Research on China's renewable energy strategic development strategy from the perspective of sustainable development

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Abstract. Under the dual pressure of international energy crisis, global warming and environmental deterioration, the construction and development of sustainable energy system has become the focus of social concern. The alternative use of renewable energy will effectively prevent energy depletion, ecological deterioration and control the pace of global warming. The development of renewable energy strategy will effectively resolve the energy resource tension and meet the energy demand of national economic development. On the basis of discussing the serious problems facing the development of China's renewable energy strategy, this paper expounds the significance of the promotion of renewable energy strategy to the sustainable development of China, and puts forward some suggestions for the development of renewable energy in China.

1. Introduction
The energy strategy plays an important role in determining the sustainable development of the national economy. China's energy utilization has been dominated by fossil energy consumption for a long time, leading to such prominent problems as unreasonable energy structure, high energy consumption and high environmental cost. Therefore, speeding up the development and utilization of new and renewable energy, realizing the transition from fossil fuel to new energy, and improving the efficiency of renewable energy utilization have become the inevitable choice for the transformation of China's energy strategy. The year of 2003 is a symbol year for China's energy development to enter the period of strategic transformation. The proposal of scientific outlook on development has brought new adjustments and changes in China's energy policy, which has greatly promoted the transformation of China's energy development mode and strategic transformation. China has been the world's largest investor in renewable energy for seven consecutive years, accounting for about a third of the world's total investment in renewable energy in 2018, amounting to US $91.2 billion, according to a report released by the United Nations renewable energy consultancy. With the continuous expansion of the installed scale of renewable energy in China, more specific development measures are needed to promote the development of renewable energy.

2. Problems faced by China's renewable energy strategy
2.1. Low use of renewable energy in China
The energy system is shifting from large-scale fossil energy supplies to renewable energy such as wind, solar and biogas around world. China has also made substantial strides in the development of renewable energy. According to the” Renewable 2018 Global Status”, China's renewable energy
capacity in 2018 ranked first in the world (404 GW). However, in the energy composition of our country, there is an obvious gap between the utilization efficiency of renewable energy and the developed countries. Firstly, the use of renewable energy is mainly concentrated in the field of power generation, and less used in transportation, heating and cooling and other aspects. As shown in Figure 1, China's installed capacity of renewable energy, especially wind and solar energy, continues to rise. By the end of 2018, China's installed capacity of major renewable energy power generation was 72,896 kw, up 12% year on year, accounting for 38.4% of the total installed capacity. The installed capacity of both hydropower and wind power ranked first in the world, the installed capacity of solar photovoltaic power ranked second. But 80.2% of living energy is still coal. In the rural areas of China, which account for more than 49.68% of the total population, the living energy use is still dominated by firewood, straw and feces, which not only has low utilization rate of heat energy, but also brings great damage to the ecological environment. Secondly, China's total renewable energy consumption is low. As shown in Figure 2, China's energy consumption structure has been given priority to with coal, coal production accounted for about 60% of the total energy, in 2018 China's coal consumption of 1906 million tonnes oil equivalent, annual primary energy consumption 3273 million tonnes oil equivalent, an increase of 4.3%. However, the total consumption of renewable energy is far lower than that of primary energy, which has great potential. Moreover, as the world's largest installation of renewable energy, the share of the grid in China is still relatively small.

| Year | Cumulative installed wind capacity (Megawatts) | Cumulative installed solar power (Megawatts) | Cumulative installed geothermal power capacity (Megawatts) |
|------|-----------------------------------------------|---------------------------------------------|----------------------------------------------------------|
| 2008 | 253                                           | 8388                                        | 25                                                       |
| 2009 | 415                                           | 17599                                       | 25                                                       |
| 2010 | 1025                                          | 29634                                       | 24                                                       |
| 2011 | 3113                                          | 46355                                       | 26                                                       |
| 2012 | 6726                                          | 61597                                       | 26                                                       |
| 2013 | 17762                                         | 76731                                       | 26                                                       |
| 2014 | 28402                                         | 96819                                       | 26                                                       |
| 2015 | 43552                                         | 131048                                      | 26                                                       |
| 2016 | 77802                                         | 148517                                      | 26                                                       |
| 2017 | 130816                                        | 130816                                      | 26                                                       |
| 2018 | 175032                                        | 175032                                      | 26                                                       |

