# Global Warming and Climate Change: Causes, Effects and Solutions

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**ABSTRACT**

*Global warming is the long-term warming of the planet's overall temperature. Though this warming trend has been going on for a long time, its pace has significantly increased in the last hundred years due to the burning of fossil fuels. As the human population has increased, so has the volume of fossil fuels burned? The burning of these fuels produces gases like carbon dioxide, methane and nitrous oxides which lead to global warming. Deforestation is also leading to warmer temperatures. The 'Conclusion' confirms that global warming is the major challenge for our global society. There is very little doubt that global warming will change our climate in the next century. So what are the solutions to global warming? First, there must be an international political solution. Second, funding for developing cheap and clean energy production must be increased, as all economic development is based on increasing energy usage. We must not pin all our hopes on global politics and clean energy technology, so we must prepare for the worst and adapt. If implemented now, a lot of the costs and damage that could be caused by changing climate can be mitigated. The paper introduces global warming, elaborates its causes and hazards and presents some solutions to solve this hot issue.*

**KEYWORDS:** *Climate, fossil fuels, deforestation, global warming*

## Introduction

Global warming and climate change refer to an increase in average global temperatures. Natural events and human activities are believed to be main contributors to such increases in average global temperatures. The climate change, caused by rising emissions of carbon dioxide from vehicles, factories and power stations, will not only affects the atmosphere and the sea but also will alter the geology of the Earth. Global warming in today's scenario is threat to the survival of mankind. In 1956, an US based Chief consultant and oil geologist Marion King Hubert, (1956) predicted that if oil is consumed with high rate, US oil production may peak in 1970 and thereafter it will decline. He also described that other countries may attain peak oil day within 20-30 years and many more may suffer with oil crises within 40 years, when oil wells are going to dry. He illustrated the projection with a bell shaped Hubert Curve based on the availability and its consumptions of the fossil fuel. Large fields are discovered first, small ones later. After exploration and initial growth in output, production plateaus and eventually declines to zero.

Crude oil, coal and gas are the main resources for world energy supply. The size of fossil fuel reserves and the dilemma that when non-renewable energy will be diminished, is a fundamental and doubtful question that needs to be answered. A new formula for calculating, when fossil fuel reserves are likely to be depleted, is presented along with an econometrics model to demonstrate the relationship between fossil fuel reserves and some main variables (Shahriar Shafiee et.al. 2009). The new formula is modified from the Klass model and thus assumes a continuous compound rate and computes fossil fuel reserve depletion times for oil, coal and gas of approximately 35, 107 and 37 years, respectively. This means that coal reserves are available up to 2112, and will be the only fossil fuel remaining after 2042.

In India, vehicular pollution is estimated to have increased eight times over the last two decades. This source alone is estimated to contribute about 70 per cent to the total air pollution. With 243.3 million tons of carbon released from the consumption and combustion of fossil fuels in 1999, India is ranked fifth in the world behind the U.S., China, Russia and Japan. India's contribution to world carbon emissions is expected to increase in the coming years due to the rapid pace of urbanization, shift from non-commercial to commercial fuels, increased vehicular usage and continued use of older and more inefficient coal-fired and fuel power-plants (Singh, BR, et al., 2010).

Thus, peak oil year may be the turning point for mankind which may lead to the end of 100 year of easy growth, if self-sufficiently and sustainability of energy is not maintained on priority. This chapter describes the efforts being made to explore non-conventional energy resources such as: solar energy, wind energy, bio-mass and bio-gas, hydrogen, bio-diesel which may help for the sustainable fossil fuel reserves and reduce the tail pipe emission and other pollutants like: CO2, NOX etc.. The special emphasis is also given for the storage of energy such as compressed air stored from solar, wind and or other resources like: climatic energy to maintain energy sustainability of 21st century. This may also leads to environmentally and ecologically better future.

## ROLE OF GLOBAL WARMING IN CLIMATE CHANGE

Strengthening of the greenhouse effect through human activities is known as the enhanced (or anthropogenic) greenhouse effect. This increase in radioactive forcing from human activity is attributable mainly to increased atmospheric carbon dioxide levels.

