

# Global Warming: Its causes and consequences

## 1. Introduction

## 2. Causes of Global Warming

### a. Rising industrialization

- (i) Release of fluorinated gases
- (ii) Disturbs the chemical composition of atmosphere

(iii) Heavy machinery increases temperature

### b. Excessive burning of fossil fuels

- (i) Major contributor to carbon dioxide
- (ii) In addition of carbon dioxide, emission of sulphur dioxide
- (iii) Australia is the largest producer

### c. Deforestation

- (i) Forests as carbon-sinks
- (ii) conversion of forests into residential areas

### d. Application of nitrogen fertilizers

~~is a source of fluorinated gases~~

(i) Green revolution

(ii) Increase yield but pollutes soil

e. Emission of chlorofluorocarbons (CFC)

f. Agriculture activities

ii Methane: product of livestock, digestion, paddy rice, farming and manure.

iii Bacteria breaks organic matter.

g. Aerosols

i. Absorb solar and ultraviolet radiations

ii. Alter microphysical and chemical properties of clouds

iii. Mixture of organic droplets and soot

iv. America is the biggest producer

h. Ozone depletion

ii Ozone absorb harmful ultraviolet radiations

iii Chlorine containing gases destroy ozone

ii cement manufacturing

i. Upon heating calcium oxides carbonate release lime and carbon dioxide.

2. Consequences of Global Warming

a. Melting of polar ice glaciers and ice-sheet,

(i) 1/6 of world population lives

melting zones.

ii Destruction of Greenland ice-sheets

iii Reduction in Arctic Sea Ice

iii) of ice officially lost glacier status

b. Ocean acidification

ii Excessive carbon dioxide leads to ocean acidification

iii) change in ocean circulation

iii) Effects on marine life.

c. Rising of sea level

d. Frequency increased in hurricanes

e. ~~Temperature~~ ~~increase~~ ~~in~~ ~~the~~ ~~ocean~~ ~~level~~

f. ~~Temperature~~ ~~increase~~ ~~in~~ ~~the~~ ~~ocean~~ ~~level~~

g. Encroachment of coastal areas

h. Ozone depletion

(i) Chlorine deteriorates ozone molecules

ii) Passage of ultraviolet rays

(i) Increase the range of diseases

(ii) Decline in agriculture production

3. Measures to Reduce Global Warming:

a. Use of renewable energy

b. Energy conservation

c. Genetically engineered crops

d. Forest planning

e. Technology transfer

f. Cyclone shelters

4. Conclusion

Although the Industrial Revolution (IR) occurred approximately 200 years ago, the Industrial Revolution (IR) was a period of major mechanization and innovation that began in Great Britain during the mid of 18th century and early 19th century and later spread throughout much of the world. The British Revolution Industrial Revolution (BIR) and the American Industrial Revolution (AIR) continued through the world war II, so the BIR is dominated by the exploitation of coal and iron and the ATR era saw the mechanization of agriculture and new modes of transportation including

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steamships, the automobiles and airplanes. The Industrial Revolution shifted societies from an agrarian economy to a manufacturing economy where products were no longer made solely by hand but by machines. The IR created an increase in employment opportunities wages and factories were higher than what individuals were making as farmers. IR increased innovation also led to higher levels of education, often resulting in several groundbreaking inventions that used today, these inventions that included the assembly line, telegraph, steam engine, sewing machine, internal combustion engine, x-rays, lightbulb and calculator etc. Technologies available to them, and in turn where they lived, it made life comfortable for many through living conditions. Industrial Revolution was engine of economic growth, but industrial progress, negative impact of globalization



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a chain buried in seafloor sediments. If global warming exceeds 2C, it will create climate destabilization. Melting ice caps and thawing tundra will create a feedback loop that leads to a permanent hothouse Earth. Global warming cause climate change. That's created more extreme weather, health risks, a rise in sea level and higher food ~~costs~~ costs.