Figure 1. Accumulated installed capacity of Renewable energy in China

Figure 2. Energy consumption in China

2.2. Low level of renewable energy technology
With the gradual transition of the energy system based on large-scale production and consumption of traditional fossil energy to a new energy system, the impact of energy technology on the development of renewable energy is increasingly important, and China will shift from resource dependence to
technology dependence. The problems of China's renewable energy technology are as follows: firstly, from the perspective of renewable energy technology equipment, the technical performance of relatively advanced equipment is only about 1/3, resulting in a serious waste of energy development and utilization in China. At present, China's energy efficiency is about 31.2%, 10 percentage points lower than that of developed countries. Secondly, from the perspective of the degree of technology industrialization, most technologies in the fields of conventional energy and renewable energy have been in the industrialization stage. On the other hand, the industrialization level of energy storage, hydrogen energy and technologies supporting renewable energy (such as energy Internet) is not high. On the whole, the proportion of technologies in the field of renewable energy in the industrialization stage is lower than the international level. Finally, from the perspective of cutting-edge technologies of renewable energy, the overall technology level of renewable energy is the closest to the world's advanced level, but the outstanding cutting-edge technologies in this field are mainly concentrated in the United States, Europe and Japan. Nearly half of the technologies in the clean utilization of conventional energy and the supporting sectors of renewable energy (such as the energy Internet) have kept pace with the major developed countries.

2.3. The development of renewable energy lacks institutional guarantee
The challenges facing the development of renewable energy strategies involve three specific subjects: governments, enterprises and end users. Better coordination among the relevant subjects will contribute to the successful implementation of the renewable energy strategy. For this kind of coordination and realization, the institutional guarantee should be placed in an important position. To begin with, the lack of laws and regulations to protect. In 2005, China passed the renewable energy law of the People's Republic of China, which established the priority status of renewable energy development. However, the development of renewable energy needs to be supported by different laws and policies at the national level. Secondly, the lack of national technical personnel development policy support. The high uncertainty of quantifiable costs and benefits requires more support and guidance from the national level. Thirdly, the lack of practical policy guarantee. China's main state subsidies or economic incentives to support the renewable energy sector by 2018 will be phased out after 2019. For example, starting from January 1, 2021, China will eliminate subsidies for wind and solar power. The policy framework of the support plan after 2020 needs more certainty, which requires China to accelerate the formulation of the specific policy framework to support the development of renewable energy in 2020-2050.

3. The importance of renewable energy strategy to China's sustainable development

3.1. Promote the sustainable development of the ecological environment
China's energy structure, which is dominated by fossil energy, especially coal, has caused tremendous impact and damage to the ecological environment. It is particularly worrisome that the impact of environmental pollution and damage will be long-term. Once the consequences of pollution and damage occur, the huge cost of environmental governance will become the economic burden of the country, which in turn will seriously restrict the sustainable and healthy development of China's economy in the future. China has become the largest emitter of carbon dioxide (CO2) in 2011, so China not only faces the pressure of energy sustainable development, but also faces serious ecological and environmental problems. The storage capacity of renewable energy is huge and has great development potential, which can fully cater to the concept of economic development of recycling and reuse at the present stage, and will not pollute the social environment and ecological environment, so it has good development value.

