

Exploring Negative Impacts and Measures of Climate Warming and Fossil Energy Use

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Abstract. The overuse of fossil energy intensifies climate warming and other disasters. Global governments need to implement sufficient and useful measures to tackle these problems. This essay explores the current situation and negative influence of the use of fossil energy and climate warming as well as the positive and potential measures. According to the research, climate warming has become more and more serious around the world, resulting in catastrophes like glacier melting and the destruction of ecosystems. The overuse of fossil energy by humans for hundreds of years is the main reason to explain this situation, which leads to critical climate problems and destroys the global environment and human society. Global governments have done some actions and received plenty of benefits. However, to achieve the long-term objective and promote sustainable development, it is necessary to implement more positive measures. This essay aims to help readers have a deeper understanding of the reason and influence of climate problems and offer new research directions and visions to policymakers, academic researchers, and environmentalists.

Keywords: Climate warming, fossil energy, energy structure.

1. Introduction

Climate warming is a global challenge, rather than a short-term phenomenon. According to the reports from the World Meteorological Organization(WMO), global temperatures have continued to rise over the past 144 years, starting from -0.1°C in 1880 with occasional fluctuations. By 2023, the global average temperature was close to the lower limit of 1.5°C set by the Paris Agreement, which even broke some related records significantly. It is obvious that the corresponding changes are accelerating considerably. As a result, disasters caused by climate warming have become more frequent and serious, including melting glaciers, rising sea levels, the destruction of the ecosystem, intensified extreme weather, declining agricultural yields, and threats to human health, all of which caused huge damage to human society. Therefore, it is meaningful for human society to tackle the climate problem. However, humans use a large amount of fossil energy, including coal, oil, and natural gas, which considerably intensifies climate warming. While burning these fuels, they generate many greenhouse gases, which greatly damage the environment. Governments of all countries must take effective measures as soon as possible, adhere to the principle of sustainable development, reform the energy structure, reduce dependence on fossil energy, and align with the 1.5°C temperature control target set by the Paris Agreement, otherwise the problem will become worse and the next generation may live in disaster and pain. There are already plenty of researches focusing on the influence on society and environment from climate warming and reform in energy structure. This essay analyses plenty of data and examples and additionally explore the use and negative impacts of fossil energy, as well as feasible technological, political and environmental measures which promote the sustainable development.

2. Climate Warming

2.1. The Current Situation of Climate Warming

Climate warming has become an unquestionable fact. In 2019, WMO confirmed that the world had experienced the hottest June on record. Australia, Japan, Pakistan, India and other countries have broken the heat records [1]. Meanwhile, the Global Climate Report released by the National Oceanic

and Atmospheric Administration in 2019 pointed out that some high-latitude regions, such as Siberia and Alaska, which were previously considered to be cold, also experienced an increasing temperature [2]. According to the report from the Intergovernmental Panel on Climate Warming in 2019, global cryosphere change was accelerating, with the area of thick ice in the Arctic decreasing by about 90% and the Antarctic ice sheet decreasing by an average of 155 billion tons per year [1]. Besides, the impact of rising global average temperature on different regions varies. Scientists found that if the global average temperature rises by 1.5° C, then the average temperature increases by 4.5° C in high latitude regions while it increases less than 1° C in low latitude regions [3]. This means that people who live in low latitudes find it more difficult to detect the climate warming comparing with people who live in high latitudes. In addition, United Nations Intergovernmental Panel on Climate warming showed that the total heat capacity of the oceans was continuously increasing, while the amount of heat added was accelerating. In 2019, The Guardian pointed out that the ocean has absorbed 93% of the extra heat since the Industrial Revolution, playing a significant role in mitigating climate warming [4]. In 2023, the WMO published the assessment called "2023 Global Climate Status", which pointed out that some records like global temperatures have been broken again. UN Secretary General Guterres referred to this as a "distress signal" sent by the Earth. Facing the accelerating climate warming, how to adapt to it has become a difficult problem for all countries.

2.2. The Influence of Climate Warming

2.2.1. Glacial Melting and Sea Level Rising

Climate change is causing the rapid melting of glaciers in both oceans and land directly, leading to accelerated sea level rise. In 2019, the Amery Ice Shelf in eastern Antarctica, a massive iceberg with an area of 1636 square kilometers, collapsed and slid into the sea [1]. In addition, climate warming also affects sea level through precipitation. For every increasing 1° C, the air will be able to hold 7% more water vapor and thus create more rainfall. With the increase in rainfall, especially the frequency of heavy rainfall events, the risk of urban waterlogging goes up significantly, particularly of coastal cities like Venice [5]. Currently, 8 out of the top 10 cities in the world are located near the coast and about 50% of the global population resides in coastal areas that are facing internal migration issues, posing a serious threat to the stability of society, especially to densely populated coastal countries such as China and India [6]. Some small countries are even facing survival crises. The entire area of Tuvalu has shrunk by 2% while it is expected that 60% of territory will be submerged in 50 years [7]. In fact, island countries like Maldives and Nauru are also facing the same problem. These countries and regions may choose to reclaim land from the sea, but this not only leads to economic losses but also exacerbates sea level rise.