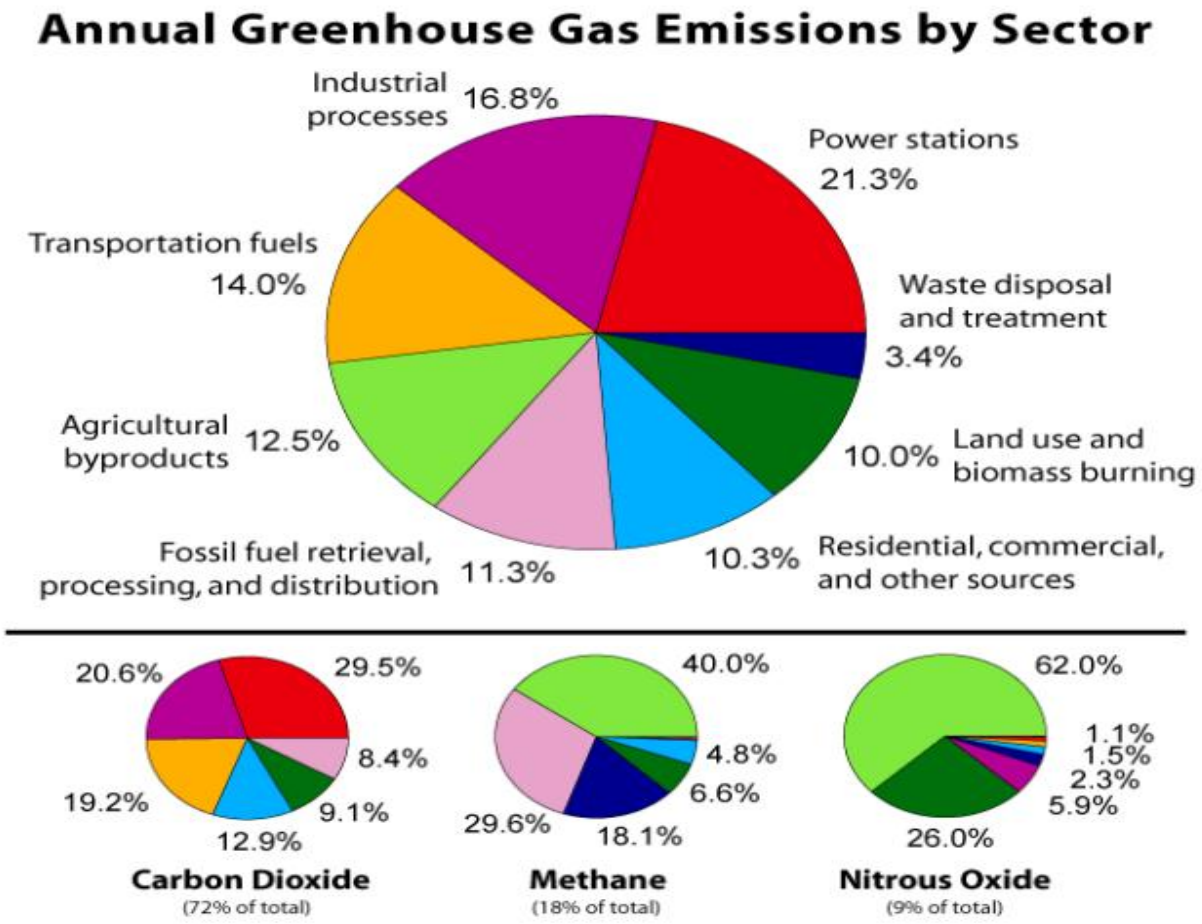
$CO_2$ is produced by fossil fuel burning and other activities such as cement production and tropical deforestation. Measurements of $CO_2$ from the Mauna Loa observatory show that concentrations have increased from about 313 ppm in 1960 to about 389 ppm in 2010. The current observed amount of $CO_2$ exceeds the geological record maxima (~300 ppm) from ice core data. The effect of combustion-produced carbon dioxide on the global climate, a special case of the greenhouse effect first described in 1896 by Svante Arrhenius, has also been called the Callendar effect.

