

Countermeasures to Improve China's Energy and Water Resources Policies and Laws

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Abstract: Energy and water resources are important strategic resources related to the sustainable development of the national economy and society. It is pointed out that the objective correlation and interaction between them requires that energy and water resources policies and laws must respect this objective law, and strive to realize the coordinated operation between the two resources management. Based on the discussion of the relationship between energy and water resources and its legal impact on energy and water resources policies, combined with the legislative practice and lessons in the field of the relationship between energy and water resources in the United States, this paper analyzes the relationship between energy and water resources in China. Specific suggestions are put forward for further improving China's energy and water resources policies and laws: under the guidance of the law of the relationship between energy and water resources, integrate the policies and laws of energy and water resources management, establish a coordination mechanism between energy and water resources management, and strengthen the data collection and basic scientific research of the law of the relationship between energy and water resources.

Keywords: Water Resources Protection; Energy Security; Social Sustainability; Law and Policy

1. Introduction

Energy is the blood of the national economy, while water resources are the source of life, the essence of production, and the basis of ecology. At the same time, these two resources are interrelated, restrictive, and interdependent. In 2006, the United Nations World Water Resources Development Report: water, shared responsibility pointed out: "Economic development needs energy resources and industrial activities, and they all depend on water." ^[1] and relevant issues are discussed in Chapter 9 "water and energy" of the report. On March 22, 2014, with the theme of "water and energy", the United Nations World Water Day called on countries to implement more "coordinated, coherent, and consistent" energy and water resources management policies. In the same year, the United Nations World Water Resources Development Report: water and energy focused on the relationship between energy and water resources ^[2]. At present, it has become a hot spot for western countries to study the policies and laws related to the relationship between energy and water resources from the perspective of national governance. However, there is almost a gap in related research in China currently. Promoting economic development, ensuring national energy security, safeguarding people's livelihoods, and protecting the ecological environment are the four main objectives of national energy regulation. On this basis, water resources are of great significance to economic development, national energy security, people's livelihood, and ecological environment. In order to meet the requirements of sustainable socioeconomic development, this paper examines China's energy and water resources policies and laws from the perspective of the relationship between energy and water resources, and puts forward relevant improvement suggestions based on natural and social laws and lessons learned from the United States.

2. Relationship between energy and water resources

2.1 Impact of energy on water resources

With the expansion of energy demand and the increasing scarcity of water resources, the International Energy Agency (IEA) pointed out in the World Energy Outlook in 2012 that the impact of energy production on water resources will gradually increase, and its demand for water resources will grow at twice the rate of energy demand. It is estimated that the amount of water extracted from energy production in 2010 was 583 billion cubic meters, of which 66 billion cubic meters were consumed (i.e., not returned after extraction). With further growth in demand for electricity generation and expansion of biofuel production, global water consumption will increase 85% by 2035. The water resources required by the energy will also reach 8% of the world's total water withdrawal, with the proportion in developed countries reaching 45%. Different energy types require varying water requirements. The water consumption for the production of conventional oil or natural gas capable of producing 1 GJ energy is 1-10 DM³, oil sand 100-1000 DM³, and biomass fuel 10 000-100 000 DM³. The same type of energy will also produce different water consumption due to different production technologies and raw materials. In oil exploitation, the water demand of secondary exploitation technology (technology that supports reservoir pressure through water injection) is about 10 times that of exploitation relying on natural pressure. In terms of biomass energy, about 500, 1000, 2000, 3500, and 10000 DM³ of water are required to produce 1 DM³ of biofuel from sugar beet, corn, sugarcane, rapeseed, and soybean, respectively ^[3].

2.2 Impact of water resources on energy

The exploitation, transportation, supply, processing, and treatment of water resources will inevitably consume a certain amount of energy. Depending on the type of water resources, the energy consumed to produce or obtain clean water is also different. Taking the production or acquisition of 1 m³ clean water as an example, it takes about 0.37 kW · h from surface water (rivers or lakes); 0.62-0.87 kW · h is required from recycled wastewater; 2.58-8.5 kW · h is required through seawater desalination technology. Energy consumption is associated with the wastewater treatment process as well. On one hand, the electric energy consumed by the sewage treatment plant is mainly used in the biological sewage treatment process, with a proportion of up to 70%; while the proportion of sludge treatment process is up to 20%, and the unit treatment energy consumption of the sewage treatment plant decreases with the expansion of its scale. On the other hand, the shortage of water resources has had an impact on energy production. In 2014, the United Nations World Water Development Report: water and energy indicated that the growing demand for limited water supply has increased the pressure for water-intensive energy producers to seek alternative methods. Water consumption, especially in urban areas where water, sanitation, and other ecological services may be mutually limiting, intensifies this pressure in particular ^[4].

