

# Analysis of the Possibility of Slowing Down the Melting of Arctic Glaciers from the Perspective of the Global Energy Economy

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**Abstract:** In 2020, Antarctica's surface temperature exceeded 20 degrees Fahrenheit for the first time. This also demonstrates that global warming has become a very significant issue that will cause a number of problems for the planet's species and ecosystem. Many people think that global warming is an old-fashioned problem, but in fact, most people are far from correctly recognizing the terrible consequences caused by global warming. Therefore, this paper studies the problem of glacier melting and analyzes the impact of the development of new energy industry on delaying glacier melting. The results show that the goal of global rise of 1.5 °C is difficult to achieve and requires multi-party cooperation. In the future, global temperature rise is inevitable, and more advanced technology can achieve the goal. It should consider that increasing research and development of new energy technologies to essentially replace petrochemical energy. In terms of economic activities, how to change the existing business model, improve efficiency and reduce carbon emissions is a matter of consideration.

**Keywords:** Arctic Glaciers, Global Energy Economy, Carbon Emission.

## 1. Introduction

### 1.1 Background

What exactly is the connection between the economy of energy and the state of the environment? During the country's second release of the White Paper on Environmental Protection, the Deputy Director General of the National Environmental Protection Agency stated that China's economic losses due to environmental pollution are projected to be around 10 percent. [1] To begin, air pollution has a negative impact on economic growth and is responsible for a significant amount of wasted labor, resources, and money. To begin, the use of coal and oil as fuel in industrial facilities is the primary contributor to the pollution that is released into the atmosphere and is the greatest source of exhaust gas. Air pollution has a negative impact on economic growth and is a substantial contributor to the waste of human, material, and monetary resources. To start, there are acid pollutants in the air, as well as corrosion caused by sulfur dioxide, nitrogen dioxide, and other materials, equipment, and buildings used in construction. Second, the rise in dust is having a detrimental effect on the production of precision tools and equipment, as well as their installation, commissioning, and usage. The negative effects of air pollution on industrial output may be broken down into three categories: an increase in the cost of manufacturing; an increase in the cost of the product; and a reduction in the product's lifespan.

Air pollution amplifies the greenhouse effect, which in turn warms the water, causes the melting of glaciers, raises sea levels, and makes waves and storm surges that are more destructive. For instance, Hurricane Katrina, which made landfall on the southeastern coast of the United States in 2005, was responsible for nearly \$2.2 billion worth of damage to the nation's ports [2]. After a storm, there are ongoing expenditures associated with recovery and costly delays in transportation. The costs of the port's efforts to adapt to the effects of climate change will also be borne by the port. It is possible

that the port may require an expansion of its existing facilities, the construction of protective barriers such as "sea embankments," or perhaps a relocation to higher land. The cost of the ship needing to open up new routes in order to avoid hazardous weather is another consideration.

In 2008 Obama made a series of pledges to combat climate change: wean us off Middle Eastern oil and promote clean energy. The tone of energy policy is to emphasize energy efficiency, reduce dependence on foreign oil, limit the use of fossil fuels, encourage the development of new energy sources, improve fuel economy standards and reduce carbon emissions, ensure energy security and promote energy independence. Facing the severe economic situation, the Obama administration expects to make the new energy industry a new driving force for the economic growth of the United States. Under the strategic layout of "clean energy", the United States has carried out the "green revolution" in many fields.

To vigorously promote energy conservation and emission reduction: establishing the first national standard to address carbon pollution from the U.S. power sector. The final plan for the Clean Power Plan proposes a 32% reduction in carbon emissions from US power plants by 2030, compared with 2005 levels; investing in and develop clean energy: it invested \$4 billion to promote the renovation and upgrading of buildings in the public and private sectors, and provide energy conservation assistance to 2 million houses; reducing energy waste in community building: it launched the "Better Buildings Challenge" program to promote public utilities, manufacturing, commercial enterprises and schools in all states and cities to improve energy efficiency, with data centers and outdoor lighting systems as key regulatory objects.

