An Analytical Study on Greenhouse Gases Emission and Control

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Abstract

Introduction: The study is based on the emission of the greenhouse gases and the control measures associated with it. It has been observed from the collected information that the emission levels increased at an alarming rate over the last decades for India. The most important greenhouse gases are CO_2, Methane, Nitrous oxide and other gases. Therefore, greenhouse gas emissions impact the atmosphere largely.

Purpose: The purpose of the study is to find out ways to control greenhouse gas emissions. The main reason behind this is termed as the rapid industrial development along with mass consumption of various fossil fuels.

Findings: It is found that greenhouse gas emissions impact not only the environment but also humans. Mostly, humans are responsible for the increase of greenhouse gases emissions in the environment. A secondary qualitative analysis is used in this study to discuss suitable methods of estimating the concentration level of greenhouse gases in the atmosphere.

Conclusion: In conclusion, it can be said that humans have to ensure that they adopt all the possible ways to reduce the greenhouse gases emissions from the environment. Time based variation of CO_2 and CH4 is mainly depicted in this study along with the concentration of O_3 and NOX in the atmospheric air.

Keywords

CO_2 Emission, Fossil Fuels, GHG Analyser, GHG Emissions, Paris Climate Accord.

INTRODUCTION

There are some gases that increase the temperature of the atmosphere and those gases are called the greenhouse gases. Therefore, one of the major greenhouse gases is *Carbon dioxide* or CO2 and there are a lot of sources of CO2 gas. Thereafter, another main greenhouse gas is *Methane* or CH4 that generally can be found in the production of coal and natural oil. Furthermore, there are *Nitrous oxide* or N2O and *Fluorinated gases* that mix and make greenhouse gas. Apart from that, the impacts of greenhouse gas on humans and animals are described in this research study. Thus, the ways of controlling greenhouse gas and protecting the environment is another description in this study.

DIFFERENT SOURCES OF GREENHOUSE GAS EMISSION IN INDIA

India was one of the first countries that signed up for the Paris Climate accord back in 2015. Quite surprisingly, India is one of the top countries that emit greenhouse gases, after the US and China. There are a number of factors that contributed towards this. In the case of countries like China and the US, the main sources of emission can be traced back to the coal plants, energy usage [4]. However, the per capita gas emissions are still increasing. India is a country full of natural resources along with environmental diversity. This also means that vulnerabilities related to climate change are greater for the country. The increasing rate of melting of the Himalayan glaciers can be stated here as an example. Even after a pledge to reduce the greenhouse gas emissions (GHG),

rise in the emission levels are observed. In 2015, the GHG emissions were at 3572 million tons of CO2 equivalent [9]. However, the per capita emission of India is still at a controllable level. As the collected data indicates, the overall emission of India stood at 2308 MtCO2e in 2018, which is a massive increase compared to the previous years.
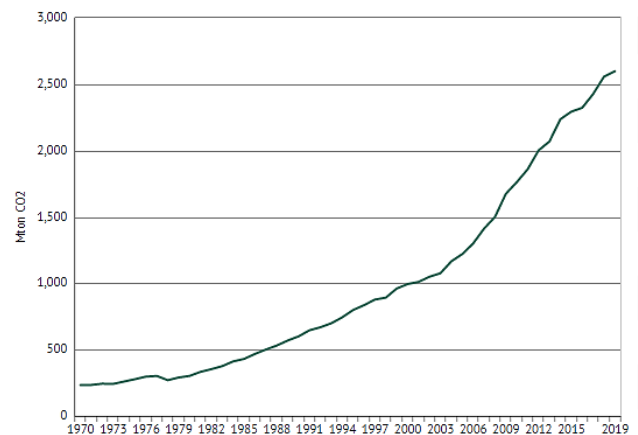

Figure 1: Annual increase of GHG emission, India (1970-2019) [9]

India is facing problems related to the uneven resource distribution. This has resulted in an uncontrolled consumption of fuels which have contributed heavily towards the increase of the GHG emissions. Furthermore, the country is going through a phase of industrial growth as both the industrial and economic activities are accelerated. The intensified productivity is also a reason behind the growing GHG growth along with rising levels of pollution. The

collected data indicates the rise of CO2 emissions over the years [13]. The prime source of this is the carbon dioxide emissions along with the consumption of fossil fuels. This is backed by the consumption of both solid and liquid fuels. Over the last decades, the rate of GHG emissions increased by more than 300% compared to 1990 [18]. The other reasons behind the emissions are categorized as transformation activities, road and constructional redevelopment and steel production plants. Other than CO2, N2O and CH4 emissions are also observed. The CH4 emissions mainly originated from rice production and livestock fermentation. Furthermore, the aspects related to industrial redevelopment also contributed towards the GHG emissions. According to the statement of Singh *et al.* (2019), 28% of the overall GHG emission is resulted by various industrial processes such as land usage and construction. The manufacturing of different production in the process sector such as limestone, dolomite iron and steel also contributed heavily towards the scenario. It can be mentioned that controlling the overall GHG emission will be difficult due to the ongoing industrial revolution along with the unsupervised consumption of fossil fuels as it is constantly increasing the overall levels of emission. Identifying the prime sources of GHG emissions will be essential to formulate essential steps[12].

