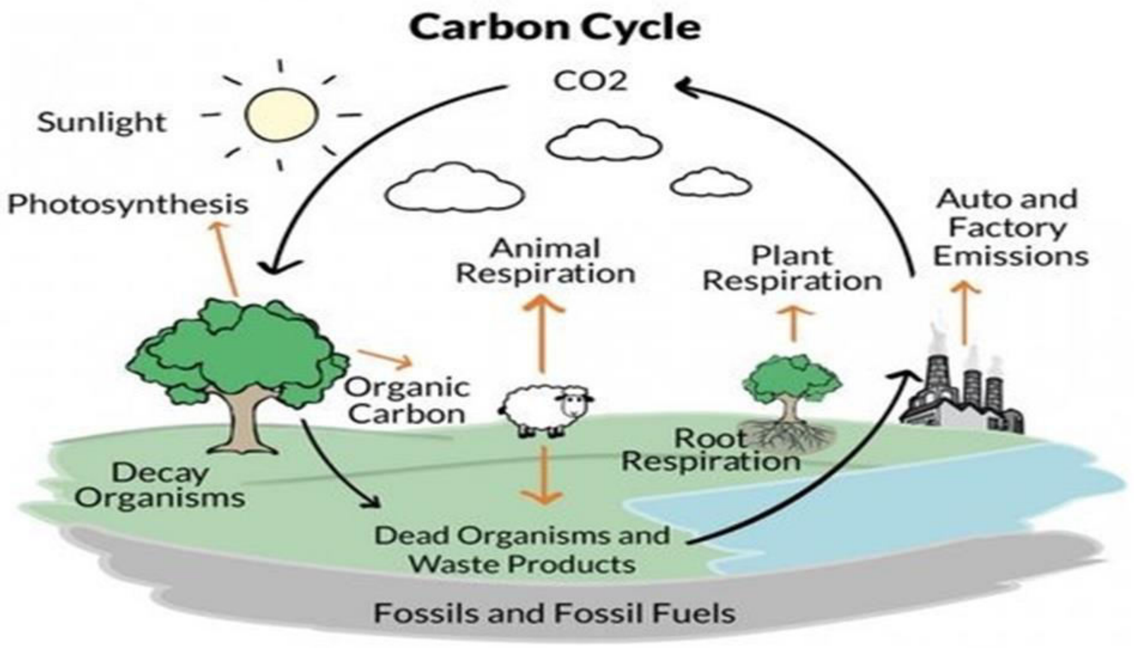
CLIMATE CHANGE

LASKHAY ONLINE

GUNJAN MESHRAM


Carbon Cycle
CO2
Sunlight
Photosynthesis
Animal Respiration
Plant Respiration
Auto and Factory Emissions
Organic Carbon
Root Respiration
Decay Organisms
Dead Organisms and Waste Products
Fossils and Fossil Fuels

CLIAMTE CHANGE

Climate change describes a change in the average conditions — such as temperature and rainfall — in a region over a long period of time. ... Global climate change refers to the average long-term changes over the entire Earth

LIKE TEMPERATURE, OCEANIC CURRENT , WIND PATTARN , CLOUD COVER

GLOBAL WARMING

- GREEN HOUSE EFFECT
- GREEN HOUSE GASES
- IMPACT – POSITIVE AND NEGATIVE
- CARBON SEQUESTRATION
- SOLAR RADIATION MANAGEMENT
- UNFCCC- KYOTO AND INDC

GREENHOUCE 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 the rest is absorbed and re-radiated by greenhouse gases.

Greenhouse gases include water vapour, carbon dioxide, methane, nitrous oxide, ozone and some artificial chemicals such as chlorofluorocarbons (CFCs).

The absorbed energy warms the atmosphere and the surface of the Earth. This process maintains the Earth's temperature at around 33 degrees Celsius warmer than it would otherwise be, allowing life on Earth to exist.

Greenhouse effect

Step 1: Solar radiation reaches the Earth's atmosphere - some of this is reflected back into space.

Step 2: The rest of the sun's energy is absorbed by the land and the oceans, heating the Earth.

Step 3: Heat radiates from Earth towards space.

Step 4: Some of this heat is trapped by greenhouse gases in the atmosphere, keeping the Earth warm enough to sustain life.

Step 5: Human activities such as burning fossil fuels, agriculture and land clearing are increasing the amount of greenhouse gases released into the atmosphere.