Climate change deniers have argued that there has been a "pause" or "slowdown" in rising global temperature but numerous studies, including in a 2018 paper published in the journal Environmental Research Letters have disproved this claim, global temperature rise by 0.9C or 0.3 9F per decade.

Scientists have concluded that we must limit global warming to 1.5C by 2050, if we are to avoid a future in which everyday life around the world is marked by its worst, most devastating

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effects: the extreme droughts, wildfires, floods, tropical storms and other disasters ~~collectors~~ that we refer collectively as climate change.

Natural ~~one~~ cycle and fluctuations have caused the earth's climate to change several time over the last 800,000 years, our current era of global warming is directly attributable to human activity specifically to our burning of fossil fuels such as coal, oil gasoline, fluorinated gases, methane ~~water~~ and natural gas which result in greenhouse gases. In Pakistan's greenhouse gases GHG profile is dominated by emission from the energy and agriculture sector whose combined emission is 87% of national GHG emission. According to the World Resources Institute's climate analysis indicator Tool (WRI CATI) manufacturing contributes 25%. GHG emission to of Pakistan's total annual GHG emission of rising industries, manufacturing, factories

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in the world by which they released the fluorinated gases (F-gases), F-gases are man-made gases used in a range of industrial applications, F-gases are used inside of products like refrigerators, air-conditioners, foams and aerosol cans. Emission from these products are caused by gas leakage during the manufacturing process as well as throughout the product's life. F-gases are often used as substitutes for ozone ~~depleting~~ depleting substance because they do not damage the atmospheric ozone layer. However, F-gases are powerful greenhouse gases, with an even higher warming potential than carbon dioxide (CO<sub>2</sub>). They thus contribute greatly to climate change.

The factories and facilities that produce our good significant source of greenhouse gases, they were responsible for fully 21% of Paris US emission, 25% Pakistan emission.

Most industrial emissions come from the production of a small set of carbon-intensive products including basic

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chemical, iron, and steel, cement and concrete, aluminium, glass and paper. To manufacture the building blocks of our infrastructure and the vast array of products demanded by consumers, producers must burn through massive amounts of energy. In addition, older facilities in need of efficiency upgrades frequently leak these gases, along with other harmful forms of air pollution.

To control emissions from F-gases, including hydrofluorocarbons (HFCs), the European Union (EU) has adopted two legislative acts: the F-gas Regulation and the Mobile Air Conditioning Systems (MAC) Directive. The European Economic Area (EEA) contributes by collecting data reported by companies on the production, import, export, destruction and feedstock use of F-gases in the EU. These data are published in Fluorinated Greenhouse Gases report on an annual basis. These gases are banned in new products across the EU. On way to

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reduce the industrial sector's carbon footprint is to increase efficiency through improved technology and stronger enforcement of pollution regulations. Another way is to rethink our attitudes toward consumption particularly when it comes to plastics so recycling and reuse so that we don't need to be producing so many things <sup>first</sup> place. Since major infrastructure projects rely heavily on industries like cement manufacturing responsible for 7% of annual global greenhouse gas, policy mandates must leverage the government's purchasing power to grow markets for cleaner alternatives, and ensure the state and federal agencies procure more sustainably produced materials for these projects. Hastening the switch from fossil fuel to renewables will also go a long way toward cleaning up this energy-intensive sector.

There are both natural and human sources of carbon dioxide emissions.

