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New Energy and Petroleum: Economic and Environmental Analysis

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Abstract: Energy serves as the fundamental industry of our national economy and a requisite for people's lives. During the recent years of high-quality development, new quality productive forces have been nurtured and evolved in the energy domain. In line with the new practical demands, China's new energy industry urgently needs to break free from traditional growth models and development routes. Thus, in the context where the significance of new energy in society is steadily escalating, it is particularly crucial to accurately analyze the pros and cons of new energy and how to rationally allocate it. This study employed the method of comparison and exemplification, making use of data related to new energy vehicles and traditional automobiles, along with the allocation of social new energy, to carry out relevant analyses centered on new energy, and explored the ways to enhance the production efficiency of the new energy industry in order to achieve maximum economic benefits in the subsequent development of the new energy industry. Finally, based on the aforementioned challenges, targeted recommendations were provided for the new energy industry to assist it in promoting the traits of economic development.

Keywords: Renewable Energy Systems, Energy Storage Solutions, Electric Vehicles, Hydrogen-Powered Cars, Traditional Gasoline Vehicles.

1. Introduction

As the issue of global climate warming becomes increasingly severe, the low-carbon economy has become an important development goal pursued by countries around the world. The Intergovernmental Panel on Climate Change (IPCC) has observed that human-generated greenhouse gas emissions are having a growing impact on the global climate. Despite some efforts to mitigate this issue, the planet has already experienced significant consequences due to climate change [1]. Earth was about 2.45 degrees Fahrenheit (or about 1.36 degrees Celsius) warmer in 2023 than in the late 19th-century (1850-1900) preindustrial average. The 10 most recent years are the warmest on record.

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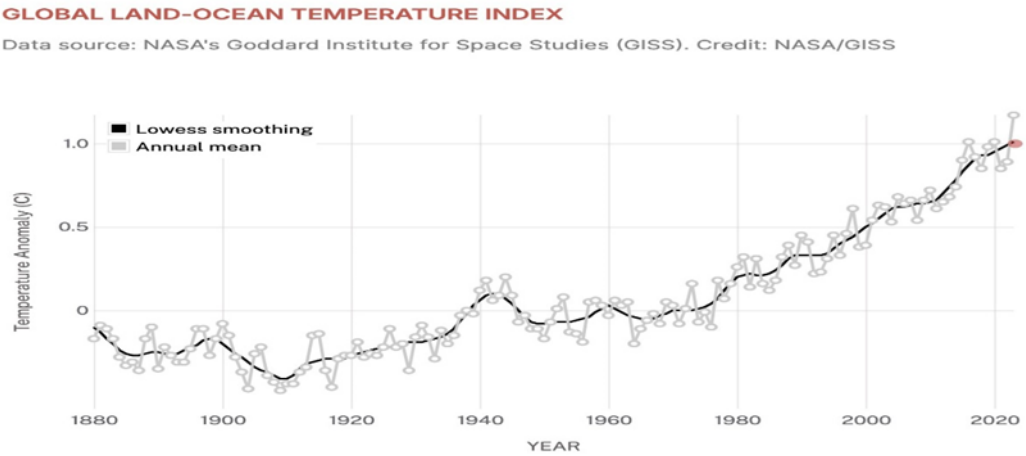

Figure 1: Global Land-ocean Temperature Index
Data Source: NASA's Goddard Institute for Space Studies (GISS)
Photo Credit: NASA/GISS

Against this backdrop, China, as one of the major carbon-emitting countries, achieving the gradual replacement of high-carbon oil emissions with new energy sources is of significant importance for global climate change. The oil and petrochemical industry, as one of the main sources of energy consumption and carbon emissions in China and even globally, faces enormous challenges and opportunities in this process. China holds the title of being the biggest carbon emitter globally; however, it is also actively engaged in efforts to combat climate change on a global scale [2].In recent years, China has taken the lead in global-warming pollution, producing about 26 percent of all CO2 emissions. The United States comes in second. Despite making up just 4 percent of the world's population, our nation produces a sobering 13 percent of all global CO2 emissions.Furthermore, China's overall carbon emissions have risen in recent years, showing a notable rise between 2002 and 2011 (see Figure 2, the blue line indicates the emissions, while the orange line represents China's share of global carbon emissions.) [3].)

