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The socio-political impact of UN's aim in achieving and targeting a universal 'Net Zero' goal; An in-depth analysis

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ABSTRACT

It is important that all nations adhere to Net Zero goal to counteract problems that have risen through climate change. There are various measures whereby sustainability and protection of the environment can be protected. These measures range from reduction in dependence on fossil fuels to saving glaciers as well as adoption of environment protection methods on agriculture, manufacturing and the service industry . The cost involved in not achieving Net Zero will be phenomenal in case it is not addressed.

Keywords; Net Zero, Carbon Sinks, Emissions, Greenhouse Gases, Environmental Degradation, Sustainable Development Goals, Climate Change, Conservation, Mitigation

Research Question; The paper would attempt to analyse the concept of a universal 'Net Zero'. How would this impact developing and developed economies? What are the socio-economic impact of such an aim? How are the governments of various types of economies expected to react and form policy measures? Who are the stakeholders involved? Are the roles different for developed and developing economies? These and similar questions would be attempted in the course of the paper.

Introduction

Net Zero target is known as "carbon neutrality". "It is a state in which a country's emissions are reimbursed by the absorption and removal of greenhouse gases from the atmosphere. It also suggests that reduction of carbon emissions to a diminutive amount such that whatever remains can be absorbed and easily stored by nature. They can also be mitigated by carbon dioxide removal measures ultimately leaving zero in the atmosphere."(UN SDG)

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Fig 1-Visual Representation of Net Zero Emission

Source-https://sustainability-speakers.com/news/top-10-lists/best-net-zero-speakers-to-hire

Net Zero in reality, is a balance between the amount of greenhouse gases (GHG) that's produced and the amount that's removed from the atmosphere. It involves both emission reduction and emission removal. The reason through which it has become extremely vital is due to the unparalleled impact of 'climate change'. "Evidence has declared that the warmest twenty years have taken place in the last twenty two years", according to the World Metrological Organisation and the warmest four amongst them were between 2015 and 2020.The global average temperature is currently 1.2^0C. This is higher than it was in the pre-industrial era. The reason that the pre industrial era is taken into consideration is because since industrialisation has begun, the use of fossil fuels have increased manifold. The utilisation of these fuels since the 18^{th} century have emitted an excess amount of carbon in the atmosphere.

As a large number of countries have decided to undertake the path of development in the same manner that had been done by other countries. It has resulted in increased use of fossil fuels leading to high global temperatures.

A degree does not sound so alarming but in reality this one degree has already resulted in a negative impact on the world. This one degree increase has resulted in heatwaves, floods , severe storms, loss of polar ice and rising sea levels. This is likely to worsen and the prediction is that by 2100, the increase could be as much as 2. 7^0C per annum

2) Definition

To gain a comprehensive understanding of the importance of 'Net Zero' it would be necessary to examine the large number of definitions that are available under Sustainable Development Goals(SDGs).The final goal is to seek to transform the world:

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- eradicate poverty and inequality

- safeguard the planet

-ensure that all beings relish the benefits of good health, justice and prosperity.

It also implies that development needs to take place in a way that meets the needs of the present without compromising future generations. It is an effort in building an inclusive, sustainable and resilient future for people and the planet.

Fig 2.1-Visual Representation of the SDG Goals adopted by the UN

Source- https://trellis.net/article/why-un-sdgs-are-critical-climate/

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2.1 SDG Goals

On 1st January, 2016 ,these 17 SDGs were adopted by world leaders. “These are also known as global goals and are unique in that they call for action by all countries poor, rich and middle income to promote prosperity while protecting the planet” (UN SDG 2016) .

It is imperative that ending poverty must accompany economic growth. This addresses a range of social needs that include education, health, social protection and job opportunities tackling climate change and environmental protection at the same time.

These goals are not legally binding to countries but they are expected to establish a national framework for their achievement. In the process, countries would ensure quality, accessibility and accurate data collection.

A continuous check on these would eventually achieve the 2030 SDG agenda.

2.2 Climate Change

The above refers to long term shifts in temperature and weather patterns. This might have been a natural phenomena but has been adversely effected by human activities.

Since 1800, *human activities have been the main driver of climate change*. Burning of fossil fuels has generated greenhouse gas emissions. This has led to long-term shifts in temperature and weather patterns that have been primarily caused by human activity. Rising sea levels and loss of biodiversity are factors that have harmed the environment economy and health. The impact of the earth’s climate is seen in

-changing temperature

- precipitation patterns

-increases in ocean temperatures

-sea levels and acidity.

