

Research on Evaluation for Sustainable Development of Energy Economy in Hebei Province

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Abstract

Based on the sustainable development theory of energy economy, this paper constructs the evaluation system of sustained development of energy economy considering the following four sub-systems: the sustainable development of energy usage, environment protection, economy and society. Based on this system, it evaluates the sustainable development level of energy economy in Hebei province during 2008 to 2014, and compares the situation of Hebei with the average level of nation.

Keywords: Energy economy; Sustainable development; Energy consumption; energy demand; Energy utilizing; Regional economy

1. Introduction

Energy is not only closely related to the economic and social development, but also the important factor affecting the international politics, military and diplomacy. In the modern industrial production, energy is the main source of power, and it is the important material basis for the sustainable development of the economy and society. At present, China is in the rapid development of the national economy, the development of industrial and agricultural production is largely limited by the shortage of energy. And, as the population continues to grow, the demand for energy is increasing^[1].

Hebei province, whose the energy resources endowment is good and the energy variety is complete, is the energy production big province, and simultaneously is the energy consumption province. As China's important energy and basic industrial base, Hebei province has an advantage in coal and other aspects of natural resources,

and has also made tremendous achievements in energy industry. However, Hebei Province belongs to the energy input province. The industrial structure of energy consumption is irrational, the power generation investment based on coal is too large. Thus, it is necessary to realize that the achievements of Hebei province are mainly rely on large consumption of energy resources in the extensive mode of development. The extensive mode of development makes originally the shortage of energy resources and fragile ecological environment is facing greater pressure. And the rapid development of economy supported by this mode also won't last long. Therefore, the Hebei province should vigorously develop renewable energy, develop nuclear energy and coal conversion and clean technology, adjust the economic structure to achieve energy security and sustainable development.

2. The theory of energy economy and sustainable development

Energy economy and its sustainable development are the core of energy economics. Energy economy refers to the sum of the energy of various types of industrial economy, and is an important part of the national economy, specifically, refers to those that produce the energy of the material production, exchange, distribution and consumption of economic activity. Sustainable development is a new concept of development, which emphasizes the comprehensive coordinated development of population, economy, resources and environment.

The sustainable development of energy economy refers to the development of energy not only meeting the needs of economic development, and not causing intolerable damage to the human survival environment and

ecological health and life. It not only satisfies the current needs of energy, and do not cause bad influence and even pose a hazard to meet the needs the ability of future generations. Therefore, sustainable development of energy economy includes not only first energy development, transportation, processing, transformation, distribution and usage, but also is an complex system which regards economic factors, social factors and ecological factors as the important part of it^[2].

3. The evaluation system of sustainable development of energy economy

According to the characteristics of the energy economy, concerning the coordinated development of energy, economy and society, the evaluation system of sustainable development of energy economy can be made up by the sustainable development of energy utilization, the sustainable development of environment, the sustainable development of economy and the sustainable development of society. Every sub evaluation system includes several evaluation indexes. The core evaluation index and the evaluation criteria of the sub evaluation system are as follows^[3]:

(1) The sustainable development of energy utilization.

In order to achieve the the sustainable development of energy utilization, the efficiency of energy utilization should be increased. Namely, the change rate of the energy consumption per unit of GDP is less than zero.

$$r_1 = \Delta R_1 / R_{10} < 0 \quad (1)$$

$$\Delta R_1 = R_1 - R_{10} \quad (2)$$

Where, r_1 represents the rate of energy consumption per unit of GDP; R_1 represents the energy consumption per unit of GDP in evaluation system; R_{10} represents the energy consumption per unit of GDP in referring system; ΔR_1 represents the energy consumption changes per unit of GDP.

(2) The sustainable development of environment. In

order to ensure the sustainable development of the environment, the pollution caused by the waste gas emission of unit industrial GDP should not increase.

$$r_2 = \Delta R_2 / R_{20} < 0 \quad (3)$$

$$\Delta R_2 = R_2 - R_{20} \quad (4)$$

Where, r_2 represents the change rate of waste gas emissions of unit industrial GDP; R_2 represents the waste gas emissions of unit industrial GDP in evaluation system; R_{20} represents the waste gas emissions of unit industrial GDP in referring system; ΔR_2 represents the changes of waste gas emissions of unit industrial GDP.

