

Present Status and Outlook of Coal-fired Power in China

Yobun Inoue*

As a solution to serious air pollution, the Chinese government aims to increase the use of non-fossil energy and to reduce coal-fired power generation. While China has the excessive power generation by the coal-fired power plants in operation, projected to increase to 150 GW by 2030, however, there has emerged a rising concern that shutdown of coal-fired power plants will have a negative impact not only on power companies' business condition, but also local economy and employment. Meanwhile, Chinese power sector is beginning to find new opportunities to export its overcapacity to overseas especially in accordance with the "One Belt, One Road" strategy. This paper explores the current situation of coal-fired power in China and its future prospects.

Keywords : China, Coal, Environmental Problem, Global Warming

1. Introduction

The air pollution in China is serious. In the winter, around the capital and in the northeast, there are even days where the PM2.5 value exceeds $1,000 \mu\text{g}/\text{m}^3$, so countermeasures to air pollution have become a major political challenge for the Chinese government. Analysis has shown that the emission of pollutants through the use of coal account for a considerable proportion of the causes of air pollution, and the reduction of this is an urgent issue.

Furthermore, in August 2016 China ratified the "Paris Agreement" which was adopted by the United Nations Framework Convention on Climate Change, and announced to the world its CO₂ reduction targets. Reducing the use of coal which is one of the major causes of air pollution, that results in large volumes of CO₂ omissions, forms the main pillar for achieving these targets. Curbing the development of coal-fired power plants which are the main use of coal, and cutting the amount of power they generate are considered key targets within Chinese energy policy. In this article, we have analyzed the coal-fired power policy in China, which has turned toward the reduction of coal facilities and power generated, as a result of the current situation in coal-fired power which over several decades has played the main role in providing the country with electricity, and the drastic changes in the surrounding environment. We have also summarized the future prospects for

coal-fired power generation based on this analysis.

2. Current situation of coal-fired power in China

2.1 Status of coal-fired power development

China is the world's largest producer of coal. The amount it produced in 2016 is recorded to have been 3.96 billion tons, and the country consumed roughly one half of this for coal-fired power development. Over the past ten years, China has been the country with the largest number of coal-fired power facilities in the world; supported by the vigorous demand for power based on the country's high rate of economic growth, there continues to be new development of 50 million kW-scale plants every year, and at the end of 2016, the total output of facilities in the country reached 0.94 billion kW. The demand for power had shown increasing growth for many years, but the country has entered a sudden phase of stagnation. This growth in demand has started to slow due to the economic slowdown which has been observed since around 2013. In 2015 the overall growth rate was 0.5%, and the growth rate of the secondary industry was -2%.

However, as a part of its decentralization efforts, the National Development and Reform Commission granted local governments the authority to approve the development of new power sources in 2014. The local governments then strengthened their tendency to proactively approve new power plant development plans that will directly benefit the regional economy in terms of growth, and have continued to develop new coal-fired power plants despite the slowing of demand increase.

2.2 Expansion of non-fossil fuel energy

The Chinese government is striving to reduce environmental load and CO₂ emissions; it has expanded its use of renewable energy and as of the end of 2016, the country boasts the world's largest scale of output from facilities, for all three of hydroelectric, wind and solar power generation. It is also proactively advancing the development of nuclear power, with the output of its operational facilities at the end of 2016 being 33.63 million kW.

The slowing growth in demand for power, in addition to the introduction and expansion of these non-fossil fuel energy sources has resulted in a huge decrease in the rate of operation of coal-fired power. In 2016, the number of hours of operation was approximately 4,000, which in ratio terms, is a drop to merely 45%, putting pressure on the management of thermal power plants. Originally, government approval for new coal-fired power development had the basic condition of an internal rate of return of 8% for 5,500 hours of operation (rate of operation 63%), but the actual situation has been reported as falling well below this threshold, and a large number of power plants have dropped into the red. The decreasing rate of operation is caused by facility surplus exceeding demand, but it is expected that the construction of new thermal power will continue from the current approval situation, for several years to come. Coal-fired power can be classified as an excess production industry typical of China.

