



Development status of coal industries in the world's major coal-producing countries

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Abstract

The global coal industry has changed significantly in recent years. In this paper we analyse the coal production and consumption, imports and exports, and coal prices in China and other major coal-producing countries during the past four decades. The analysis shows that global coal production and consumption have declined over the last three years, in striking contrast to the continuous growth for most of the past 35 years. Australia, Indonesia, and Russia have become the world's major coal providers, while China, India, and the USA, and Germany are the major coal consumers. The world's, and China's, coal industry can be classified into four stages of development: the stable growth phase, stable phase, rapid growth phase, and high-quality phase. Coal prices rose in the world's four major coal markets in 2016 after four consecutive years of falling prices. The elimination of overcapacity and production-optimizing operations in China could assist in achieving a demand and supply balance.

Keywords

coal, production, consumption, import, export, supply and demand balance, coal price

Introduction

China is the world's largest coal producer and consumer, contributing 47.6% of global coal production in 2019 (BP, 2020). Even so, the Chinese coal industry has been eliminating excess capacity and optimizing its operations since 2015, in order to combat declining coal prices and corporate profits. Other major coal producers, including the USA, India, Australia, Indonesia, Russia, and South Africa, together accounted for about another 38.4% of the world's total coal production in 2019. The conditions of the coal industry and trends in production and consumption in these countries, however, vary to a large extent.

Since coal production and consumption have serious environmental consequences, the world is shifting to a cleaner, lower-carbon energy mix and coal is expected to be replaced by lower carbon alternatives (Hu et al., 2010; Bian et al., 2010; Bell, Stacey, and Genske, 2000). The imbalance between coal supply and demand also has a significant negative impact on the coal price, company interests, and labourers' benefits. Therefore, the major coal producers and consumers are accordingly adjusting to a more scientific and sustainable pattern of growth in production and consumption in the domestic industries. In this paper we attempt to summarize the situation of the coal production and consumption in the world in recent years, with emphasis on the Chinese coal industry.

Current situations of major coal-producing countries

Coal production and consumption

Figure 1 compares the coal production and consumption for the six major coal producing countries (excluding China) from 1981-2019. It shows a large discrepancy between different countries, which will be illustrated in detail below.

The USA is the second largest coal producer and consumer in the world. Following the steady increase from 1981-2009, coal production and consumption have been decreasing for the last 12 years. This might be due to the extraordinary boom in shale gas during that period. Both coal production and consumption declined to approximately 640 Mt in 2019. In particular, coal production has varied significantly over the last four years.

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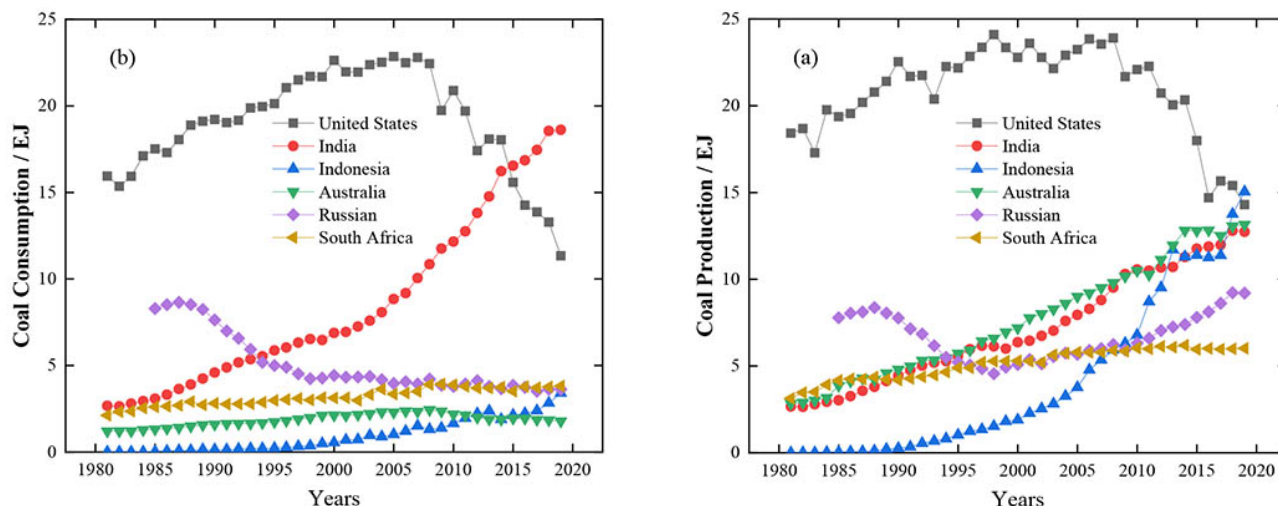


Figure 1—Coal production and consumption of other major coal producers during the period of 1981-2019
Note: 1 EJ (exajoule) = approx. 34.12 Mt

India, in contrast, has been increasing coal production and consumption for the last four decades, and has seen the fastest increase in coal production, bypassing the United States in 2015 to become and the world's second largest coal consumer. India's coal consumption has grown faster than production for almost four decades, with 218 Mt imported in 2020.