From 2008 to 2015, the United States achieved economic growth of 10.6 percent while reducing carbon dioxide emissions by 9.4 percent, according to the White House. The use of new energy in the United States has increased significantly. Between 2008 and 2016, wind power grew from 55,000 megawatt-hours to 165,000 megawatt-hours, while solar power grew from 865 megawatt-hours to 4.5 megawatt-hours. Renewable energy accounted for 10% of the U.S. energy mix in 2015, up 3% from 2008. At the same time, the United States' dependence on foreign oil decreased significantly, with crude oil imports dropping from 11,115 b/d in 2008 to 4,711 b/d in 2015. In 2015, the US imported 24 percent of its oil consumption, taking a big step towards achieving its dream of "energy independence".

## 1.2 Related research

Aktar et al. studied the causal relationship between energy consumption, carbon dioxide emissions and economic growth in Bangladesh from the perspective of decomposition by integrating capital and labor into the total production function in a multivariable framework. The conclusion shows that Bangladesh does not need to sacrifice economic growth or reduce energy consumption in order to reduce pollutants [3]. West and Marland studied the energy demand and subsequent carbon emissions in the current agricultural practice in the United States through the full c-cycle analysis of the data in the existing literature for estimating agricultural inputs. The conclusion is that in the United States, the change from CT to NT provides an opportunity to increase carbon sequestration while reducing agricultural carbon emissions [4].

Zhang and Cheng used data and unit root tests to study the intertemporal relationship between income and energy environment relationship. The conclusion is that the Chinese government can implement stronger energy conservation policies without damaging long-term economic growth [5]. Liu and Zong-Yi studied the time series carried out nationwide, analyzed the interaction between the three, and revealed this regional difference through panel data analysis. The conclusion is that there are two-way causal relationships between provincial energy consumption and carbon emission, energy consumption and economic growth, and carbon emission and economic growth [6]. Chang explored the causal relationship between carbon dioxide emissions and energy consumption related to China's GDP growth through multiple cointegration tests; In addition, the energy consumption levels of crude oil, natural gas, coal and power generation are also considered. The conclusion is that this growth will have an adverse impact on global climate change [7].

### 1.3 Objective

This paper will study the problem of glacier melting, and analyze it combined with the existing economic and business model and energy supply. Combined with the existing research, the problem of high global temperature rise is judged. Finally, this study wants to put forward some effective solutions.

## 2. Situation

### 2.1 Energy demand is rising

Global carbon dioxide emissions from energy consumption increased by 1.7 percent (560 million tons) in 2018, reaching an all-time high of 33.1 billion tons of carbon dioxide, driven by rising energy demand, the International Energy Agency (IEA) reported. That was the fastest pace since 2013 and 70 percent higher than the average since 2010. The increase of 560 million tons is equivalent to the total emissions from international aviation worldwide. The power sector accounts for nearly two-thirds of the rise in total fossil fuel emissions. Coal consumption in the power sector alone emits more than 10 billion tons of carbon dioxide. The increase in emissions is being driven by higher energy consumption as a result of strong global economic growth, as well as weather conditions in some parts of the world that have triggered increased energy demand for heating and cooling. For the first time, the International Energy Agency has assessed the impact of fossil fuel use on rising global temperatures. The study found that the global average surface temperature rose by 1°C above pre-industrial levels, with carbon dioxide emissions from coal-burning causing more than 0.3°C, making coal the single largest source of global temperature rise. Global warming will have different impacts on human health ecosystems and socio-economic areas depending on geographical distribution. For example, Hurricane Katrina, which hit the Gulf coast of the United States in 2005, caused about \$2.2 billion in damage to U.S. ports. After the storm, the cost of reconstruction and transportation delays are high. After that, the port may also need to upgrade its structure, build "seawall" and other protective barriers, or even move to higher places. In addition, ships must open up new routes to avoid the influence of bad weather.