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natural resources include decomposition, ocean release and respiration. Human sources come from activities like cement production, deforestation as well as burning of fossil fuels like coal, oil and natural gas. Due to human activities, the atmospheric concentration of carbon dioxide has been rising extensively since the industrial revolution. According to the journal of CO<sub>2</sub> Human Emission that 87% of all human produced carbon dioxide emissions come from the burning of fossil fuels like coal, natural gas and oil. Fossil fuels are formed from the decomposition of buried carbon based organisms that died millions of years ago. They create carbon-rich deposits that are extinct and burned for energy. They are non-renewable and currently supply around 80% of the world's energy according to the Climate Communication reports 2022. They are also used to make plastic, steel and a huge range of products. Fossil fuel burned, they

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release large amount of carbon dioxide  
greenhouse gas into the air. greenhouse  
gases trap heat in our atmosphere,  
causing global warming. Already the average  
global temperature has increased by 1°C.  
warming above 1.5°C risks further sea  
level rise, extreme weather, biodiversity loss  
and species extinction, as well as food  
and security, worsening health and poverty for  
millions of people worldwide.

The Inter-governmental Panel on Climate  
Change (IPCC) has found the emissions from  
fossil fuel are the dominant cause of  
global warming. In 2018, 89% of global  
CO<sub>2</sub> emission came from fossil fuel and  
industry. Coal is a fossil fuel, and is the  
 dirtiest of them all, responsible for over  
0.3°C of the 1°C increase in global  
average temperatures. This makes it the  
single large source of global temperature  
rise. Oil release a huge amount of  
carbon when burned approximately a third  
of the world's total carbon emission.

oil and compressed natural gas in  
driving increase in consumption of fuel  
million in 1990 to 15 million 2023  
and number of motor vehicles increased  
energy come from thermal (fossil fuel)  
Regulatory Authority's (NERA) report,  
according to the National Electric Power  
from 54% in 1990 to 64% in 2021  
electricity generation has increased  
fossil fuels (coal, oil, natural gas) in  
sectors were the main drivers of  
emission growth, contributing 30% and  
87% respectively, of the total energy  
sector. Relative share GHG-emissions  
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the transport sector. Energy sector emission grew by 87 Mtonne from 1990-2022 contributing 57% of total emissions growth.

Global warming is caused by the change by the greenhouse gases effect. Carbon dioxide and other greenhouse gases trap the sun's heat radiation and reflect it back to earth. In 1850 the CO<sub>2</sub> level was 280 per million since then human have burned colossal amounts of ~~plant~~ plant based fuels such as gasoline, oil and coal, that released the CO<sub>2</sub> the plants had absorbed during their lifetimes, so, in Feb 2021, the CO<sub>2</sub> level was 416 parts per million. Australia is the world's 14th highest emitter, contributing just over 1% of global emission. Australia emitted 499 million tonnes of CO<sub>2</sub> equivalent a 5% decrease on 2019 according to the Australia Government report, 2020

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Australia carbon emission is the largest contributor including transport (17.6%), agriculture (14.6%), fugitive emission (10.0%), industrial processes (8.2%) and waste (2.7) energy (33.6%). The United States has produced more than 400 billion metric tons of cumulative carbon dioxide emission than China and Pakistan CO<sub>2</sub> emission per capita increased from 0.31 tons of CO<sub>2</sub> per capita in 1972 to 1.04 tons an average annual rate of 2.62%.

The atmosphere of greenhouse gases already in the atmosphere that temp will keep rising even if we stop emitting today. According to the NASA these natural causes are still in play today, but influence is too small or they occur too slowly to explain the rapid warming seen in recent decades, like

deforestation refers to the purposeful clearing and thinning of trees and forests when deforestation occurs, much

with the and international. less than 1%. greenhouse gases. extremely change

the carbon stores by trees is released back into the atmosphere as CO<sub>2</sub> which contributes to climate change. In the last decade, the largest amounts of deforestation occurred in the humid tropics, mostly in Africa, followed by South America. The UN and Agriculture Organisation (FAO) estimates that around 140 million hectares of forest were lost between 1990 and 2020 and the annual rate of deforestation has since slowed but was still 10 million hectares per year between 2015 and 2020.

