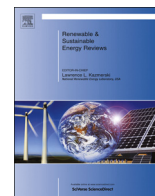




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## The energy supply and demand pattern of China: A review of evolution and sustainable development



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## ABSTRACT

Energy is the basis of social development. Practices show that national and regional economic development speed and degree are more obviously depending on the construction of modern energy supply support system. As one of the biggest developing countries of the world, the remarkable achievement of China during the last three decades is inseparable with the powerful support for energy. Nevertheless, the limitations of resource distribution and exploitation make the sustainable development of China's energy supply face numerous challenges. This paper reviews the evolution process of China's energy supply and demand pattern, analyzes from two dimensions: time and space, further puts forward the upcoming problems that may occur during the long-term, stable and sustainable development. Finally, several suggestions are proposed from the aspects of matching policy support, structure adjustment and layout optimization, which provide theoretical reference and practical guidance for the comprehensive management of the sustainable energy supply and demand development of China.

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**1. Introduction**

The development of the energy industry of any country or region is a procedure of seeking for the coordination between time and space of products' supply security. The procedure of time means the changing trail outlining the total energy demand growing and diverse structure evolution of the country or region; the procedure of space means the expanding process of energy producing range from limited area to the whole region or country, even all over the world [1]. Caiguo and Zhang [2] constructed the theory of temporal and spatial (time–space) coordination process of national industrialization on the base of the interrelation and interaction between the temporal and spatial process in terms of the long-term practice of world's energy security, aiming at proposing policy advises for energy consumption security and sustainable energy development. Zhang Lei [3] also shows that the national energy supply system could extend its spatial bordering as the increasing demands for the fuels, especially oil and gas, due to the uneven distribution of mineral resources of the whole world. Asif and Muneer analyzed four countries, including China, India, UK and USA, to uncover the demand and security issues of energy supply [4]. Yuan Jiahai put forward an outlook of energy demand and supply into 2050 and drafted the roadmap to realize sustainable energy development to set the framing constraints for China's energy policy options [5]. Industrialization practice indicates that, the state of the space–time coordination determines the stability and reliability level of national or regional energy supply security. With the rapid growth of China's total economic scale, it is getting more complicated for coordinating the time and space of national energy supply security. The overall coordination relation is shown in Fig. 1.

Energy supply and demand pattern of a country or region means the situations of energy resources' production, transformation, transportation and consumption within a particular period, and also the circumstances of coordination of energy supply/

demand and trans-regional transportation, divided by the variety of the energy and region, of which the “key elements” are the “gross, structure, layout and flow” of the supply and demand development of various energy within a period.

Since the reform and opening-up of China, the evolution of energy supply and demand pattern is generally expressed as three characteristics [6]: (a) the production, consumption and supply space of energy has greatly increased and expanded with the social and economic development; (b) the spatial expansion process of energy supply is not only the result of the increasing of total energy consumption, but the outcome of consumption structure upgrading, of which the trend of the decline of coal at an absolutely dominant status before and the enhancement of the function of petroleum and natural gas is getting clearer; and (c) Under the joint effect of resource endowment and economic development, the development pattern of energy supply and demand is clearer, of which the elevation of western area's energy output status is of great importance. Therefore, it has profound implications for the stable economic growth and sustainable energy development to thoroughly analyze the space–time feature of China's energy supply and demand development.

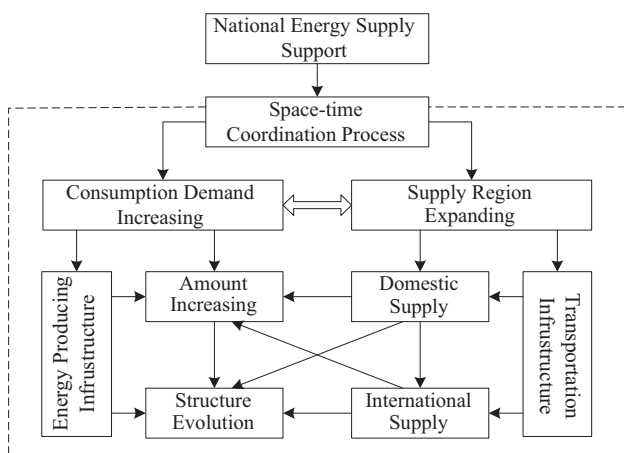
The above works to a large extent explained the internal mechanism between energy supply/demand and other influencing factors that determine the coordination of time and space. Besides, they have made a detailed analysis on the current structure of energy supply and demand system. However, shortcomings still exist in these researches. First, some researches fail to relate the energy supply and demand pattern to the overall circumstances of China's energy policy; second, previous reviews focused only on fossil fuel based energy and ignored other important factors including renewable energy sources [7]; third, the energy transportation system has not yet been formally introduced, which is an important part in the current energy supply and demand system of China. This paper focuses on the “pattern” of energy supply and demand of China. The temporal evolution process of energy supply and demand during 1970–2010 is presented, from aspects of energy production and consumption structures; the energy flow situation is especially emphasized in the study of the spatial development of energy supply and demand pattern, where the transport distance is calculated from the angles of nation and region respectively. In the last part, the issues and problems of energy uncovered during the development are analyzed, and accordingly, the suggestions for optimizing the energy policies are proposed to enhance the sustainable development of energy supply and demand.

**2. The temporal development of energy supply and demand pattern of China**

*2.1. Energy production*

*2.1.1. Total energy production analysis*

Since the year of 1978, the total production of primary energy resources has been rapidly increasing, from 0.637 billion ton of



**Fig. 1.** Temporal–spatial coordination diagram of China's energy supply and demand development.

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