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Effects of Greenhouse Gas Emission

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ABSTRACT: Gases that trap heat in the atmosphere are called greenhouse gases. A greenhouse gas is a gas in an atmosphere that absorbs and emits radiation within the thermal infrared range. This process is the fundamental cause of the greenhouse effect. Since the beginning of the industrial revolution (taken as the year 1750), the burning of fossil fuels and extensive clearing of native forests has contributed to a 40% increase in the atmospheric concentration of carbon dioxide, from 280ppm in 1750 to 392.6ppm in 2012. It has now reached 400ppm in the northern hemisphere. This increase has occurred despite the uptake of a large portion of the emissions by various natural "sinks" involved in the carbon cycle. Under ongoing greenhouse gas emissions, available Earth System Models project that the Earth's surface temperature could exceed historical analogs as early as 2047 affecting most ecosystems on Earth and the livelihoods of over 3 billion people worldwide.

KEYWORDS: Greenhouse effect, Greenhouse gases, Anthropogenic emission, Kyoto Protocol, Global warming.

I. INTRODUCTION

The greenhouse effect:

- Solar radiation reaches the Earth's atmosphere – some of this is reflected back into space.
- The rest of the sun's energy is absorbed by the land and the oceans, heating the Earth.
- Heat radiates from Earth towards space.
- Some of this heat is trapped by greenhouse gases in the atmosphere, keeping the Earth warm enough to sustain life.
- Human activities such as burning fossil fuels, agriculture and land clearing are increasing the amount of greenhouse gases released into the atmosphere.
- This is trapping extra heat, and causing the Earth's temperature to rise.

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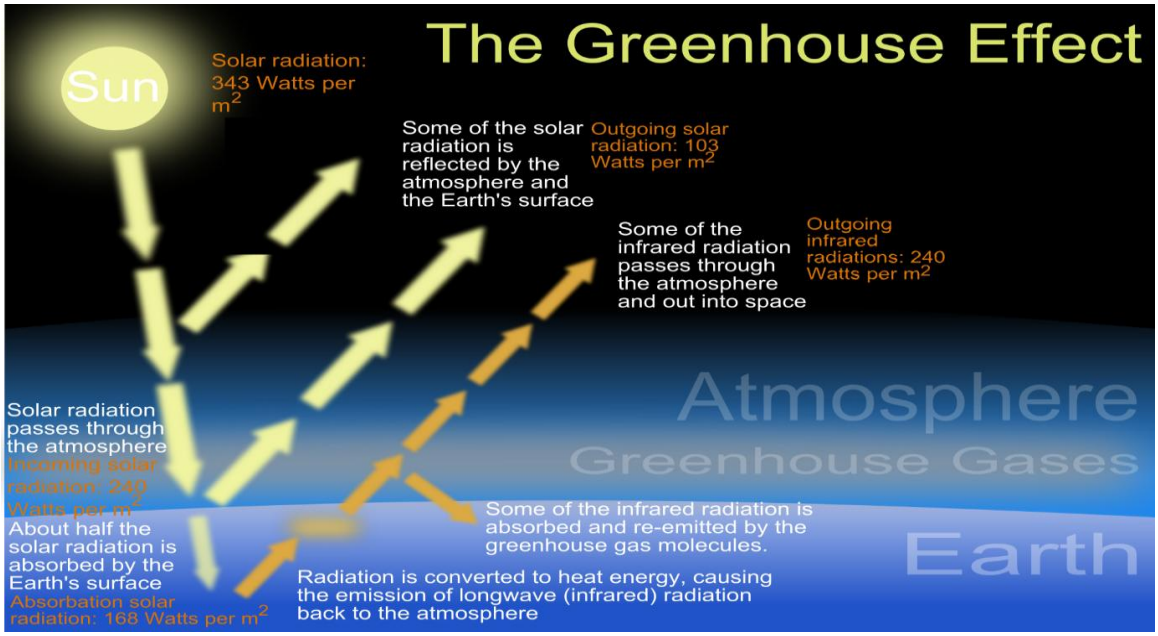