3. Coal-fired power policy of China

3.1 Energy policy and curbing development of coal-fired power

In March 2016, the Chinese government published the "13th Five-Year Plan for National Economic and Social Development of the People's Republic of China" followed in January 2017 and April 2017 respectively, by the "13th Five-Year Plan on Energy Development" which focused on the energy sector and the "Energy Production and Consumption Revolutionary Strategy (2016-2030)" which served as a long-term plan to 2030. These plans promote containment of the growth in energy consumption and reduction of coal consumption on the one hand, while increasing the use of natural gas and non-fossil fuel energy and setting the target to have non-fossil fuel energy account for 50% of the total power production in 2030 on the other. In terms of output from power generation facilities, they announced the numerical target of keeping the output from coal-fired facilities,

which was 0.94 billion kW at the end of 2016, to within 1.1 billion kW by 2020.

If we look at the power output in 2016 by source, we find that the rate of coal-fired power was 65%, and the rate of all thermal power sources including gas was 72%, but this is to be brought down under the long-term plan, to 50% in 2030. If we forecast the output by fuel source in 2030 on the basis of these plans, we can expect coal-fired power to decrease down from 1.1 billion kW in 2020 to 1.02 billion kW. Wind and solar power generation, on the other hand, will expand substantially, and renewable energy will grow from 0.56 billion kW in 2016 to roughly 1.5 billion kW.¹⁾

3.2 Response to the pollution

According to government reports, air pollution that originates from coal usage has been analyzed as accounting for one fourth of all pollution. According to a China Electricity Council (hereinafter the "CEC") report, the establishment of environmental measures such as desulfurization, denitration and dust removal facilities has been implemented as some of the most advanced environmental countermeasures in the world with respect to coal-fired power, having resulted in just a small impact from such power generation on the environment. Analyses have shown that most of the environmental pollution originates from the use of coal in steel, cement and other general plants, and within the home. As a result, it has been noted that it is possible to reduce air pollution by a considerable level through electrification of general plants and households, as well as shifting fuel from coal to natural gas. It is also noteworthy that going forward, there will be increasing consumption of electricity.

The Chinese government announced that it will make progress in increasing the combustion efficiency of coal by remodeling its facilities, as a countermeasure to reduce environmental load due to existing coal-fired power, and set the numerical target of raising its performance in the mean combustion efficiency of all of its coal-fired power from 318g/kWh in 2015, to 310g/kWh in 2020. For this purpose, it will implement three types of remodeling with existing power, namely for lowering emissions, and improving energy saving and load following capability. It announced that already by June 2017, it had completed remodeling on 0.57 billion kW across all coal-fired power.²⁾

In addition, the CEC has plans to further introduce high-efficiency coal usage technology, while for the coal-fired power it will develop in the near future, it aims to install double reheat and other technology in its Ultra Super Critical (USC) power plants and to raise efficiency further. Meanwhile, analyses have shown that there is a low probability that high-efficiency power generation technology such as A-USC and IGCC, as suggested in the 13th Five-Year Plan, will be introduced for coal by 2020, considering the cost-effectiveness.

3.3 Measures to curb the new development of coal-fired power

In its “13th Five-Year Plan on Energy Development” the Chinese government announced that it would keep the output from coal-fired power to less than 1.1 billion kW in 2020. With a plan to curb the development of coal-fired power set out, since September 2016, the central government has pointed out the risk of excessive coal-fired power several times, and repeatedly announced policies aimed at reducing this power generation. There follows here the five main points.

- ① September 2016, the National Energy Administration will withdraw permission to build 12.40 million kW of new coal-fired power plants, including those for which construction has begun,
- ② March 2017, the National Development and Reform Commission will designate coal-fired power plants as the target for supply side structural reform.
- ③ March 2017, in the Report on the Work of the Government by the National People’s Congress, the Premier Li Keqiang announced that the output from coal-fired power, for which measures were taken such as abolishing, suspending or discontinuing operations in 2017, was less than 50 million kWh.
- ④ May 2017, the National Energy Administration published the “Risk Alarm for New Construction of Coal-fired Power Until 2020” as a criterion on which to judge the suitability of building new coal-fired power plants.
- ⑤ August 2017, the National Energy Administration published its “Opinion on the Risk of Excess Coal-Fired Power” and announced that by 2020, it will suspend or discontinue construction work for 0.15 billion kW of coal-fired power plants, and abolish 20 million kW of dilapidated facilities.