Because it is a greenhouse gas, elevated $CO_2$ levels contribute to additional absorption and emission of thermal infrared in the atmosphere, which produce net warming. According to the latest Assessment Report from the Intergovernmental Panel on Climate Change, **"most of the observed increase in globally averaged temperatures since the mid-20th century is very likely due to the observed increase in anthropogenic greenhouse gas concentrations".**

Over the past 800,000 years, ice core data shows unambiguously that carbon dioxide has varied from values as low as 180 parts per million (ppm) to the pre-industrial level of 270ppm. Pale climatologists consider variations in carbon dioxide to be a fundamental factor in controlling climate variations over this time scale.

## CAUSES OF GLOBAL WARMING

The major cause of global warming is the greenhouse gases. They include carbon dioxide, methane, nitrous oxides and in some cases chlorine and bromine containing compounds. The build-up of these gases in the atmosphere changes the radioactive equilibrium in the atmosphere.




Global warming is the extra heat within the earth's atmosphere which has caused the rise in global temperature. Global warming leads and continues to cause climate change. Climate change can cause rising sea levels, destruction of communities, as well as extreme weather conditions. There are many causes of global warming that are contributing to the climate crisis.

1. **Fossil Fuels:** The massive use of fossil fuels is obviously the first source of global warming, as burning coal, oil and gas produces carbon dioxide - the most important greenhouse gas in the atmosphere - as well as nitrous oxide.
2. **Deforestation:** Deforestation is the clearance of woodland and forest; this is either done for the wood or to create space for farms or ranches. Trees and forests turn carbon dioxide into oxygen, so when they are cleared like the stored carbon is then released into the environment. Deforestation can also occur naturally which a greater effect because of the fumes has released from the fire.
3. **Waste Disposal:** Humans create more waste now than ever before, because of the amount of packaging used and the short life cycle of products. A lot of items, waste and packaging are not recyclable, which means it ends up in landfills. When the waste in landfills begins to decompose/break down it releases harmful gases into the atmosphere which contribute to global warming.
4. **Power plants:** Power plants burn fossil fuels to operate; due to this they produce a variety of different pollutants. The pollution they produce not only ends up in the atmosphere but also in the water ways, this largely contributes to global warming. Burning coal which is used in power plants is responsible for around 46% of total carbon emissions.
5. **Oil Drilling:** Oil drilling is responsible for 30% of the methane population and around 8% carbon dioxide pollution. Oil drilling is used to collect petroleum oil hydrocarbons in this process

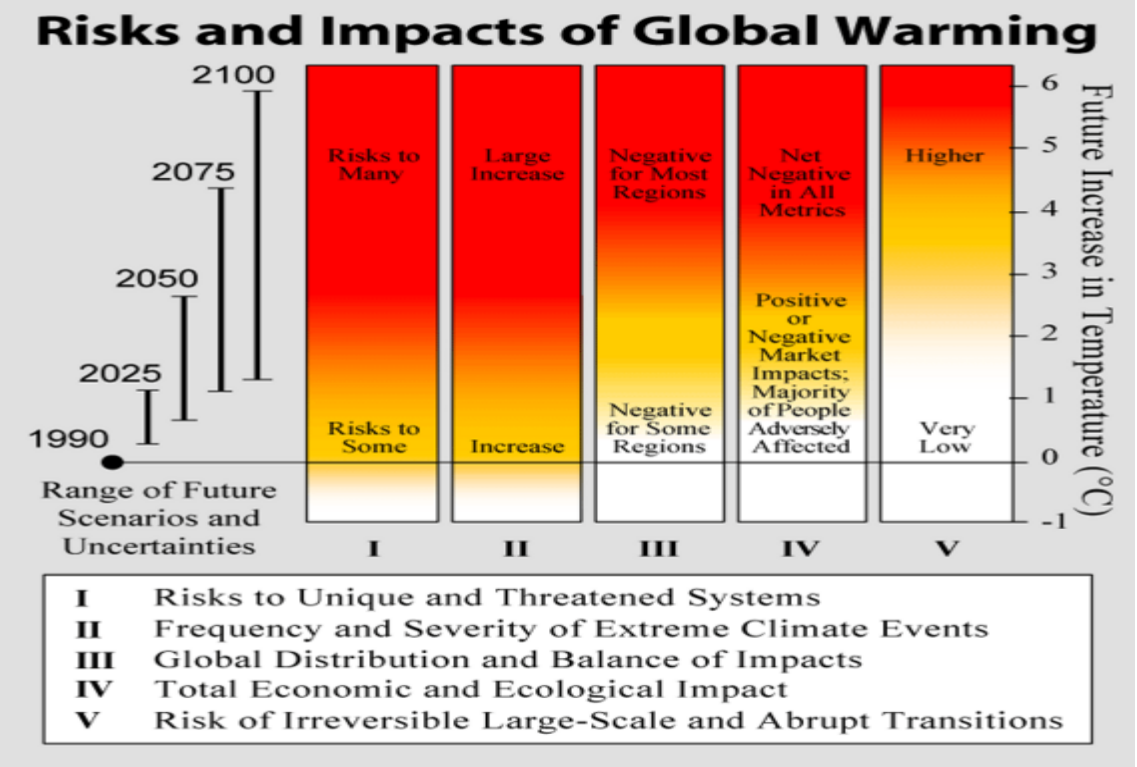
other gases are released into the atmosphere, which contribute to climate change; it is also toxic to the wildlife and environment it surrounds.