### 2.2 Development of new energy

The movement of the energy structure away from traditional fossil energy and toward new renewable energy as well as away from high carbon to low carbon emissions is an unavoidable trend that is being driven by climate change. Due to the challenges of non-renewable fossil energy and uneven geographical distribution, the issues of energy security and environmental pollution have become more and more important as time has passed and the major growth in energy consumption has occurred. In this setting, there is an increasing demand for the development of alternative energy sources as well as the promotion of the transformation of new energy sources. The advent of nuclear power in the 1950s and 1960s marked the beginning of international attempts to transition away from the use of fossil fuels. Since the end of World War II, nuclear power has emerged as a clean and reliable new source of energy in the annals of world history. In the 1960s, the Western world had a largely positive attitude toward nuclear power. It is anticipated that nuclear energy will become a competitor to oil as alternative forms of energy continue to gain ground. On the other hand, the unforeseen events that followed took place. The world community has come to reject nuclear energy and has placed various restrictions on the development of nuclear power as a result of their worries about nuclear proliferation and nuclear accidents. Following the two oil crises that occurred in the 1970s, the second wave of alternative energy development began. Significant progress has been made in the development of renewable energy sources such as solar energy, wind energy, hydro energy, and geothermal energy, while the nuclear energy industry has reached the pinnacle of the second stage of development. Despite this, progress toward developing other forms of energy has slowed significantly since the middle of the 1980s, coinciding with a precipitous drop in the price of oil on the international market. The 21st century has once again drawn the attention of nations all over the

world and ushered in new developments as a result of rising energy consumption, rising oil prices, and the intensifying difficulties posed by climate change. In addition, the 21st century has also brought about new innovations. In recent years, the rise in the price of energy, government promotion and the stimulation of mechanisms for the development of clean energy, the rapid growth of global investment, and the continuous expansion of the size of the market have all contributed to an acceleration in the development and utilization of renewable energy. An annual growth rate of between 15 and 30 percent can be attributed to the rapid expansion of the world's renewable energy sources between 2002 and 2006. The quick expansion of the alternative energy sector as well as the clean energy industry is raising the expectations of the international community for a new energy revolution and transformation. The conversion of existing energy sources into new forms is a general trend in the long run. Traditional methods of energy utilization will eventually be phased out in favor of new energy systems, new models of energy utilization that are helped by technology, and new energy utilization concepts.

### **3. The melting of Arctic glaciers**

#### **3.1 Melting index prediction**

In the last decade, the possibility of an intensified Arctic response to rising greenhouse gas levels has heightened interest in the region's climate. Furthermore, studies of various Arctic climatic indicators have revealed significant changes in recent decades, such as reports that winter surface air temperatures in the Arctic have risen by 3 to 4 degrees Celsius during the last 50 years. Meanwhile, over the last several decades, Arctic sea level pressures have dropped over the Arctic Ocean [8]. Summer sea ice extent in the Northern Hemisphere has fallen by 15%–20% in the last half-century, with the three most recent summers having a record or near-record minimum ice extents in the Arctic [9,10]. Given these intriguing recent trends and the potential for increased climate change, adequate modeling of Arctic processes in global climate models (GCMs) is required if model projections of future climate in the Arctic are to be reliable.

#### **3.2 The control of 1.5 ° C**

A guarantee was made in the Paris Agreement<sup>1</sup> that ratifiers will make an attempt to reduce the rise in global temperature to pre-industrial levels of 1.5 degrees Celsius. The carbon budget, which is consistent with warming below 1.5 degrees Celsius and was reported in the fifth assessment report by the IPCC, is based directly on the response of the Earth System Model (the combined model ratio to Project Phase 5), and on average, the response to historical CO<sub>2</sub> emissions is greater than the observed values and other coercion. This is because the Earth System Model takes into account feedback loops. According to the model, the median budget for the remainder of the budget starting in January 2016 is 55 PgC (base period: 1870), which is comparable to emissions for approximately five years at the rate of 2015. We eliminated the difference in model observations of the historical climate-carbon response by calculating the global warming and carbon budget for the 10-year period 2006-2015. In doing so, we increased the median remaining carbon budget to 208 PgC (in the range of 130-33-66 percent) and increased it to January 2016 (an average of 0.89°C in 2006-2015 compared to 1861-2080). The observational datasets that were used to infer that warming has taken place are not overly sensitive, and their accuracy does not depend greatly on the emission scenario that was used. Therefore, despite the fact that the IPCC AR5 carbon budget speculates that it will be extremely challenging to keep the median of predicted global warming below 1.5 degrees Celsius, this demonstrates that it is not impossible to do so.