MATERIALS AND METHODS

A secondary qualitative analysis is incorporated in this study to discuss suitable methods of measuring greenhouse gases emitted from different resources. It is found that the Greenhouse gas (GHG) analyzer used in the Los Gatos research is the most effective appliance to measure two major greenhouse gases such as CO_2 and CH_4 [10]. Apart from the concentration level of these GHGs in the atmosphere this instrument is also used to measure the level of H_2O in atmospheric air. An advanced technology of enhanced off-axis integrated cavity output spectroscopy is used in this instrument for measuring the concentration level of GHGs with both precision and accuracy. True wavelength scanning method is incorporated with this instrument to record the fully resolved line shapes by fixing the flow rate at 7 L/min [7].

Main method of this analysis includes entering atmospheric air into the analyzer through two diode lasers. These lasers are equipped with the system of near infrared distributed feedback. One of the diodes is used for CO_2 absorption with an absorption line of 1.60 µm and another with 1.65 µm is used for absorbing CH_4 and H_2O [14]. Concentration level of both the GHGs is measured by means of respective absorption lines of these two gases within a sampling time of 1 second.
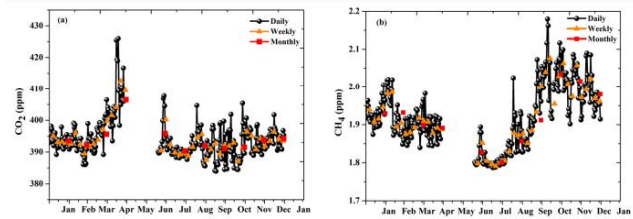

Figure 2: Time based variation in the concentration of CO_2 and CH_4 [14].

Apart from the aforementioned major GHGs, surface concentration of other elements such as O_3 (Ozone) and nitrogen compounds (NO_x) can also be measured by using online analyse available on the thermal scientific, USA [8]. It is found that ambient air is allowed to enter the instrument through inlet pipes. There is a system that prevents the ingression of rain water along with the atmospheric air by means of a 0.5 µm air filter. This filter also prevents the entrance of dust particles into the instrument. This ozone gas analyse works on the principle of Beer-Lambert-Bouguer Law that includes absorption of light by a certain level of concentration of gaseous species [11]. An in-built calibration unit is also present in this device that helps in determining the concentration in a periodic manner.

In the case of NO_x analyse a molybdenum converter is used that facilitates the conversion of NO_2 into NO. The concentration level of NO_x compounds is estimated by measuring the intensity of light emitted at the time of a photochemical reaction between NO and O_3 [15]. A zero and span calibration is integrated with this instrument that helps in performing this analysis twice in a month. In addition to the adobe mentioned instruments, suitable constellation observation systems are also used in this regard for conducting the meteorological observations in all weather conditions. COSMIC-RO is a GPS system consisting of six microsatellites (identical) that possess self-calibration and high accuracy characteristics [1]. It is used to estimate the atmospheric temperature rise due to greenhouse gas emission along with the percentage of aerosols and water vapour in the atmosphere.

RESULTS AND DISCUSSION

Results

It is found that the temperature of the earth is increasing day by day due to the increase of greenhouse gases. Therefore, about *2 degrees* Fahrenheit temperature has increased in the year 2020 and there are more chances of increasing temperature of the atmosphere [3]. Thereafter, increasing the temperature leads to a lot of issues for the atmosphere such as the ice of northern areas is melting day by day and as a result the level of sea is increasing. Furthermore, there is a chance of flooding in the coastal cities if the level of sea increases. Apart from that, one of the most important impacts of greenhouse gases is that global warming is increasing due to the increase of greenhouse gases worldwide.
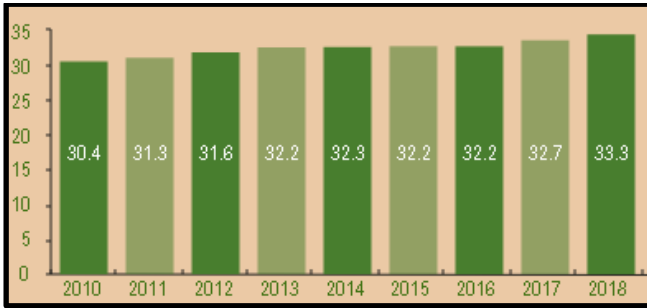
Figure 3: Increasing CO_2 gas in the environment [3].