Fig. 1: Greenhouse effect

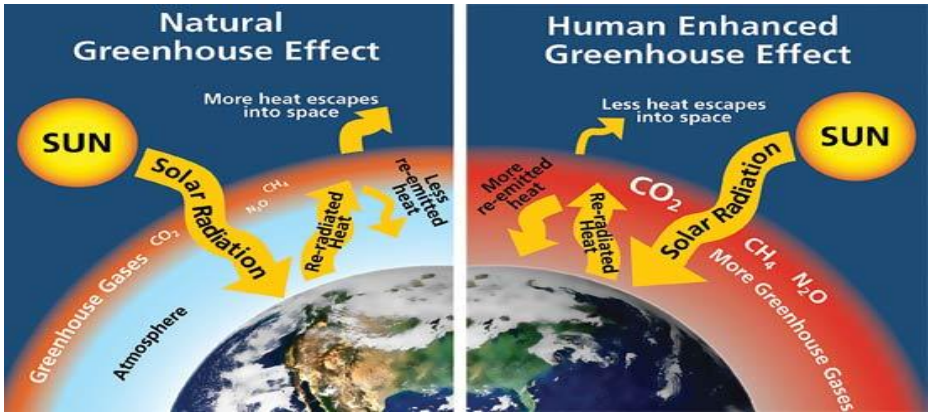

Fig. 2: Natural & human enhanced greenhouse effect

Greenhouse gases are those that can absorb and emit infrared radiation, but not radiation in or near the visible spectrum. In order, the most abundant greenhouse gases in Earth's atmosphere are:

- Water vapour (H2O)
- Carbon dioxide (CO2)
- Methane (CH4)
- Nitrous oxide (N2O)
- Ozone (O3)
- Chlorofluorocarbons (CFCs)
- Hydrofluorocarbons (HFCs)

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- Perfluorocarbons (PFCs)
- Sulfur hexafluoride (SF6)

Non-greenhouse gases:

- Nitrogen (N2)
- Oxygen (O2)
- Argon (Ar)

Between the period 1970 to 2004, GHG emissions increased at an average rate of 1.6% per year, with CO2 emissions from the use of fossil fuels growing at a rate of 1.9% per year. Total anthropogenic emissions at the end of 2009 were estimated at 49.5 gigatonnes CO2 equivalent. These emissions include CO2 from fossil fuel use and from land use, as well as emissions of methane, nitrons oxide and other GHGs covered by the Kyoto Protocol.