- intense drought

-water scarcity,

-severe fire

-flooding

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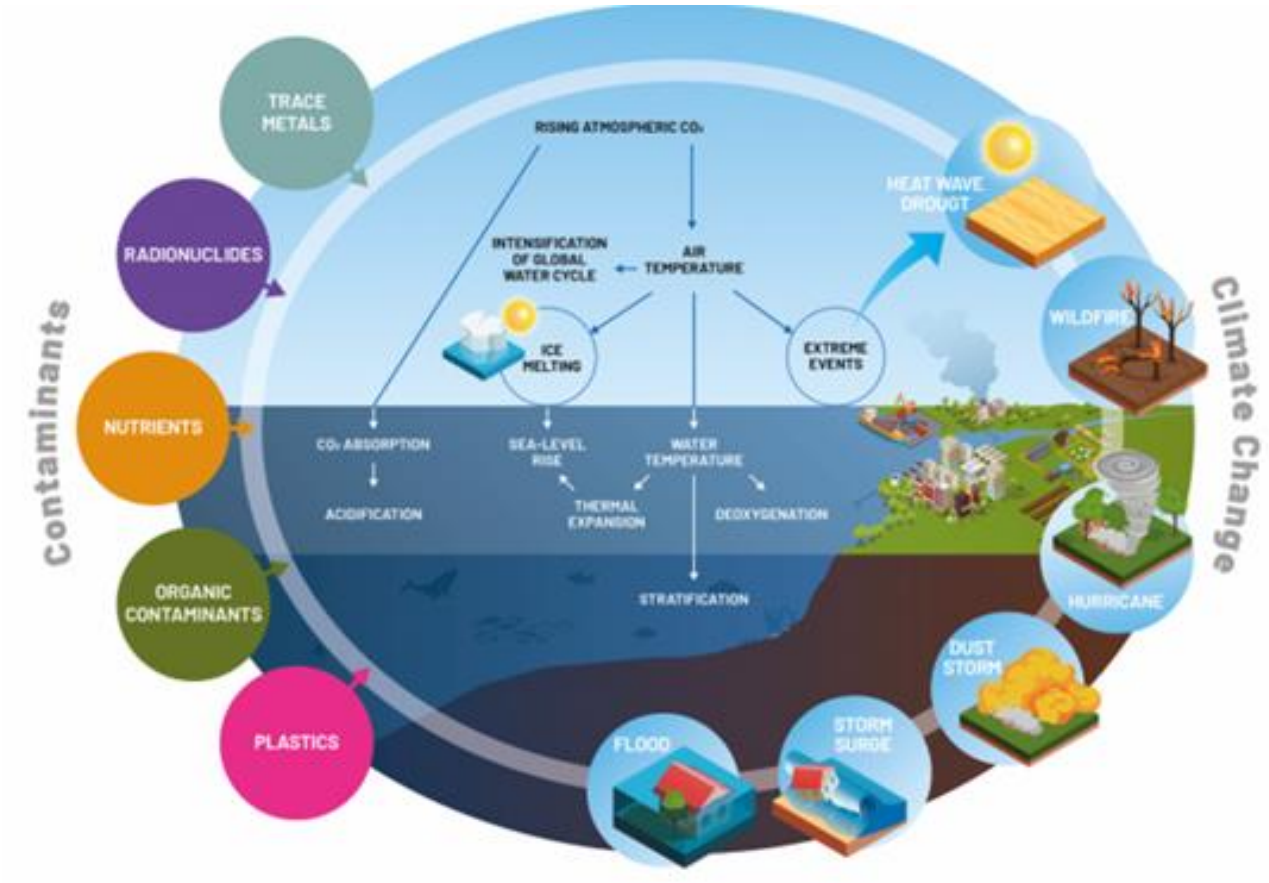
- declining biodiversity

The decade (2011-2020) was the warmest on record due to higher usage of fossil fuels.

Fig 2.2-Visual Representation of Climate Change



Source-http://www.gesamp.org/work/groups/wg-45-ghg-impacts-on-contaminants-in-the-ocean

2.3 Net Zero

This basically means a state in which the greenhouse gases that enter into the atmosphere are going to be balanced by removal of these gases by countries of the world. The reason that the word 'Net' has been added to the word 'Zero' because it indicates a balance between greenhouse gases that are emitted and gases that are removed. There needs to be a balance between anthropogenic emissions by various sources and removal of the same from the atmosphere.It is extremely difficult to completely do away with the ***emission of gases***. Thus, an effort should be made as far as possible to remove poisonous gases from the atmosphere.

