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Development strategy of regional energy transportation in China

Guang-jun Jiang
College of Mechanical Engineering, Inner Mongolia University of Technology, Hohhot, 010051, (CHINA)
E-mail: jgj42715068@163.com

ABSTRACT

This paper respectively analyzes and states from the supply and demand space distribution, energy transport flow directions and regional transportation load; through the comparison of area output and consumption, analyzing the transport balance of the five conventional energies respectively, studying the overall transport directions of each energy, the energy scheduling input and output attributes for all of these seven large regions; accomplishing each kind of energy interregional transportation load analysis by calculating all the transforming volume of each area, respectively ascertaining the high load transportation areas, and then putting forward the developmental suggestions to the construction of China's regional energy transport channel.

KEYWORDS

Energy transport balance;
Demand trends;
Load analysis;
Developmental suggestions.

INTRODUCTION

China covers a vast region with an extensive range of the energy distribution, and many areas are rich in energy production, but due to the influence of the local energy demand, it is hard to judge the external supply capacity through the output[1]. This can directly influence the construction force and the development direction of the energy transport channel, which is the basis and guarantee for the policy research. According to the characteristics of regions and energy supply and demand, China can be divided into seven large regions[2]. They respectively are: the Jing-Jin-Ji region, the Shanxi-Shaanxi-Inner Mongolia -Ningxia region, Northeast China, East China, Central China, Southwest China and the Xin-Gan-Qing region. The energy production and consumption attributes of these seven large regions are different. The current five conventional energies in China are raw coal, coke, oil, natural gas and electricity.

China's conventional primary energy resources are mainly distributed in the underdeveloped west and north parts. According to the related department statistics, by the end of 2012, 892.3 billion tons of conventional energies were said to be standard coal, which includes coal, oil, natural gas, water and electricity proportion were respectively 84.5%, 4.2%, 4.1% and 7.2%; and most of the coal resources were centralized in Shanxi, Shaanxi, Inner-Mongolia and Xinjiang, and took up over 70% of the total national reserves[3]. Oil and natural gas resources were mainly distributed in the northeast, north China, and northwest and on the sea[4]. Calculating in accordance with the exploitable economic capacity, more than 60% of the water resources were concentrated in Yunnan, Guizhou, Sichuan, Chongqing and Ti-

betan.

With regard to China's current five conventional energies: raw coal, coke, oil, natural gas, and electricity, energy supply and demand of different regions can be further confirmed by the analysis of nearly five years of regional average proportions of production and consumption. Through the data analysis, we can see that the energy supply and demand of different regions was different concerning types and quality. The top three regions of the proportion of coal production are: the Jin-Shan-Meng-Ning region, East China and Southwest China; and the top three on the consumption ratio are: East China, the Jin-Shan-Meng-Ning region and the Mid-southern China. The top three on the proportion of coke production are: the Jin-Shan-Meng-Ning region, East China and the Jing-Jin-Ji region. The top three on consumption ratio are: East China, the Jing-Jin-Ji region, the Jin-Shan-Meng-Ning region. The supply and demand situation of the other energies is shown by TABLE 1.

TABLE 1 : Regional energy production and consumption average proportion of recent years (%)

Region	Attributes	Raw Coal	Coke	Crude Oil	Natural Gas	Electricity	Total Energy
The Jing-Jin-Ji Region	Production	4.60	12.87	12.07	3.74	7.52	6.47
	Consumption	10.34	20.14	9.54	9.54	9.99	10.93
The Shanxi-Shaanxi-Inner Mongolia-Ningxia Region	Production	44.40	38.62	9.51	15.03	13.20	38.52
	Consumption	17.93	15.82	4.22	4.22	10.02	14.67
Northeast China	Production	9.03	8.38	36.46	10.28	8.26	12.76
	Consumption	12.02	11.25	26.55	26.55	9.65	13.93
East China	Production	14.02	16.90	16.78	3.21	31.41	14.91
	Consumption	27.23	24.31	32.89	32.89	32.35	28.05
Mid-southern China	Production	11.77	10.37	10.75	12.31	24.19	11.68
	Consumption	18.41	14.04	16.89	16.89	24.25	18.36
Southwest China	Production	12.08	10.67	0.11	30.01	11.23	10.39
	Consumption	10.05	11.48	0.50	0.50	9.53	9.40
The Xin-Gan-Qing Region	Production	4.10	2.19	14.31	25.42	4.18	5.27
	Consumption	3.57	2.96	9.41	9.41	4.21	4.66

TABLE 1 shows that all seven of the regions have certain producing capacity. In theory, they can all be used as energy supply bases. However, another important factor cannot be ignored: while each region has the ability to supply and also has consumption demand, even for most regions, the need is far more than the supply capacity. This means that they need to import energy from other regions to ensure the balance. The real meaning of the energy supply base can carry on the external output on the basis of its own region's energy demand. Therefore, a region's energy transport attributes can be determined by the difference (the positive and negative numbers) of its production and consumption ability. Supposing there is no unreasonable phenomenon of energy backward transportation in the real production, namely, the energy consumption gap of a region can be replenished by external import after all the local production of energy is used up. Then the definition can be made: the difference of a region's energy consumption volume and production volume is its regional transport volume. If it is negative, it means that the regional energy consumption is less than production in this region, so it has the ability to supply energy to other regions, making the total transport attribute export. Conversely, the total transport attribute would be import. Accordingly to this, the regional transport volume of different kinds of energy can be calculated and their transport attributes will be known. Just as TABLE 2 shows.