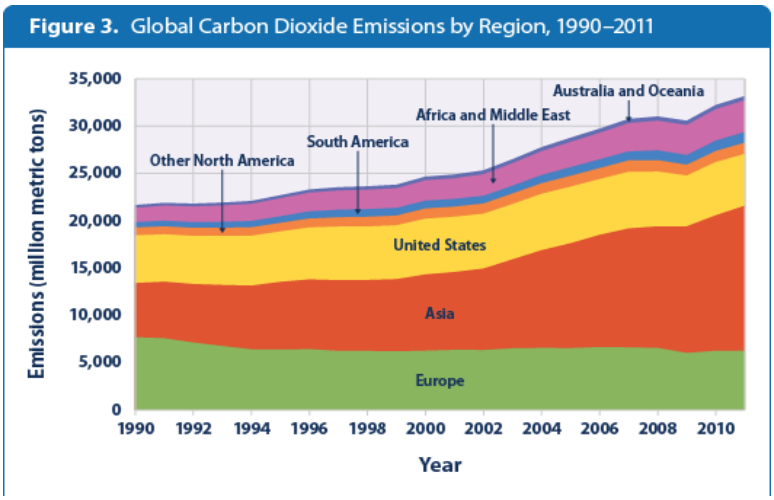

Fig. 3: Global carbon dioxide emission

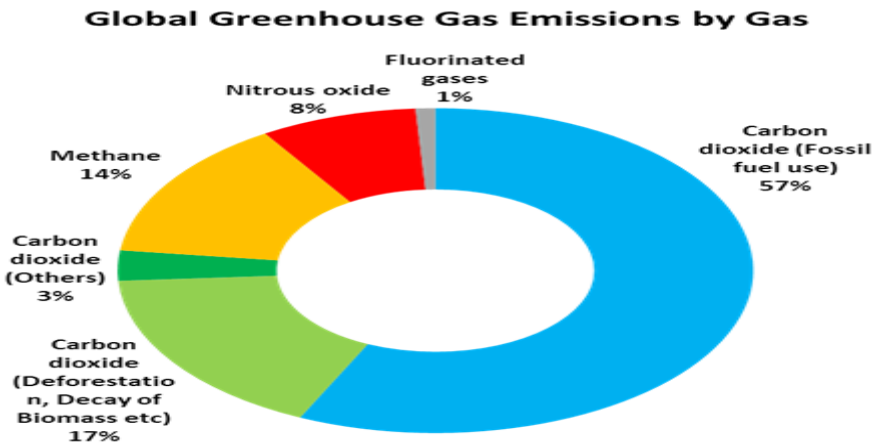

Fig. 4: Global greenhouse gas emission

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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 gases emissions, based on the premise that global warming exists and man made CO2 emissions have caused it. The Kyoto Protocol was adopted in Kyoto, Japan, on 11 December 1997 and entered into force on 16 February 2005. There are currently 192 parties to the Protocol. The Kyoto Protocol implemented the objective of the UNFCCC to fight global warming by reducing greenhouse gas concentrations in the atmosphere to 'a level that would prevent dangerous anthropogenic interference with the climate system.

