

Carbon Emission and Carbon Footprint of Different Type Based Energy Consumption: Definition and Role in Tracking Human Pressure on the Planet

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Abstract—Carbon emission means release of carbon into the atmosphere. Greenhouse gas emissions are often calculated as carbon dioxide's equivalent. Carbon dioxide (CO_2) is a colourless, odourless and non-poisonous gas formed by combustion of carbon. Emission means release of greenhouse gases which causes global warming due to massive irreversible damage to the environment. Carbon dioxide and water vapour strongly absorb infra-red radiation and effectively block a large fraction of the earth's emitted radiation. The radiation absorbed by CO_2 and H_2O vapour is partly reemitted to the earth's surface. The net result is that the earth's surface gets heated up by a phenomenon called the greenhouse effect. The current global trends in deforestation along with increased combustion of fossil fuels have a cumulative effect on the net increase in carbon dioxide content. The gross carbon emission from biomass burning events and post burning decomposition fluxed in Amazon rain forest in recent time is a matter of concern. Carbon footprint, on the other hand, is the total emission caused by an individual event, organization, a product emitted carbon dioxide. It discusses how many earths be required if everyone on the planet consumed resources at the same level as the person till date, and the number is threatening. The carbon footprint is used for measuring carbon emission, and it is a very powerful tool to understand the impact of personal behaviour on global warming. This paper tends to focus how global warming effects the temperature of earth's atmosphere since century and why India's carbon dioxide emission have been growing as faster rate than in any other major energy consuming nation. It is observed that, in 2018 CO_2 emission in the country rose 4.8 % from the previous year as accorded by International Energy Agency, Paris. It is accorded that India's higher CO_2 emission have been spurred by fossil fuels which lead by coal for power generation and oil for transportation. Under the Paris Climate Agreement, India has set a target to reduce the emission intensity by 2030. The paper tries to find out possible solutions and measures to redress the carbon emission, so that a green and blue planet is handed down to next generation.

Introduction

In order to understand the issue of Carbon emission, it is important to understand the basic science behind the concern. Carbon dioxide is naturally present in the earth's atmosphere and is part of a natural circulation among the atmosphere. Carbon dioxide remains as part of a natural circulation among

the atmosphere, oceans, soils, plants and animals. Human activity interferes with its natural biological cycle because people extract fossil fuels with high concentration of carbon from fathom deep the earth's surface. They burn them for producing energy. During this combustion process, carbon mixes with oxygen and creates even more carbon dioxide. Carbon dioxide is the primary gas emitted from human activity. Everyday people start a car, flip on a switch or use anything associated with petroleum, coal, natural gas or electricity; and thus emit carbon dioxide in the air, and this is called carbon emission. On the other hand Carbon Footprint is the sum of all emissions of carbon dioxide which has been induced by a man in a given time frame. The total amount of greenhouse gasses produced to support human activities has been termed as carbon dioxide. In other words, when a person drive a car, the engine burns fuel which creates a certain amount of CO_2 , depending on its fuel consumption and the driving distance. When a person heats his house with oil, gas or coal, then he or she also would generate carbondioxide. Even he or she heat his or her house with electricity, the generation of electric power would also emit certain amount of carbon dioxide. Even when she or he would buy food and goods, the production of the food or goods would surely emit some quantities of carbondioxide. And Carbon Footprint is the sum of all emission of carbon dioxide around the year. Carbon footprint is a very powerful tool to understand the impact of personal behaviour on global warming. Often people become shocked when they come to know the amount of carbon dioxide which they produce. A person can calculate and monitor his or her personal carbon foot print with a view to resisting global warming.

Marc Lallanilla said in his essay "Green House Gases: Causes, Sources and Environmental Effects" that a greenhouse gas is any gaseous compound in the atmosphere that is capable of absorbing inferred radiation, thereby happening and holding heat in the atmosphere. By increasing the heat in the atmosphere greenhouse gases are responsible for the greenhouse effects which ultimately leads to global warming.