Step 6: This is trapping extra heat, and causing the Earth's temperature to rise .(GLOBAL WARMING)

ANTROPOGENIC SOURCES OF GREEN HOUCE GASES

- INDUSTRIES INCLUDING POWER PLANTS
- TRANSPORTATION
- AGRICULTURE – TILLAGE, FETILIZERS
- ANIMAL FARMING
- CONSTRUCTION

GREENHOUSE GASES

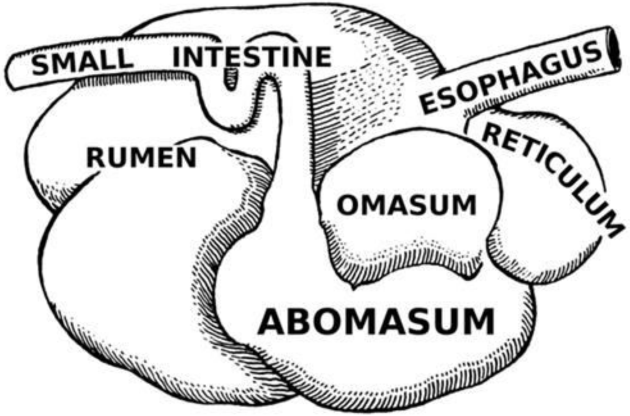
- H20- Water vapour accounts for the largest percentage of the greenhouse effect,

Indirectly, human activity that increases global temperatures will increase water vapou concentrations, a process known as water vapour feedback.

- Methane :
- Permafrost: Permafrost is ground that continuously remains frozen for two or more years, located on land or under the ocean. Permafrost does not have to be the first layer that is on the ground. It can be an inch to over miles deep into the Earth's surface.
- Fossil fuel BURNING
- Coal mining, oil and gas production and distribution
- Biomass burning:

Animal farming and diary :

Ruminant livestock – cattle, sheep, buffalo, goats, deer and camels – have a fore-stomach (or rumen) containing microbes called methanogens, which are capable of digesting coarse plant material and which produce methane as a by-product of digestion (enteric fermentation): this methane is released to the atmosphere .



- Agriculture – rice field , anaerobic condition and presence of wet area – methane
- Waste water, organic waste & solid waste:
- Urban waste landfills / dumping ground
- Natural sources :
  - Wetlands :
  - Termites: Like livestock, termites also emit methane when they break down the the leaves and wood they've eaten with their gut bacteria
  - Ocean :

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Some other factors responsible for GW

Particulate matter:

- Brown carbon - is brown smoke released by the combustion of organic matter.
- Soot- is a mass of impure carbon particles resulting from the incomplete combustion of hydrocarbon is more properly restricted to the product of the gas-phase combustion process
- Black carbon -Black carbon consists of pure carbon in several linked forms. It is formed through the incomplete combustion of fossil fuels, biofuel, and biomass, and is one of the main types of particle

IMPACT OF GW

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1. Melting of glaciers

- Submergence of coastal area and islands
- population and economic establishment
- Displacement
- INDIA- HIMALAYA-SUNDARBAN-COASTAL AREA

2. Ecosystems :

- coral reef – coral bleaching – (1. 5 C – 70-90 % AND 2 % ALL DEAD)
- Wetlands – hydrological changes
- Mangroves – increasing sea level
- Tropical rainforest / forest

3. biodiversity:

- destruction of ecosystems
- Case study of turtles – FEMINIZATION OF SEA TURTLE
- Lack of food – CASE STUDY OF POLAR BEAR

Reduction in sea-ice cover also forces bears to swim longer distances, which further depletes their energy stores and occasionally leads to drowning.

Thinner sea ice tends to deform more easily, which appears to make it more difficult for polar bears to access seals.

Insufficient nourishment leads to lower reproductive rates in adult females and lower survival rates in cubs and juvenile bears

Mothers and cubs have high nutritional requirements, which are not met if the seal-hunting season is too short.

Changes in sea ice affect the ability of pregnant females to build suitable maternity dens

4. Extreme weather condition:

- human-induced global warming is increasing the periodicity and intensity of some extreme weather events like cold waves, heat waves, tropical cyclones
- Heat waves- Severe heat weather can damage populations and crops due to potential dehydration or hyperthermia, heat cramps, heat expansion and heat stroke. Dried soils are more susceptible to erosion, decreasing lands available for agriculture.
- outbreaks of wildfires can increase in frequency as dry vegetation has increased likeliness of igniting
- Cold wave-

5. Arctic has warmed at roughly twice the rate as the entire globe, a phenomenon known as Arctic amplification.

- This means that global warming and climate change are impacting the Arctic more than the rest of the world.

CAUSES:

- OCEANIC CURRENT -Ocean currents normally bring in warmer water from the Pacific, and colder water exits out of the Arctic into the Atlantic.But those currents may be changing because more melting ice is injecting the Arctic Ocean with freshwater.
- MELTING OF GLACIER – LESS ALBEDO

6. Positive feedback loop:

From melting glaciers and dying forest there will be more emission of GHG ---- GW

7. Zombie fire:

It is a fire from a previous growing season that can smoulder under the ground which is made up of carbon-rich peat. When the weather warms, the fire can reignite. These are also known as holdover fires.

The fires in the Arctic spreading to areas which were formerly fire-resistant is a more worrying feature.

The tundra is drying up and vegetation there like moss, grass, dwarf shrubs, etc are starting to catch fire

8. . HUMAN HEALTH –

- FOOD PRODUCTIVITY
- METABOLIC RATE – MORE SUPPLEMENTS
- India, home to around 400 species of mosquitoes, is the ideal home for the winged creatures. Tropical weather, characterised by warm temperatures and rainfall, help mosquitoes spread and grow. This is why mosquitoes are more prevalent in Asia, Africa and the Americas. global warming adds an interesting twist to the tale of mosquitoes.
- regions that have so far been too cold for the mosquitoes are getting warmer. As a result, regions like Europe may see unprecedented growth in mosquito population in a few decades.