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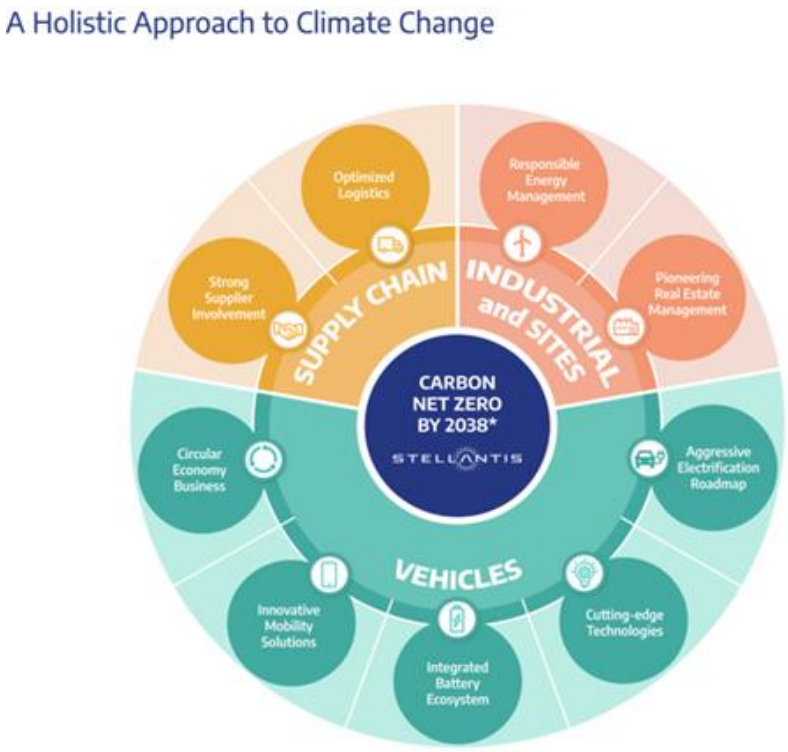
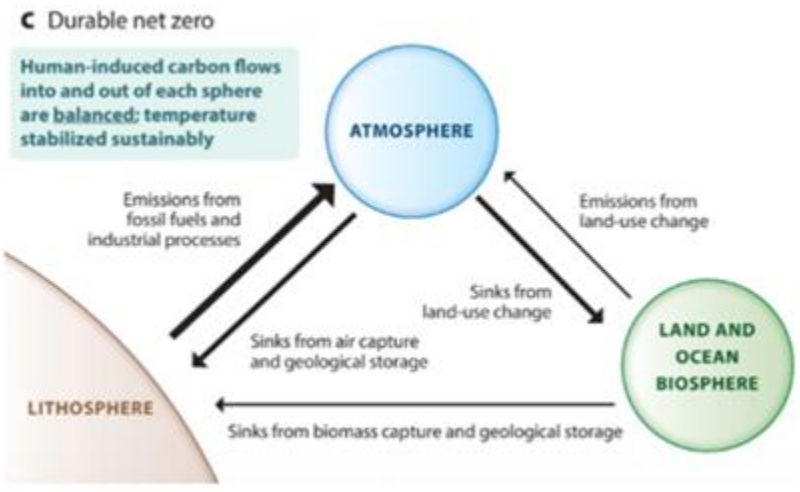
Fig 2.3.1-Visual Representation of Net Zero



Source-https://www.stellantis.com/en/responsibility/carbon-net-zero-strategy

Fig 2.3.2-Representation of Human Induced Carbon Flows



Source -https://netzeroclimate.org/what-is-net-zero-2/

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3) Net Zero goals attempted to being realised by developed economies

The Net Zero economy has recently emerged as a pivotal way to:

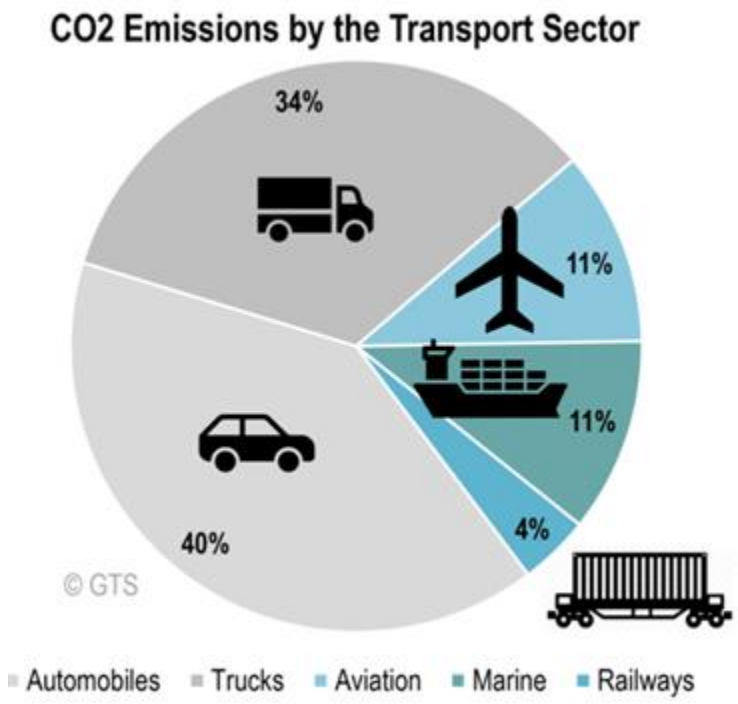
1) Conserve the environment

2) Mitigate health issues

3) Address sustainable development goals

One of the critical factors that have been shown to contribute to greenhouse gas emissions has been automobiles. “Industrial sectors such as manufacturing, coal, energy, cement, iron and chemicals immensely contribute to carbon emissions released into the atmosphere. The transportation industry contributes significantly to greenhouse gas emissions(GGE)”(a study by Giuliano et al.(2021)). The transportation sector accounted for 28% of GGE and 62%of the emissions are from internal combustion engines.(Logan et al,2020)

Fig 3.1-GGE emissions by Transport Sector



Source-https://transportgeography.org/contents/chapter4/transportation-and-environment/greenhouse-gas-emissions-transportation/

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The automobile industry according to the United Nations Intergovernmental Panel on Climate Change,(UNIPCC, 2021)has stated that 23% arises from this sector.

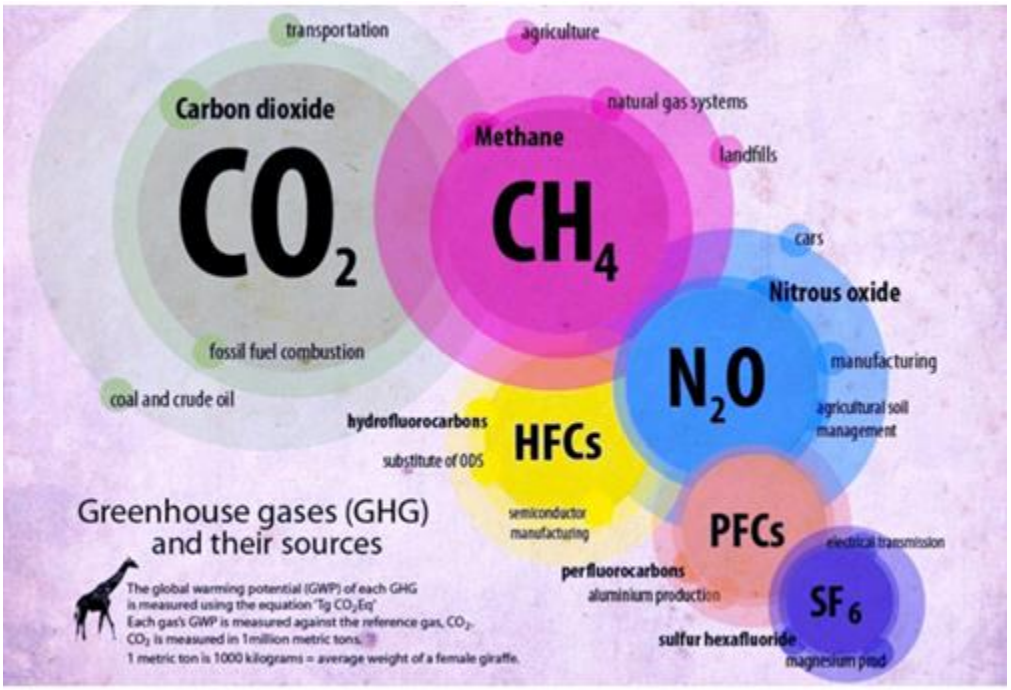
The concept of Net Zero strategy is in its infant stage presently. Various industry stakeholders in both developed and developing economies like suppliers, consumers and investors are figuring out technology that would help in reducing carbon footprints.

It is important to first identify those industry and areas which are enhancing the GGE's in the world. The extent that is being emitted by developed and developing economies. As well as the financial implication of adoption of this technology.

3.1 Identifying Industries that emit maximum GGEs

The *energy sector* is a critical emission hotspot that contributes to GHJ emissions. The process that is being adopted by them involves burning of fossil fuels that results in release of substantial amount of CO_2 and other pollutants into the atmosphere.

Fig 3.2-Visual Representation of Greenhouse Gases(GHGs)



Source-https://www.change-climate.com/Greenhouse_Gases.htm

CO_2 is emitted from:

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1) Coal(40%)

2) Oil(32%)

3) Natural Gas(21%)

4) Cement(5%)

5) Flaring and other small sources(2%)

In developed countries like the United States, the largest source of greenhouse gas emission is by burning of fossil fuels for:

1) Electricity

Generating electricity by exhaustion and burning of fossil fuels such as coal, oil and gas is a key cause of the release of harmful greenhouse gas emissions like carbon dioxide($C0_2$) and nitrous oxide(N_2O) that confine the heat received by natural source of sunlight.

