Resources, Conservation and Recycling xxx (2016) xxx–xxx

Contents lists available at ScienceDirect

Resources, Conservation and Recycling

journal homepage: www.elsevier.com/locate/resconrec

Full length article

Peak coal in China: A literature review

Shuai Han, Hong Chen*, Ruyin Long, Xiaotong Cui

School of Management, China University of Mining and Technology, Xuzhou, Jiangsu 221116, PR China

ARTICLE INFO

Article history:
Received 30 April 2016
Received in revised form 27 July 2016
Accepted 9 August 2016
Available online xxx

Keywords:
China
Peak coal
Forecast
Influencing factors

ABSTRACT

Coal is the main energy resource in China. However, currently there is an overcapacity of coal; this is problematic in relation to sustainability, emphasizing the importance of research on peak coal. This paper presents a comprehensive overview of the research conducted on peak coal and summarizes the influencing factors, forecast methods, and forecast results of peak coal. This review has ascertained that the key premises of peak coal forecasts mainly rely on historical coal production and reserves, which excludes the effects of other factors such as the market, resource, technology, environment, transport, safety, new energy and policy. In addition, the data standards and ports of the historical data are not uniform, and the scenario analysis forecasting method is less than the trend extrapolation forecasting method. All of our findings demonstrate great deviations between the forecasting outcomes and the actual situations of China's peak coal. The use of realistic factors of China's situation should be a precondition to improving the distortion of the current forecasting of peak coal. These factors should include the macroeconomic slowdown, forced carbon emission reductions, supply-side reforms, and new energy shocks, which will be the key constraints in remodeling the forecasts of peak coal.

© 2016 Elsevier B.V. All rights reserved.

1. Introduction

Coal is the main energy resource in China, accounting for almost 70% of the energy structure. About 80% of electric energy, 70% of chemical energy, and 60% of civilian commercial energy are provided by coal (NBSC, 2015; Qi et al., 2012), so it is clear that the development and application of coal contribute a lot to China's economic development. In recent years, the excessive growth of coal consumption and its inefficiency and uncleanness have focused attention in China on the sustainability problem related to the resource, the environment, the economy, and the society. In order to promote the construction of a biologically sound civilization and green development, it is necessary to control the total amount of coal used, to adjust the energy structure, and to develop the clean and efficient use of coal (Chinese Research Group of Coal Control and Policy, 2016). China's government has paid high attention to the adjustment of the energy structure, especially in respect of controlling the total volume of coal consumption and decreasing the proportion of coal in energy consumption. For example, the State Council of China established its policies to deal with excessive production and achieve development in the coal industry, which has helped to reduce the production capability by about 5 billion tonnes and reconstruct the industry in the three to five years since the policies were proposed in 2006 (The State Council of China, 2015d). In addition, the government work report in 2016 and the 13th Five Year Plan also clearly pointed out that it is necessary to strictly control the newly increased coal production capability, close down the outdated production capability, and actively and prudently dispose of state-owned zombie enterprises in order to eliminate the excessive coal production capability. A goal was proposed that the percentage of coal consumption should be limited to 62% by 2020, which indicates that the coming of peak coal is inevitable. Chinese peak coal refers to the maximum coal production (peak point) and when that point will be reached. It is generally believed that coal production will reach its peak at a certain point after which production will enter a terminal decline. In addition to the above plan for the reduction of China's coal production capacity, to maintain a steady growth of the country's economy, the government of China is focusing on developing new energy to replace the demand for coal. However, China's energy resource structure is characterized by rich coal deposits, meager oil, and little gas; the existing energy reserves are made up of 94% coal, 5% oil, and only 0.6% gas. On the premise that coal replacement is equipped with a cost advantage, it is estimated that only when the growth rate of clean energy reaches 22% can 1% of coal demand be replaced (Xu, 2016). This indicates that from the perspective of national economic safety, the realistic strategy of China should be still based on coal in the future.

* Corresponding author.
E-mail addresses: hessa1222@163.com (S. Han), hongchenxz@163.com (H. Chen), longruyin@163.com (R. Long), 6721502502@qq.com (X. Cui).

http://dx.doi.org/10.1016/j.resconrec.2016.08.012
0921-3449/© 2016 Elsevier B.V. All rights reserved.

Please cite this article in press as: Han, S., et al., Peak coal in China: A literature review. Resour Conserv Recy (2016), http://dx.doi.org/10.1016/j.resconrec.2016.08.012

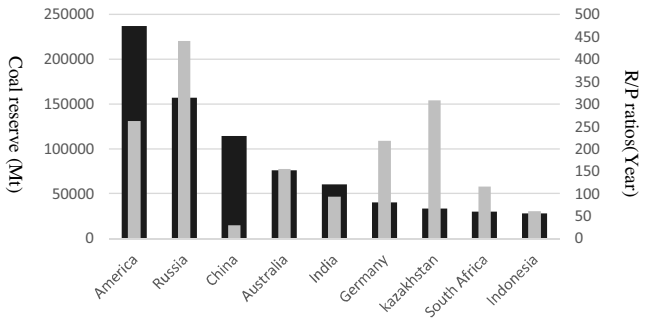

Fig. 1. Coal reserves and R/P ratios in 2015 (9 top countries in coal reserves). Sources:BP (2015, 2016b)

Hence, given the imperative to control the coal production capability, when will peak coal production occur? What is the specific number? Whether this production capability can ensure the energy supply that the economy needs for growth is a significant problem that is worth studying. Domestic and foreign scholars have carried out wide research about the problem of China's peak coal amount, but given China's current situation with regard to resources, the environment, and the economy, a lot of factors will influence the peak value of coal. The ability to exactly predict the peak coal value and to effectively handle the capability planning and deployment would contribute a lot to reasonably controlling the total amount of coal consumption, achieving the healthy and stable development of the coal industry, and realizing the sustainable development of China's economy. On the basis of systematically reviewing the literature about the peak coal value and combining this information with the new situation of China's economic development, we have proposed new constrained variables that should be taken into consideration in the research involved with the prediction of the peak coal value.

