

# Relationship of Shaanxi Province Energy Consumption and Carbon Emissions

Juan-Ru Shi

School of Management, China University of Mining & Technology, Beijing, 100083, China

Email: 951516626@qq.com

**Abstract**—In recent years, with rapid economic growth, the economic pillar of the energy industry has been concerned by all circles of society, while energy consumption and a large number of exhaust gas emissions to the environment had a bad impact, especially the carbon dioxide emission. The article used the IPCC calculation method to measure the total emission of CO<sub>2</sub> in Shaanxi Province in recent years. According to data it shows that CO<sub>2</sub> emissions of Shaanxi Province in recent years are rapidly raising, especially the CO<sub>2</sub> from the coal, oil, gas, etc. These fossil fuels account for the most part. Considering energy resources and the ecological, historical and cultural aspects of Shaanxi, the paper comes up with some suggestions to adjust energy consumption structure, to increase the intensity of the development of tourism and service industries, and to promote the development and use of low-energy and new energy in Shaanxi Province to develop low carbon economy.

**Keywords**—Shaanxi province; energy consumption; carbon emission reduction; low-carbon economy

## I. INTRODUCTION

With the rapid development of China's economy, energy consumption is sharply increasing, especially in the 21st century, energy consumption growth momentum is more obvious. Based on such understanding, it has a very important significance to the relationship between energy consumption and carbon emissions in Shaanxi Province, and the relationship between economic growth and energy consumption in Shaanxi Province and predict the energy consumption of Shaanxi Province per year [1]. Since 2006, in order to reduce energy consumption per unit of GDP to binding targets, it has been included in "Eleventh

Five-Year" national economic and social development planning of Shaanxi Province, which have a clear requirement to make relative energy consumption per unit of GDP compared in 2005 reduce the about 20% in the "Eleventh Five-Year" period, and reduce carbon dioxide emissions correspond [2].

Shaanxi is in the period of continuing to promote industrialization from the mid to late and thus economy has great potential for growth and its potential advantages, so it's inevitable to lead to the increase of energy consumption. At the same time, as Shaanxi is China's main province of energy consumption, it's crucial to make plans to save energy [3]. In recent years, economic development in Shaanxi Province is extremely fast, but also with the continuous deterioration of the environment, particularly the distinct effect of greenhouse that caused by the high CO<sub>2</sub> emission. Therefore, it's high time to find a sustainable way to keep the high-profit economy and low emission.

### A. The General Situation of Energy Consumption and Economic Growth in Shaanxi Province

At present, the development of Shaanxi Province faces with a new round of western development, the construction of the West Ham District, the implementation of the national "Gansu-Ningxia old revolutionary base areas revitalization plan" [4]. It is shown in Fig. 1 that GDP of Shaanxi Province increased from 393.372 billion RMB in 2005 to 1.768994 trillion RMB in 2014, which has increased four times for a short decade. However, rapid economic development accompanied by a large consumption of energy, especially coal, oil, natural gas and high emissions of fossil-based energy.

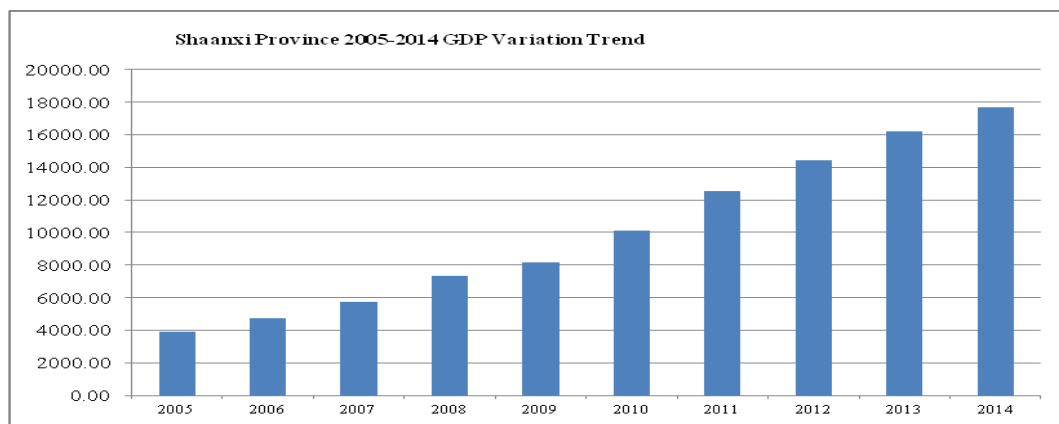
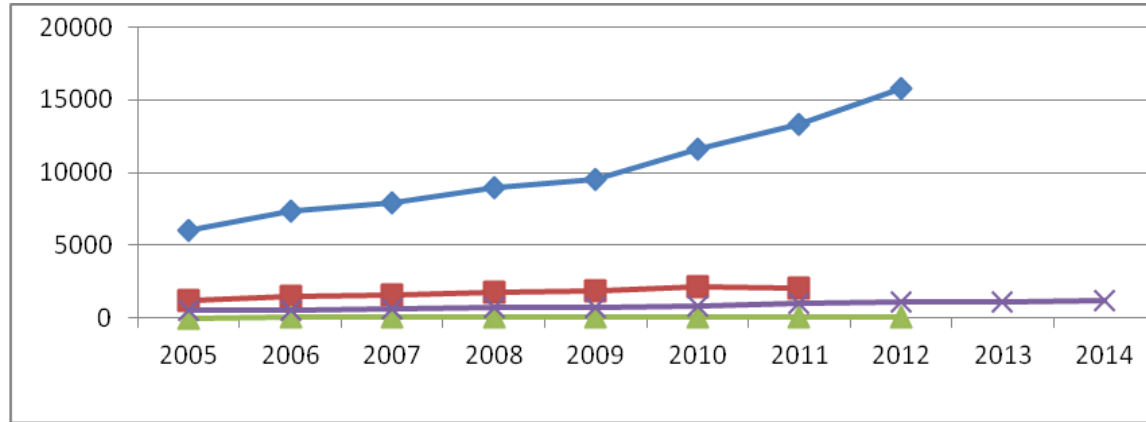