### 3.3 The global temperature continues to rise

As shown in Figure 1, the ERA-40 reanalysis of annual, seasonal, and monthly means are compared to the comparable observation-based annual, seasonal, and monthly means for this period. Figure shows mean surface air temperatures from the ERA-40 reanalysis (top row), a composite of temperatures from 14 IPCC AR4 GCMs (middle row), and GCM–observation differences for the winter [December–February (DJF)], spring [March–May (MAM)], summer [June–August (JJA)], and autumn [September–November (SON)] seasons from 1981–2000. (bottom row). The 14-GCM composite–ERA-40 discrepancies show the 14 GCMs' composite surface air temperature biases to the extent that the ERA-40 reanalysis properly depicts the observed present-day climate period 1981–2000. The geographical patterns of mean temperatures simulated by the GCMs are fairly close to those of the ERA-40 overall seasons, with slight biases. From this side-by-side comparison, it's tough to claim that GCMs aren't properly replicating seasonal mean temperatures in the Arctic. One probable exception is the GCM composites' lack of detail over large topographic features. The smoothing is most likely caused by the GCMs' coarser grid resolutions and the average of the GCM fields over 14 data sources. From 1978 to 2000, we can see that the global temperature continues to climb.

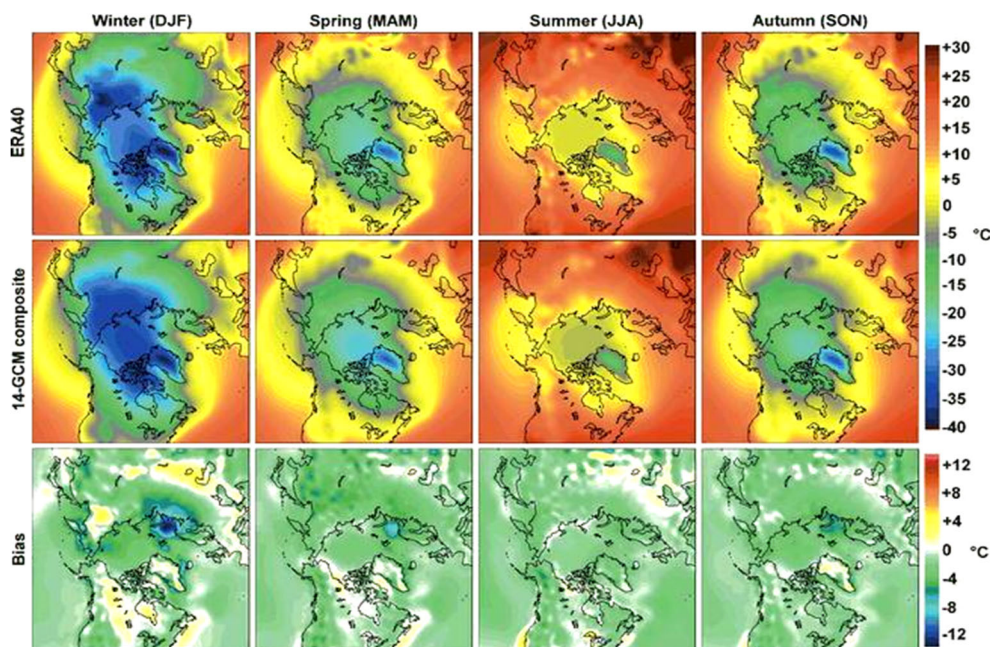


Figure 1. The trend change in the global temperature

### 3.4 Carbon dioxide emission

SRESB1, SRESA1B, and SRESA2 are three alternative sets of prescribed greenhouse gas forcing for the twenty-first century, reflecting a variety of emission scenarios in the IPCC AR4 GCM forecasts. Figure 2 shows a two-century time record of GCM-simulated and predicted temperature change averaged over 60°–90°N. Annual temperature variations expected for the twenty-first century for the three greenhouse gas forcing scenarios are also displayed for the initial ensemble members from each model: (SRESB1 in blue, SRESA1B in green, and SRESA2 in red). While all models predict warming in the Arctic beyond 2030 for all scenarios, the estimated increases differ greatly depending on the forcing scenario. Temperature changes predicted under the SRESB1 scenario by the end of the twenty-first century vary from +1° to +5.5°C, +2.5° to +7.0°C by the SRESA1B scenario, and +4.0° to +9.0°C by the SRESA2 scenario. In some respects, the model's ultimate conclusion cannot be less than or equal to 1.5 degrees Celsius, implying that the following policies must be altered.

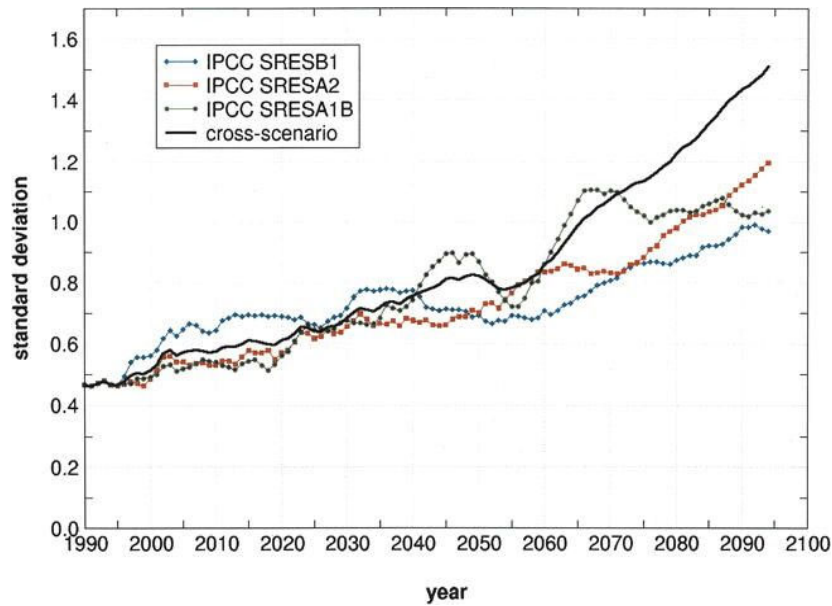


Figure 2. Carbon dioxide emission trend and forecast