Australia, on the contrary, shows a higher growth rate of production than consumption. Australian coal production increases linearly, and almost keeps at the same level with India. Consumption, however, maintains at around 1.2-2.5 EJ (about 40-85 Mt) for most of the past 39 years.

Indonesia has also seen a sharp growth in coal production since 1985. Production peaked at 474.6 Mt in 2013 and remained fairly steady until 2018, when it increased again. Consumption shows a clear increasing trend, reaching a maximum of 106.4 Mt in 2013 and then increasing again. However, consumption is increasing at a much slower rate than production.

Coal production for Russia is a V-shaped curve, in striking contrast to the inverted V-shaped curve of the United States. The production decreases and then returns to about 440 Mt in 2019, the same level as in 1985. Consumption, however, shows an overall decline before stabilizing at 200 Mt/a from about 2005.

The trend of coal production in South Africa shows a slight increase from 1981-2019. Both production and consumption have remained fairly stable over the past 15 years.

Imports and exports

To better illustrate demand and supply in the domestic coal industries, Figure 2 compares the coal imports and exports of the major coal producers in the world. India has been a net importer of coal since 1983, with imports growing exponentially since 2004. India has become the world's largest net importer of coal, surpassing China in 2011.

The net exporters among the major coal producers are Australia, Indonesia, Russia, South Africa, and the United States. Of those, Australia has been the largest coal provider in the world for most of the past 39 years. The excess of production over consumption has increased steadily, reaching approximately 11.64 EJ (396 Mt) in 2019. Indonesia is the second largest coal provider, and an exponential growth is observed for the excess of production over consumption from 2003-2019. Russia has steadily increased exports,

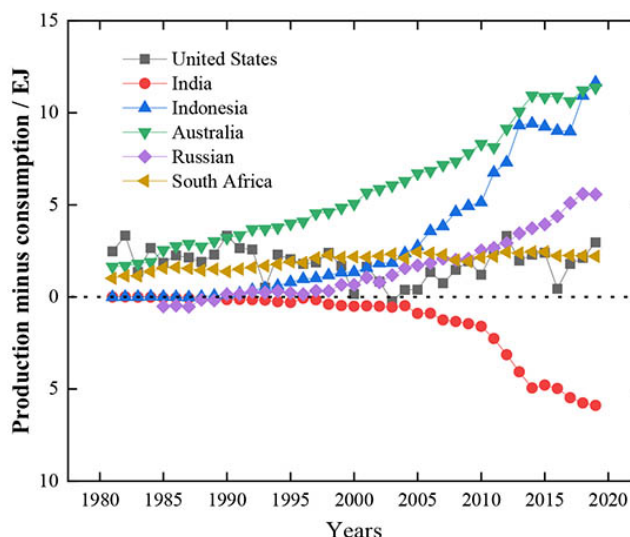


Figure 2—Coal imports minus exports for the major coal producing countries in the world

becoming the world's third largest coal provider. The production of coal in South Africa has remained at approximately 100 Mt more than domestic coal consumption since 1998. In contrast, the curve for the United States shows significant fluctuations over the studied period. The difference between production and consumption in 2000, 2003, and 2016 is close to zero, indicating an overall balance between demand and supply.

Coal price

Figure 3 illustrates the changes in coal prices in China, Japan, Europe, and the USA. It shows that both the Northwest Europe coal market price and the US Central Appalachian coal spot price index were relatively stable before 2000, with significant variations thereafter. The coal prices in the four major coal markets saw an overall increasing trend from 2000-2011, with a marked increase in 2008. This is likely an effect of the 2008 global financial crisis. Coal prices rose in the four major coal markets in 2016 after four consecutive years of decline. Generally, prices were higher in China and Japan, at US\$85.9 and 77.6 per ton respectively in 2019, compared to the lowest price of US\$57.2 per ton in the USA.