Forests act as a major storage for carbon and they represent the most significant terrestrial carbon sink as they contain 77% of all carbon stored in vegetation and 39% of all carbon stored in soils. It has also been estimated that forests store more carbon than any other type of land cover since they absorb CO<sub>2</sub> from the atmosphere, which is then used to produce

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carbohydrates, fats and proteins that make up trees. Increasing in CO<sub>2</sub> concentration when deforestation occurs many of the trees are burnt or they allowed to rot, which results in releasing the carbon that is stored in them as CO<sub>2</sub>, this in turn leads to greater concentrations of CO<sub>2</sub> in the atmosphere. This dissolves into oceans causing imbalance. In nature and are a major factor leading to climate change, extinction of rare animals, desertification and displacement of the population.

Presently, Pakistan serving as a forest-poor country. The worldwide recommended level for forest is 20-25% of land area whereas in our country only about 1.34 million (4.8%) of its total land area is under forest, out of 3.44 million ha are state-owned, tree cover on farmlands and private forest is 0.781 million ha (0.887%).

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The Forestry sector Master Plan has estimated that the country is suffering an annual loss of 2.3 billion rupees as a result of flooding, erosion of fertile soil from upland watersheds and siltation of reservoirs and irrigation systems.

The fraction of land area under forest cover in different parts of the country also varies; Balochistan (0.7%), Punjab: 2.8%, Sindh: 2.8%, KPK: 16.6%, Northern Area: 9.5%, AIZ: 20.7%, different area people using forest wood for different uses like Mansherwah.

90% of the respondents were using the forest wood for cooking, 56% were using for timber in the same village; Swat 96% use fuel wood for cooking, 24% for their timber needs. Fuel wood is an important component of household economies and Pakistan fuel wood covers about 53% of total annual domestic energy. According to the journal

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Natural Science research paper that in Dir Kohistan 83% use fuel wood is the main cause of lack of alternate resources and in Dir Kohistan second main cause of deforestation is unemployment as a source of income by illegal manner. determined that poverty and over population are believed to be the main cause of forest loss according to the intergovernmental agencies such as FAO and and pollution is interlinked (38%), burning wood release CO<sub>2</sub> in the atmosphere which create GHG gases.

Nitrogen pollution is a threat to human health, when nitrogen is active form, such as in fertilizer, is exposed to soil, microbial reactions take place that release more nitrogen oxide, this gas is 300 times more potent at warming the atmosphere than carbon. It also remains active in the atmosphere for more than 100 years. Algal blooms in lakes and

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waterways, often caused by fertilizer run-off, also emit greenhouse gases. Water containing elevated level of nitrate resulting from animal waste, plant decomposing and fertilizer run-off, raises the risk of infants developing methemoglobinemia commonly refer "blue baby syndrome" which can be fatal, nitrate in drinking water increase the risk of cancer in adults according to UNEP's 2018-2019 Report CFCs are anthropogenic compounds that have been released into the atmosphere since the 1930s in various applications such as air-conditions, refrigeration, blowing agents in foams etc, CFCs make up just four parts per billion of atmosphere but they are so efficient at warming the planet that they are still an important contributor to climate change, CO<sub>2</sub> is the most and significant greenhouse gas causing climate change, destroy the ozone layer in the stratosphere.  
Global warming is no longer a

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philosophical threat, no longer a future threat, no longer a threat at all. It's our reality"  
Bill Melibben.  
Agriculture is the predominant source, livestock emissions from manure and gastroenteric release account for roughly 32% of human caused methane emission. Population growth, economic development and urban migration have stimulated unprecedented demand for animal protein and with the global population approaching 10 billion, this hunger is expected to increase by up to 70% by 2050. Agriculture methane does not only come from animals, though. Paddy rice prevent oxygen from penetrating the soil. Methane is the primary contributor to the formation of ground level ozone, a hazardous air pollutant and greenhouse gas exposure to which causes 1 million premature deaths every year, methane



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is also a powerful greenhouse gas, over a 20 year it is 80 times more potent at warming than CO<sub>2</sub>. Methane has accounted for roughly 30% of global warming since pre-industrial times according to (USNOAA), ~~and~~ agriculture, 54% of emission growth from this sector is due to enteric fermentation while 18%, 14% came from synthetic fertiliser and manure left on pasture respectively