HENCE MORE MALARIA , DENGUE , YELLOW FEVER , CHICKEN GUNYA

- HEAT WAVES

9. plant–pollinator mismatches:

Global warming has the potential to disrupt this mutualism, leading to potential mismatches (i.e. a failure to achieve an efficient interaction) hence putting plant and pollinator species at risk of extinction

Climate change is making flowers bloom earlier each year, which means that plants are now blooming a month earlier than 45 years ago. This means that they do not get pollinated and bees are left without food, the report stated.

increase in temperature is also affecting the pollinators. For example, four species of hummingbirds in North America — including Allen's hummingbird, Black-chinned hummingbird, Calliope hummingbird and Rufous hummingbird — are at risk.

10. Alien invasive species : due to destruction of ecosystem

An alien species is an animal, plant or other organism that is introduced by humans, either intentionally or accidentally, into places outside its natural range. Some alien species – classed as ‘invasive’ – become established and negatively impact native biodiversity, as well as ecosystem services on which humans depend.

Rising temperatures on land and sea are increasingly forcing species to migrate to cooler climes, pushing disease-carrying insects into new areas, moving the pests that attack crops and shifting the pollinators that fertilise many of them,

12. seasons: unpredictable rainfall , elongated summer , mild winters

13. Agriculture and food security:

Agriculture seasons: short rabbi seasons,

Less rainfall

13. LOCUST ATTAKC:

- Desert locust is type of grasshopper
- Solitary species
- Solitary phase to gregarious phase
- Swarming behaviour is a response to overcrowding. Due to increased levels of serotonin, locust change colour, eat much more, and breed much more easily

in each breading season they multiply by 20 times

- Cyclone Mekunu in May 2018 and then cyclone Luban in October 2018 brought extreme rain in arabian peninsula
- Creating lakes in desert which is ideal condition for breeding
- when the locusts returned from Gujarat and Rajasthan to Pakistan-Iran in January / February 2020, there were already third-generation insects that had bred due to the extended monsoon in Rajasthan

Then there was heavy rain in the Red Sea coast — also unseasonal — in January 2019. An extended rain period of nine months enabled the creature to multiply

It was unseasonal rain in Pakistan's Sindh province and western Rajasthan. This desert region of India is not the ideal breeding ground for locusts. But last year, the region received rain ahead of schedule, which is why there was news about locust attacks as early as in May 2019. then the monsoon got extended — it did not retreat till October

In 2019, scientists say locusts crossed the Red Sea towards Africa and the Persian Gulf to reach Iran, which, is in any case, its winter resting place

14. Ocean:

- Warming of ocean
- he global ocean has become more layered and resistant to vertical mixing as warming from the surface creates increasing stratification.
- Oceanic water generally forms stratified layers with lighter waters near the surface and denser waters at greater depth, i.e. warmer fresher waters atop colder more saline ones. This stable stratified configuration acts as a barrier to water mixing that impacts the efficiency of vertical exchanges of heat, carbon, oxygen and other constituents.
- It prevents the vertical exchanges of nutrients and oxygen, and impacts the food supply of the whole marine ecosystems.
- IMPACT ON Oceanic current
- Warm water also lose co2 easilY

POSITIVE EFFECT OF CLIAMTE CHANGE

studies show that, up to a certain point, crops and other plants grow better in the presence of higher carbon dioxide levels and seem to be more drought-tolerant

CO_2 fertilization effect or carbon fertilization effect is the increased rate of photosynthesis in plants that results from increased levels of carbon dioxide (CO_2) in the atmosphere. The effect varies depending on the plant species, the temperature, and the availability of water and nutrients.

- new route for navigation
- new area for agriculture
- natural resource for exploitation