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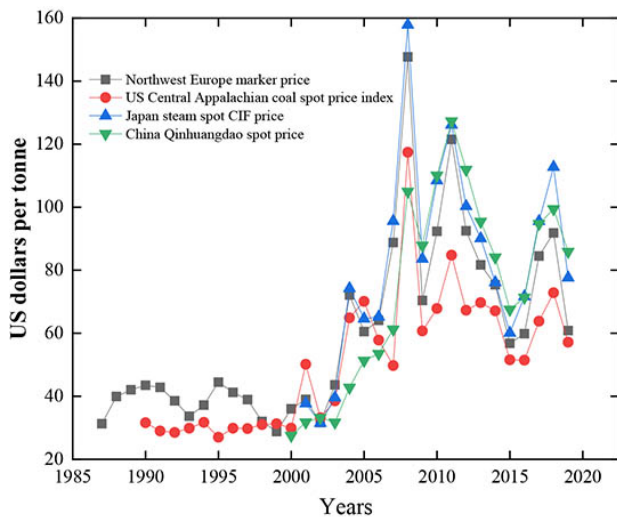


Figure 3—Variation in coal prices in China, Japan, Europe, and the USA

Current situation of the Chinese coal industry

Coal production and consumption

Development of the Chinese coal industry

Chinese and the world's coal production and consumption during the period 1981-2019 are analyzed in this section. As can be seen in Figure 4a, the development of the Chinese coal industry can be classified into four phases, i.e., the stable growth phase, stable phase, rapid growth phase, and high-quality phase, based on increases in coal production and consumption since 1981. The first 15 years constitutes the stable growth phase, which is characterized by a steady increase in both production and consumption from 1981-1995. During this period, China became the world's largest coal producer, exceeding US production in 1985, and the world's largest coal consumer, again by surpassing the USA two years later (BP, 2020). This is followed by the stable phase from 1996-2001, with production and consumption levelling off at around 1350 Mt/a. The following 'golden age' from 2002-2012 is characterized by rapidly-growing coal demand and supply, and a noticeable faster growth pattern of production and consumption at an average rate of approximately 220.4 Mt/a (CICER, 2016), with consumption slightly higher than production for most of the years. After peaking at

around 4000 Mt in 2013, both production and consumption started to decline, which is in sharp contrast to the rapid growth over much of the past 30 years. Since then, the Chinese coal industry has entered the so-called high-quality phase. This might be due to the overcapacity-cutting and production-optimizing operations at the end of the 'golden age'. Affected by the downward pressure on economic growth and excess production capacity, 90% of the coal companies in China ran at a heavy loss during this recession (Zhang, 2015). The fundamental cause of this increasing high-quality drive is excess production capacity. Even so, China is still the largest coal producer and consumer, and accounts for nearly 47% of the world's total share.

Since China is highly influential in the global coal industry, global trends in production and consumption from 1981-2019 follow a very similar pattern to that of China, and can be classified into the same four stages (see Figure 4b), except for a slight difference in the duration of each phase. The stable growth phase ends in 1989 and is followed by a 10-year stable phase from 1989-1999, which is four years longer than the corresponding Chinese stable phase. The global rapid growth phase begins in 1999, two years earlier than the corresponding Chinese 'golden age'. This development stage ends at around 2013, similar to China, preceding the high-quality phase. World coal production peaked at 8274.6 Mt in the same year as Chinese production, and decreased to 7460.4 Mt in 2016. Again, this might be due to overcapacity-cutting in the Chinese coal industry.

Distribution of Chinese coal production

China's coal reserves are unequally distributed across the country, with the bulk of the total proved reserves in the northern and western regions. Coal production is likewise unevenly distributed (Gao et al., 2013; Liu 2008). Figure 5 shows the major Chinese coal producing provinces in 2020. The provinces with production over 100 Mt are Shanxi (1063.1 Mt), Inner Mongolia (1000.9 Mt), Shaanxi (679.4 Mt), Xinjiang (265.9 Mt), Guizhou (119.4 Mt), Anhui (110.8 Mt), Shandong (109.2 Mt), and Henan (104.9 Mt). The total production of these eight provinces accounted for about 90.6% of China's total coal production in 2020.

Coal imports and exports

In the domestic coal industry, coal is normally transported from the west to the east, and from the north to the south (Tian, Shang, and Tang, 2006). This is because while most production is located