Svante Arrhenius did intensive work on global warming. He accorded that greenhouse effect occurs because the bombard earth with enormous amount of radiation, which strikes earth's atmosphere in the form of visible light and ultraviolet, infrared and other types of radiation that are invisible to the human eye. About 30 percent of the radiation striking the earth's surface is reflected back out to space by clouds, ice and other reflective surfaces. The remaining 70 % is absorbed by the oceans, the land and the atmosphere, according to NASA. Further, the ocean, land and atmosphere release heat in the form of infrared thermal radiation, which passes out of the atmosphere into the space. The balance between incoming and outgoing radiation keep earth's overall average temperature at about fifty nine degree Fahrenheit. And the exchange of incoming and outgoing radiation that warm earth has been referred as greenhouse effect. And the gasses in the atmosphere that absorb radiation are known as greenhouse gases because they are largely responsible for greenhouse effect. And the greenhouse effect, in turn, is one of the leading causes of global warming. Greenhouse gas has the property of absorbing infrared radiation emitted from earth's surface and radiating it back to earth's surface, thus contributing to greenhouse effect. Carbon dioxide, methane, nitrous oxide, chlorofluorocarbons and water vapour are the most important greenhouse gases.

Global Warming and Green House Effect:

The overabundance of a carbon dioxide in the earth's atmosphere causes more heat to be trapped, increasing temperature that causes global warming. Natural events and human activities are believed to be contributing to an increase in average global temperatures. This is caused primarily by increases in 'greenhouse' gases such as Carbon Dioxide (CO₂), Sulfur Dioxide (SO₂), Methane (CH₄), Nitrous Oxide (N₂O), Water Vapour etc. Over the last 100 years, the average temperature of the air near the Earth's surface has risen a little less than 1° Celsius. It is responsible for the conspicuous increase in storms, floods and raging forest fires we have seen in the last ten years. Their data show that an increase of one degree Celsius makes the Earth warmer now than it has been for at least a thousand years. Out of the 20 warmest years on record, 19 have occurred since 1980. The three hottest years ever observed have all occurred in the last eight years. The major cause of global warming is the emission of greenhouse gases like carbon dioxide, methane, chlorofluorocarbons, nitrous oxide etc. into the atmosphere. These greenhouse gases trap heat in earth's atmosphere and thus result in increasing the temperature of earth. The amount of heat trapped in the atmosphere depends mostly on the concentration of greenhouse gasses and length of time they stay in the atmosphere. The average global temperature is 15°C. In absence of greenhouse gasses this temperature would have been -18°C. Heat trapped by greenhouse gasses in the atmosphere keeps the planet warm enough to allow us and other species to exist. The greenhouse effect was discovered

by Joseph Fourier in 1824, first reliably experimented on by John Tyndall in 1858, and first reported quantitatively by Svante Arrhenius in 1896. It is found that greenhouse gases are abundantly present in earth and these are: Carbon dioxide 56%, Methane 18%, Nitrous oxide 6%, Ozone 7%, CFCs 13%. The major greenhouse gas which causes global warming is carbon dioxide. It contributes about 56% to global warming from greenhouse gasses produced by human activity such as Automobiles, Fossil fuel burning, Deforestation and Land clearing and burning. Concentrations of greenhouse gases are directly correlated with temperature. CO₂ stays in the atmosphere for about 500 years. CO₂ concentration in the atmosphere was 355 ppm in 1990 that is increasing at a rate of 1.5 ppm every year.