6. **Transport and Vehicles:** The large amount of transportation is done through cars, planes, boats and trains, almost all of which rely on fossil fuels to run. Burning fossil fuels releases carbon and other types of pollutants into the atmosphere. This makes transportation partly responsible for the greenhouse gases. This effect could be reduced with the introduction of electric vehicles.
7. **Consumerism:** Due to the innovations in technology and manufacturing customers are able to purchase any product at any time. This means we are producing more and more products every year, and over producing them. Most items we purchase aren't very sustainable, and because of the reduced lifetime of electronics and clothing items, we are creating more waste than ever.
8. **Intensive Farming:** Farming takes up a lot of green space meaning local environments can be destroyed to create space for farming. These animals produce a lot of greenhouse gases for example methane, as well as this they also produce an extreme amount of waste. Factory farming is responsible for even more climate issues because of the extra pollution it produces and the more animals it can hold.
9. **Industrialization:** Industrialization is harmful in a variety of ways. The waste this industry produces all ends up in landfills, or in our surrounding environment. The chemicals and materials used within industrialization can not only pollute the atmosphere but also the soil underneath it.
10. **Overfishing:** Fish is one of humans main sources of protein and a lot of the world now rely on this industry. Due to the amount of people buying and consuming fish, there is now a reduced amount of marine life. Overfishing has also caused a lack of diversity within the ocean.

## EFFECTS OF GLOBAL WARMING

Predicting the consequences of global warming is one of the most difficult tasks faced by the climate researchers. This is due to the fact that natural processes that cause rain, snowfall, hailstorms, rise in sea levels is reliant on many diverse factors. Moreover, it is very hard to predict the size of emissions of greenhouse gases in the future years as this is determined majorly through technological advancements and political decisions. Global warming produces many negative effects some of which are described here.

Warmer temperatures over time are changing weather patterns and disrupting the usual balance of nature. This poses many risks to human beings and all other forms of life on Earth. As can be inferred from figure, we are currently experiencing severity of extreme climate events in the form of thunderstorms, floods and earthquakes. This destruction will take a sharp hike if nothing is done to stop this menace. Fig. depicts global mean temperature in the recent years according to National Aeronautics and Space Administration (NASA). The trend clearly puts up a serious question for us. How will we survive on earth given the rise in temperature to prevail?