INDIAN OCEAN DIPOLE

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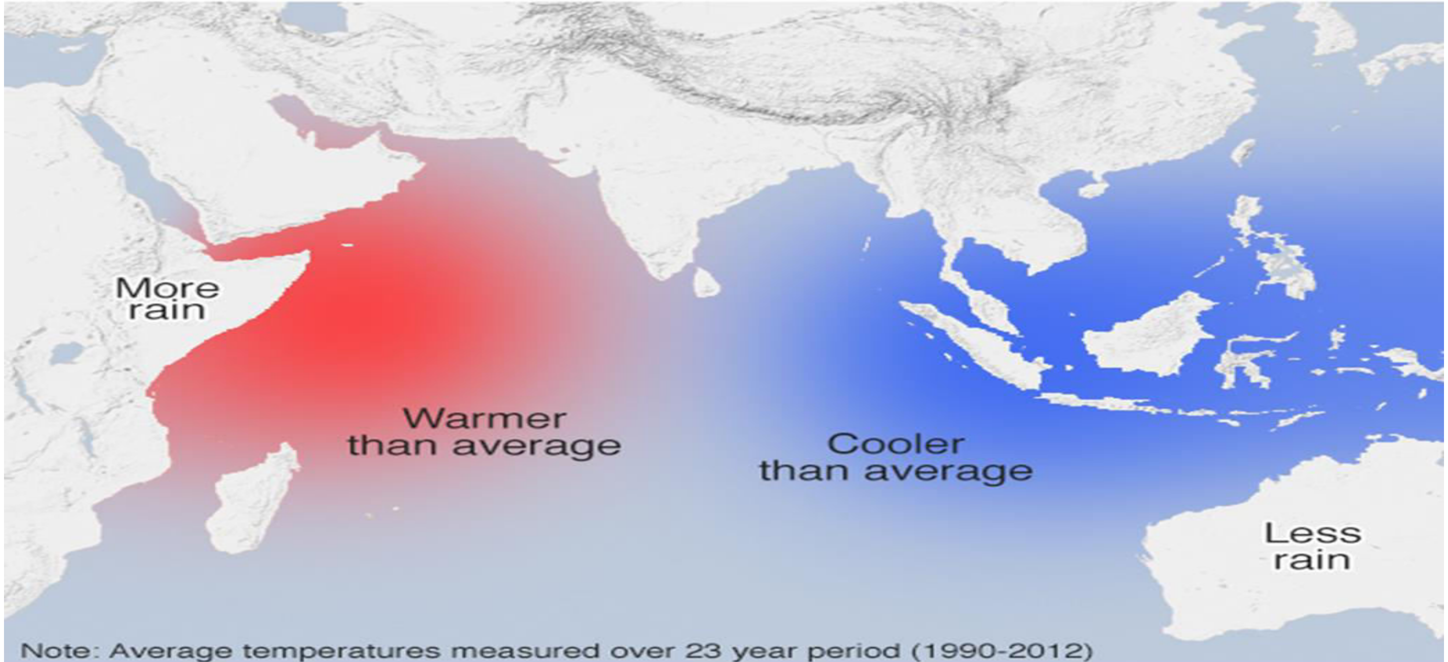
The Indian Ocean Dipole (IOD), also known as the Indian Niño, is an irregular oscillation of sea surface temperatures in which the western Indian Ocean becomes alternately warmer (positive phase) and then colder (negative phase) than the eastern part of the ocean.

The IOD involves an aperiodic oscillation of sea-surface temperatures (SST), between "positive", "neutral" and "negative" phases.

A positive phase sees greater-than-average sea-surface temperatures and greater precipitation in the western Indian Ocean region with a corresponding cooling of waters in the eastern Indian Ocean—which tends to cause droughts in adjacent land areas of Indonesia and Australia. The negative phase of the IOD brings about the opposite conditions, with warmer water and greater precipitation in the eastern Indian Ocean, and cooler and drier conditions in the west

A positive Indian Ocean Dipole means a wetter west and drier east



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SOLAR RADIATION MANAGEMENT

with GUNJAN MESHRAM

Climate engineering or climate intervention, commonly referred to as geo-engineering, is the deliberate and large-scale intervention in the Earth's climate system, usually with the aim of mitigating the adverse effects of global warming.