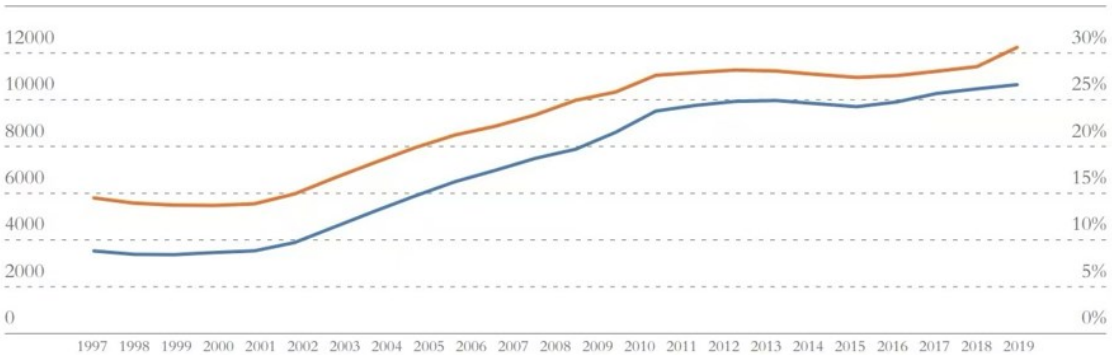

Figure 2: China's Carbon Emissions from 1997 to 2019 and Its Share in Global Emissions
Data source: Global Carbon Project

The following sections of this paper are organized as follows: Section 2 introduces the types of cars that primarily use new energy and oil as their main energy sources, and then analyse the advantages and disadvantages of new energy and oil based on three issues: hydrogen production capacity, environmental concerns, and range. Section 3 introduces the new energy development strategies from the perspectives of the government and enterprises, thereby addressing the

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optimization of energy distribution and achieving environmental protection (optimization of environmental resources).

2. Advantages and disadvantages comparison

2.1. Advantages of Electric and Hydrogen Vehicles

2.1.1. Hydrogen Vehicles Produce No Emissions

Fuel cell vehicles operate using hydrogen as their energy source, which reacts chemically with oxygen to produce electricity. The only byproduct is water vapor, meaning there are no emissions of carbon dioxide, nitrogen oxides, or fine particulate matter. This significantly contributes to reducing air pollution, as demonstrated by the use of hydrogen vehicles during previous Olympic events [4].

2.1.2. Government Support

New energy vehicles primarily depend on electricity and other environmentally friendly energy sources that do not cause pollution. In a time when environmental awareness is prevalent among the public, this initiative receives strong backing from the Chinese government. For instance, in June 2023, during an executive meeting at the State Council, it was announced that the exemption from purchase tax for new energy vehicles would be extended until the end of 2027 [5]. Additionally, there are certain government subsidies available for electric vehicle charging stations.

2.2. Disadvantages of Electric Vehicles and Hydrogen Fuel Cell Vehicles

2.2.1. Production Expenses and Storage

The manufacturing costs associated with fuel cell vehicles tend to be higher primarily due to the expensive nature of fuel cell production, as well as the significant investment required for hydrogen storage and refueling infrastructure [4]. Additionally, storing hydrogen necessitates high-pressure technology, which adds to the overall expense.

2.2.2. Environmental Concerns

how to properly dispose of the batteries of new energy vehicles after they have reached the end of their life has always been a problem for the new energy vehicle industry at home and abroad [6]. If the batteries of new energy vehicles cannot be properly disposed of after they have reached the end of their life, they will pose a threat to the environment and human health. When the outer layer of the old batteries is rusted away by sun and rain, the heavy metal components inside will seep into the soil and groundwater. If people consume crops grown on polluted land or drink polluted water, these toxic heavy metals will enter the human body and gradually accumulate, posing a great threat to human health. Moreover, our country's electricity supply has always been more dependent on burning coal or hydroelectric power generation. Therefore, electricity itself may not necessarily be environmentally friendly, but the way it is stored has changed.