3.4 Situation regarding development of coal-fired power and causes of excess facilities

The CEC released the results of its analysis of the situation regarding new coal-fired power plants as of April 2017. According to this, a total of 165 projects have received government development approval and are already underway with construction; their total output has reached 0.178 billion kW. Furthermore, it revealed that there is 20 million kW of as-yet-non-started projects which have received approval from the government already, and in total, approximately 0.2 billion kW of projects which have received government approval. It also points out that there are 38 million kW of projects which have commenced construction illegally, having not obtained government approval, as well as at least 0.1 billion kW of projects which are currently undertaking the procedures to obtain building permission³⁾. Looking at this in terms of the total for existing coal-fired power, we can regard an amount equivalent to 0.2 billion kW as excess.

Usually, new power plant development plans are established by envisioning future demand growth based on the supply and demand situation for power; it seems that excess in new development that exceeds several hundred thousand kW sets a new global precedent. If we analyze the causes of this, we can infer the following six points.

- ① Over the past ten or more years, we have seen a dramatic increase in demand for power, the likes of which have yet to be seen before in the world. However recently, there has been a dramatic change in demand, in that the growth has changed and slowed. Unfortunately, this change could not be forecast in the long-term electricity plan, and the government has not been able to respond adequately.
- ② Based on increased demand in recent years, the leading power companies have aimed to strengthen their voice and negotiation power within the electricity wholesale and fuel procurement markets by increasing their size, and excessive competition has arisen in development.
- ③ Local government has proactively supported source development, in which large amounts are invested and roll-on effects to the local economy are great.
- ④ Because new source development requires long periods of time from planning until the start of operations, large-scale development plans have come to span multiple years.
- ⑤ There are rampant illegal activities, wherein suppliers

have proceeded with construction work while undertaking the approval procedures, in order to ensure a quick start for operations and revenue in new projects; local governments may also be complicit in this.

- ⑥ Private power generation by industries that consume large amounts of power has seen progress, as a solution to the issue of insufficient power supply which arose around the year 2000. They have expanded this while sidestepping the relevant government controls, such that the output of their facilities, as of the end of 2016, had reached 0.115 billion kW. Privately-generated power is linked into the electricity network, which gives impetus to the excess of power supply.

3.5 Problems with countermeasures to supply excess

The past ten years in China have seen efforts to advance the “Large Increase/Small Replace” policy which encourages small and dilapidated thermal power plants to be abolished and replaced with larger and more efficient power generation. Because the government took preferential measures in the granting of approval quickly under Large Increase/Small Replace, there came to be a large-scale progress in the replacement of small-scale thermal plants on the basis of the policy. As a result, all small and dilapidated thermal power plants in China are already abolished, more or less, and there are only a few new facilities that are subject for abolition. The majority of current coal-fired facilities are of the 300 thousand kW and higher-scale and commenced operation since the year 2000 and it is not possible for these to be immediately abolished based on their number of years of service.

In May 2017, North China Electric Power University published the results of trial calculations of the economic impact that comes with stopping construction and abolition of new coal-fired power plants. It predicted that the excess from facilities in 2020 would be 0.14 billion kW, with 233 coal-fired plants of the 600 thousand kW scale. It calculated the corresponding cost of abolition to be 2.45 trillion yuan (approximately 40 trillion yen)⁴⁾. The scale of fiscal spending by the Chinese government at the time of the 2008 collapse of Lehman Brothers is said to be 4 trillion yuan (approximately 50 trillion yen), but if we consider the massive losses incurred through the stopping of development, then we may find ourselves impelled to question the practicality of the measure of stopping development projects.

Furthermore, measures to curb development and respond to supply excess have a huge effect on companies in the power industry that are not suppliers. According to the report, the amount of new coal-fired power generation in 2016 was one third of that producible by the three largest producers in China (the three electric power groups, Harbin, Shanghai and Dongfang)⁵⁾; it has been noted that this caused worsened revenue for each producer. It is a fact that the amount of development since 2017 has been curbed even more than in 2016, and the economic situation for relevant companies in the industry, including the three leading producers, has worsened substantially.