1. **Hotter Temperatures:** Nearly all land areas are seeing more hot days and heat waves; 2020 was one of the hottest years on record. Higher temperatures increase heat-related illnesses and can make it more difficult to work and move around. Wildfires start more easily and spread more rapidly when conditions are hotter.
2. **More Severe Storms:** Changes in temperature cause changes in rainfall. This results in more severe and frequent storms. They cause flooding and landslides, destroying homes and communities, and costing billions of dollars.
3. **Increased Drought:** Water is becoming scarcer in more regions. Droughts can stir destructive sand and dust storms that can move billions of tons of sand across continents. Desserts are expanding, reducing land for growing food. Many people now face the threat of not having enough water on a regular basis.
4. **A Warming, Rising Ocean:** The Ocean soaks up most of the heat from global warming. This melts ice sheets and raises sea levels, threatening coastal and island communities. The ocean also absorbs carbon dioxide, keeping it from the atmosphere. More carbon dioxide makes the ocean more acidic, which endangers marine life.
5. **Loss of Species:** Climate change poses risks to the survival of species on land and in the ocean. These risks increase as temperatures climb. Forest fires, extreme weather, and invasive pests and diseases are among many threats. Some species will be able to relocate and survive, but others will not.
6. **Not Enough Food:** Changes in climate and increases in extreme weather events are among the reasons behind a global rise in hunger and poor nutrition. Fisheries, crops, and livestock may be destroyed or become less productive. Heat stress can diminish water and grasslands for grazing.
7. **More Health Risks:** Changing weather patterns are spreading diseases such as malaria. Extreme weather events increase diseases and deaths, and make it difficult for health care systems to keep up. Other risks to health include increased hunger and poor nutrition in places where people cannot grow or find sufficient food.
8. **Poverty and Displacement:** Climate change increases the factors that put and keep people in

poverty. Floods may sweep away urban slums, destroying homes and livelihoods. Heat can make it difficult to work in outdoor jobs. Weather-related disasters displace 2.3 crore people a year, leaving many more vulnerable to poverty.

**Scientists already have documented these impacts of climate change:**

- Ice is melting worldwide, especially at the Earth's poles. This includes mountain glaciers, ice sheets covering West Antarctica and Greenland, and Arctic sea ice. In Montana's Glacier National Park the number of glaciers has declined to fewer than 30 from more than 150 in 1910.
- Much of this melting ice contributes to sea-level rise. Global sea levels are rising 0.13 inches (3.2 millimeters) a year. The rise is occurring at a faster rate in recent years and is predicted to accelerate in the coming decades.
- Rising temperatures are affecting wildlife and their habitats. Vanishing ice has challenged species such as the Adélie penguin in Antarctica, where some populations on the western peninsula have collapsed by 90 percent or more.
- As temperatures change, many species are on the move. Some butterflies, foxes, and alpine plants have migrated farther north or to higher, cooler areas.
- Precipitation (rain and snowfall) has increased across the globe, on average. Yet some regions are experiencing more severe drought, increasing the risk of wildfires, lost crops, and drinking water shortages.
- Some species including mosquitoes, ticks, jelly fish, and crop pests are thriving. Booming populations of bark beetles that feed on spruce and pine trees, for example, have devastated millions of forested acres in the U.S.
- Other effects could take place later this century, if warming continues. These include:
- Sea levels are expected to rise between 10 and 32 inches (26 and 82 centimeters) or higher by the end of the century.
- Hurricanes and other storms are likely to become stronger. Floods and droughts will become more common. Large parts of the U.S., for example, face a higher risk of decades-long "megadroughts" by 2100.
- Less freshwater will be available, since glaciers store about three-quarters of the world's freshwater.
- Some diseases will spread, such as mosquito-borne malaria (and the 2016 resurgence of the Zika virus).

**GLOBAL WARMING PREVENTION**

To figure out the most impactful global warming solutions, we looked into the behaviors that have the highest impact on the biggest causes. For example, we asked: What is the most impactful way for individuals to cut down electricity usage? And while things like composting, smart thermostats, and recycling help our planet; they do not address the biggest sources of global warming as much as other solutions do. There are various ways of preventing global warming such as:

1. **Use of Energy Efficient Products:** Energy efficient products like fluorescent bulbs go long way in saving energy and that too at low cost. Energy produced by electronic gadgets at home or industry are largest producer of global warming. Using energy efficient products has vast potential to save both energy and money, and can be deployed quickly.
2. **Energy & Water Efficiency:** Producing clean energy is essential, but reducing our consumption of energy and water by using more efficient devices (e.g. LED light bulbs, innovative shower

systems) is less costly and equally important.