2.3. Benefits of Gasoline Vehicles

2.3.1. Quick Refueling

Gasoline vehicles can refuel their energy supply more rapidly compared to electric and hydrogen-powered vehicles. The process by which gasoline cars obtain fuel is generally quicker and more consistent than that of electric or hydrogen alternatives. A typical gasoline vehicle has a fuel tank

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capacity of approximately 60 liters, requiring only about two minutes for a complete fill-up. In contrast, achieving similar charging speeds for an electric vehicle involves stringent conditions related to the charging current and voltage levels. Higher currents and voltages lead to increased power from the charging station, resulting in faster recharging times; however, this necessitates advanced infrastructure for both chargers and batteries. If numerous high capacity charging stations are established, simultaneous usage by many drivers could potentially trigger circuit overloads or other electrical issues.

2.3.2. Extended Longevity

New energy vehicle batteries typically have shorter lifespans on average compared to traditional vehicles' components. For instance, electric cars rely on large-capacity batteries as their main power source, but these batteries have limited durability and require regular replacements, leading to higher maintenance expenses over time. Conversely, conventionmodels. Theiles usually incur lower routine maintenance costs under normal operating conditions while enjoying significantly longer service lives than new energy models. The power source for these vehicles is the battery, which has a finite lifespan and requires regular replacement, leading to increased maintenance expenses. Currently, many new energy vehicles offer complimentary first maintenance services. For future maintenance needs, the cost for pure electric vehicles typically ranges from 400 to 500 yuan, comparable to that of minor repairs on traditional cars; however, this does not cover major repair costs. Major repairs for pure electric vehicles can range between 800 and 1,000 yuan based on specific circumstances. Additionally, if the vehicle frequently operates under poor road conditions, the associated costs may be higher (The Boundary Tram from the Internet).

2.4. Disadvantages of Gasoline Vehicles

2.4.1. Domestic policy suppression

The evolution of conventional gasoline commercial vehicles is significantly shaped by the national policy landscape. In recent years, numerous countries have been implementing various environmental protection measures to tackle pollution issues, which include restrictions on traditional gasoline vehicle usage [7]. Although there has been no official announcement regarding a complete ban on gasoline car sales in China by 2025, the Chinese government has already rolled out several initiatives aimed at promoting and popularizing electric vehicles, such as offering purchase incentives, free parking options, and complimentary charging services.

2.4.2. Oil resources are becoming increasingly scarce

Conventional vehicles consume substantial amounts of oil and other energy sources that are currently limited in availability. In light of the "dual carbon" initiative, the global crude oil market is experiencing high prices, significant spreads, elevated profits, and a robust structural framework.

3. Allocation of New Energy Resources

3.1. The Importance of Renewable Energy in Society

Renewable energy offers significant economic and social advantages, although it also presents some drawbacks for the new energy sector. Consequently, careful attention must be given to how renewable energy is distributed. With a global focus on sustainable development and environmental conservation, various policies have been implemented by governments to address these issues.

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3.2. Government Initiatives for Renewable Energy Distribution

The use of energy within the automotive sector is quite broad, leading to advancements in traditional gasoline vehicles. The Thai government prioritizes the growth of its automotive industry and considers it a key area of focus. As such, they have actively supported local manufacturers in creating new energy vehicles and technologies by not only providing policy backing but also promoting eco-friendly transportation options like electric taxis and buses. Nevertheless, there are certain challenges associated with new energy vehicles; the pace of market evolution is rapid, and consumer expectations regarding aspects such as charging infrastructure, limited range, and safety concerns are becoming increasingly prominent. Therefore, future automobiles should embody high-tech characteristics while adapting to market needs through ongoing technological advancements and innovative approaches [8].

3.3. Methods for Businesses to Enhance Their Adoption of Renewable Energy

Businesses play a crucial role in both society and the economy. While the renewable energy sector is steadily maturing, it frequently faces challenges such as shifts in policy, lack of financial resources, and an inconsistent development framework. To achieve effective management in businesses, it is essential to adopt a refined approach. During this transition, companies may face challenges such as unclear understanding of precise cost management and an inadequate operational budgeting framework. Thus, enhancing the awareness of meticulous cost control and refining the operational budget system becomes crucial. Regarding organizational governance, it is important to define the roles of each department clearly and establish the authority of relevant personnel to ensure that they operate within their designated responsibilities [9].