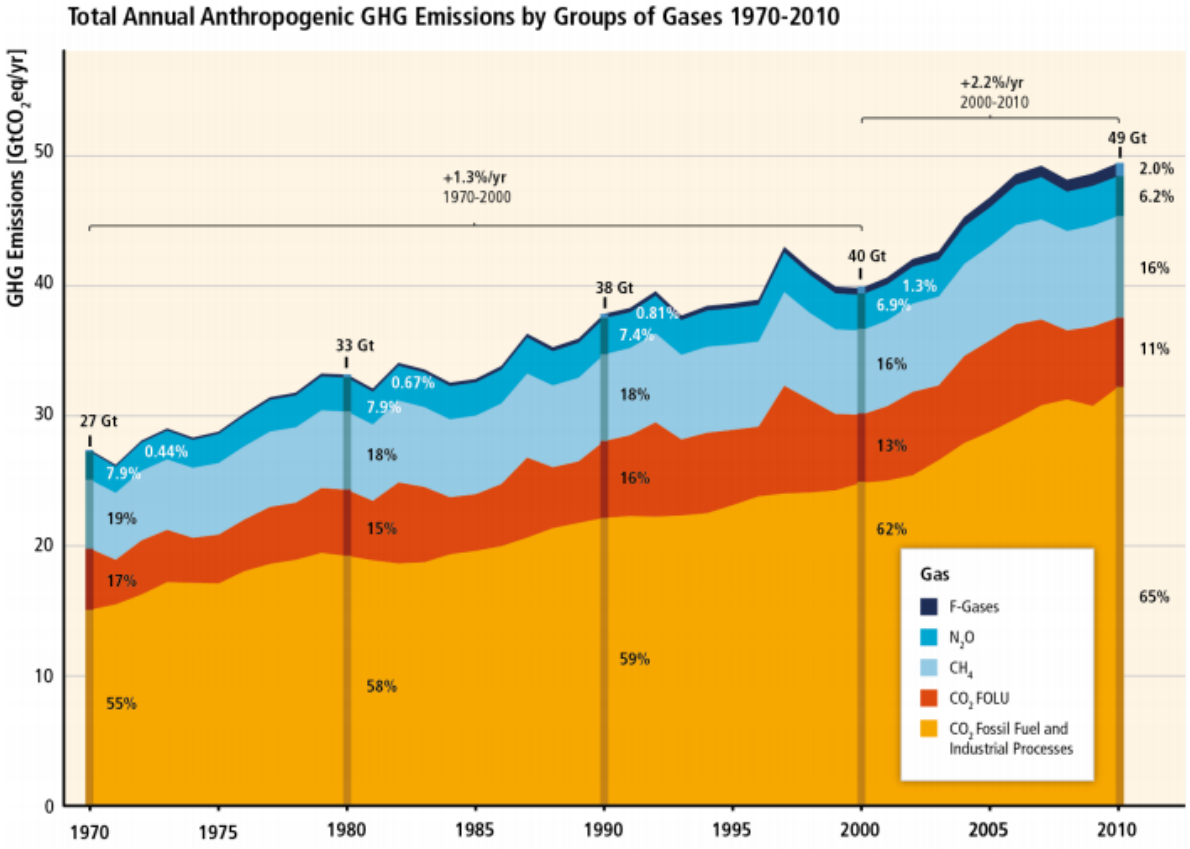

Fig. 5: Anthropogenic GHG emission

Each of greenhouse gases can remain in the atmosphere for different amounts of time, ranging from a few years to thousands of years. All of these gases remain in the atmosphere long enough to become well mixed, meaning that the amount that is measured in the atmosphere is roughly the same all over the world, regardless of the source of the emissions.

II. METHODOLOGY

- Anthropogenic carbon dioxide emissions (i.e. emissions produced by human activities) come from combustion of carbon-based fuels, principally wood, coal, oil, and natural gas.

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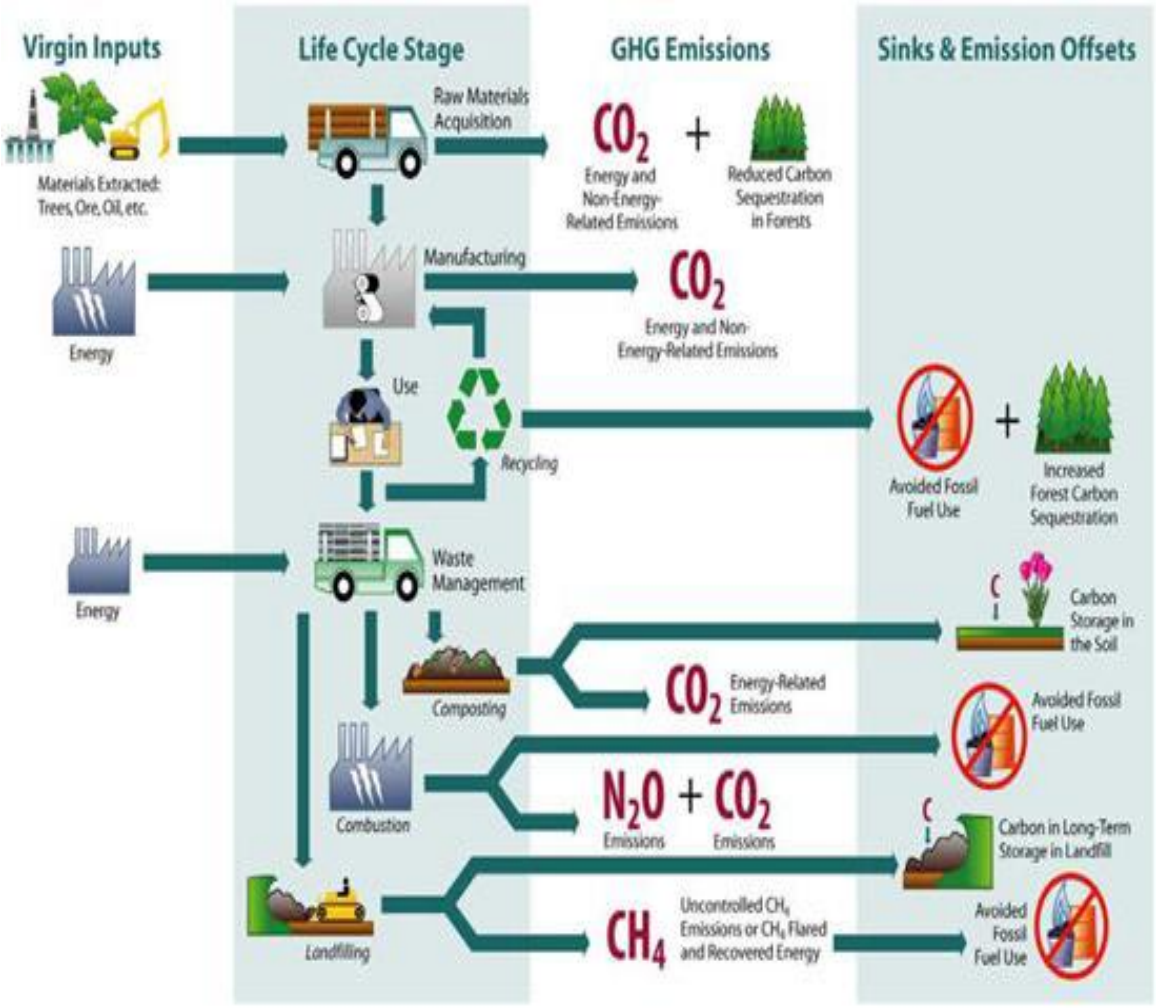