3. **Passing out Fossil Fuels:** Burning of fossil fuels like wood or coal produces more carbon emissions than other product. Phasing out coal burning power plants and not burning fossil fuels directly will reduce dependence on fossil fuels.
4. **Sustainable Transportation:** Promoting public transportation, carpooling, but also electric and hydrogen mobility, can definitely help reduce CO2 emissions and thus fight global warming.
5. **Sustainable Infrastructure:** In order to reduce the CO2 emissions from buildings - caused by heating, air conditioning, hot water or lighting - it is necessary both to build new low energy buildings, and to renovate the existing constructions.
6. **Stop Deforestation:** Less trees means less absorption of greenhouse gases which are in itself responsible for more global warming. We can fight global warming by reducing deforestation and reducing forest degradation. Managing forests and agriculture therefore should be the top priority to reduce carbon emissions.
7. **Sustainable Agriculture & Forest Management:** Encouraging better use of natural resources, stopping massive deforestation as well as making agriculture greener and more efficient should also be a priority.
8. **Responsible Consumption & Recycling:** Adopting responsible consumption habits is crucial, be it regarding food (particularly meat), clothing, and cosmetics or cleaning products. Last but not least, recycling is an absolute necessity for dealing with waste.
9. **Use of public transportation:** Pollution from vehicles account for major portion of carbon emissions. Usage of public transportation, carpooling and low carbon fuels not only reduce pollution but also reduce vehicular traffic on the road. Public transportation appears to be more cost friendly and does not pinch the pocket in the long run.
10. **Use less Hot Water**: It takes a lot of energy to heat water. Use less hot water by taking shorter and cooler showers and washing your clothes in cold or warm instead of hot water (more than 500 pounds of carbon dioxide saved per year).
11. **Avoid Products with a Lot of Packaging**: You can save 1,200 pounds of carbon dioxide if you reduce your garbage by 10 percent.
12. **Adjust your Thermostat**: Moving your thermostat down just 2 degrees in winter and up 2 degrees in summer could save about 2,000 pounds of carbon dioxide a year.
13. **Recycle More**: You can save 2,400 pounds of carbon dioxide per year by recycling just half of your household waste.
14. **Plant a Tree**: A single tree will absorb one ton of carbon dioxide over its lifetime.
15. **Turn off Electronic Devices**: Simply turning off your television, DVD player, stereo, and computer, when you're not using them, will save you thousands of pounds of carbon dioxide a year.
16. **Developing Low Carbon Technologies:** Research and development of low carbon technologies will further help in reducing carbon emissions.
17. **Creation of awareness:** Word of mouth is the best way to create awareness among the people to stop carbon emissions. Presentations, Meetings and Discussions over global warming provide information about viable solutions to global warming, and reinforcing the economic benefits available throughout the Midwest from the development of renewable energy and energy efficiency.

## CONCLUSION

The logical and environmental community is in total agreement with respect to the harsh truth of a global warming and the association of human factor in it. The paper discussed here has just imprinted the outside of what is an extremely complicated line of logical and designing investigation. Global warming is a major hazard and proper measures should be taken to handle this significant issue. This issue isn't just raising a ruckus to the people yet in addition to creatures and plants. Softening of polar ice caps will prompt floods which can cause commotion all over. Ascent of ocean levels will decimate rural and fishing exercises. To leave upon these issues, some healing advances should be ideal taken which incorporate however are not restricted to the utilization of inexhaustible wellsprings of energy and halting deforestation. Inventive arrangements should be presented to end this risk once and for eternity.

Climate is reshaping human civilization. But, how we will respond to the climate will determine the future of our species. Ensuring climate stability, establishing protection from storm, assuring sufficient food and availability of sufficient drinkable water are the main elements demand the preservation of climate. Substantial scientific evidence indicates that an increase in the global average temperature of more than 2°F above where we are today poses severe risks to natural systems and human health and wellbeing. Extracting, burning and transporting fossil fuels all carry significant risks to our public health, to the climate and to those directly involved in these archaic industries. Therefore, we should not be using deadly and outdated technology to power our homes, schools, hospitals, and businesses but, we have to keep the majority of known fossil fuel reserves in the ground. The climate and the future of our kids will be saved when all of us are moving in the same direction.

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