The second major greenhouse gas after carbon dioxide, which causes global warming, is Methane. Methane is more than 20 times as effectual as CO₂ at entrapping heat in the atmosphere. Methane is produced when bacteria break down dead organic matter in moist places that lack oxygen such as natural wetlands paddy fields, bovine flatulence. Production and use of oil and natural gas and incomplete burning of organic material are also significant sources of Methane. Methane stays in the atmosphere for 7-10 years. Atmospheric concentration of methane is 1.675 ppm and it is increasing at a rate 1% annually. Nitrous oxide, which is a colorless gas with a sweet odour, is another greenhouse gas. The main sources of nitrous oxide include nylon and nitric acid production, cars with catalytic converters, the use of fertilizers in agriculture and the burning of organic matter. A greater emission of nitrous oxides in the recent decades is leading global warming. Its life span in the troposphere is 140-190 years and it traps about 230 times as much heat per molecule as CO₂. The atmospheric concentration of NO₂ is 0.3 ppm and is increasing at a rate of 0.2% annually. Ozone: For the last 450 million years the earth has had a natural sunscreen in the stratosphere called the ozone layer. This layer absorbs harmful ultraviolet radiation from the sunlight. Absorption of UV radiation results in heating of the stratosphere. CFCs: These are believed to be responsible for 13% of the human contribution to greenhouse gases. They also deplete ozone in the stratosphere. The main sources of CFCs include leaking air conditioners and refrigerators, production of plastic foams, aerosols, propellants etc. CFC takes 10-15 years to reach the stratosphere. Atmospheric concentration of CFC is 0.00225 ppm that is increasing at a rate of 0.5% annually.

In very recent days, Amazon rain forest draws attention of masses across the world due to constant and continuous bonfire. Amazon is the world's largest rainforest contains millions of species of plants and animals. Many of them are still unknown. Among the best known animals are jaguars, eagles, river dolphin, parrot, large snakes and many butterflies. It contains over 40 thousand species of plants and 6,500 KM of river contain 3,000 kinds of fresh water fish. The area drained by the Amazon River over 40percent of South

America. The forest extends over seven other countries and a French territory. More than 30 million people including 350 indigenous and ethnic groups, live in the Amazon area and depend on the forest for food and shelter. The rain forest of Amazon is often called the lungs of the planet. But it also absorbs other heat trapping gasses produced by burning fossil fuels, like oil and coal. The fire in Amazon rain forest in recent days release huge amount of carbon into the air. Scientist Carlos Nobre observed that due to acute human pressure on Amazon rain forest, it started shrinking. The current fires in the Amazon are not naturally occur forest fires. They are mostly set illegally by people who are clearing the forest to raise cattle and crops. NASA researcher Dong Morton said that inhabitants of Amazon burn piles of trees which they gather through cutting during raining season. They burn them in dry season and produce enormous amount of bonfire which produces enormous CO₂ in the atmosphere.

Effects of Global Warming:

One of the major effects of global warming is the climatic change. (In 1994, the northern hemisphere experienced the coldest winter in 50 years in Europe and USA. Brewing one after another in the Atlantic, the fierce storms moved across Europe into Russia. A second string of storms, having their track further south, afflicted south and south Eastern Europe, Turkey and West Asia. Most of Europe was affected by heavy snowfall, blizzards and floods. In Asia the worst blizzards in 25 years smashed Japan and Korea while Thailand reeled under the coldest winter in 50 years due to penetration of Arctic air remains far to the south. Such intensely cold winter was followed by one of the worst summers. Europe and Japan were backed by record sizzling heat. For London it was the driest summer in 300 years and for the Germany it was the hottest summer ever. Japan had record breaking day temperatures and the drought was so severe that it had to close down 2000 factories. Heavy floods overwhelmed many countries of the world including USA, Europe and Asia. In China heavy monsoon rain killed 1000 people. Not only heavy rain but several “killer cyclones” including “super typhoons” ravaged a few islands and coastal areas of the world. China was devastated by super typhoon, Fred which took toll of more than 1000 lives. These are symptoms indicating that the world’s weather is in turmoil. Though it is a matter of a single year’s aberrations but the climatologists are concerned that the world’s climate is being plagued for more than a decade or so by extreme heat and cold, deluge, drought and super typhoons. They are the opinion that the accumulation of greenhouse gases could be more dangerous than imagined earlier.