On the other hand, there are other impacts such as migration of species and negative impacts on agriculture. Therefore, migration of species can be the cause of an unbalanced environment and that is not good for the atmosphere. Apart from that, one of the largest parts of the economy of India is based on agriculture and negative impacts on agriculture can be the cause for decreasing economic growth [6]. Along with that, the greenhouse gas not only impacts the environment but also impacts the humans by impacting agriculture. As the food security of humans is based on agriculture then issues in agriculture can be the cause of food shortage for the human. Thus, these are the results or findings that are found by using the secondary data collection method.

Discussion

Theme 1: Causes greenhouse gas emissions

It can be said that humans are responsible for the increase of greenhouse gas emissions in the world. Therefore, one of the main reasons for greenhouse gas is *cutting trees manually*. Humans are cutting trees to fulfil their needs but trees help us by taking CO_2 gas from the environment. Thus, as the number of trees is decreasing similarly the level of CO_2 gas is increasing in the environment [16]. Thereafter, there are other reasons that other greenhouse gases are increasing such as *burning fossil fuels*, *cement manufacture* and others. In addition to that, the number of industries is increasing day by day.

In several industries, the *usage of machines* is harmful for the environment and it helps to increase the greenhouse gases in the air. Apart from that, nowadays several *machines are used in agriculture* for quick production and those machines are helpful to create greenhouse gases. Therefore, *deforestation* is another reason for the increase of greenhouse gas [2]. Humans are cutting trees but not planting and because of that the number of trees is decreasing and as a result the greenhouse gas is enhancing.
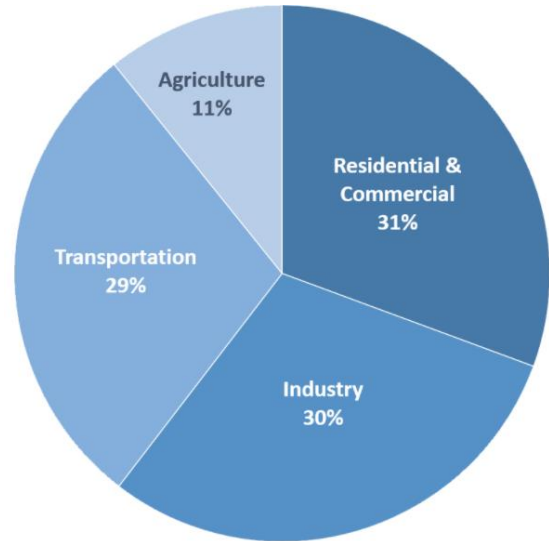

Figure 4: Major causes of greenhouse gas emissions [2].

Theme 2: Process of controlling greenhouse gas

There are some effective ways that can be adopted by humans for the reduction of greenhouse gases or controlling the greenhouse gases. Therefore, the most important way is to *plant trees* as trees are helpful to reduce the CO2 gas from the environment. Apart from that, the usage of air conditioners increases the level of CO2 gas in the environment and humans should *use fans instead of air conditioners* that will help to reduce greenhouse gas emissions. Along with that, different types of car increase the level of greenhouse gas in the air [5]. Therefore, humans can *use hybrid cars instead of petroleum cars*, which helps to reduce greenhouse gas significantly. Thereafter, humans can use cycles as a means of transport instead of cars if they cannot afford hybrid cars as hybrid cars are very expensive.

Figure 5: Process of controlling greenhouse gas [5].

On the other hand, there is a need to control the usage of machines that produce greenhouse gas emissions. Therefore, humans can *use machines that do not produce greenhouse gases*. Apart from that, a sustainable farming process should be used in agriculture as the usage of several machines in agriculture produce so much greenhouse gas emissions. In addition to that, a *sustainable farming process* is helpful to reduce the greenhouse gases emissions and that helps in good

quality and healthy food too [17]. Thereafter, people should *use the recycle and reuse system* as it helps to reduce the garbage that produces greenhouse gases emissions. These are the process that human can use to reduce the greenhouse gases emissions.

CONCLUSION

In conclusion, it can be said that greenhouse gas emissions are very impactful on the environment and humans. Therefore, humans should adopt all the ways that are described for reduction of greenhouse gases emissions from the environment. Furthermore, people should use renewable energiesfor electricity and other basic needs as it helps to control the enhancement of greenhouse gases emission in the environment. Thus, these are the ways for protecting the environment from greenhouse gases emissions. Hence, humans are responsible for the increase of greenhouse gases emissions and now humans can reduce this.

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