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WAYS OF REDUCING GREENHOUSE GASES

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Abstract: Greenhouse gas emissions have become a major environmental concern due to their significant contribution to global warming and long-term climate change. Human activities such as industrial development, fossil fuel combustion, rapid urbanization, intensive agriculture, and the loss of forested areas have led to increasing atmospheric concentrations of carbon dioxide (CO₂), methane (CH₄), and nitrous oxide (N₂O). This paper explores the primary sources of greenhouse gas emissions and discusses their environmental, economic, and social consequences. It also reviews current mitigation strategies, including the adoption of renewable energy technologies, improvements in energy efficiency, sustainable transportation systems, low-carbon industrial processes, and forest conservation initiatives. Furthermore, the importance of international climate agreements, environmental regulations, and policy frameworks in achieving emission reduction targets is examined. The findings indicate that effective greenhouse gas mitigation requires an integrated approach combining technological innovation, governmental action, and sustainable development practices to support long-term environmental protection.

Keywords: greenhouse gas emissions, climate change mitigation, carbon dioxide, renewable energy, sustainable development, energy efficiency, environmental management, carbon neutrality.

1.Introduction

In the modern era, climate change is considered one of the most serious global environmental problems. The rapid increase in greenhouse gases in the atmosphere leads to rising global temperatures, melting glaciers, sea level rise, and an increase in the frequency of extreme weather events. Although the greenhouse effect is a natural process, human activities have intensified its impact. Industrial production, the use of fossil fuels, agriculture, and transportation are among the major sources of greenhouse gas emissions.

According to reports from international organizations, the global average temperature has increased by approximately 1.1°C over the last century. If this process continues, it may cause severe socio-economic problems in the coming decades. Water scarcity, reduced agricultural productivity, and biodiversity loss are among the major consequences of climate change.

For this reason, reducing greenhouse gas emissions has become one of the priority goals of countries around the world. International agreements such as the Paris Climate Agreement have established specific targets for emission reduction. The purpose of this article is to analyze scientifically the methods of reducing greenhouse gas emissions and to examine the main approaches used in this field.

1.1 Sources of greenhouse gases and their impacts

Greenhouse gases are gases that trap heat in the Earth's atmosphere. The main greenhouse gases include carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), and fluorinated gases. The increasing concentration of these gases disrupts the Earth's energy balance and accelerates global warming.

Carbon dioxide is mainly produced through the burning of fossil fuels such as coal, oil, and natural gas. Electricity generation and industrial activities account for a significant share of CO₂ emissions. Methane is mainly emitted from agriculture, livestock farming, and waste disposal sites. Nitrous oxide is generated through the use of chemical fertilizers and industrial processes.

The impact of greenhouse gases is not limited to temperature rise. Changes in the atmosphere affect the hydrological cycle and increase the frequency of droughts, floods, storms, and other extreme weather events. Melting glaciers contribute to sea level rise, threatening coastal regions around the world.

In addition to environmental problems, greenhouse gas emissions also create economic and social challenges. Reduced agricultural productivity weakens food security, while air pollution and heatwaves negatively affect public health [1-4].

Table 1. Global Share of Major Greenhouse Gas Emissions

Greenhouse gas	Share of total emissions (%)	Main sources
Carbon dioxide (CO ₂)	76%	Energy production, industry, transportation

Methane (ch ₄)	16%	Livestock farming, waste, agriculture
Nitrous oxide (n ₂ o)	6%	Fertilizers, industrial processes
Fluorinated gases	2%	Refrigeration systems, chemical industry

As shown in the table, carbon dioxide accounts for the largest share of greenhouse gas emissions. Therefore, emission reduction strategies mainly focus on the energy and industrial sectors. Methane reduction is also important because methane has a much stronger heat-trapping effect than carbon dioxide [5].

2. Experimental Section

2.1 Methods and modern approaches to reducing greenhouse gases

One of the main approaches to reducing greenhouse gas emissions is the development of renewable energy sources. Solar, wind, hydroelectric, and geothermal energy produce little or no greenhouse gas emissions. In recent years, the widespread use of solar panels and wind power plants has contributed significantly to emission reduction.

Improving energy efficiency is another important solution. Modern technologies help reduce energy consumption through better building insulation, energy-saving appliances, and smart energy management systems. In industry, the reuse of waste heat also contributes to lowering emissions.

The transportation sector is responsible for a large proportion of global emissions; therefore, the introduction of environmentally friendly transport technologies is essential. Electric vehicles, hydrogen-powered transportation, and the development of public transport systems can significantly reduce carbon emissions. Many countries have already begun implementing policies aimed at gradually phasing out internal combustion engine vehicles.

Forest conservation and afforestation are also key strategies. Forests absorb carbon dioxide from the atmosphere and function as natural carbon sinks. Therefore, preventing deforestation and increasing forested areas are major components of climate policy [6].

3.Result and Discussion

Artificial intelligence and digital technologies are increasingly applied in emission reduction efforts. Smart energy grids optimize electricity consumption, while satellite monitoring systems help track emission sources. Big data analytics enable more efficient management of energy systems and environmental resources.

International cooperation plays a vital role in reducing greenhouse gases. Under the Paris Climate Agreement, countries aim to limit global temperature rise to 1.5–2°C. Many governments have adopted long-term strategies to achieve carbon neutrality in the coming decades [7,8].

4.Conclusion

The increase in greenhouse gases is one of the main drivers of global climate change and poses a serious threat to modern society. Rising concentrations of carbon dioxide, methane, and other greenhouse gases disrupt ecological balance, increase global temperatures, and intensify natural disasters. Preventing these processes requires comprehensive and sustainable measures.

The analysis presented in this article shows that the development of renewable energy, improvement of energy efficiency, implementation of environmentally friendly transportation systems, and forest conservation are among the most effective methods for reducing emissions. Artificial intelligence and digital technologies also provide new opportunities for optimizing energy management and improving emission monitoring systems.

In the future, strengthening international cooperation, improving environmental policies, and increasing public ecological awareness will be essential for achieving carbon neutrality. Only scientifically based measures implemented in accordance with sustainable development principles can effectively reduce the negative impacts of climate change.

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