



Discussion on the Sustainable

Development of Electric Power Industry in China

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Abstract

Nowadays, the effects of the development of electric power are becoming more and clearer in the development of national economy, and it influences the increased speed of GNP. The generated construction of Electric Power Industry for our country is not very appropriate, and there are a long distance to the international level. First, it discusses the macro-circumstance, the thought of sustainable development and the practical situation of china. At last, this article puts forward the difficult which our country facing and gives some feasibility methods.

Keywords: Sustainable development, Electric power industry, development strategy, Path

With the development of science technology, the electric power industry has become important production and life goods for the economic society. Our country has put into effect of open policy for more twenty years, the increment speed of the economy has been keeping 9.7% each year, and the GDP has been increasing 9.9% per year between 1990 and 2000. In 1994, the government built the first sustainable development strategy in the world named *21st Century Agendum for China*, and it has become the guidebook of the sustainable development for every walk of life. The electric power industry is the based industry in national economy, and if the national economy wants to develop, we must improve the electric power at first. The electric power industry must supply with enough power support to implement the national economy faster, more sustained, and stabilized. The sustainable development of electric power industry is significant for the society, and it is a important part of the sustainable development of the whole economic society.

1. The Sustainable Development of Electric Power Industry

With the development of economy, the total quantity consumed of energy is very great. The whole country consumes 1425Mtce in 2002, and the consumption of coal, oil, rock gas, nuclear power and hydroelectricity each occupies 66.5%, 24.6%, 2.7%, 1.6% and 5.6%. It can be seen from table 1, the proportion of USA 24.2%, 39%, 26.2%, 8.1% and 2.5% separately. The garage proportion of coal consumption is 25.5% in world, but our country has reached 66.5%. It is very apparent that more coal consumed and more terrible environment, so this phenomenon is unfavorable for the sustainable development of the country.

The quantity energy consumption for generating electricity occupies 38.88% in the total of primary energy sources consumption, and it has increased 20 percents from 1980. The electrical energy consumption occupies 11.4% in the terminal energy consumption, it has increased 6.59 percents from 1980. It can be seen that the GDP of our country has increased up to 2877.84 billions from 451.78 billions between 1980 and 2000, but the consume of unit GDP has been fallen down to 0.44 kg coal per yuan from 1.33 kg coal per yuan. So the development of electric power industry plays a important role for the energy conservation in our country.

With the quick development of the electric power industry, the balance of current supply and demand has improved better and better. Because the environmental pressure, many areas has spark plugged to reduce the directed consumption and encouraged to use electricity, and there will be more demand of electric power. From the Figure 1, it can be seen that the

electric demand will catch up to 4400 Twh in 2020 of the whole society, and the per capita quantity of electric power consumption will also reach a higher level. The trend in development of the energy is electrification. So the demand of energy development strategic is to improve the level of electrification in China.

It can be found that there are 58000MW equipped capacitor at the beginning of open –ended, 100000 MW in 1987, 200000MW in 2000, 400000MW in the first half of 2004. The equipped capacitor has reach 20000MW from 100000MW in 7 years, and it has spent nearly 7 years from 20000MW to 300000MW, more than 4 years from 300000MW to 400000MW. The building of electric power has being developed in exaggerated scale speed. At present, the additional equipped capacitor per year can be as the total equipped capacitor of Sweden, and the total equipped capacitor per two years of England.

The economic outlook is able to fine based on the faster peed of the world’s economic resurgence. Because the international and national capital which invested to develop our country is increasing, the national economy keeps increased potential head steadily. The developed trend of the secondary industry which has more influence to the demand of electric power shows these features: Firstly, there will be faster develop of the industry for treatment and high energy-consume. Secondly, the development of chemical circles is being faster and the proportion be raising quickly. Thirdly, the consumption of unit GDP has increased from fallen on annual basis. Experts forecast that the electric demand growth will be higher than the economic growth in the next three years, so it should pick up speed the building of electric power project.

2. The problem of implementing the sustainable development of electric power industry

In the high speed increased economic environment, the development of electric power is facing on the double pressures of economic growth and environmental protection, and there are many problems and contradictions.

First, as the development of national economy and the improvement of people life’s quality, the demand of electric power increases quickly, the electric power industry must develop continually to supply enough electric power with sustainable speed. This problem relates to plurality of the energy source of electric power generation.