2) Heat

Heat consumption from harmful sources that depend on the ignition of fossil fuels has been a major contributor in the significant increase of greenhouse gases(GHGs) in the atmosphere.As fossil fuels are the primary source of energy for heat generation in domestic households, power plants and industries, they let out a large amount of carbon dioxide(CO_2), a gas already excessively present into the atmosphere.

Moreover, the process of extracting, transporting and utilisation of natural gas for heating purposes releases additional harmful contenders in the atmosphere such as methane(CH_4), a gas which contributes significantly more than carbon dioxide(CO_2) in heat generation.

3) Transportation

Research depicts how over 94% of the fuel used in the smooth functioning of vehicles such as cars, trucks, ships and trains is petroleum based which means and due to the components of gasoline and diesel being prevalent, it results in direct emission of greenhouse gases(GHGs).Through the burning of petroleum based fuel, it releases gases such as carbon dioxide(CO_2) which further cause damage to the atmosphere.

4) Manufacturing

Overproduce, wastage and severe dependency on fossil fuel ignition have been the three foundational pillars upon which the practice of manufacturing has been established.Most

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emissions in this sector arise from the chemical and refining industries.For example- the practice of chemical manufacturing emits nitrous oxide(N_2O) which is more hazardous than the release of CO_2 as it possesses more potential to contribute into the disaster of global warming.

5) Construction(Cement and similar material)

Construction activities such as production and utilisation of materials such as cement and steel leave behind a significantly large carbon footprint. Globally, construction activities contribute approximately 33% of greenhouse gas emissions(GHGs).Cement, a key contributor in emissions release due to the various chemical reactions involved in its production. The construction of buildings involve land clearing through deforestation, altering the natural landscape resulting in release of carbon from vegetation and soil.

6) Agriculture

The agrarian practices such as manure and soil management in anaerobic conditions releases GHG emissions of gases like nitrous oxide and methane which possess the 25% more potential of becoming a key player in global warming than other gases like carbon dioxide.The process of burning residues in agricultural fields releases GHGs which increases global warming.

Though CO_2 makes up the vast majority of gas emissions the other chemicals are methane(CH_4) and nitrous oxide(N_2O).These gases are released during the combustion of fossil fuels such as *coal*, *oil* and *natural gas*.

The largest source of methane(CH_4) are :

1) Agriculture

2) Fossil Fuels

3) Landfill waste

4) Production and Transport of Coal, Natural Gas and Oil

Sources of nitrous oxide(N_2O), this gas is emitted during:

1) Agricultural

2) Land use

3) Industrial activities

4) Combustion of fossil fuels and solid waste

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5) Treatment of waste water

4.) Measures to increase 'Carbon Sink' to Neutralise Impact of Global Warming

Developed economies have developed 'carbon sinks' which absorb more carbon dioxide from the atmosphere each year than they emit. Carbon sinks are natural or artificial carbon sequestration process that removes a greenhouse gas.

Some of the world's largest areas where absorption of carbon dioxide is and can take place are

-Oceans: They store a quarter of the world's carbon emission. While they are known as the "lungs of the planet", they also prove to be one of the major key players in the global carbon cycle, acting as one of the largest carbon sinks. They absorb 25% of the detrimental carbon dioxide(CO_2) released into the atmosphere by hazardous human activities such as burning of fossil fuels, deforestation and various other industrialisation processes. As the rising CO_2 acidifies seawater, it reduces the positive impact of the "lungs of the earth" in stabilizing the climate.

Fig 4.1-Oceans

https://www.weforum.org/stories/2023/07/

-Forest: They capture almost 16 billion tonnes of carbon dioxide each year. As natural green shields, NASA satellite depicts how the forests follow through on their pivotal role of shielding the world from excessive carbon emissions by absorbing 15.6 billion tonnes of CO_2 per year. Though the natural disasters that occur in forests such wildfires and deforestation due to human activities undo all the corrective measures forest perform by releasing almost half as much approximately 8.1 billion tonnes back into the atmosphere. Therefore it is pivotal to preserve woodlands and their integral properties that regulates CO_2 in a responsible manner