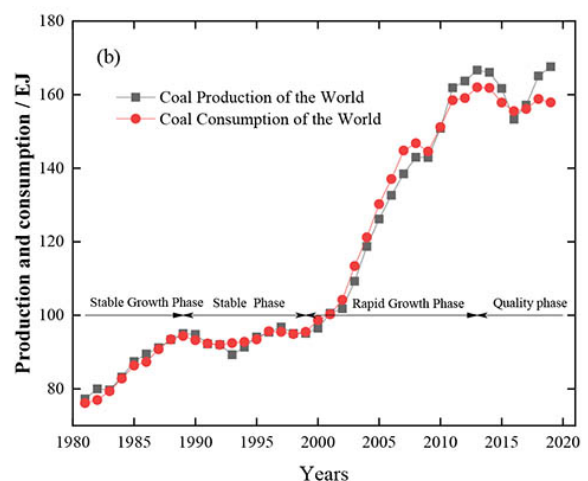
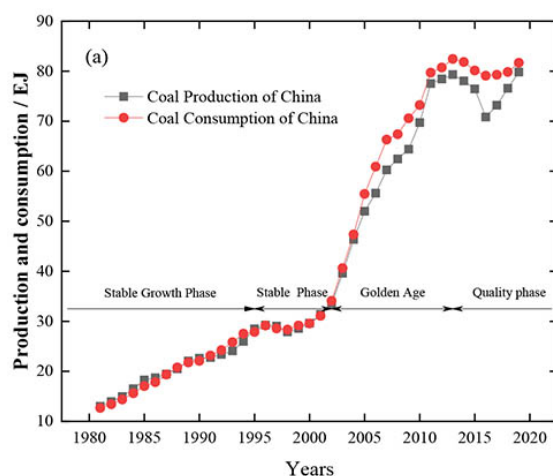


Figure 4—Coal production and consumption of China and the world, 1981-2015

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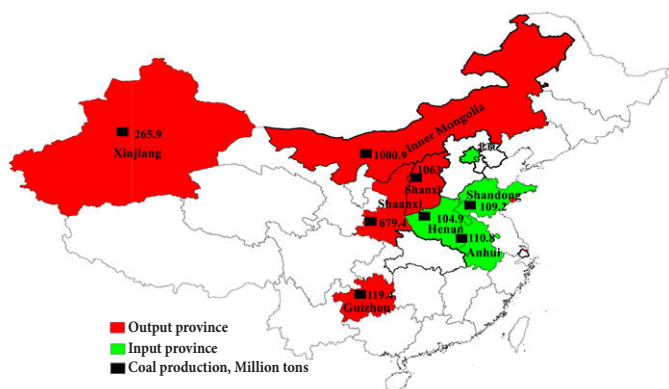


Figure 5 – Distributions of the major coal producing provinces in China in 2020

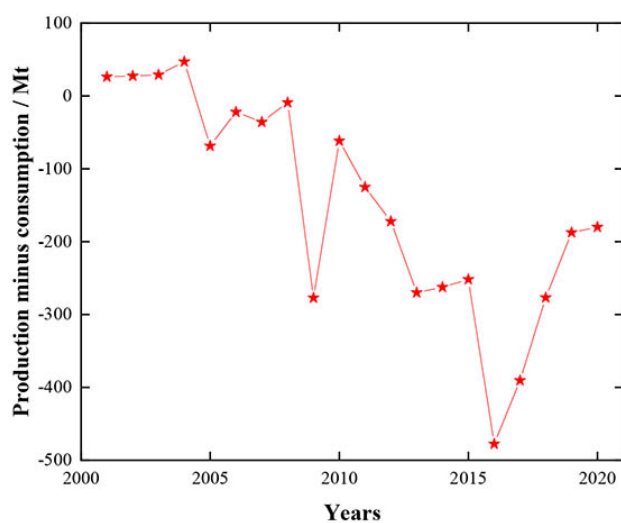


Figure 6 – Coal imports and exports, 2001-2020

in the northern and western provinces, the eastern parts of China consumes more coal than the west. Xinjing, Inner Mongolia, Shanxi, Shannxi, and Guizhou in the west are the net exporting provinces, and Henan, Shandong, and Anhui the net importing provinces.

China as a whole has been a net importer of coal since 2005, despite the fact that domestic coal production has reached almost 50% of the world's total. An overall increase in the demand for coal imports is observed during the studied period (Figure 6), with an extraordinarily high demand during 2005-2016, which corresponds to the 'golden age' of the Chinese coal industry. In 2016, coal imports reached a peak of 477.6 Mt.

Conclusions

- The development of the world's and China's coal industries can be classified into four phases: stable growth, stable, rapid growth, and high-quality – based on coal production and consumption.
- Global coal production and consumption have declined for the last three years, in striking contrast with the continuous growth for most of the past 35 years. This is largely due to overcapacity cutting in China and the extraordinary boom in shale gas in the USA.
- Australia, Indonesia, and Russia have become the world's major coal providers, while China, India, the USA, and Germany are the major consumers.

- Coal prices rose in the world's four major coal markets in 2016 after four consecutive years of falling prices. Overcapacity cutting and optimization of production in China could assist in balancing demand and supply.

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