Fig. 6: Sinks & emission offsets

- The major non gas contributor to the Earth's greenhouse effect, clouds, also absorb and emit infrared radiation and thus have an effect on radiative properties of the greenhouse gases. Clouds are water droplets or ice crystals suspended in the atmosphere.
- Use of chlorofluorocarbons (CFCs) in refrigeration systems, and use of CFCs and halons in fire suppression systems and manufacturing processes.

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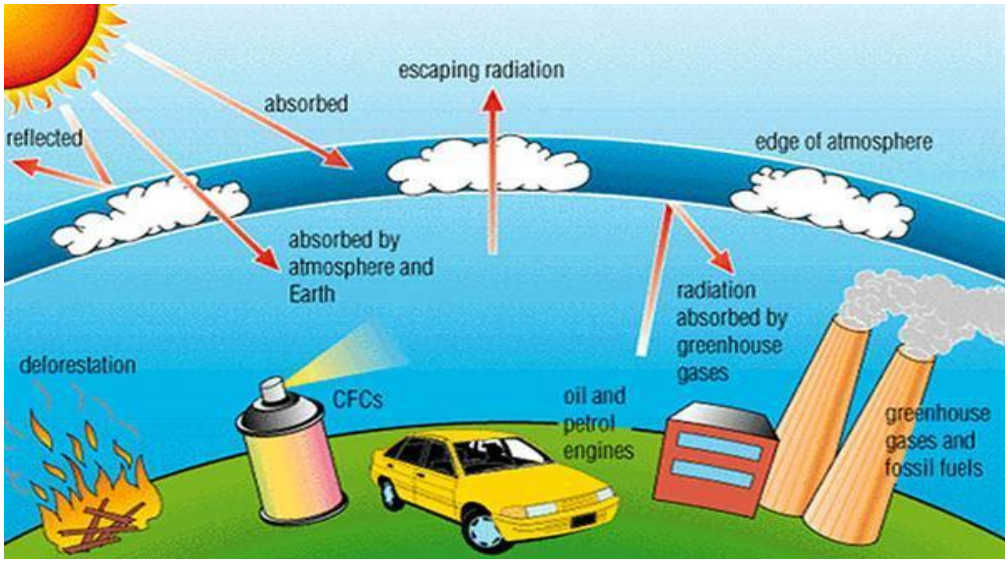