#### 4. Suggestion

According to The Working Group III report of the Intergovernmental Panel on Climate Change (IPCC), the 3,675-page of the new report noted that the average annual global emissions of greenhouse gases from 2010 to 2019 were at their highest level in human history, but the rate of growth had slowed down. Global carbon dioxide emissions from the energy sector reached 36.3 billion tons in 2021, up 6 percent year on year, surpassing pre-COVID-19 levels and setting an all-time high, according to the Global Energy Review: CO2 Emissions to 2021, released by the International Energy Agency (IEA). The IEA attributed a "strong rebound" in energy emissions to a strong recovery in coal-fired power generation due to soaring natural gas prices in 2021. In 2019, the European Union presented the European Green Agreement (EGD) which concluded a 50-point action plan for the next five years across sectors aimed at making the EU economy climate-neutral by 2050. Thus, limiting global warming to 1.5°C will be possible to carry out.

Here are some specific actions extracted from the research these years and they are possible to proceed in the future.

##### 4.1 Diversifying the clean low-carbon acceleration

Although the total energy consumption is increasing from history to nowadays, the primary energy mixture is accelerating to a diverse, clean and low-carbon direction, which may develop in the direction of high efficiency and integration. In order to echo the new policy--The State Council of China issued the 14th Five-Year Plan for Market Supervision Modernization on Dec 14, 2021, which made comprehensive plans for establishing and improving a system of carbon peak in 2030 and carbon-neutral standards in 2060. According to a recent survey by the Ultra Low Carbon Photovoltaic Alliance, China has 83% of the polysilicon industry, 96% of the wafer industry, 79% of the photo-voltaic cells and 70% of the photovoltaic modules in the world. For diversifying the clean low-carbon acceleration, the photovoltaic industry is one great choice. It has a broad future in being used on the roof of the house. Especially in the north part of China, where the coal is essential for northern people to go through the winter and there is little sunlight that can be used efficiently. In terms of electricity, wind power is emerging as the largest renewable energy source. In 2018, renewables accounted for 32% of electricity in the European Union. The EU has made significant investments in renewable energy thanks to strong renewable energy policies such as the Renewable Energy Directives (RED I and II). Due to lower natural gas prices, there has been a major conversion of coal