4. Application of New Energy Storage Technology

4.1. Optimization of Photovoltaic and Wind Energy with Energy Storage as the Primary Energy Source

Given the significant uncertainties associated with wind and solar power generation, which pose challenges to the reliable operation of power grids, there is an urgent need to investigate energy storage planning and configuration in order to support the coordinated development of renewable energy sources, power grids, and energy storage systems in China. Numerous studies have focused on optimizing concentrated energy storage for renewable energies. The first approach involves utilizing a two-layer optimization model to enhance shared energy storage capacity, thereby achieving economic efficiency while notably decreasing the curtailment rates for wind and solar power. The second method establishes a robust optimization framework aimed at planning and configuring shared energy storage that aligns with both supply-side needs and grid requirements. Lastly, a two-stage stochastic programming model is employed to optimize the capacities of wind, solar power, and energy storage specifically for electricity providers; this aims at cost minimization through a shared ownership strategy that enhances equipment performance.

4.2. Realizing the Economic Advantages of Energy Storage Configuration in Integrated New Energy Power Stations

The configuration of power and capacity within the energy storage system has a direct impact on the economic metrics related to mitigating power fluctuations. By employing an energy storage configuration approach that stabilizes output power variations from new energy sources, it is possible to determine the real-time charging and discharging requirements necessary for effective fluctuation

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management while remaining within the limits of rated power. This technique establishes the cutoff frequency for a low-pass filter based on frequency analysis results, enhancing compensation accuracy and ensuring that fluctuation demands are satisfied with minimal capacity usage.

4.3. The Efficiency of Energy Storage

When calculating compensation power, factors such as charging and discharging losses in energy storage systems, along with constraints regarding energy balance during these processes, are taken into account; thus, resulting in more dependable compensation values. Additionally, when determining both the required capacity for energy storage and its initial state, considerations regarding state-of-charge limitations ensure that overcharging or excessive discharge does not occur.

5. Renewable Energy Supply - Using rural areas as a case study

5.1. Technological Advancements for Enhancing the Development of New Energy Systems in Rural Areas

The establishment of a new energy framework in rural regions should be grounded in technological advancements while taking into account China's current technological capabilities and the specific conditions present in these areas [10]. This approach aims to address the deficiencies in essential technologies related to rural new power systems and their integration with energy grids. To begin with, it is crucial to enhance grid technology, which serves as vital technical support for both distributed and centralized renewable energy sources within rural settings. Efforts should be made to expedite the modernization of rural power grid infrastructure and facilitate the development of decentralized microgrids. It is important to investigate integrated solutions for distributed generation that incorporate wind and solar resources alongside load management and storage options, thereby addressing challenges associated with self-generation and consumption at a local level. Additionally, advancing large grid capacity expansion technologies will create opportunities for extensive integration of renewable energy sources into existing grids. Researching and implementing cutting-edge technologies such as grid adaptability, hybrid AC/DC interconnected networks, and intelligent dispatch systems are essential steps toward accelerating digital transformation and smart upgrades across county, town, and village-level grids. By optimizing resource allocation through larger grids while enhancing fault detection capabilities, people can effectively meet the energy demands of rural communities as well as production activities.

To begin with, it is essential to enhance the development of extensive wind and solar power facilities along with transmission infrastructure in rural regions. Additionally, people should focus on advancing new energy storage technologies. The expansion and intensification of wind and photovoltaic initiatives in deserts, Gobi areas, and wastelands within Northwest China's rural locales must be approached scientifically and economically. Furthermore, improving the integrated use of land alongside wind and solar resources in these areas is crucial while also bolstering the construction of transmission networks. It is important to innovate energy storage solutions that feature bidirectional power capabilities and flexible regulation to address the inconsistencies in energy supply due to weather variations or time-of-day changes associated with renewable energy generation. This will facilitate better local consumption patterns as well as ensure stable operations for new energy sources in rural settings. Concurrently, efforts should be made to expedite the establishment of green hydrogen storage systems, enhancing synergies between agricultural practices—such as crop cultivation and livestock farming—and the green hydrogen sector while promoting a shift away from conventional energy sources in these communities.