Fig. 7: Deforestation, CFCs & fossil fuels

- Agricultural activities, including the use of fertilizers, that lead to higher nitrous oxide concentrations.
- Carbon dioxide enters the atmosphere through burning fossil fuels (coal, natural gas and oil), solid waste, trees and wood products, and also as a result of certain chemical reactions (e.g. manufacture of cement).
- Methane is emitted during the production and transport of coal, natural gas, and oil. Methane emissions also result from livestock and other agricultural practices and by the decay of organic waste in municipal solid waste landfills.

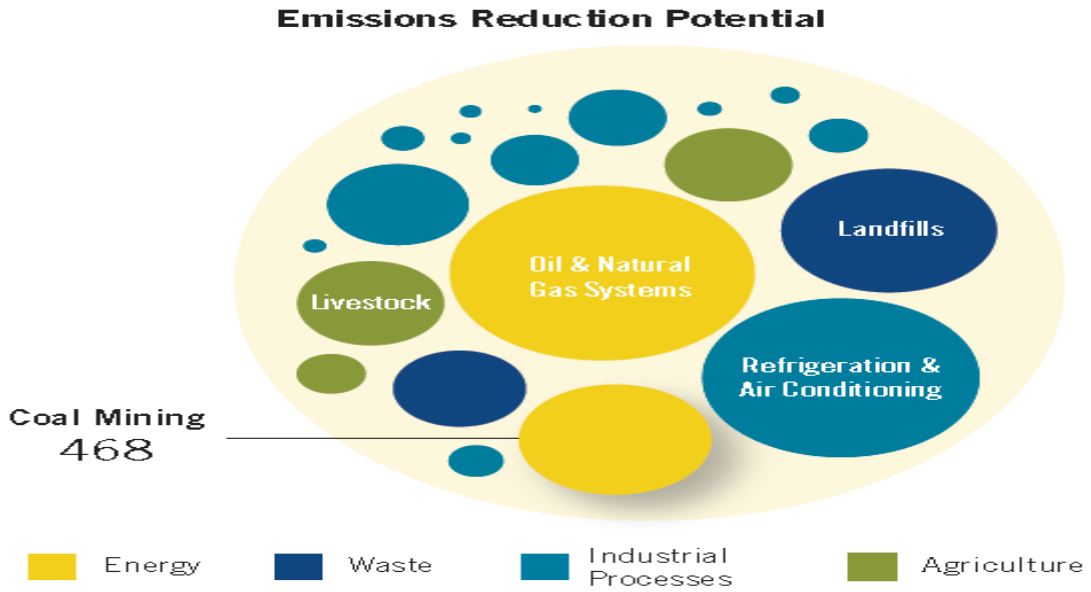

Fig. 8: Livestock, oil and natural gas systems, Landfills & refrigeration and air conditioning

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- Nitrous oxide is emitted during agricultural and industrial activities, as well as during combustion of fossil fuels and solid waste.
- When ranked by direct contribution to the greenhouse effect, the most important are:

Compound	Formula	Contribution(%)
Water vapour and clouds	H2O	36-72%
Carbon dioxide	CO2	9-26%
Methane	CH4	4-9%
Ozone	O3	3-7%