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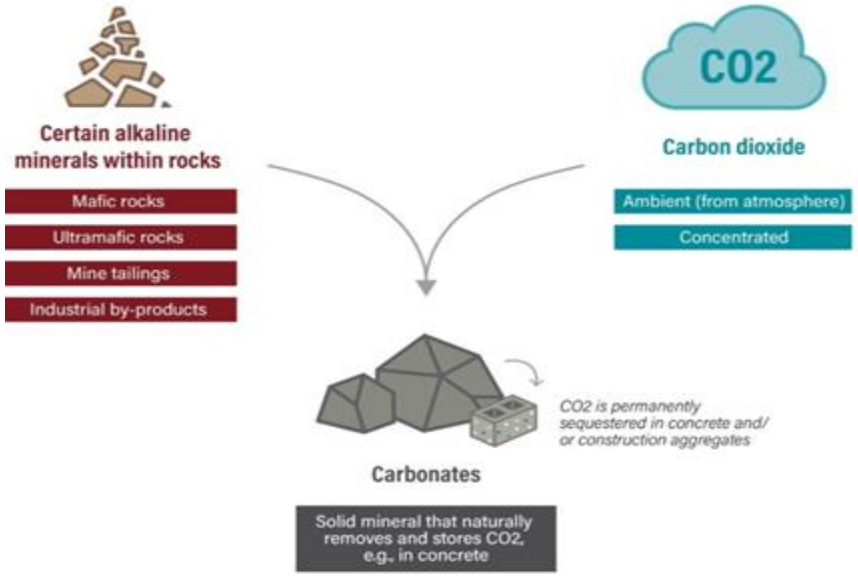
Fig 4.2-Forests

https://www.weforum.org/stories/2023/07/

-**Soil and Rock**: Carbon is naturally absorbed by certain types of rocks through a process known as carbon mineralization as the soil has great carbon absorbing properties which can be verified as scientists estimate that the soil can withhold 2500 billion tonnes of carbon. The evolution of various sustainable practices such as sustainable farming methods of crop rotation further contribute in the withholding of harmful emissions.

Fig 4.3-Visual Representation of Carbon in Soil and Rocks



https://www.weforum.org/stories/2023/07/

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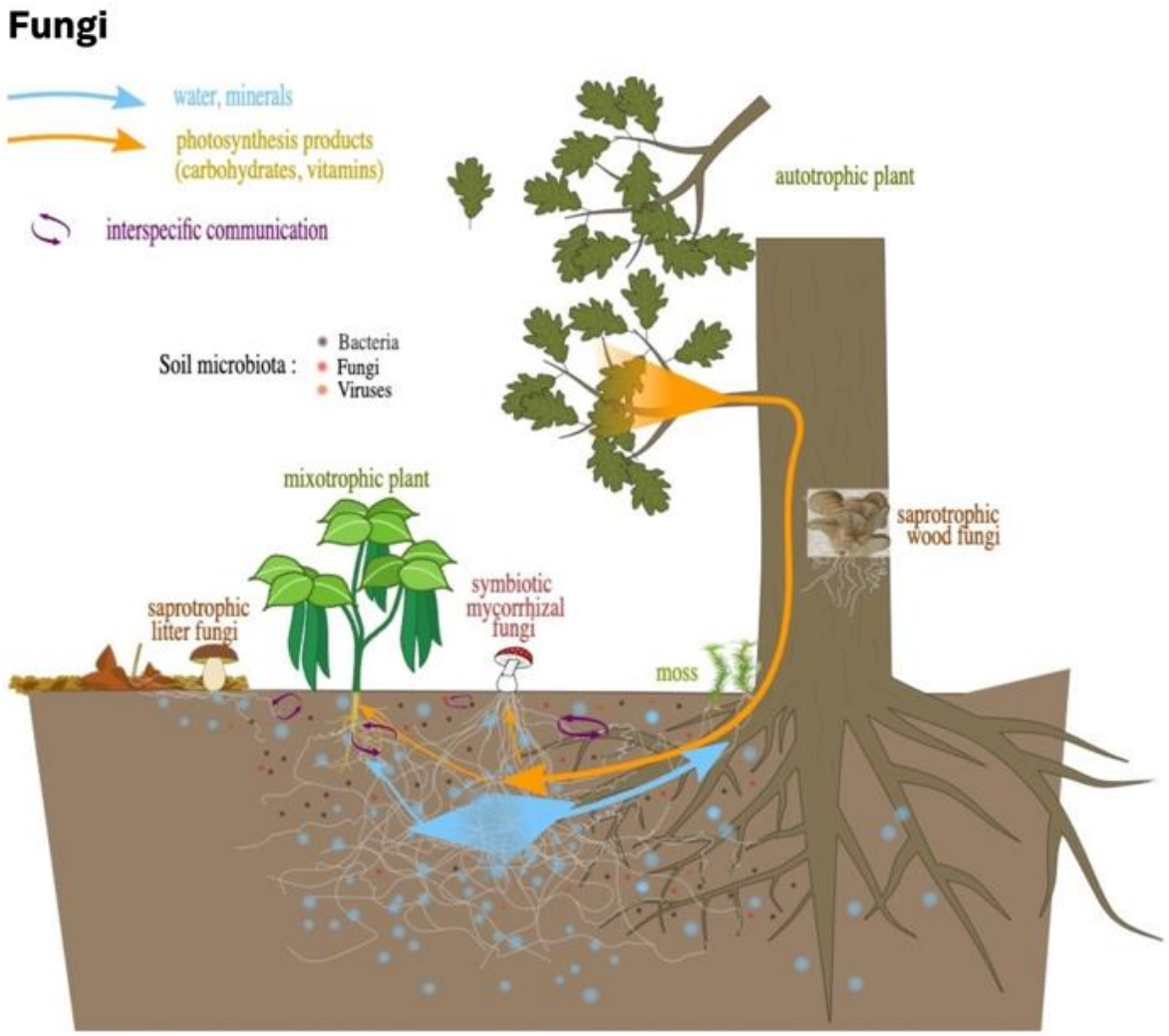
-Fungi: Microscopic fungi like mycorrhizas on plant roots extending and extracting nutrients from the soil which they share with their host. They form a mutualistic relationship with plant roots by extending their reach, extracting and imparting nutrients to their hosts.Likewise, they get hold of and store over a third of global carbon emissions annually.