3. Hydropower resources and their role in the design and development of policies and laws

In the relationship between energy and water resources, hydropower production has its own special characteristics, which is also the most direct manifestation of the relationship between energy and water resources. Hydroelectricity is the direct utilization of water and energy power. Hydropower generation can be divided into runoff power generation and water storage power generation. The main difference between the two lies in the fact that the former generally does not regulate river flow, while the latter requires the power generation of drop-through water storage. Water storage for power generation will have an impact on the temporal variation of river flow, and the increased watershed area due to dam construction will play an important role in water evaporation at the same time. For hydropower, the amount of water has a direct impact on its power generation capacity. During dry periods, the amount of water used for power generation may be affected by the demand for other uses, such as irrigation or drinking water ^[5]. Thus the relationship between energy and water resources is of great significance to the design and formulation of energy policy and law. Nevertheless, as an important part of the strategy of reducing pollution caused by fossil energy and diversifying energy, biomass energy development policies often fail to evaluate the cost from multiple perspectives, including the impact of its development on energy, water resources, land, and

biodiversity. From the perspective of the relationship between energy and water resources, the development of different types of bioenergy needs to be treated differently according to their water consumption. It is worth noting that the exploitation of unconventional natural gas, especially shale gas, can increase energy supply, but the extraction of shale gas by hydraulic fracturing technology will create pressure on water resources. Therefore, China should pay full attention to the relationship between energy and water resources in relevant energy policies and laws, so as to realize the optimization and sustainable development of the energy industry.

4. Countermeasures to improve China's energy and water resources policies and laws

4.1 Integrate energy and water management policies and laws

Guided by the laws governing the relationship between energy and water resources, paying high attention to the path and role of soft law can facilitate the integration of energy and water management policies and laws and avoid duplication of legislative content by the National People's Congress or its Standing Committee. When formulating policies and regulations on energy development, production, transportation, and consumption, the government should fully consider their impact on water resources and coordinate with China's strictest water resource management system. According to the matching of energy and water resources in different regions of China, energy production policies and development plans can be formulated according to local conditions to avoid or reduce excessive water-demanding and water-consuming energy production or mining activities in arid and water-scarce areas ^[6]. Furthermore, in terms of new energy development policies, the impact of new energy production on water resources should be fully evaluated, and the development of new energy sources that consume little or basically no water and are non-polluting to water resources should be encouraged and supported. In the field of water resources development, transmission, utilization, and treatment, improving energy efficiency and promoting the promotion of clean and renewable energy sources with low water consumption are what we should consider.

4.2 Establish a coordination mechanism between energy and water resources management

Although China, similar to the United States, carries out sub-sectoral management of energy and water resources, inter-sectoral consultation and coordination in China are relatively weak compared to the very well-developed inter-sectoral consultation mechanism of the U.S. government. In order to prevent each department from formulating conflicting policies solely from its own perspective or interests, China needs to establish a consultation or coordination mechanism with "clear authority, clear division of labor, standardized behavior, and coordinated operation" ^[7]. Due to the requirements of national institutional reform, it is not practical to establish a new substantive coordinating body in China, nonetheless, we can use government management platforms and non-substantive coordinating bodies, for example, leadership groups and regular consultation/coordination (meeting) mechanisms, to communicate and coordinate across sectors.

4.3 Strengthen basic scientific research and data collection on the law of the relationship between energy and water resources

Scientific legislation includes the conscientization of legal entity content, legislative procedure, and technology, respectively, while the latter serves the former. The self-consciousness of policy and legislation needs to be guided by the laws of science and based on objective reality. Consequently, the laws governing the relationship between energy and water resources in China and the corresponding data need to be further collected and researched, which also requires policy and legal safeguards to ensure the development and application of energy-efficient and water-saving technologies and the continuity and consistency of the data collected and obtained. Fundamental research should be interdisciplinary, multi-faceted, and based on advanced ideas or theories. For instance, harmony theory is one of the better theoretical paths ^[8]; furthermore, for the exploitation of hydropower resources, the impact on the environment, especially the ecosystem, should

be fully considered, and attention should be paid to the development and continuous improvement of ecological compensation policies and laws.

5. Conclusion

In the context of becoming the world's largest energy consumer, China has proposed and is implementing the promotion of an energy consumption revolution, a supply revolution, a technological revolution, and an institutional revolution, and is working to strengthen international cooperation across the board to achieve energy security under open conditions. The energy revolution requires a corresponding policy and legal revolution. In view of the laws governing the relationship between energy and water resources, when formulating policies and laws on energy and water resources, the state should not only take the perspective of a single sector, but should consider the relationship and interaction between energy and water resources in an integrated manner under the guidance of economic and social development goals. Establish the concept of mutual constraints and interdependence between energy and water resources, realize the unity of energy and water resources development, utilization, protection, and conservation, to realize the benign interaction between energy and water resources, so as to guarantee China's energy security, water security, and ecological security, as well as promote the construction of ecological civilization and sustainable economic and social development in China. The Fourth Plenary Session of the 18th CPC Central Committee made a special decision on the issue of governing the country according to law, proposing that China should form a complete system of laws and regulations and adhere to the unity of scientific legislation and democratic legislation.

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