Second, whether the land, water resources and primary energy sources can meet the demand of increased electric power or not, and what measures should be taken.

Third, what the restricted condition be put forward when exploiting the electric power and energy source from the atmosphere environmental capacity and regional environmental capacity, and what countermeasure should be adopted. With the development of economy and increase of energy consumption, the discharge of greenhouse gas is increasing quickly, China has been the second country in the world. The environmental problem has become a important restricted factor to the development of national economy. China is the second country of power generation and power consumption. The most emission source of CO₂ and SO₂ is power generation in China, they occupy about 1/3 in total emission separately. The electric power industry is developing continually, the consumption of energy, the emission of CO₂ and SO₂ will increase quickly. It is forecasts that the consumption of coal for electric power generation will be 1.7 billions t in 2020, and it will be a great challenge to the sustainable development of electric power industry for China.

Forth, how to implement the energy-saving of society-wide depend on the progress of policy and science technology. What should be done to face on the increase of electric power consumption unit GDP.

Fifth, what technology and management measures should be done to improve the reliability of electric power system, the security in operation and flexibility in manipulation, so the reliable current supply should be ensured for customers.

There are many problems in Chinese electric power industry, such as the construction is single, the makeup of electric generating set is irrational and the consumption of electric power per people is very low. So the electric power industry of China must put into effect the two inversion ultimately to improve the stage of industry, and its development must according to the demand of economic development and the environmental requirements.

3. The countermeasure should be made for electric power industry in the sustainable development strategic

The trend of contamination regulation is becoming better and better, so this is a good chance for China to celebrate the originality innovation of technology, organization and system in the aspect of environment protection and resource complex utilization, and find a suitable way that can develop the electric power industry quickly and improve the living environment. For this project, it must carry out the policy of environment protection is “prevention being key measure, combining prevention and cure, complex regulation”, the suitable emission of contamination and the gross domination should be the centre, to improve the control level of contamination based on science and technology advancement. In the next years, this industry should stick to measures such as energy-saving and consumption-dropping, combining the ended regulation and clear production, combining the pollution control and complex utilization of resource, increasing investment, reinforcing management, strengthening the work of environment protection.

3.1 Optimizing the construction of the development of electric power industry

At present, there are many problems in the construction of electric power industry. Firstly, the capacity volume pre unit engine set is too low. The total capacity volume of below 50MW engine set occupies 26.62% in the whole volume, and the medium electric power plant is composed the majority of the whole electric power plants. There are many small plants and

they are employing more people per plant, so the extent of industrial concentration, the efficiency of labor and the level of management is lower, these are the prominent problem in construction of industry. Secondly, the proportion of clear-electric power generation should be raised. In 2003, the proportion of capacity volume of clear-electric power generation installed engine is 25%, and the generated energy occupies 21% in the total, but this has long distance from the project (31%) of “the tenth five plan”, so the proportion of capacity volume of clear-electric power generation installed engine should be raised higher in the following years of “the eleventh five plan”. Thirdly, the technical and economic target need be improved. Although the coal consumption of power supply has been fallen down 37g/kwh from 1993 to 2003, there is 50g/kwh between the level of China and the level of developed country. So some measure should be taken to reduce the coal consumption. Meanwhile, the level of line loss is too high in China, and the rate of line loss can be reduced yet. Fourthly, the scaling relation between the current source and electric network is not co-ordinated.

There are several problems should be major settled when the construction of electric power industry are adjusting in the period of “The Eleventh Five”, the problems is as follows: Firstly, the problem of stopping the small generating set. This needs set up the mechanism of exit depending on the market mechanism, and confine the build of small generating set depending on the conjunction of many measures. In the plan of “The Eleventh Five”, it has been shut the small generating set about 18500MW. Secondly, the problem is the development of overcritical and beyond overcritical generating set. The condition of a wider scale promotion of overcritical generating set has been matured, so it should raise the proportion of capacity volume of overcritical generating set, and it need be supported by corresponding industrial policies. Thirdly, the problem is exploitation of hydroelectricity.

The cyclic of economical evaluation for the exploitation of hydroelectricity should be extended, and it should be paid attention of the trend of expanding the equipped capacitor a plant, the proportion between unit capacity volume and the firm capacity should be kept 3:1. The hydroelectricity should be developed based on the regulation of market transaction and the condition of the least of allocated cost of resource, and it implements general optimization. The exploitation of pumped-storage power station is the problem of system resource allocation, and it should not be the unique or principal measure to variable load. At last, it should accelerate the building of pneumoelectric and nuclear power.