After calculating nearly five years of energy transport volume of different regions, it can be found that most number are positive, showing that although most areas have the ability for energy to produce. They still cannot meet their consumption demands, only to reach a balance of supply and demand from external provinces. Of these, only the transport volume number of the Jin-Shan-Meng Ning region is negative, not con-

cerning single variety energy or total energy, namely, this region is in an output state. It means the five conventional energy coal, coke, oil, gas and electricity in this region on the basis of meeting its own demands, can also realize the energy supply for external provinces, which proves that this region is a true energy-supply base. This data also provides support for further proof to show that the Jin-Shan-Meng Ning region is China's leading energy supply base. In addition, the energy transport of coke, natural gas and electricity in Southwest China, and the energy transport of natural gas and electricity in the Xin-Gan-Qing region are in a state of output too, which shows that these regions are bearing a task of supplying the external provinces.

TABLE 2 : Energy transport volume of each region in recent years (hundred million tons of standard coal)

Category		JingJinJi Region	JinShanMeng Region	North China	East China	Southern China	Southwest China	XinGanQing Region
Raw Coal	Transport Volume	7.57	-23.37	4.35	20.57	11.02	0.16	0.14
	Attribute	Input	Output	Input	Input	Input	Input	Input
Coke	Transport Volume	1.06	-3.36	0.14	0.77	0.18	-0.15	0.07
	Attribute	Input	Output	Input	Input	Input	Output	Input
Oil	Transport Volume	0.29	-0.22	1.78	6.45	2.8	0.15	0.35
	Attribute	Input	Output	Input	Input	Input	Input	Input
Natural Gas	Transport Volume	0.39	-0.27	0.08	0.7	0.31	-0.12	-0.88
	Attribute	Input	Output	Input	Input	Input	Output	Output
Electricity	Transport Volume	0.58	-0.74	0.1	0.39	0.19	-0.45	-0.02
	Attribute	Input	Output	Input	Input	Input	Output	Output
Total Energy Volume	Transport Volume	11.2	-24.7	7.94	34.56	19.16	2.71	1.75
	Attribute	Input	Output	Input	Input	Input	Input	Input

According to the energy transport properties and the total transport data, the main supply situation of energy can be further defined. Through the research of the regional energy transport volume index, we can know the energy transport attributes. At the same time, the absolute value of the index is reflecting the actual transport volume in each region, this part of energy may be transferred from or to other provinces. No matter what attribute it has, it is realized by the internal transport system. Therefore, this index is helpful for studying transport load conditions of each region. The absolute value of the data from TABLE 2, we can get the interregional transport volume; after collecting this value of all the regions, we can get the national interregional transport volume, the ratio of this two numbers is the proportion of the interregional transport volume in one region takes up of the whole nation's, which reflects a general situation of the proportion of the region transportation load energy.

The regions with high transport load of different kinds of energy can be confirmed by analyzing the regional distribution proportion of energy. Making clear of different regions of the transport load and flow can provide a scientific and accurate decision for developing the regional energy transportation system construction. Therefore, ranking and analyzing the regional transport load of different kinds of conventional energy can determine the high load regions of different kinds of energy.

According to the above analysis of energy region

supply and demand situation, transport attribute and transport load, we finally make sure the total transport flow of the five conventional energy, the energy transport attributes of import and export in different regions and find out the regions where is with high transport load of different kinds of energy. The above analysis results are benefit for us to raise pertinent advices for regional energy transport channel development.

First, both developing the railway and electricity net of the JinShanMengNing region

At present, the Jin-Shan-Meng-Ning region has already been the main supply base of coal and electricity in China, the fluency of energy external transport determines the effective realization of the base guarantee. As a traditional energy transport way, railway has the advantages such as high safety degree, large capacity, and low cost, low pollution and no weather restriction; we should continue to increase railway construction force, especially the energy line construction.

In addition, as an important electricity supply base, the external transport ability of the Jin-Shan-Meng-Ning region is also equally important. Electricity generation is considered as one of the best energy usages of coal, the coal and electricity conversion rate ranks only second to coal to gas. Especially when extra-high voltage electric power transmission technique is higher and higher, energy in situ transformation can be realized by developing a new effective and clean coal electricity generation technique. Therefore, for the current situation, while accelerating the development of energy railway special line, we should increase the regional electricity-generation proportion and energetically promote the aerial transmission line construction of extra-high voltage electric network.

Second, greatly promoting the natural gas pipeline construction of the XinGanQing region

We should make sure that the ten gas pipelines with a total length as 1,441 kilometers can be successfully invested during the "Eleventh Five" period, and in the following ten to twelve years, an aim of constructing 350 thousand kilometers natural gas pipelines can be realized, to ensure the flexible transport and the forceful guarantee of the natural gas pipeline net.

Third, diversified guarantee of energy transport in East China

East China is a main consumption region of energy in China, the interregional transport volume of the coal, coke, oil and natural gas of this area respectively is on the top three. Therefore, diversified guarantee of energy supply should be carried out in East China.

Besides, East China, as China's most leading economically developed region, should quicken its pace of building oil and gas pipelines and improving the supporting station facilities, due to a huge oil and gas consumption. Different from other steps such as oil and gas exploitation and development, pipeline transportation requires an overall layout of national pipe networks and involves unified deployment, coordination and management, in order to avoid duplicate construction such as the waste of manpower and material resources. Therefore, it is essential to establish a unified management organization in important areas of dense pipe networks such as East China and South China, in particular establish maintenance and repair systems to ensure continuous operation of pipe networks and realize resource sharing effectively.

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