Methane risk the health, global warming contributes to 450,000 deaths each year. By 2020 that number will reach 150,000. It climbs to 12.6 million death, the impact of pollution, one in every nine person faces hunger caused by crop failure. Health care cost are higher \$50 million asthma and allergy suffers. Plants now produce more pollen, including larger and more allergenic 'super pollen' between 1995-2015, the pollen season has increased by

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15 days in some areas of North America by 2010 pollen counts will double according to the standard university professor Mark Jacobson estimated that 20,000 people die from air pollution for every 1°C rise in global temperature carrying west Nile virus, malaria and even bubonic plague. From 2004 to 2009, mosquito flea and tick-borne illness have tripled to 640,000.

Aerosols usage, another human, is the second major cause of global warming. Aerosols present in the atmosphere cause global warming by changing climate into two different ways. They absorb the solar radiation as well as alter the microphysical and chemical properties of clouds, impacting their lifetime and duration. According to a recent study, the absorption of aerosols has increased twofold at the beginning of this century which is increasing temperature. Moreover, biomass

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burning, generates a mixture of organic droplets and soot particles, which play a vital role in increasing temperature. Currently, the US is the biggest producer of aerosols, but ironically the small supporters of curtailing global warming.

Besides aerosols, ozone depletion is another striking factor responsible for global warming, when ozone molecules absorb harmful ultraviolet radiation, they actually prevent them to reach the earth. However, chlorine-containing gases are destroying the chemical makeup of ozone molecules, resulting in the destruction of this protective layer. Therefore, ozone depletion ultimately raises the temperature of the earth. Some of the human activities mentioned earlier are causing this ozone depletion and making it happen faster than expected.

Furthermore, cement manufacturing coupled with the natural activity of volcanic eruptions is causing a further

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rise in temperature and the depletion of the ozone layer, when a volcano erupts, it injects a substantial amount of sulfate in the atmosphere. The volcanic activity in Indonesia in the last year has caused a massive release of sulphur particles, some happen during cement manufacturing when calcium carbonate is heated which in turn produces lime and carbon dioxide, can mixes in the air to causing global warming.

The major disaster that is staring in our faces is the melting of polar ice, glaciers, and ice-sheets. According to the Intergovernmental Panel on Climate Change (IPCC) about one-sixth of the total population of the world lives in the regions which shall face direct impacts of this melting of ice. The panel has presented pieces of evidence suggesting that an additional 3°C of warming could lead to the ultimate destruction of the



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of the Greenland Ice sheets, an event that would add another 5 to 6 inches to the existing sea level. One of the most dramatic effects of global warming is the reduction in the Arctic sea ice hitting a record low in both the fall and winters of 2015 and 2016. Why isn't the sea level that high now? Warming has happened so fast that the ice hasn't had time to fully melt. It's like putting an ice cube in hot coffee, it doesn't melt instantly. Over thousands of years, ice will continue to melt unless the temperature is used. July 2019 was the worst month of melting when Greenland lost 217 billion tons of ice land, which reminder of the sea storm hitting our coastal areas every other day.

Increasing global warming is the death of marine life. It is because ocean serve as a sink for carbon dioxide. If the level of CO<sub>2</sub> acidification of ocean increases, it also increases oceanic circulation. This causes difficulty to the marine creatures in

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breathing, ultimately leading to their death. Various mysterious deaths of whales have been reported in some areas in Australia, which has conclusive pieces of evidence of the oceanic acidification. Moreover, it also has pernicious effects on the algal blooms and coral reefs, CO<sub>2</sub> increase is playing havoc with the oceanic climate. Furthermore, hurricanes and typhoons are expected to become more intense as the planet warms, hotter oceans evaporate more moisture, which is the engine that fuels these storms. Scientists have claimed that hurricanes will become more intense and more frequent due to climate change, global warming ability to turn a category 3 storm into a more dangerous category 4 storm, the frequency of North Atlantic hurricanes has increased since the early 1980s, as has the number of storms that reach - breaking 30 tropical storms, 6 major hurricanes and 13 hurricanes altogether.