2.2.2. The Destruction of Ecosystem

The impact on the biosphere also be widely concerned. Some categories of migratory birds fly to Northeast China every summer. However, due to climate warming, the summer is extended so these birds leave the Northeast later and thus return later [6]. Therefore, the pests that these birds prefer preying on rapidly proliferate, disrupting the food chain. Additionally, the rise in water temperature reduces the level of dissolved oxygen, which has adverse effects on fish and other aquatic animals that rely on oxygen for their livelihoods. Climate warming also poses a serious threat to the survival of polar bears. With a quick melt in Arctic sea ice, it's difficult for polar bears to hunt for food [5]. In a research report in January 2021, the journal "Biological Sciences" indicated that climate warming may destroy over 300 species of mammals and birds in the next century, leading to more species extinct [5]. Not only animals but also plants are considerably affected, especially the urban garden plants. A study on the planting history of approximately 200 common garden tree species in 20 cities in the United States found that the number of these species was decreasing in 6 cities [8]. Besides, in the past 30 years, climate warming also had a significant impact on the development cycle of urban landscaping plants. For example, since the 1980s, the effect of climate warming changed the flowering period of cherry blossoms in Kyoto city, earlier than those in nearby parks and suburbs.

2.2.3. Extreme Weather

The ocean is the major source of energy for extreme weather events such as typhoons and hurricanes, and warmer oceans provide more energy. In 2018, there were 70 tropical cyclones and hurricanes in total in the Northern Hemisphere, compared with the average data of 53 per year in usual [3]. In 2018, East China was continuously hit by typhoons such as Anbi and Wenzhao. Among them, three typhoons made direct landfall in Shanghai, which is very rare in history [4]. In October 2019, Typhoon Hagibis made landfall on the Izu Peninsula in Japan, bringing huge rainfall and mudslides to nearby cities, causing enormous human and economic losses. With the continuing rising global temperature, the frequency and strength of extreme weather will go up, bringing human more challenges.

2.2.4. Public Health

High temperatures also relate to public health. The heatwave in France from June to September in 2019 caused 1462 deaths and over 20000 people sought emergency room treatment for heat related illnesses [5]. Furthermore, due to the warming climate conditions, the living range of mosquitoes and lice expanded a lot, thereby some tropical diseases have spread to high latitude regions. For example, with the spread of the dengue virus, the global incidence rate of dengue fever has risen sharply in recent decades [5]. Meanwhile, multiple studies indicated that climate warming may also decrease human intelligence. Human cognitive ability is related to the amount of carbon dioxide inhaled, so an increase in carbon dioxide concentration can make people more stupid. Professor William Ripple stated that if the concentration of carbon dioxide in the air continues to rise rapidly, human cognitive ability may be damaged in the future [5].

2.2.5. Financial Loss and Decrease in Grain Production

The impact of climate warming on economy cannot be ignored. A study from Stanford University shows that since the 1960s, climate warming has exacerbated the economic inequality between countries [9]. Researchers have found that in years with temperatures above average, economic growth accelerated in cold regions and slowed down in hot regions. The main reason is that cold countries have more suitable weather under the rising temperatures while the amount of arable land has greatly increased. However, The heat waves in hot countries led to a reduction in labor working times, severely impacting productivity. Researchers predict that the average income will decrease by 23% by 2100 if keeping the current trend of climate warming and the impact will be most pronounced in low latitude regions [7]. At the same time, due to the high requirements of weather, climate warming further expands the instability of agricultural production and then leads to economic instability. Climate warming seriously deteriorates the growth environment of crops, reducing the total yield of agricultural products through increasing pests and diseases, promoting frequent droughts and exacerbating floods. It also increases the unit yield cost, successfully reducing the enthusiasm of farmers [10]. Besides, the warming contributes to the increasing activities of microorganisms, enhancing their ability to decompose organic matter in the soil, which directly leads to the decline of the quality.

3. Fossil Energy

3.1. Using of Fossil Energy

Climate warming may be caused by natural factors such as changes in solar activities and large-scale volcanic eruptions. But since the 19th century, human activities have been the main reason because of the over-use of fossil energy, which is the hydrocarbon that has evolved over tens of thousands of years from the remains of underground flora and fauna, including coal, oil, and natural gas. Since the Industrial Reform, humanity has entered into an unprecedented development, where people have discovered that burning fossil energy can generate incredible power. However, this procedure produced a large amount of greenhouse gases such as carbon dioxide and formaldehyde,

which are highly transparent to visible light from the sun and highly absorbent of longwave radiation emitted by the Earth which caused the rapid increase of Earth's temperature. According to the research, the concentration of carbon dioxide has been between 170 and 300 ppm for at least 800000 years, while it increased to over 410 ppm from the Industrial Reform to 2019 [4]. As a result, the use of fossil energy can be regarded as the main factor of climate warming.