3.2. Meet the country's growing energy needs
With the development of economy, China's energy demand will continue to increase, which will cause great pressure on the sustainable supply of resources. According to statistics, the growth rate of
China's energy consumption increased from 3.3 percent in 2017 to 4.3 percent in 2018, and the average growth rate over the past decade was 3.9 percent. In the next 15 years, China's per capita energy consumption and total energy consumption will continue to grow, as shown in Figure 3. However, China's per capita ownership of coal, oil and natural gas and the reserve to production ratio (R/P) are far below the world average. From the perspective of domestic energy resources, although China's coal resources are relatively rich, but the oil and natural gas resources are relatively poor. Proven coal level is still low, the Total proved reserves at the end of 2018 to 138819 million tonnes, or Share of Total world total13.2 %, far cannot satisfy the demands of the recent construction of coal mines. In addition, 86 percent of the untapped coal is in the arid, water-scarce central and western regions, which are far from the center of consumption and are difficult to develop, transport and use. In the long run, domestic energy supply will face potential total shortage, especially oil and natural gas supply will face structural shortage, energy has become a serious problem restricting China's economic and social development. In the future, the development and utilization of new energy will become the core measure to solve the problem of energy shortage.

|         | oil   | Natural gas | coal |
|---------|-------|-------------|------|
|         | R/P   | capita (barrel) | R/P | Per capita (m3) | R/P | capita (ton) |
| China   | 18.7  | 12.8        | 37.6 | 2289.4      | 38.0 | 234.4       |
| World average | 50.0 | 264.8 | 50.9 | 29719.3 | 132.0 | 312.7 |

Figure 3. Comparison between China's proven reserves of fossil energy and the world average

3.3. Ensuring sustainable energy security
Energy is the lifeblood of national security and the important foundation of national economic development. On the one hand, as the world's energy demand continues to rise, fossil fuels will eventually run out. As shown in Figure 4, China's total energy consumption has been high, and the output is lower than the total consumption. The renewable energy development strategy can address the country's growing demand for electricity, heating/cooling, transportation and domestic energy. The country can provide energy in an economically safe, environmentally friendly and reliable manner. Meeting the growing economic and national defense needs is one of the basic goals of our energy strategy. The renewable energy strategy will alleviate the potential pressure of future energy demand growth and avoid the dilemma of energy exhaustion while promoting constant production capacity. On the other hand, the security of energy supply determines the development orientation of each renewable energy in the whole energy architecture or structure in the future. China's renewable energy consumption totaled 140 million tons in 2018, and renewable energy, led by wind and solar, continues to grow much faster than any other form of energy.

4. Suggestions on the development of China's renewable energy strategy
The implementation of renewable energy strategy has become an important guarantee for the sustainable development of energy. The continuous supply of energy resources can not only lay a good foundation for the development of national economy, but also help to form an internal driving force
for the development of social economy. To promote the development of renewable energy strategy in China, we should start from the following four aspects:

4.1. Enhance the national strategic status of renewable energy strategies and formulate long-term development plans

The state attaches importance to the promotion of the strategic position of renewable energy, which is the basis for realizing the development of renewable energy strategy. To accelerate the pace and improve the quality of China's energy strategic transformation, the following three measures can be taken: one is the government should optimize the current management mechanism of renewable energy resources, appropriately increase the input of human and material resources, formulate policies and regulations for the development of renewable energy, and provide guidance for the development of renewable energy. Secondly, invest sufficient human and material resources to optimize the market environment for the development of new energy. The government guides the establishment of a market environment dominated by renewable energy, so that renewable energy gradually occupies the advantages of the energy market. At the same time, we should intensify the fight against vicious competition and create a favorable market development environment. The long-term development plan of renewable energy will be conducive to the overall strategic planning of the development goals and safeguard measures of renewable energy and play a crucial role in the development and utilization of renewable energy in the future. Thirdly, adopt a positive preferential policy system to encourage long-term and efficient development. Through financing policies, preferential taxation, price subsidies, consumption incentives and other means to guide and support private enterprises, small and medium-sized enterprises to invest in renewable energy infrastructure, increase application and development of renewable energy technology. If an additional ecological tax is imposed on traditional energy, renewable energy is exempted from ecological tax or support the construction of promising renewable energy power generation projects through financing or loan concessions.