3.6 Challenges facing efforts to curb coal-fired power

The development of coal-fired power has brought enormous benefits to regional economies. However, the problems currently faced go beyond simply curbing and reducing investment in power; the effects on the economy of coal producing regions and on the coal transporting industry, and other effects that extend to local economies are substantial, and are assumed to have a strong potential to exacerbate hiring issues.

In 2016, the National Development and Reform Commission announced reforms to the structure of the steel and coal production industries and measures to reduce supply, in this excess supply industry. As a result of these efforts, as many as 1.8 million individuals will need to be reduced from the workforce or relocated. It announced the budgeting of 100 billion yuan (approximately 1.6 trillion yen) as targeted expenses. As for measures to address the excess of coal-fired power, the scope of their effects will extend beyond simply electricity suppliers, reaching to coal producers, equipment manufacturers, construction workers and beyond, and it may be assumed that there is a strong potential for hiring-related measures to be necessary.

If we consider the characteristic features of Chinese politics and economy, then we find that the politics and policy efforts are centralized, while the economy appears to be largely independent, within each ministry and each region managing its economy separately. Because policies to address excess supply have effects that directly impact regional economies, it may be assumed that the actual realization of abolishing new coal-fired power and curbing development will come with considerable difficulties.

4. Future outlook for coal-fired power in China

4.1 Future prospects for development

According to statistics by the Federation of Electric Power Companies of Japan, the amount of electricity consumed per person in China in 2014 was 3,972kWh/person per year, which is one fourth that of America and half that of Japan. The amount of power consumed for everyday consumption in 2016 in China was merely 14% of the total power consumed, but in the near future, the demand for power is expected to grow along with the level of living for citizens. The amount of power consumed per person in 2020 is forecast to be 5,000kWh/person per year, which is then expected to increase further to 7,000kWh/person per year in 2030⁶⁾, reaching the level of advanced nations. Based on the prediction of continued increase in power demand beyond 2020, it will be necessary to develop new power sources in response to the future demand, and coal-fired power is expected to undergo continued development alongside the implementation of environmental measures. Specifically, the amount of development until 2020, under the 13th Five-Year Plan, is expected to slow down, but due to the increase in power demand, it is presumable that projects to discontinue and suspend construction will restart development gradually from around 2020. Moreover, subcritical facilities of the 300 thousand kW level, as developed from around the year 2000, will start one-by-one to reach their life expectancy around 2020, so it may be assumed that the measure to be taken is to abolish these and replace them with new high-efficiency power facilities.

The development of new coal-fired power plants in China will continue going forward, but the scale of that development is limited, so it will be difficult for the situation of excess development capacity by manufacturers and construction workers to be resolved. On the other hand, under the strategy of “One Belt, One Road” that it is pursuing, the Chinese government is aiming to strengthen its relationship with countries along the Belt and Road and create a new Chinese economic zone, in addition to which it aims to redirect its own excess supply industry abroad. It is practically impossible for the power-related industry in China to resolve its excess capacity by domestic consumption alone, so one may say that it is in a situation where it must develop overseas through the use of its “One Belt, One Road” strategy.

4.2 Overseas development of power industry

The advance overseas of Chinese power companies started with the purchase of the Australian company of OzGen in 2003 by the

leading Chinese company China Huaneng Group. After that time, there was progressive overseas investment by numerous suppliers, but many companies met with difficulties, due not only to their limited international experience and lack of technological level and personnel training, but also because they advanced into these new markets on their own, independently of one another, resulting in insufficient ability to gather information for projects or analyze the risks.