3.2. The Reform of Energy Structure

In 2023, fossil energy still accounts for 81% of the global energy structure, contributing by oil and coal, at 32% and 26% respectively, closely followed by natural gas, at 23% [11]. Obviously, fossil energy still plays the most important role in human production and life today. With the intensification of climate issues, energy structure reform is necessary. Take China as an example. With the rapid growth of the economy, the scale of energy consumption in China has increased rapidly year by year. In 2021, the proportion of oil and natural gas consumption in China was 17.62% and 4.03% respectively, and the proportion of coal consumption was the highest, at 70.45% [11]. By the contrary, the development of sustainable energy sources such as solar and wind power is slow. Therefore, China focused on formulating a sustainable development strategy and vigorously promoting energy structural reform, including adhering to the energy-saving priority and improving economic competitiveness. China has proposed the 14th Five-Year Plan, announcing to reduction energy intensity by 13.5% and carbon intensity by 18% by 2025.

4. Solutions

The following are feasible measures to address climate warming and excessive use of fossil fuels.

4.1. Technical Measures

One of the most important reasons limiting the development of the new energy industry is the immaturity of power generation and transmission [12]. Therefore, developing advanced technologies is useful in improving the quality of power generation. In addition, wide monitoring of the power grid can identify existing problems in time and make improvements as soon as possible, ensuring the smooth and safe operation of the power grid. Therefore, a sound management system can improve the quality of electricity, ensuring the stable development of new energy generation and related industries.

Moreover, Carbon Capture and Storage(CCS) is excellent. It refers to the process of separating CO₂ from industrial or related energy sources, transporting it to storage sites for storage and isolating it from the atmosphere for a long time. CCS respects the existing energy system and is less limited by energy resource conditions. At the same time, compared with other technologies, it has obvious effects and fast results.

Developing new energy vehicles is also a good choice. China has published numerous policies to support the development of new energy vehicles since the 15th Five Year Plan as well as various financial support, including subsidies and tax reductions [13]. This is of great help in getting rid of reliance on fossil energy.

4.2. Environmental Measures

Promoting wooden boards can also be helpful. Wooden houses store a large amount of CO₂ during the building procedure, most of which is stored in boards. A study shows that a wooden house can contain approximately 8 tons of carbon, 2 of which are stored in wooden boards [14]. It means that before the house reaches its lifespan, a large amount of CO₂ is stored in the house rather than released into the atmosphere. It can be regarded that the wooden boards provide not only low-carbon buildings but also important carbon storage.

It is very important to promote afforestation. Thomas Krauser, a climate warming ecologist, stated that this is the most cost-effective measure [1]. The green vegetation, especially forests, has a dual

effect of energy storage and emission reduction. On the one hand, vegetation converts solar energy into chemical energy through photosynthesis and stores it, playing an important role in heat fixation; On the other hand, a large amount of carbon dioxide will be absorbed, contributing to heat dissipation.

4.3. Political Measures

Strengthening international cooperation is extremely important. Climate warming knows no borders and no country on the earth can be alone. To actively address this challenge and effectively slow down the pace of warming, countries around the world should cooperate actively, shoulder their responsibilities and take effective measures to strive for a win-win situation for the interests of humanity. The Paris Agreement is a perfect example. On December 12, 2015, approximately 200 countries reached the Paris Agreement, committing to keep global temperature rise below 2°C, which become the goal in the coming decades.

China also actively cooperates with foreign governments. In 2022, the Conference of the Parties 26 was held and China officially submitted a new climate commitment to increase the proportion of renewable energy to 85% by 2025, reach peak emissions before 2030, and achieve carbon neutrality before 2050. This conveys China's determination to the world and encourages global governments to work together.

5. Conclusion

This article analyzes the current situation and negative influence of climate warming, the use and negative effects of fossil energy and feasible technological, political, and environmental measures that play unequal roles in sustainable development through the analysis of existing data and facts. The use of fossil energy by human beings in centuries has exacerbated climate warming, leading to a series of derivative disasters like melting glaciers and sea levels rising, the destruction of the ecosystem, threats to public health and the damage to marine ecosystems. To alleviate these problems, countries need to take active and feasible measures, such as developing new technologies including new energy vehicles, promoting artificial boards and afforestation, and strengthening active cooperation between countries. Otherwise, the earth will no longer be suitable for humans to live. One of the key points is the reform of energy structure, for which countries should increase the proportion of clean energy and reduce their dependence on fossil energy. In the future, to achieve the goal of sustainable development, governments should increase their financial investment in sustainable strategies. Developing green finance and green bonds is a suitable choice that can help promote green industries. Also, governments are encouraged to raise awareness among the public about the severity of the problems through ads, like inviting celebrity to give speeches.

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