4.2. Strengthen technological innovation in the field of renewable energy and improve autonomy of key technologies

China will accelerate the process of technological innovation in renewable energy, promote the growth of renewable energy types, reduce the cost of energy production, and create higher social value. To promote the development and innovation of renewable energy technologies, the following three measures can be adopted: The first is focus on the development of renewable energy technologies and the development of wind power generation and solar power generation. For example, the construction of wind power generation facilities can be improved in regions rich in wind energy resources (Inner Mongolia) to fully satisfy the daily electricity consumption of the public; in regions rich in solar energy (xizang), the construction of solar power generation infrastructure can be improved. The second is we will strengthen our capacity for technological innovation, develop technologies other than power generation, and use renewable energy in a wide range of other areas such as transportation and daily life. The third is the government should lead the society to attach importance to technology research and development, provide sufficient financial support and a good research and development environment, and vigorously support renewable energy technology innovation projects. And through high-quality talent investment, overcome the development of renewable energy technology bottleneck.

4.3. Improve laws and regulations on renewable energy strategies and formulate guiding measures and strategies

By amending the energy laws and regulations, it indirectly promotes the technological innovation of the renewable energy industry, continuously improves the energy conversion rate, and provides a standardized environment for the development of the renewable energy strategy. First of all, we should strictly control the safety of new energy use and ensure the safety of renewable energy use. For example, the Chinese government may formulate corresponding nuclear safety plans in view of the safety of hydrogen energy use, implement the matters needing attention in the use of nuclear energy in
the form of legal provisions, and realize effective constraints on the development and use of new energy. Secondly, relevant departments formulate laws and regulations to coordinate the development of new energy, make unified provisions on its use requirements, improve the standardization of the development and utilization process of new energy, and form a scientific guarantee for the safety of new energy utilization. Specific indicators include macroeconomic policy, government credibility and plans for renewable energy development.

4.4. Adjust and optimize the development mode and rationally distribute renewable energy
China's renewable energy development mode and the layout should adhere to market-oriented, gradually weaken the renewable energy base of intensive development mode, to develop the distributed solar power, wind power and distributed to promote renewable energy "private reserve", conditional areas can develop wind, light, water, can complement each other, improve the stability of system output. In terms of layout, we should abandon the idea of giving priority to the traditional resources, and turn to the consideration of demand side power market space and comprehensive landing cost. Wind power development can be combined with the market advantages of near load and high electricity price to gradually transfer to southeast and coastal areas. Solar power generation is mainly distributed development, and organically combined with new urbanization construction and rural poverty alleviation work. Construction should make full use of building roofs, fish ponds, greenhouses, beaches and so on, so as to minimize the occupation of land resources.

5. Conclusion
China's 2014-2020 strategic action plan for energy development clearly states that by 2020, Non-fossil energy accounts for 15% of primary energy consumption, natural gas for more than 10%, and coal for less than 62%. The development of renewable energy strategy can effectively reduce carbon emissions, promote the sustainable development of economy and ecological environment, and gradually realize China's energy development strategic plan. The current problems in the development of renewable energy in China also promote the status of renewable energy strategy in China. In the future, the degree of interdependence and mutual restriction of energy security problems in various countries will deepen, and solving new energy problems requires the joint efforts of the international community.

References
[1] Wang Lei 2019 Discussion on Energy Security from Energy Technology Perspective (China: Journal of China Energy) p38-43
[2] Li Junfeng 2020 Reflections on Energy Security in the Transition and China Programme (China: Journal of China Energy) p 4-10
[3] BP.BP Energy Outlook-2019 edition[EB/OL].https://www.bp.com/content/dam/bp/pdf/energy-economics/energy-outlook-2019/bp-energy-outlook-2019.pdf. 2019-04/2019-11.
[4] Feng Zhaokui 2015 Energy security and science and technology development (China: Journal of China Social Sciences Press)
[5] Zhang Guangyao 2020 Current Status and Prospects of EU Laws and Policies on Renewable Energy (China: Journal of Sino-Global Energy) p25-32