Meanwhile, the Chinese State Grid, which is the country’s largest state-owned company, has pursued more proactive overseas development compared to other power companies. It is reported that its cumulative total investment is 15 billion US dollars, and the annual rate of return on average from foreign business exceeds 10%⁷⁾, so this is held up as a success story in foreign business. For its advance overseas the State Grid took a method involving the conclusion of comprehensive agreements which spanned consultation, design and construction, equipment export, EPC orders and OM, as well as investment. It employed a system of joint business, with construction workers, manufacturers and other enterprises associated with energy, focused primarily on the grid. In recent years, there has been a growing trend of expanding overseas business via power-related enterprises following the One Belt, One Road strategy; the method of the State Grid is regarded as a model for overseas expansion by power suppliers, and it appears that the same kinds of methods could be adopted going forward, by coal-fired power generation for overseas development.

4.3 Competition in Asia in coal-fired power

With the global trend toward suppressing the emissions of greenhouse gases, there is a head wind against coal-fired power, but in the countries of Asia where there is expected to be a large increase in power demand due to its economic potential and ease of fuel procurement, construction of coal-fired power plants is expected to continue for the time being. China has targeted the Asian market as its destination for overseas expansion of coal-fired power, and it is recognized on the Chinese side that competition with Japanese companies is unavoidable.

Within the Asian market, Vietnam is viewed as the largest potential market for new coal-fired power facilities, due to its abandonment of nuclear power. According to a Chinese report, “Vietnam is a valuable market for Chinese thermal power companies, and competition with Japan cannot be avoided. However, our companies have reached a level already where

they stand favorably aside Japanese ones in areas such as USC technology, facility manufacturing ability and OM technology. From the perspective of cost competitiveness, Chinese companies are actually in a superior position.”⁸⁾

4.4 Overseas development and future prospects of coal-fired power

In May 2017, the “One Belt, One Road” international forum was held in Beijing and attended by 130 countries and 70 international organizations from around the world. This was the largest international event of 2017 by the Xi Administration; it promoted the importance both at home and abroad of the aforementioned strategy. It is expected by the country as a whole that the industry will expand further overseas in the coming years.

Under this environment, the CEC established the “Chinese Power International Production Capability Cooperating Company Association.” Based on reflections upon past power investment and State Grid techniques that are success stories in terms of advancement overseas, it was organized as a system for supporting the future overseas development of Chinese power industry companies, that firmly sets out a position for providing support by the industry as a whole.

4.5 Dealing with Chinese companies

Concerns have been raised, and criticisms voiced by the international community with respect to the “One Belt, One Road” strategy, toward its sudden spread and techniques. The head of the EU criticized the proactive advance of Chinese companies into Africa, saying “Africa is exposed to the risk of becoming a Chinese colony,” while the Financial Times noted that “the Chinese methods of aiming for enlarged influence backed by the country’s financial strength is the 21st century version of colonialism”⁹⁾. It criticized the fact that “increasing exports and accepting orders to build infrastructure to help out companies at home that have excess production is nothing other than increasing the export of non-performing stock overseas.” China reacted sensitively to these criticisms from the West and argued that “China has no colonialist ambitions of any kind”¹⁰⁾; one may guess that this kind of criticism hits a painful nerve to the Chinese government.

To China, there is an important challenge in realizing investment in great projects overseas, while avoiding criticism from other countries. Cooperation with influential companies abroad has the

benefit not only of potentially bringing lowered investment risk, but also of allowing this criticism to be avoided.

Centered on the Asian market, it seems that Japanese companies that cannot avoid competition with their Chinese counterparts should take this chance to advance either the efforts of Chinese companies toward their projects or utilize the Chinese companies themselves. Even among the Chinese companies, there are those that have an interest in the international experience of Japanese companies, their technological strengths and their overseas investment, and one may assume that the Japanese companies should try to make use of Chinese companies to help in securing and increasing their opportunities for coal-fired power.

Resources

- 1) China Energy Research Society “China Energy Outlook 2030”
- 2) People’s Network 9/25/2017
- 3) Energy Research Institute National Development and Research Commission Club 7/25/2017
- 4) China 5e 5/19/2017
- 5) China 5e 12/23/2016
- 6) National Energy Administration, Energy Demand Prospects, 2/20/2013, 11/7/2016
- 7) China 5e 5/15/2017
- 8) China 5e 2/6/2017
- 9) Financial Times 16/5/2017
- 10) People’s Network 2017/4/1