of extra labor, equipment repair costs, and interference with scheduled water deliveries. Our ingenious Team Soham at Jog devised a simple solution to reduce the number and severity of trash related problems. Our construction team developed a scheme by which the trash so collected flows over an opening . This is made possible by cutting the wall directly thereby reducing down trash menace clogging the trash rack and increase in the overall power output.

Current Capacity of the plant: A 22 MW hydropower plant.

Sources :

* Hydro Power 2017 research done by Research and Markets

*Ministry of New and Renewable Energy

*Power sector in India by India Brand Equity Foundation.