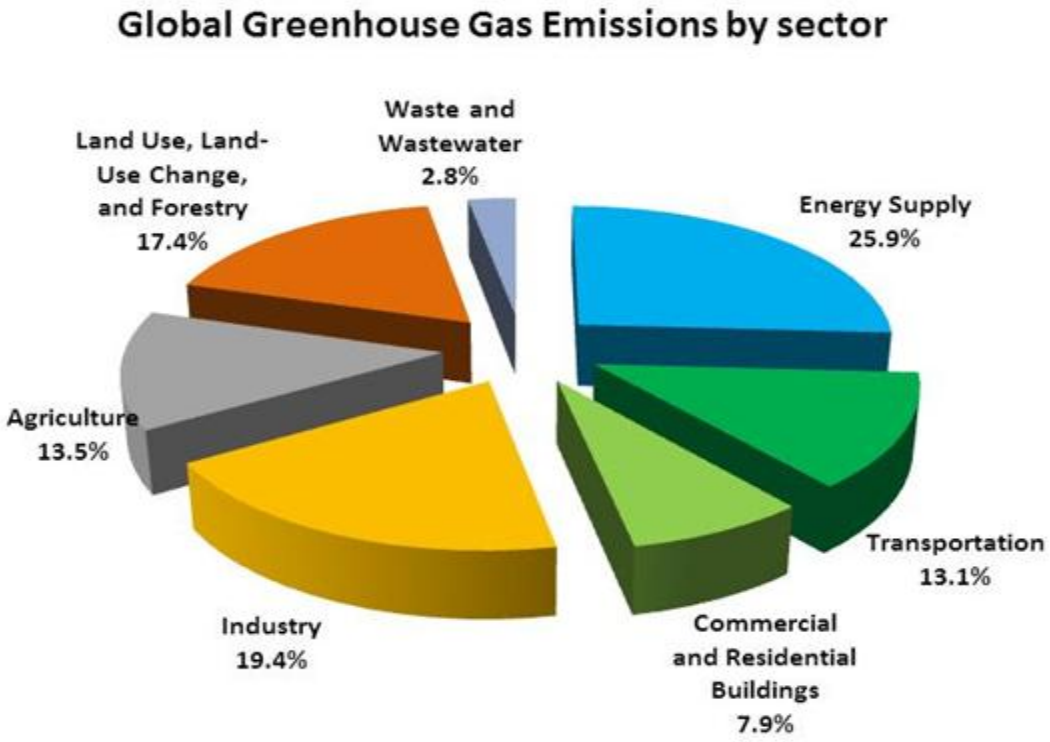

Fig. 9: Global greenhouse gas emission

III. RESULT

The release of GHGs and their increasing concentration in the atmosphere are already having an impact on the environment, human health and the economy. These impacts are expected to become more severe, unless concerted effects to reduce emissions are undertaken.

Environmental impacts:

- Overall average annual temperatures are expected to increase.
- Snow, sea ice and glacier coverage will decrease because of higher temperatures, resulting in rising sea levels and increased coastal flooding. Rising temperatures will also thaw permafrost in the Arctic.

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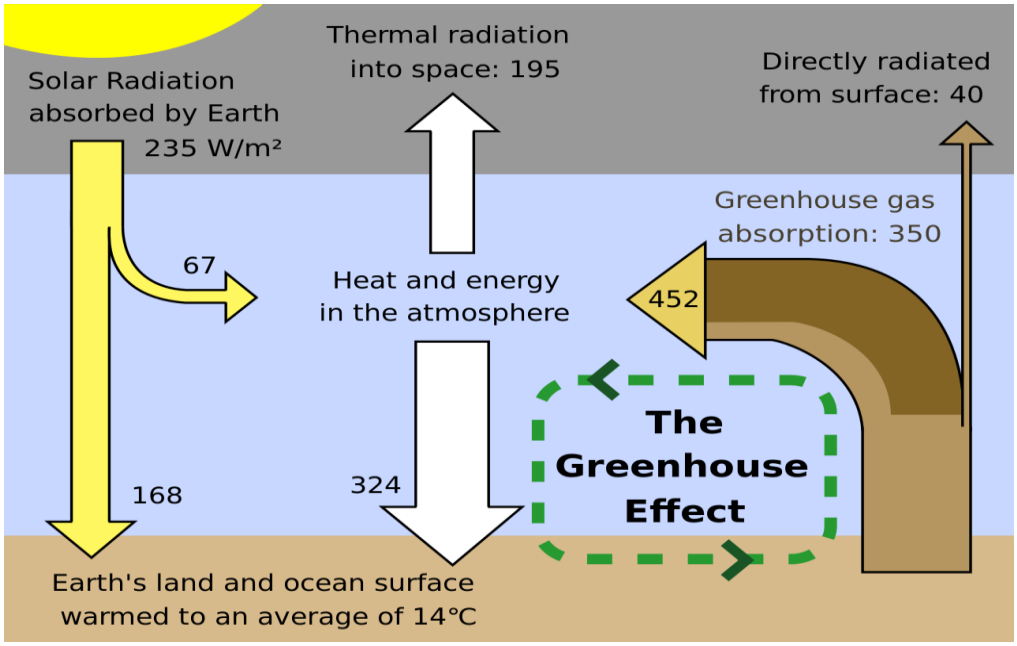