Fig 4.4-Visual Representation of Fungi



https://www.weforum.org/stories/2023/07/

-Elephants: Large mammals like elephants inhibit wildfires by eating flammable vegetation and by trampling plants underfoot. They also accelerate the process by which carbon in foliage is forced into the soil where it is much less likely to be released back into the atmosphere.

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Fig 4.5-Elephants(Mammals)

https://www.weforum.org/stories/2023/07/

5) World consensus in achieving the goal

Many countries have committed to net zero emission target. As of March 2022, 33 countries and the European Union(EU) have set net zero target. To reach net zero emissions by 2050, annual clean energy investment worldwide will need to more than triple by 2030 to $4 trillion. This would create millions of new jobs leading to the increase in global economic growth and achieving universal access to electricity and clean cooking worldwide.

Most of the reductions in CO_2 emissions through 2030 come from technologies that already exist in the market but in 2050, half a reduction would come from technologies that are currently at the prototype phase. Major innovation would be required in the coming decades to market these technologies.

By 2035, the mandate of Net Zero means a huge decline in the use of coal oil and gas. This requires steps such as completely doing away with sales of new internal combustion, engine passenger cars by 2035 and phasing out coal and oil power plants by 2040. This would have a major impact on the economies that are dependent on these resources for their GDP growth, e.g.-

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the middle east economies. The impact of such universal decisions has led to these economies promoting other avenues to increase their GDP growth.

By 2040, electricity generation will need to reach net zero emissions globally in all sectors. This would require an increase in electricity system flexibility such as batteries, demand response, hydrogen based fuels, hydropower, etc to ensure reliable supplies.

By 2045, new energy technologies will be wide spread and the vast majority of cars would be running on electricity or fuel cells and planes would be relying on advanced bio and synthetic fuels. Industrial plants would be using carbon capture or hydrogen around the world.

By the time one reaches 2050, it is possible that the global energy sector would be based on renewables with solar being the single largest source of supply.

Achieving this cleaner healthier future would require unwavering focus from all governments working with all stakeholders like :

-Businesses

-Investors

-Citizens

Besides this, there would be the need for international cooperation especially amongst developed and developing countries such that developing economies have the finance to reach the net zero goal.

6) Countries that have already reached Net Zero Emission

US and many other countries are targeting 2050 as a national commitment to reach Net Zero level. Countries like China and India are likely to reach this stage a few decades later but there are 8 countries that have already achieved Net Zero emissions.

These are:

1) Bhutan-Subsistence farming, tourism and sustainable forestry formulate the majority of Bhutan's economic activity. This dominion has pursued policies that promote sustainable forestry management rather than deforestation. Preserved and protected national parks preside over two fifths of the country's geology which are tethered by habitat corridors allowing wildlife to move between them, undeterred by human beings.

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Fig 6.1-Bhutan

https://www.nathab.com/blog/kingdom-of-bhutan/

2) Comoros-This country is on the east coast of Africa, north of Madagascar. It is one of the world's most impoverished countries, where the population is concentrated in the major coastal town of Moroni. Due to its limited resources and economic challenges, many residents rely on agriculture and fishing for their livelihoods while facing ongoing struggles with education and healthcare access on each of its four islands. The agriculture, fishing, and rearing livestock's low emissions account for about 50% of the nation's economy, blended with stern environmental protection systems for 25% of the landmass, aids in supporting its Net Zero status.