(3) The sustainable development of economy. In order to achieve sustainable development of economy, the elasticity coefficient of energy consumption is less than 1 and its change is less than zero.

$$R_3 < 1 \quad (5)$$

$$\Delta R_3 = R_3 - R_{30} < 0 \quad (6)$$

Where, R_3 represents the elasticity coefficient of energy consumption in evaluation system; R_{30} represents the elasticity coefficient of energy consumption in referring system; ΔR_3 represents the changes of elasticity coefficient of energy consumption.

(4) The sustainable development of society. In order to achieve the sustainable development of society, the change rate of per capita energy amount is more than zero.

$$r_4 = \Delta R_4 / R_{40} > 0 \quad (7)$$

$$\Delta R_4 = R_4 - R_{40} \quad (8)$$

Where, r_4 represents the change rate of per capita energy amount; R_4 represents per capita energy amount in evaluation system; R_{40} represents per capita energy amount in referring system; ΔR_4 represents the changes of per capita energy amount.

4. The evaluation of sustainable development of energy economy in Hebei province

Considering the changes in the concept of energy consumption and economic and social development of stability and continuity in our country, this paper selects data in 2008 as the basic frame of reference, regard 2011 as the transition period, select the data in 2014 as the final evaluation system. Evaluate the state of sustainable development of energy economy in Hebei province and compare it of the national average level. The relevant evaluation index data are shown in Table 1.

Table 1. The relevant evaluation index data

Index	Hebei province			National average level		
	2008	2011	2014	2008	2011	2014
Industrial emissions	15768	39254	50779	198906	330992	436064
Energy consumption elasticity coefficient	1.22	0.75	1.67	1.53	0.87	0.57
Total population	6769	6898	7034	129227	131448	133474
Coal basic reserves	89.0	68.2	56.3	3342	3335	3190
Total energy consumption	15279	21690	28266	174990	246270	306647
GDP	6921	11660	17235	135822	210871	340506
Industrial GDP	3212	5490	7983	54946	91311	135240
Unit GDP energy consumption	2.21	1.86	1.64	1.29	1.17	0.90
Unit Industrial GDP emissions	4.91	7.15	6.36	3.62	3.62	3.22
Per capita energy amount	131	98	80	259	254	239

(1) The evaluation of energy utilization. Compared with 2011, the r_1 of Hebei province in 2014 was -11.83%, which is below 0. At the same period, the national average level is -23.08%. It can conclude that compared with 2011, the energy utilization efficiency of Hebei province in 2014 is improved to some extent, but compared with the national average level at the same period, the improvement was significantly lower than the national average.

(2) The evaluation of environment. Compared with 2011, the r_2 of Hebei province in 2014 was -11.04%, which is below 0. At the same period, the national average level is -11.05%. It shows that, compared with 2011, the waste gas emissions of unit industrial GDP reduced, and kept the same level compared with the national average level, which is in favor of environmental sustainable development. But in 2008, this value increased, so the situation of environment pollution in Hebei province has yet to be further improved.

(3) The evaluation of economy. Compared with 2011, the R_3 of Hebei province in 2014 was 1.67, which is above 0. And ΔR_3 is -0.3, which is below 0. Similarly, compared

with 2008, the energy consumption elasticity coefficient of 2011 in Hebei province and the whole country can be calculated, which are respectively -0.66 and -0.47. These data indicate that Hebei province failed to reverse the economic growth which depends on a lot of energy consumption situation. The extensive mode of economic development has not been changed, which is not conducive to the realization of the sustainable development of economy.

(4) The evaluation of of society. Compared with 2011, the r_4 of Hebei province in 2014 was -19.04%, which is below 0. At the same period, the national average level is -5.81%. Compared with 2011, the change rate of per capita amount in 2014 is less than 0, which indicates that with the increasing efficiency of energy usage, the per capita amount of energy do not increase, which is conducive to social sustainable development. At the same period, this value of national average level is also less than 0, which shows that the national per capita energy physical quantity also declines, but the decline speed is not faster than that of Hebei province.

5. CONCLUSIONS

In a word, the sustainable development of energy economy in Hebei province still should deeply improve. We should implement the scientific concept of development, and maintain the sustainable economic development of the high degree of perseverance to do a good job of energy-saving.

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