

# Climate Change Assessment And Reduction Policies

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**Abstract**— There are changes in the entire climate system due to global warming; land and sea temperatures are rising, snow cover and glaciers are shrinking, sea levels are rising and rainfall patterns are changing. After the industrial revolution and the last 40 years the "human-induced climate change" which is accelerating year by year, due to increased concentrations. Atmospheric concentrations of carbon dioxide, methane and diazotmonoxide, which are mainly greenhouse gases, have reached an unprecedented level in the last 800 thousand years. The purpose of reducing greenhouse gas is to reduce the amount of Greenhouse Gas Emissions. The aim of this study is to give information about how green house gases (GHG) can be reduced.

**Index Terms**— Climate change, Emissions, Global warming, Green house gases

## 1 INTRODUCTION

CLIMATE change is the biggest problem mankind has ever faced. There is no doubt that global temperatures are increasing due to human influences.

Many incidents, such as the rise of sea levels, the melting of glaciers, the increase in the temperature of the oceans, indicate that the average temperature of the earth is increasing. This process, called global warming or climate change, threatens the lives of living things in many ways. Observations made since 1979 indicate that the temperature of the land is 0.25 °C per decade, and the temperature of the seas increased by 0.13 °C. Climate change can increase the average temperature, rise of the seas, increase of deserts, rise of drought, increase of natural disasters such as floods, storms, and change the degree of acidity of the oceans. Fossil fuels with high carbon content that are heavily used as a result of developing industrial and urbanisation emit excessive amounts of greenhouse gases into nature. These gases are caused by the increase in the natural balance of temperatures. As the usage area of fossil fuels, which are preferred in many areas such as heating, industry, transportation, increases, the greenhouse effect and global warming which are happening in nature are inevitable. Excessive amounts of carbon dioxide and other harmful gases released into the atmosphere cause climate change, the warming of the earth and the depletion of the ozone layer.

With regard to global warming and climate change, the Kyoto Protocol, which is part of the United Nations Framework Convention on Climate Change, has been signed with the aim of reducing the amount of greenhouse gas released to the environment in order to take responsibility and prevent

mented by 38 countries that ratify the Kyoto Protocol are trying to minimize the effects of global warming.

Since the second half of the 20th century, carbon dioxide and other harmful gases stored in the atmosphere, called greenhouse gases (GHG) cause the world to heat up more and more to prevent solar radiation from being reflected back to the space. Greenhouse gases are usually quantified in "CO<sub>2</sub>equiv" being the mass of equivalent CO<sub>2</sub> :

$$CO_2 \text{equiv} (t) = \sum (Gas (t) \times GWP_{gas}) / GWP_{CO_2} \quad (1)$$

GWP indicates the "global warming potential" of any particular gas or CO<sub>2</sub>, as appropriate, with masses being measured in tonnes (t) [1] .

## 2 CLIMATE CHANGE EFFECTS

Land and sea temperatures are increasing day by day with the effect of global warming. The year 2014 has been the hottest year since 1880, when instrumental temperature measurement was started, and 14 of the hottest 15 years lived in the 21st century [2]. According to the Intergovernmental Panel on Climate Change (IPCC), the reason of the increase in global average temperatures is the observed increase in the anthropogenic greenhouse gas (GHG) concentrations [3]. A GHG is a gas in an atmosphere that absorbs and emits radiation within the thermal infrared range [4]. This process is the fundamental cause of the greenhouse effect.

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conquences for the world as a whole. Measures to be imple-

The primary GHGs in the Earth's atmosphere are water vapour (H<sub>2</sub>O), carbon dioxide (CO<sub>2</sub>), methane (CH<sub>4</sub>), nitrous oxide (NO), and ozone (O<sub>3</sub>). The greenhouse effect is a process by which thermal radiation from a planetary surface is absorbed by atmospheric GHGs, and is re-radiated in all directions. Since part of this re-radiation is back towards the surface and the lower atmosphere, it results in an elevation of the average surface temperature above what it would be in the absence of the gases [4].

Carbon dioxide concentration increased by more than 40 percent compared to the pre-industrial level, reaching over 400 ppm in 2014. The first reason is the use of fossil fuel, the second reason is deforestation and the emissions caused by improper land use [5]. Also transportation is the other important cause of the global warming. When the Kyoto Protocol was proposed in 1997, transportation was considered as the key sector that needed to be tackled. This was to have GHG emissions down; the figure shows that percentage level of the 1990 level to 2008 level has been up by 47.5 % for CO<sub>2</sub> worldwide [6]. The impact of transport on the global climate is not limited to vehicle emissions as the production and distribution of fuel from oil, a "wells-to-wheels" approach, produce significant amounts of GHG in it [7]. Figure 1 below shows the GHGs under the Kyoto Protocol and their main generators as source. The first three have been estimated to account for 50% of the global warming effect arising from human activities [8].