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with increased intensity come increased damage and death, this is because hurricanes get their energy from the temperature difference between the warm tropical ocean and the cold upper atmosphere. In US, unprecedented 22 wet and climate disasters that caused at least billion dollars worth of damage in 2020 cause of tornadoes and hurricanes in the US coastal areas. Moreover, it is the excess of the sun's ultraviolet rays to the earth. Chlorine gas released in various human activities deteriorates the ozone molecules, making harmful ultraviolet reaching the earth. These radiations are raising the temperature of our planet. It, then, severely affects the health of living beings. Excessive heat has led to an increase in the ~~stress~~ stress level which may lead to high blood pressure and heart diseases. According to the American Medical Association has reported an

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increase in diseases like malaria and dengue fever as well as the chronic condition like asthma. ~~Some~~ Impact of droughts, severe weather, lack of accumulated snowmelt, diversity of pests and resultant usage of pesticides and insecticides, lower underground water tables and loss of arable land and cloud cause severe crop failures and livestock shortages. This loss of food security may create havoc in the international food markets and spark famines, food riots, political instabilities, and civil unrest.

Apart from these efforts, some other measures need to be taken on a global warming level to reduce this issue and curtail its impacts. So, as we know that non-renewable energy source like coal, oil and natural gas must be replaced with renewable energy sources such as wind, solar energy, wind, hydro, hydro electric, biomass and geothermal.

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power. Efforts must be made to obtain the maximum amount of biofuel from organic waste. Government should developed the policies to encourage energy companies and people to use renewable energy instead of conventional energy. According to the National Determined Contribution (NDC) report 2021, Pakistan has set an ambitious goal to tackle climate challenge by reducing 15% GHG with country own resources and 35% with support of International grants by 2030, and international organizations motivating the people to shift to alternative sources of energy and discouraging them from using fossil fuels through awareness campaigns. Moreover, scientists can also devise ways to use hydrogen to feed zero emission fuel cells. Engineers need to design efficient batteries and electric grids to conserve energy and smart electric grids to conserve energy, to avoid is in the agriculture sector, there is

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a need to produce drought-resistant crops by enabling them to grow even in the acute shortage of water. Similarly, climate change is expected to make river water saltier. Scientist need to create seeds that will be able to withstand high levels of salt in water. Furthermore, inordinate deforestation needs to be controlled by discovering new forest management and adaptive re-planting options. Ensuring the availability of sufficient and properly trained forest workers with enhanced capabilities to face the challenges of climate change can save the world from extreme flooding. Also, new forests should be planted to trap excessive environmental CO<sub>2</sub>. Petrol cars must be replaced by electric cars in order to minimize the emission of fossil fuels. Carbon engineering should be introduced to capture more

cars per acre of a land footprint than the trees and plants can, the chances of reduction in the quantity of GHG.

Without a serious focus on green growth, falling water tables, rising food, water, energy prices, population growth, resource depletion, climate change, changing disease patterns, catastrophic results around the world are likely and will force migrations over the next few decades to make much of the world increasingly unstable. To prevent this, states should develop and actively pursue not only tree plantation but also the implementation of other environmental protection laws.

Non-governmental organization law along with media, can come forward to spread awareness among the masses about the likely hazards of global warming. Organizations like UN can play

their role through multilateral agreement to encourage the use of renewable energy sources. Reduction in greenhouse gas emission requires the participation of industrial countries, improving the energy efficiency of vehicles, to less the carbon-intensive energy. Despite country to country measures, it is yet to be seen how these national and international measures are going to save our planet from the likely extinction in the near future.