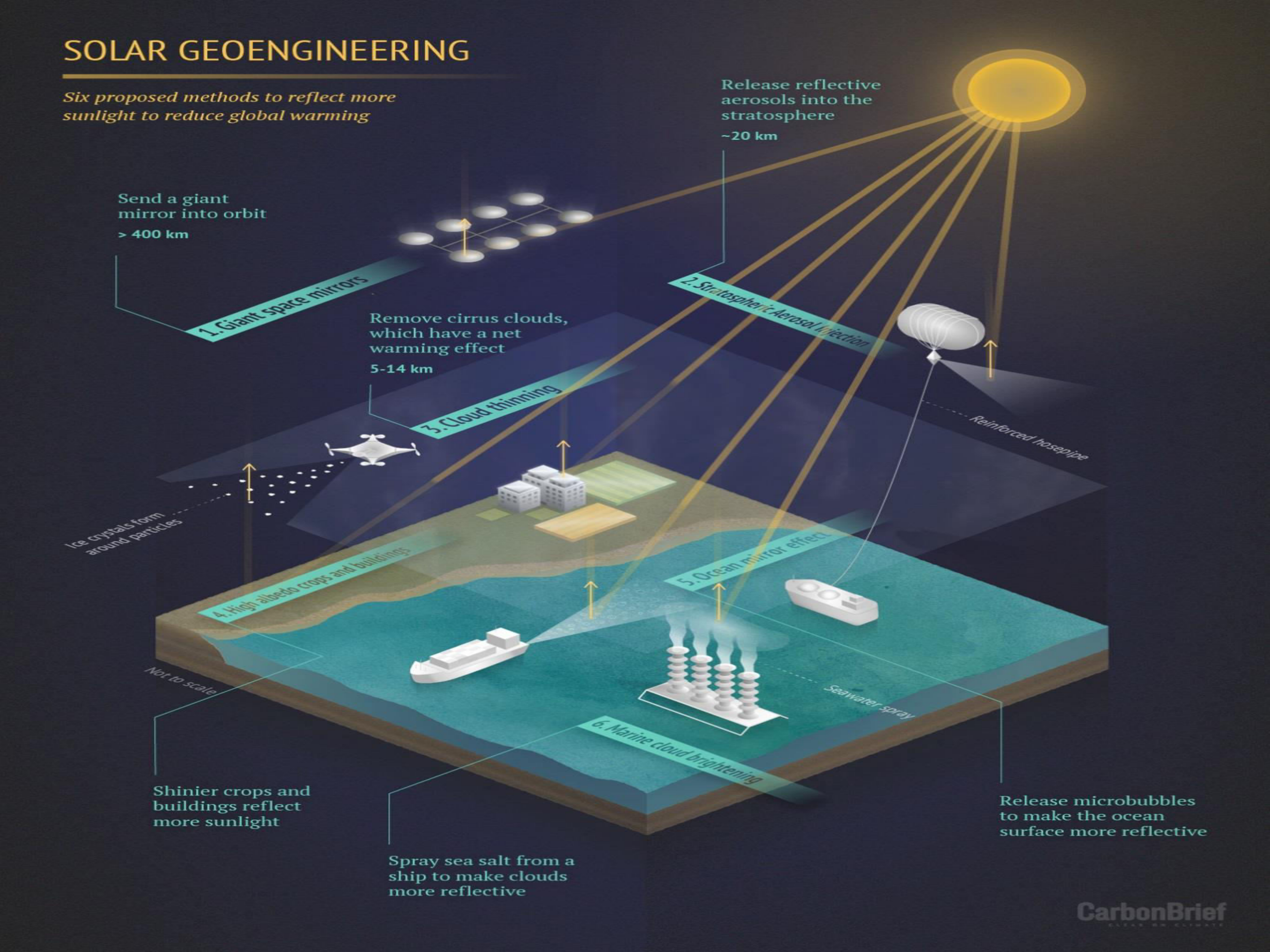
Several climate engineering strategies have been proposed. IPCC documents detail several notable ideas
These fall into two main categories:

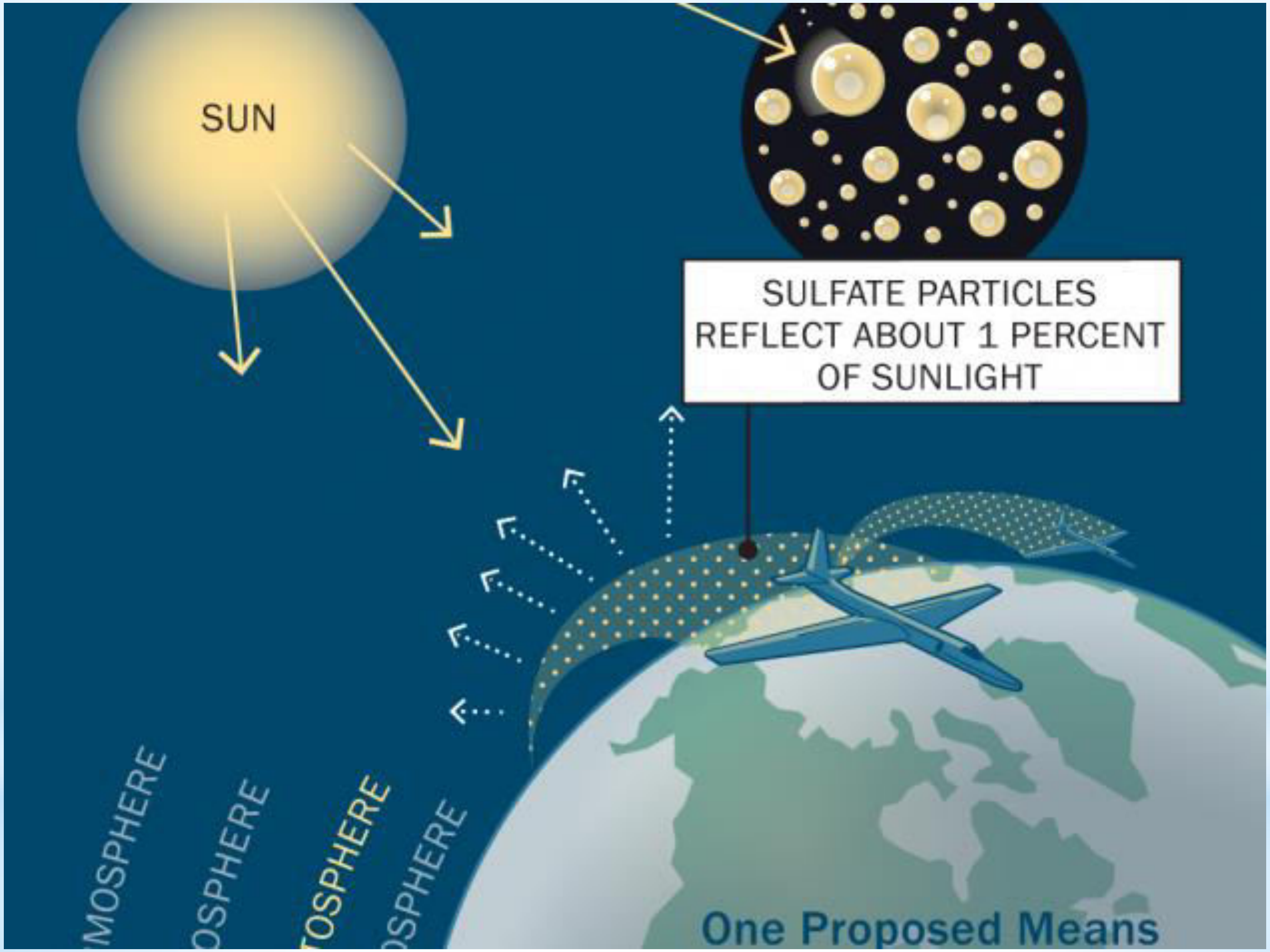
1.Solar radiation management and

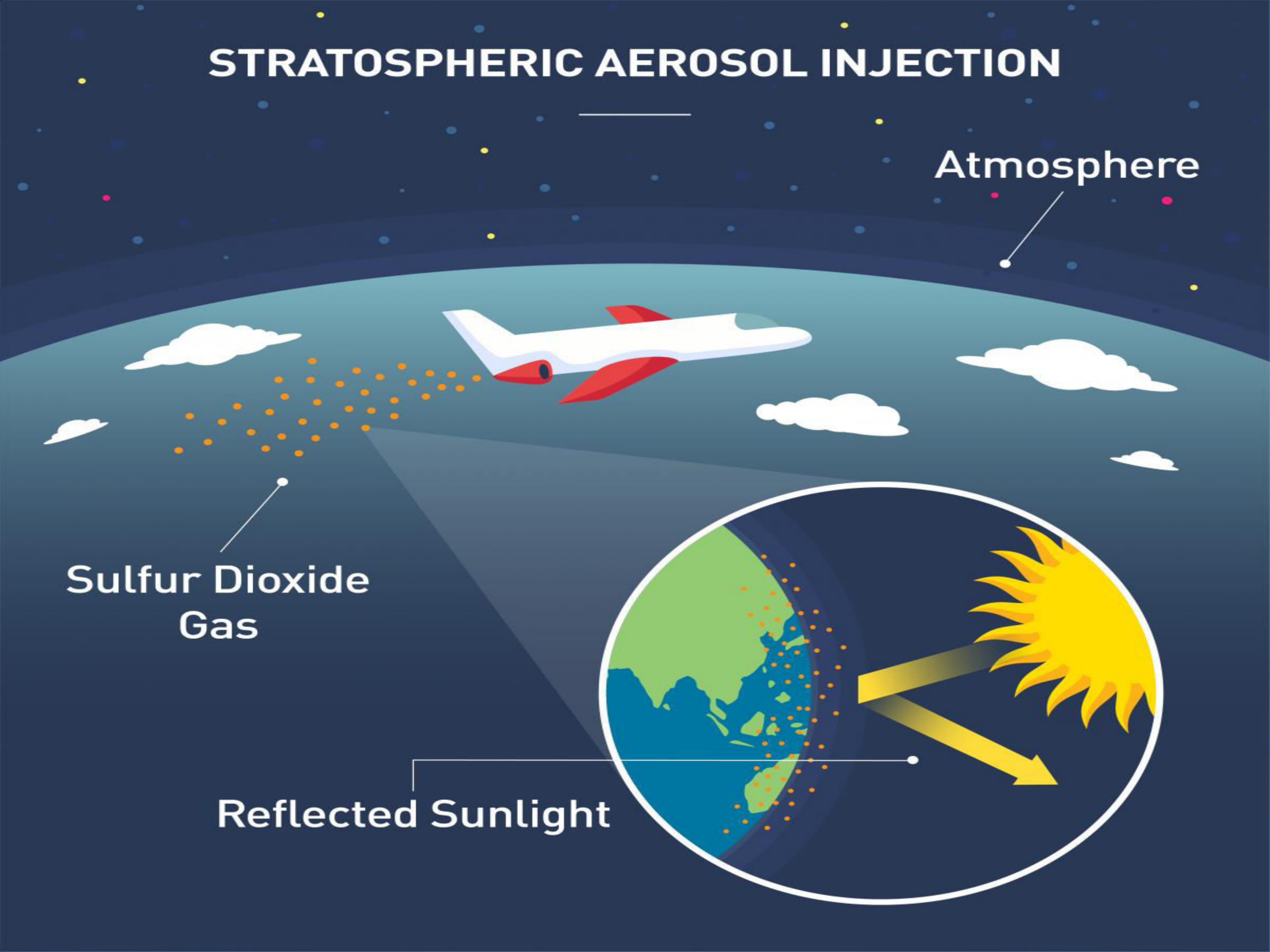
2. carbon dioxide removal from atmosphere

Solar Radiation Management

Solar radiation management (SRM) proposals are a type of climate engineering which would seek to reflect sunlight and thus reduce global warming.