Fig. 10: The greenhouse effect

- Heat waves are likely to increase in frequency and severity, resulting in higher risks of forest fires.

Human health impacts:

- Higher temperatures and more frequent and severe extreme weather events may increase the risk of deaths from dehydration and heat stroke, and of injuries from intense local weather changes.
- There may be a greater risk of respiratory and cardiovascular problems and certain types of cancers, as temperatures rise and exacerbate air pollution.
- The risk of water, food, vector and rodent-borne diseases may increase.

Economic impacts:

- Agriculture, forestry, tourism and recreation may be affected by changing weather patterns.
- Human health impacts are expected to place additional economic stress on health and social support systems.
- Damage to infrastructure (e.g. roads and bridges) caused by extreme weather events, thawing permafrost and rising sea levels is expected to increase, impacting local populations and resource development.

IV. CONCLUSION

Although it is already too late to stop climate change completely, making changes now could prevent it getting much worse. Reducing the flow of the greenhouse gases that spur global warming could prevent up to 3 million premature deaths annually by the year 2100. We must contain and then reduce our greenhouse gas emissions so that our farmers, graziers and fisherman have the best chance to feed the world, and our industries have the best opportunities for sustainable growth and new green markets.

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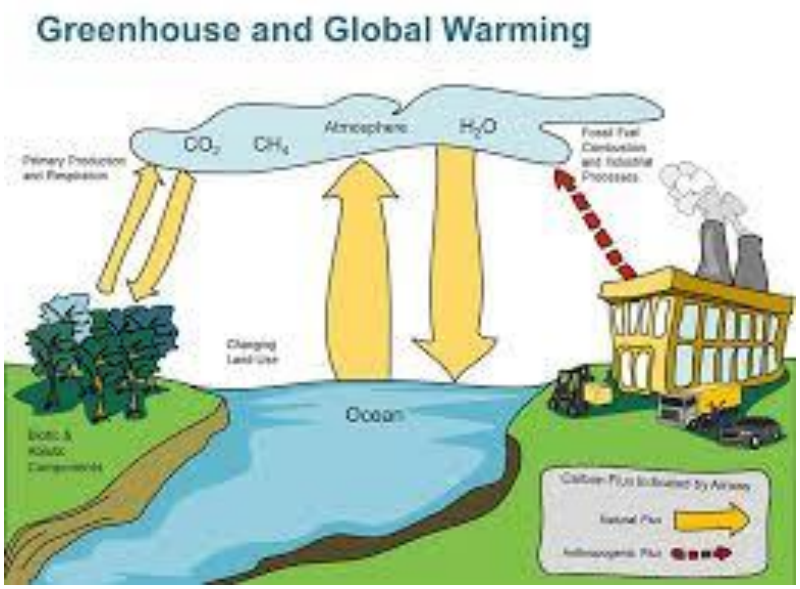

Fig. 11: Greenhouse & global warming

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