3.2 Exploitation of the generate electricity technology with lean coal

There is much more coal resource in China, and the coal will be the great part of the resource of generated electricity in the next many years. It must exploit the generate electricity technology with lean coal in order to reduce the environmental contamination.

On the aspect of the lean fired technology of coal, the technology of combined cycle between gas and steam has been developed quickly. This technology can increase the calorific efficiency of power plant and it can settle the problem of environmental contamination. It may be a generate electricity technology that has better prospect in the 21 century. At present, there are three competed programmes: IGCC, PFBC-CC and AFBC-CC are listed in the *21 Century Agendum in China*, and the government has been ejected many item to develop the lean fired technology of coal.

3.3 Intensification of electric network technology

At present, every regional electric network has been formed trunk stem grid with 220KV, and they are developing to the grid structure with 500KV. In order to implement the project that combining the electric network of whole country before 2015, every regional electric network must follow the policy decision: “uniform planning, uniform building, uniform managing, uniform dispatching”. The construction of electric network will be suitable and the operation will be flexible. Finally, it is establishing the foundation for the networking of whole country.

It should develop the electric network of city and village when developing the backbone network. The government has been invested much money on the electric network of city and village, the construction of these electric networks is very frail, and the transmission and distribution equipments are aging severely. Each regional electric network should accelerate the building and reforming speed of the electric network of city and village, as a result, it can reduce the line loss, increase the efficient supply and settle the “bottle-neck problem” of power transmission. Meanwhile, it should accelerate the building speed of electrification in village, exploit the power market of village, and increase the demand of electric power.

3.4 Implement of DSM

DSM is a energy-saving technology which presented from foreign country. DSM is a technological and economic measure for modifying the quantity and pattern of electric power consumption of customer. This technology has been used from 1992.

With the development of the electric power industry and regulation of the industrial construction of national economy, the construction of electric power consumption has been altered ultimately. Because the proportion of electric power consumption in third industry raises and the domestic load has been increased quickly, the load ratio falls annually and the distance of peak-to-valley becomes wider. With the DSM technology, the construction of the electric power consumption can be promoted, the load ratio can be raised, and the coal consumption of generate electricity can be reduced finally. The DSM technology is an important measure which can save the resource and reduce the environmental contamination, and it also

agree with the policy of the developed plan of the electric power industry.

4. Conclusion

In this article, it discusses the sustainable development strategic of electric power industry in China. The government should cultivate the electric power market actively, transit the way of the electric power growth, accelerate the regulation of the construction of it, allocate the resource suitably, increase operation rate of resource, and reinforce the building of electric power network. The broaden sources of income and energy-saving should be done simultaneously. The generate electricity technology with lean coal should be extended, the generate electricity with new resource and regenerative energy, and implement the coordinated development among electric power industry, society, economy and environment.

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Table 1. Energy consumption construction in 2002

Country	energy consumption (Mtce)	oil (%)	rock gas(%)	Coal (%)	nuclear power (%)	hydroelectricity (%)
USA	3275.7	39	26.2	24.2	8.1	2.5
Russia	914.6	19.2	54.6	15.4	5.0	5.8
German	470.6	38.6	22.6	25.7	11.3	1.8
England	314.7	35	38.6	16.6	9	0.8
Canada	412.4	31.3	25.1	10.6	5.9	27.2
Spanish	134.5	38.9	18.8	21.9	14.3	6.1
Australia	112.9	38	21.6	49.5	-	3.8
China	1425.4	24.6	2.7	66.5	0.6	5.6
world	13435.7	25.5	34.7	24.3	6.3	6.5

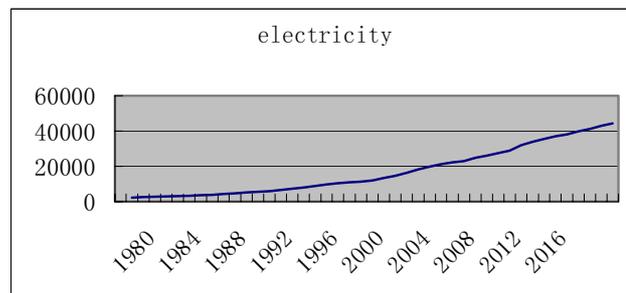


Figure 1. The Trend Figure of Electric Power consumption