SOLAR GEOENGINEERING
Six proposed methods to reflect more sunlight to reduce global warming
Send a giant mirror into orbit
> 400 km
1. Giant space mirrors
Release reflective aerosols into the stratosphere
~20 km
2. Stratospheric Aerosol Injection
Remove cirrus clouds, which have a net warming effect
5-14 km
3. Cloud thinning
Ice crystals form around particles
Reinforced hosepipe
4. High albedo crops and buildings
5. Ocean mirror effect
6. Marine cloud brightening
Seawater spray
Not to scale
Shinier crops and buildings reflect more sunlight
Spray sea salt from a ship to make clouds more reflective
Release microbubbles to make the ocean surface more reflective
CarbonBrief


SUN
SULFATE PARTICLES
REFLECT ABOUT 1 PERCENT
OF SUNLIGHT
One Proposed Means


STRATOSPHERIC AEROSOL INJECTION
Atmosphere
Sulfur Dioxide
Gas
Reflected Sunlight

Cirrus cloud thinning Cirrus clouds are high cold ice that, like other clouds, both reflect sunlight and absorb warming infrared radiation. However, they differ from other types of clouds in that, on average, infrared absorption outweighs sunlight reflection, resulting in a net warming effect on the climate. Therefore, thinning or removing these clouds would reduce their heat trapping capacity, resulting in a cooling effect on Earth's climate.

MAKING CLOUDS MORE REFLECTIVE

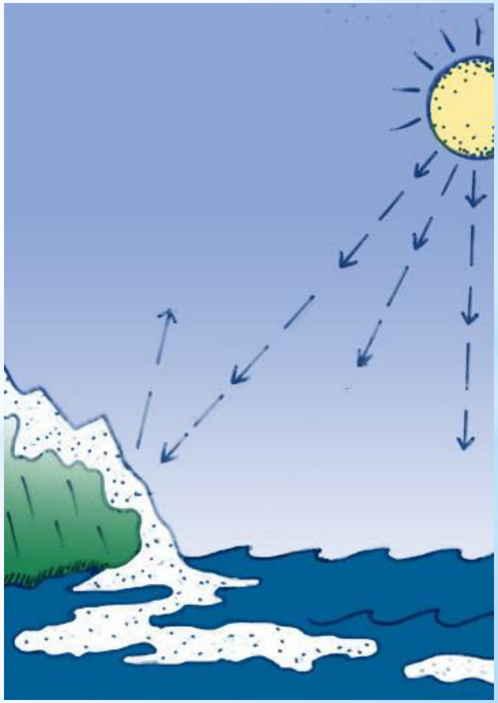
HIGH ALBEDO VEGETATION

Space mirrors are man-made satellites that are designed to change the amount of solar radiation that impacts the Earth as a form of climate engineering.
OR spreading DUST

Protecting or expanding polar sea ice and glaciers.

Snowmaking

is the production of snow
by forcing water and pressurized air
through a "snow gun,"
also known as a "snow cannon."
Snowmaking is mainly used at ski resorts
to supplement natural snow.



Cool roof/Reflective surfaces : Painting roof materials in white or pale colours to reflect solar radiation, known as 'cool roof' technology.

MAKING OCEAN MORE REFLECTIVE Micro-bubbles or sea foam are Solar Radiation Management technologies that that aim to reflect more sunlight back into space by making ocean and other water bodies’ surfaces more reflective (i.e., increasing their albedo)This could be achieved by creating tiny micro-bubbles in surface waters, or by spreading chemical foaming agents

The United Nations Framework Convention on Climate Change (UNFCCC) is an international environmental treaty addressing climate change,

United Nations Conference on Environment and Development (UNCED), informally known as the Earth Summit, held in Rio de Janeiro from 3 to 14 June 1992.

KYOTO PROTOCOL

The Kyoto Protocol is an international treaty which extends the 1992 United Nations Framework Convention on Climate Change (UNFCCC) that commits state parties to reduce greenhouse gas emissions, based on the scientific consensus that global warming is occurring and human-made CO2 emissions have predominantly caused it.

The Kyoto Protocol implemented the objective of the UNFCCC to reduce the onset of global warming by reducing greenhouse gas concentrations in the atmosphere to "a level that would prevent dangerous anthropogenic interference with the climate system" (Article 2). The Kyoto Protocol applies to the six greenhouse gases :

- carbon dioxide (CO_2),
- Methane (CH_4),
- nitrous oxide (N_2O),
- hydrofluorocarbons (HFCs),
- perfluorocarbons (PFCs), and
- sulfur hexafluoride (SF_6).

The Protocol is based on the principle of **common but differentiated responsibilities**

Flexibility mechanism

The flexibility mechanisms are

- International Emissions Trading (IET): IET allows Annex I Parties to "trade" their emissions (Assigned Amount Units, AAUs,
- Clean Development Mechanism (CDM)- Certified Emission Reductions (CERs);
- Joint Implementation (JI)- Emission Reduction Units (ERUs)

INDC

Countries first signed on to the notion of INDCs at the UN's 2013 climate negotiations in Warsaw, Poland otherwise known as COP19.