2. The current condition of China's coal production

2.1. The production and reserves

According to the statistics of the global fossil reserves in the BP Energy Outlook (BP, 2016a), oil, gas, and coal are abundant. The R/P ratio[1] (reserve/production) of coal can reach 114 years, so in the short term there is no pressure in terms of "running out" of coal resources. From the data of global main countries' fossil energy in the BP Statistical Review of World Energy 2016 (BP, 2016b), at the end of 2015 China had 114,500 million tonnes of proven coal reserves, accounting for about 12.8% of the world's proven reserves. This compares with the United States (237,295 million tonnes, 26.6%) and Russia (157,010 million tonnes, 17.6%), so it is clear that China does not have an advantage with its coal reserves. Besides, the coal production of China are the highest in the world, which results in a deficit between its coal reserves and coal production that will lead to China's domestic coal resources being inadequate in the future. China's P/R ratio is only 30, which contrasts with the United States' P/R ratio of 262. Accordingly, there is a clear limit on the sustainable mining and development potential of the Chinese coal industry, which will accelerate the arrival of Chinese peak coal (see Fig. 1).

Xu et al. divided the coal producing areas in terms of coal resources into three zones: the eastern feeding area, the middle area of supplies, and the western self-sufficient area. The coal resources in the middle and western areas are relatively abundant, with the potential coal resources accounting for 80.4% and 15.2%, respectively, of the total national reserves; the eastern area resources only account for 4.4% of the total. From the features of the geological coal reserves in China, Tian et al. (2006) divided the coal resource areas into nine zones; that is, the ##type division pattern of coal resources. These are the northeastern region, Huang-huai-hai region, southeast region, eastern Mongolian region, Jin-Shan-Meng region, southwest region, northern Xinjiang region, southern Xinjiang region, and Gansu-Qinghai region, of which the coal reserves are 32 billion tonnes, 96 billion tonnes, 9 billion tonnes, 100 billion tonnes, 592 billion tonnes, 86 billion tonnes, 98 billion tonnes, 8 billion tonnes, and 0.9 billion tonnes, respectively (Tian et al., 2006; Peng, 2012). The coal resources in China are concentrated more in the western part than in the eastern part of the country, which causes problems with coal utilization and development. The uneven distribution among these regions increases the cost of coal transport and inhibits the development of competitive advantages. To analyze the relationship between the coal reserves and production in China more closely, we now summarize in Fig. 2 the basic coal reserves[2] and R/P ratios in each province in the Chinese mainland.

The top three provinces in basic coal reserves are Shanxi (9208.9 thousand tonnes), Neimenggu (4900.2 thousand tonnes), and Xinjiang (1580.1 thousand tonnes) (NBSC, 2015). In general, the more abundant the coal reserves are, the larger the coal production is, such as Shanxi (975 million tonnes), Neimenggu (909 million tonnes), Shǎnxi (522 million tonnes), Xinjiang (146 million tonnes), and Shandong (144 million tonnes). They all have relatively rich reserves and are large coal-producing provinces. According to the R/P ratio data for each province, the reserves of most provinces are likely to last for less than 110 years. Hebei (48 years), Shǎnxi (18 years), Jilin (37 years), Hunan (20 years), and Fujian (27 years) are in the list of provinces with resources that are depleting at a high speed. Neimenggu (53 years), Henan (70 years), Guizhou (55 years), Anhui (62 years), and Shandong (53 years) have rich coal reserves but low R/P ratios, so it can be seen that their bonus of coal resource are declining. Shanxi (94 years), Heilongjiang (93 years), Xinjiang (107 years), and Sichuan (85 years) all still have large coal resources. From the data for the area distribution of coal production capacity, the current coal capacity is mainly accumulated in the Jin-Shan-Meng region, the eastern Mongolia region, the western-south region and the Huang-huai-hai region, especially in the provinces of Shanxi, Neimenggu, Shǎnxi, and Shandong; their production capability is 838 million tonnes, 717 million tonnes, 363 million tonnes and 171 million tonnes, respectively (NEA, 2016). With the depletion of the coal resources in the eastern and middle regions and the abundance of proven coal reserves[3] in the western and northern areas (231.1 billion tonnes in Xinjiang and 890.6 billion tonnes in inner Mongolia), coal enterprises are flowing into these regions to construct coal mines, and Chinese coal production will be mainly in these areas in the future.

[1] R/P ratio: the number of years of remaining reserves if the production remains unchanged every year.

[2] The basic reserves are part of the total identified mineral resources, which can satisfy the index requirements of current mining. They are expressed in terms of tonnage or volume from which the losses of designing and mining have not been deducted. They are located in measured and indicated reserve areas in which detailed or general exploration and feasibility or prefeasibility studies have been done. The results demonstrate the economic or marginal economic benefits.

[3] Proven reserves are mineral reserves that are known and have been delineated through geological exploration. This is distinguished from mineral resources that have not been investigated or are only predicted according to their general geological condition; their quality, quantity, reserve state, and conditions of exploration and utilization are not clear. In essence, proven reserves result from the geological exploration of theoretical reserves of coal resources.

Please cite this article in press as: Han, S., et al., Peak coal in China: A literature review. Resour Conserv Recy (2016), http://dx.doi.org/10.1016/j.resconrec.2016.08.012

Download English Version:

https://daneshyari.com/en/article/7494570

Download Persian Version:

https://daneshyari.com/article/7494570

Daneshyari.com