to gas in the power sector, with 25 percent of power generation in 2018 relying on nuclear. The coal industry “devotes” a lot to rising the sea level. If it cannot be held at 1.5 °C, the melting of glaciers will be even worse.

#### **4.2 Leading some technological breakthroughs and fostering new forms or models of business**

Watching some technological breakthroughs these years, the hydrogen industry must be a nova. Burning the hydrogen only leads to H<sub>2</sub>O and O<sub>2</sub> in the end, it pollutes the environment at a minimum. Just take an example, the hydrogen industry offers the United States many opportunities to decarbonize heavy industry. However, producing zero carbon or low hydrocarbon gas remains a challenge, partly due to the limited availability of electrolytic cells and high production costs. According to the U.S. Department of Energy, the U.S. hydrogen market is currently 10 million tons per year. Besides, the global hydrogen market is 65-1 million tons per year. Green hydrogen is still a negligible part of the production, as the current installed capacity of electrolytic cells is only 170 MW. Meanwhile, looking ahead to 2050, the U.S. Department of Energy expects the green hydrogen market to grow to 100 million tons per year, with 1,000GW of electrolytic cell capacity installed. Imagine that the hydrogen industry comes into the business, it may bring new possibilities to hydrogen storage and transportation. New technologies brought into the business will lead to the next invention and creation in technology as well. However, each coin has two sides-- the first entrance for new technologies in business usually have much more expensive prices and less influential crowds. Thus, it needs some policies to support and promote in the not-too-far future.

#### **4.3 Globalizing the increased opportunities for international cooperation**

The globalization process takes a more concerted effort from a group than from an individual. As a sample of the contrary viewpoint, the United States announced its official withdrawal from the Paris Agreement on November 4, 2020. The Intergovernmental Panel on Climate Change of the United Nations has issued a warning that "destructive weather" might occur beyond 2030 if the rate of global warming does not remain below 1.5 degrees Celsius. The Paris Agreement includes a strong commitment to limit the increase in global average temperatures over the course of this century to less than 2 degrees Celsius and to less than 1.5 degrees Celsius relative to pre-industrial levels. These setbacks impact not just the United States' climate governance, but also the bilateral and international climate cooperation and global governance processes in which the United States participates. [Bibliography required] A law assistant professor at Xi'an Jiaotong University did research and analysis on the following three effects: First, the United States, which has the world's largest economy and is the second-largest producer of greenhouse gases, has indicated that it would not maintain its pledge to decrease its own emissions, resulting in a considerable drop in international efforts to reduce emissions. Second, the United States will be unable to meet its funding commitments, developed nations will struggle to meet their annual endowment goal of \$100 billion, the global funding gap to combat climate change will widen, developing nations will be less able to combat climate change, and global innovation in low-carbon technologies will be delayed.

According to the scenario evaluated by the IPCC, in order to limit warming to around 1.5 degrees Celsius, global greenhouse gas emissions must peak no later than 2025 and decline by 43 percent by 2030. During this process, the amount of methane emitted into the atmosphere will be reduced by around a third. Even if this temperature barrier has been breached for some time, there is still a possibility that it may be breached again before the end of the century.

### **5. Conclusion**

In conclusion, slowing down the melting glaciers by limiting the 1.5°C standards is not easy work. The possibility of reducing climate change by 1.5°C is analyzed in this report. There are still possibilities in proceeding with the suggesting methods, like how to put hydrogen uses at a reasonable

price and increase opportunities for international cooperation. If human beings want to hold the 1.5°C before 2030 by energy economic, please keep following some related researches.

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