Intended Nationally Determined Contributions (INDC) are (intended) reductions in greenhouse gas emissions under the (UNFCCC)

INDC

Countries across the globe committed to create a new international climate agreement by the conclusion of the U.N. Framework Convention on Climate Change (UNFCCC) Conference of the Parties (COP21) in Paris in December 2015.

In preparation, countries have agreed to publicly outline what post-2020 climate actions they intend to take under a new international agreement, known as their Intended Nationally Determined Contributions (INDCs).

The INDCs will largely determine whether the world achieves an ambitious 2015 agreement and is put on a path toward a low-carbon, climate-resilient future.

UNFCCC), dealing with greenhouse-gas-emissions mitigation, adaptation, and finance, signed in 2016. The agreement's language was negotiated by representatives of 196 state parties at the 21stCOP at UNFCCC Paris, France, and adopted by consensus on 12 December 2015.

Aim: to keep the increase global average temperature to well below 2 °C above pre-industrial levels; and to pursue efforts to limit the increase to 1.5°C, recognizing that this would substantially reduce the risks and impacts of climate change.

- INDC
- GREEN CLIMATE FUND
- GLOBAL STOCKTAKE

Green climate fund

established within UNFCCC as an operating entity of the Financial Mechanism to assist developing countries in adaptation and mitigation practices to counter climate change. GCF is based in Incheon, South Korea.

*In 2009, developed countries committed to a goal of mobilizing jointly US$ 100 billion a year by 2020 to address the needs of developing countries and decided that a significant portion of such funding should flow through the GCF.

The Copenhagen Accord, established during the 2009 (COP-15) in Copenhagen mentioned the "Copenhagen Green Climate Fund".

fund was formally established during the COP 16 -2010 in Cancun as a fund within the UNFCCC framework

INDIA AND INDC

India, with 4.1% of emissions, ratified the Paris Agreement on 2 October 2016

To reduce the emissions intensity of its GDP by 33 to 35 per cent by 2030 from 2005 level.

- To achieve about 40 per cent cumulative electric power installed capacity from non-fossil fuel based energy by 2030, with the help of transfer of technology and low cost international finance,

including from Green Climate Fund.

- To create an additional carbon sink of 2.5 to 3 billion tonnes of CO_2 equivalent through additional forest and tree cover by 2030.

INDIA AND INDC : ISSUES AND STAND

At COP 25 of UNFCCC at Madrid, India reiterated its commitment to implement Paris Agreement in accordance with the principles of equity and common but differentiated responsibilities.

India wants balanced and integrated view of ambition that includes efforts for climate change mitigation, adaptation and means of implementation from developed country parties to developing country parties.

- FINANCE/ GCF
- IPR/ TECHNOLOGY: India is also advocating for IPR regimes that will enable global R&D collaborations for development and transfer of clean technologies

India is also looking to develop technologies to enable low carbon growth with special focus on technologies for clean generation from fossil fuels, energy management and storage systems for renewable energy.

Environmental integrity and rapid inclusive growth: Effectively implementing climate change actions, India also knows that current adaptation efforts are not affordable or practical on a universal scale. Current climate change resolution efforts put the burden on the economically disadvantaged of society without accounting for their growth and development aspirations

(ISA) is an alliance of 121 countries initiated by India, most of them being sunshine countries, which lie either completely or partly between the Tropic of Cancer and the Tropic of Capricorn.

The primary objective -to work for efficient exploitation of solar energy to reduce dependence on fossil fuels.

ISA Headquarters -the National Institute of Solar Energy (NISE) in GwalPahari, Gurugram, India

The ISA aims to pave the way or future solar generation, storage and technologies for Member countries' needs by mobilizing

over US$ 1000 billion by 2030. (helping them to fulfilltheir NDCs.)

ISA -entered into an understanding with the World Bank for accelerating mobilization of finance for solar energy

PERFORMANCE

To achieve its targets for increasing reliance on renewable energy, India is running one of the largest renewable capacity expansion programs in world (175 GW by 2022)

1. Solar (utility-scale, distributed, off-grid/mini-grid –100 GW)
2. Wind (utility-scale –60 GW)
3. Small hydro (5 GW)
4. Bioenergy (10 GW)

- National solar mission,
- solar power plants, solar parks.
- State of forest report

GREEN INDIA MISSION

One of 8 missions under the NAPCC

Aim: to respond to climate change by a combination of adaptation and mitigation measures, which would help: enhance carbon sinks

- adaptation of vulnerable species/ecosystems to the changing climate
- adaptation of forest-dependant communities

Objectives:

- Increase forest cover on 5 mha of forest/non-forest lands
- Improve quality of forest cover on another 5 mha
- Improve ecosystem services including, biodiversity, hydrological services, provisioning of fuel, fodder, timber and NTFP
- Forest-based livelihood income of about 3 MHHs
- Enhance annual CO2 sequestration by 50-60 million tonne