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5.2. Enhance the Infrastructure for New Energy in Rural Areas and Develop Integrated Public Services for Urban-Rural Connectivity

To achieve the objective of establishing a new energy system, it is essential to transform the rural energy framework by considering local conditions and enhancing both new energy infrastructure and integrated public services that connect urban and rural areas.

Firstly, it is crucial to bolster the development of new energy infrastructure within rural regions. The establishment of large-scale wind and photovoltaic power facilities in these areas is a primary focus during the "Fourteenth Five-Year Plan" period and beyond. People should encourage collective efforts to build substantial wind power and solar power installations on suitable vacant lands in villages, as well as on deserts, sandy terrains, and wastelands found in Northwest China's rural regions. Additionally, people must incorporate green electricity channels from wind and solar sources into the overall construction plans for urban-rural infrastructure integration.

This paper advocates for both centralized systems with storage capabilities as well as distributed photovoltaic setups featuring independent energy storage solutions. Support will be provided for utilizing clean energy either locally or through grid connections in rural locales rich in wind and solar resources. A dedicated initiative will be launched to facilitate access transformations for distributed renewable energy installations across these areas; this includes maximizing usage of rooftops, front yards, greenhouses, along with any available and to establish such facilities.

Furthermore, people aim to expedite comprehensive upgrades of outdated substations alongside transmission lines, poles, and other related infrastructures within rural settings—particularly focusing on improving underdeveloped power grids—to address issues related to weak electrical networks while enhancing service quality in water supply zones. This renovation effort will ensure that upgraded rural electrical grids meet the evolving demands posed by a new energy system.

Looking ahead, there are plans to extensively install electric vehicle charging stations throughout urban and rural environments—encompassing both public charging points as well as private ones—to promote greater adoption of electric vehicles.

Second, promote the construction of integrated urban and rural energy public service systems. While strengthening the construction of rural new energy infrastructure, utilize big data, cloud computing and other technologies to build an intelligent energy management platform that integrates urban and rural areas, enabling the full-process supervision of rural new energy production, transmission, distribution and consumption. The energy management platform will also promote urban-rural energy cooperation and exchange, providing energy consulting services for urban and rural residents and county and township enterprises. The government can provide subsidies or tax incentives to enterprises and individuals engaged in the production, operation and service of rural new energy to reduce their operating costs and enhance their market competitiveness. The market level can fully play the role of market regulation, attract social capital to participate in the investment, construction and operation of rural new energy projects with the help of preferential policies, and strengthen cooperation with financial credit institutions to reduce the financing cost of rural new energy system construction.

6. Conclusion

Currently, it is essential for the global community to prioritize tackling climate change. The world is increasingly becoming multipolar, and the trend of economic globalization throughout history remains unstoppable. It is vital to explore ways to achieve mutually beneficial cooperation among nations, take proactive measures, and foster the development of a shared future for humanity in order to enhance the welfare of people across all countries. This study examines the environmental protection implications of new energy versus oil by analyzing their respective advantages and

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disadvantages, resource distribution, and relevant policies. The results indicate that both governmental support for renewable energy sources and a comparative analysis reveal that new energy options are more environmentally sustainable and preferable for long-term growth compared to oil. In the setting of low-carbon environmental protection in China, new energy vehicles are evidently more in accord with China's fundamental demands for environmental protection at present. Nevertheless, on account of the immaturity of new energy vehicle technology and the short battery life cycle, issues require to be jointly addressed by the government and relevant individuals. Relevant individuals should also communicate proficiently with customers to gain a deeper understanding of market needs and make enhancements.As the largest developing nation, China should steadfastly pursue a path of green development, engage actively with the international community on climate initiatives, project an image of responsible leadership as a major power, improve its resilience against climate change impacts, and aim to set an international standard in this regard.

Authors Contribution

All the authors contributed equally and their names were listed in alphabetical order.

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