It is observed that the total global crop yields are expected to fall, and this will cause many problems. The effects would be most severe in the tropics and subtropics. The severe heat waves, storms and flooding will all be much more frequent. Many of the world’s hotter areas will become even less tolerable to live in. The ecosystems will not always be able to adapt to the changes, and the result would be large numbers of species becoming extinct and loss of biodiversity. Besides,

hurricanes and other tropical storms can acquire more energy and become more violent due to tropical oceans being warmer. Moreover, severe storms cause flooding, and this can also lead to epidemics of infectious diseases. Changes in rainfall render serious effect on food supplies.

Mountain glaciers in the Andes, Alps, Pyrenees, Himalayas, Rocky Mountains and other areas (not including the Arctic and Antarctic ice sheets) have decreased in area by 50% in the past century. The most serious effect for people living in the valleys of glacially fed rivers is that the water flow could be greatly reduced during much more of the year. Glaciers store snowfall from winter and from earlier years of high precipitation, and provide water in summer that is used for drinking and irrigation of crops. For example, the region of the Himalayas and Hindu Kush feeds Asia’s biggest rivers: the Ganges, Indus, Brahmaputra, Yangtze, Mekong and Yellow. Floods followed by droughts could affect 2.4 billion people living in India, China, Pakistan, Bangladesh, Nepal and Myanmar. This would affect water supplies and farming, and the resulting disruption could have very serious social and political consequences.

Increasing global temperature causes a rise in sea level, even without considering melting of polar ice, because as water warmer than 4 °C increases in temperature it expands. Although the water deep in the ocean is at about 4 °C, the upper levels of the sea are at higher temperatures, and so the water will expand if it becomes warmer. Sea levels will rise further if the Greenland or Antarctic ice melts. Since 1900, sea level has risen by an average of about 1.7 mm per year, but since 1993 this has increased to about 3 mm per year. One prediction for 2100 is a rise of 18 to 59 cm above levels in 2000, but other predictions go higher. A rise of even 20 cm in sea level is serious for low-lying countries such as Bangladesh and Vietnam, many islands, and for very low-lying coastal cities such as New Orleans. Coupled with more violent storms, many other coastal cities such as London and New York could also suffer from severe flooding. Other coastal regions would also suffer, due to breaches in sea defenses and the sea level rise.

The effects of global warming on the Indian subcontinent vary from the submergence of low-lying islands and coastal lands to the melting of glaciers in the Indian Himalayas, threatening the volumetric flow rate of many of the most important rivers of India and South Asia. In India, such effects are projected to impact millions of lives. Ongoing sea level rises have submerged several low-lying islands in the Sundarbans, displacing thousands of people. Temperature rises on the Tibetan Plateau, which are causing Himalayan glaciers to retreat. The leading daily of India The Hindu very recently reported that India emitted 2299 Million Tons of carbon dioxide in 2018, a 4.8% rise from the previous year. The country, under the Paris Climate Agreement has fixed a target to reduce the emission intensity of its economy by over 30% compared with 2005 level, by 2030, but the country continues

to build new cold plants and oil imports and these are constantly rising as its growing population.

Possible Solutions to Global Warming:

Researchers and environmentalist are constantly working in reducing the amount of threat caused by carbon emission. They have come with some basic solution to redress the carbon emission and these solutions are- (a) Cut down the current rate of use of CFCs and fossil fuel (b) Shift from coal to natural gas (c) Trap and use Methane as a fuel (d) Adopt sustainable agriculture (e) Stabilize population growth (f) Use of pollution control devices like scrubbers in industries (g) Check in vehicular emission (h) Remove atmospheric CO₂ by utilizing photosynthetic algae and (i) Plant more trees.

Conclusion:

Discourse on global warming is a 19th century phenomenon with a view to inspiring the earth dwellers to green our world. Day by day hot increases on the planet and data released by NASA urges that USA has broken all time temperature records in the last year, and even in India the same has been happening every year. Point is not to be frightened of the problems, but to develop tools and ingenuity to combat with the epidemics, so that living and non-living things can combat with the man creating problems and effects of global warming with a view to protecting the good planet as this good planet is hard to find in the galaxy.

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