Fig 6.2-Comoros

https://www.islands.com/1671863/step-into-paradise-little-known-comoros-island-africa-zanzibar-vibes-without-crowds/

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3) Gabon-Congo rainforests preside over 88% of the landmass of Central Africa due to a strong fidelity to reforestation and sustainable management of Gabon's natural resources. As it is located in the Congo Basin(world's largest 'carbon sink'), Gabon emits minimal carbon dioxide while at the same time it absorbs hefty amounts of it.

Fig 6.3-Gabon

https://www.nature.org/en-us/what-we-do/our-insights/perspectives/gabon-30-30-leading-conservation/

4) Guyana-Located on the northern coast of South America encircled by Amazon rainforest, it is yet another tree canopy rich country. It aims further for a 70% cut in emissions by the year 2030 despite having already attained the goal of net zero emissions.Though the recent development of the country becoming the world's newest producer in 2019 may impose threats to its status as a net zero greenhouse gas emitter.

Fig 6.4-Guyana

https://www.climatechangenews.com/2024/10/03/guyanas-carbon-credit-deal-to-protect-forests-undermines-forest-protectors/

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5) Madagascar-This island is located off the east coast of Africa, enclosed by the Indian Ocean, its major reliance is on agriculture and fishing for economic gains.Currently holding the status of a net zero emitter, extensive deforestation has led to the disappearance of approximately a quarter of the country's forest canopy since 2000, according to the source of Global Forest Watch. If the tree loss consistently happens at this rate, the island will transform into a net carbon dioxide(CO_2) emitter by the year 2030.

Fig 6.5-Madagascar

https://www.kensingtontours.com/tours/africa/madagascar/madagascar-highlights

6) Niue-A scaled down coral island sitting in the South Pacific Ocean, becomes home to a population of around 2,000 beings with many more residing overseas. Its main economic activities are fishing, tourism and agriculture respectively. A net carbon sink as the country's Nationally Determined Contribution(NDC) suggests, it contributes barely 0.0001% to global greenhouse gas emissions. Nonetheless, despite its low contribution to gas emissions, the exposed position of this island leaves it in a vulnerable state easily affected by climate change and natural disasters such as rise of sea level and ocean acidification. In fact, in January 2004, the capital of Niue was wrecked by a category 5 cyclone, Cyclone Heta.

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Fig 6.6-Niue

https://www.niueisland.com/discover-niue/blog/post/why-niue-is-the-best-pacific-island-to-visit

7) Panama-This country, with a population of 4.5 million and 65% of its landmasses occupied by rainforests ,formed an alliance with Bhutan and Suriname at the COP26 climate summit in Glasgow of carbon negative countries, abetting in carbon pricing and trade .Furthermore this alliance encouraged reduction of net zero to greater extent. For further reduction of its recognition as a carbon sink, the ruling body residing plans to restore 50,000 hectares of land through afforestation by 2050.

Fig 6.7-Panama

https://www.klm.co.in/travel-guide/destinations/central-america/panama/panama-city

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8) Suriname-Among the most forest intensive nations in the world with 93% of its territory surrounded by forests, it is a tiny country in the Amazon. It has been successful in establishing carbon credit agreements to mitigate emissions and safeguard its ecosystems due to its large scale biodiversity and ability to capture billions of tonnes of carbon dioxide (CO_2).

Fig 6.8-Suriname

https://surinamedude.com/the-amazonian-beauty-of-central-suriname-nature-reserve/

The Way Ahead-

Despite many pledges and efforts by governments to tackle the cause of global warming, carbon dioxide emissions from energy and industry have increased by 60% since the United Nations framework convention was signed in 1992.Gobal commitment and actions are growing but they are short of achieving the target to limit the increase in temperatures to 1.5 degrees.

The path to Net Zero involves:

1) Deployment of Green Energy Technology-Example-EVs, energy efficient building retrofits, solar power

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2) Major Innovation Efforts are required to bring technologies that reduce carbon dioxide emission into the market

3) Huge reduction in the use of coal oil and gas. This requires phasing out coal and oil power plants by 2040.

4) This requires huge increases in electricity system flexibility such as batteries, demand response, hydrogen based fuel, hydropower, etc.

5) Majority of cars by 2045 should be running on electricity or fuel cells, planes will be relying on advanced biofuels and synthetic fuels.

6) Solar, wind, nuclear, bioenergy, hydrogen based fuels and renewable energy technology would be the single largest source of supply.

Conclusion

It is extremely important for the world to adhere to policy measures that reduce global warming and climate change. Net Zero is one way in which all the countries could achieve *not adding to* processes that impact climate change adversely. Till date there are very few countries which have been able to achieve this status. Effort should be made that it becomes a universal phenomenon as the adverse factors are going to severely impact problems that arise through adverse climate change.

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