Greenhouse Gases	Main Sources
Carbon Dioxide (CO <sub>2</sub> )	Fossil fuel combustion (e.g. Road transport, energy industries, other industries, residential, commercial and public sector), forest clearing
Methane (CH <sub>4</sub> )	Agriculture, landfill, gas leakage, coal mines
Nitrous oxide (N <sub>2</sub> O)	Agriculture, industrial processes, road transport, other
Perfluorocarbons (PFCs)	Industry (e.g Aluminium production, semi-conductor industry)
HydroFluoroCarbons (HFCs)	Refrigeration gases, industry (as perfluorocarbons)
Sulphur hexafluoride (SF <sub>6</sub> )	Electrical transmissions and distribution systems, circuit breakers, magnesium production

Fig. 1. Greenhouse basketed under the Kyoto Protocol and their main generators as modified from UNFCCC [9]

### 3 CLIMATE CHANGE ASSESMENT IN TURKEY

Energy is essential for life and exists in several forms, e.g., light, heat, and electricity. Concerns exist regarding limitations on easily accessible supplies of energy resources and the contribution of energy processes to global warming as well as such other environmental concerns as air pollution, acid precipitation, ozone depletion, forest destruction, and radioactive emissions [10].

According to the results of the greenhouse gas emission inventory prepared by Turkish Statistical Institute (TUIK), total greenhouse gas emissions in 2016 were calculated as 496.1 million tons (Mt) CO<sub>2</sub> equivalent. The largest share of the CO<sub>2</sub> equivalent in the year 2016 was energy-related emissions with 72.8% followed by industrial operations and product use by 12.6%, agricultural activities by 11.4% and waste by 3.3%. CO<sub>2</sub> equivalent per capita emissions for the year 2016 is calculated as 6.3 tons / person, greenhouse gas emission intensity is 0.19 kg CO<sub>2</sub> equivalents /TL [11].

As a CO<sub>2</sub> equivalent, total greenhouse gas emissions in 2016 increased by 135.4% from 1990 levels. The CO<sub>2</sub> equivalent emission per capita in 1990 was calculated as 3.8 tons / person, which was calculated as 6.3 tons / person in 2016 [12].

#### 3.1 The largest share of CO<sub>2</sub> emissions was energy-related emissions :

In 2016, total CO<sub>2</sub> emissions were generated from electricity, heat and electricity production, 86.1% from energy, 13.6% from industrial operations and product use, and 0.3% from agricultural activities and waste [12].

#### 3.2 55.5% of CH<sub>4</sub> emissions originated from agricultural activities :

55.5% of CH<sub>4</sub> emissions were from agricultural activities, 25.8% from waste, 18.6% from energy and 0.03% from industrial operations and product use [12].

#### 3.3 The largest share of N<sub>2</sub>O emissions was agricultural activities :

77,6% of N<sub>2</sub>O emissions were from agricultural activities, 12,1% from energy, 6,5% from waste, and 3,8% from industrial operations and product use [12].

In order to avoid the devastating effects of climate change, global carbon emissions are estimated at 2.900 Gt CO<sub>2</sub> need not exceed. It's called the global carbon budget. 1,900 Gt CO<sub>2</sub> of this budget, i.e. 65 percent was consumed as of 2011. If the current emission increase trend persists, the remaining 1,000 Gt CO<sub>2</sub> will be released to the atmosphere before 2050. To achieve the 2 °C target, net carbon emissions must be reset between the years 2055-2070, and net greenhouse gas emissions must be reset between the years 2080-2100. Turkey's responsibility towards the objective of 2 °C in order to fulfil this, it needs to reduce the total carbon emissions by 2,980 Mt CO<sub>2</sub> by 2030, according to the reference scenario [13].

## 4 CONCLUSION

Alternative energies are options for fossil fuels, including solar, geothermal, hydropower, wind, and nuclear energy. Available natural energy resources are limited due to their reliability, quality, and energy density. Advanced technologies to mitigate global warming are being proposed and tested in many countries. Among these technologies, multigeneration processes, including trigeneration, can make important contributions due to their potential for high efficiencies as well as low operating costs and pollution emissions per energy output. Issues like fossil fuel depletion and climate change amplify the advantages and significance of efficient multigeneration energy systems [14].

To fight global warming;

- Renewable energy sources should be used instead of fossil fuels.
- In order to prevent global warming, which is one of the most important factors in urbanization, migration from rural areas to cities should be prevented.
- As a result of the development, the growing industry should be carried out in better conditions in terms of environment.
- The statutory legislation on waste must solidification.
- Energy resources should be consumed efficiently.
- Multigeneration energy systems can reduce CO<sub>2</sub> and CO emissions and also help reduce the cost of environmental impacts by producing several useful outputs from an energy input.
- Using hybrid systems and recovering waste energy are two ways to enhance the utilization of renewable energy resources.
- Storage of the trash should be discontinued and the landfills should be converted to bioreactors,
- An integrated management system for the recovery of assessable waste should be established,
- Vehicles with low emission values and marine vehicles should be encouraged,
- Wetlands must be protected,
- Forest areas should be increased,
- Lakes and ponds should be increased,
- Green areas should be increased in cities,
- The use of machines and devices with low energy efficiency should be discontinued,
- Energy efficient appliances and equipment should be encouraged,
- In cities, bicycle routes must be built to go to workplaces and schools,
- The wastewater is treated,
- Instead of fossil fuels, waste heat and energy should be used as supplementary fuel

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