Figure.1. Shaanxi province 2005-2014 GDP variation trend GDP(Unit: 100 million)

It is shown in Fig. 2 that in 2005-2014 this decade, in Shaanxi Province, the main energy consumption is still fossil energy and coal consumption occupy the dominant position, its growth rate is much higher than the total consumption of other energy sources. From 2005 to 2009, it is still in the stage of steady growth, but in 2009, it began a

rapid surge; and consumption compared to coal, crude oil, natural gas and electricity, although growing trend, but the growth rate is more gentle, and three It adds up to the total amount consumed by less than half of the total consumption of coal.



[Blue: Coal consumption (million tons);Red: Crude oil consumption (million tons);Green: Natural gas consumption (one hundred million cubic meters);Purple: Power consumption (million kWh)]

## II. RESEARCH METHODS

### A. Calculation of Carbon Emissions

This article refers to "IPCC Guidelines for National Greenhouse Gas Emissions 2006" apparent consumption recommended method (ie, reference method) to calculate the carbon emissions, the specific formula (1):

$$E = \sum_i AC_i * ETC_i * CC_i * O_i \times 44/12 \quad (1)$$

Where: E represents a carbon emissions (Mt); I representative of fuel type; AC is representative of actual consumption of fossil fuels (Wan million t or m3); ETC is representatives of fuel energy conversion coefficient (KJ/kg or kJ/m3); CC is representative of the amount of carbon-containing fuels (kg/GJ); O on behalf of the oxidation rate of fuel combustion, use IPCC default value of 100%; 44/12 represents C into CO<sub>2</sub> coefficient [5].

TABLE.I FOSSIL FUEL ENERGY CONVERSION FACTOR AND CARBON CONTENT

Fuel type		Net calorific (MJ / kg, KJ/m3)	Defect carbon content (Kg/GJ)
Coal-based energy	raw coal	$2.09 \times 10^4$	26.8
	gasoline	$4.31 \times 10^4$	20
Oil Energy	kerosene	$4.31 \times 10^4$	18.9
	Diesel fuel	$4.27 \times 10^4$	19.5
Gas Energy class	natural gas	$3.56 \times 10^7$	15.7

## III. DATA SOURCES

The energy and economic data, population data root in the 2010-2014 "Shaanxi Provincial Statistical Yearbook" [6]. Shaanxi Province energy structure mainly contains coal, oil, natural gas, electricity and water and energy and carbon emissions in Shaanxi Province mainly from three types of fossil fuels, that is coal, oil, gas; the total amount of the composition of combustion, while the total amount of all types can be "average all kinds of energy consumption" Every sum obtained. Carbon intensity is the ratio of carbon emissions and GDP.

### A. Analysis of Energy Consumption and Carbon Emissions

We must first find out the several years consumption of the coal, oil, gas, it is shown in table 2, and then by specific calculations through the formula (1), we can obtain the total carbon emissions from 2010 to 2014 in Shaanxi Province. The carbon emissions for each year of carbon emission

intensity can be obtained for each year (refer with:Table 3)

TABLE.II SHAANXI PROVINCE YEAR 2010 - 2014 TOTAL ENERGY CONSUMPTION TABLE

years	Coal-based energy		Oil Energy		Gas Energy class
	Coal (million tons)	Gasoline (million tons)	Kerosene (million tons)	Diesel (million tons)	Natural Gas (ten thousand cubic meters)
2010	12085.15	255.23	8.94	531.50	591913.20
2011	13640.05	279.60	9.67	576.37	624843.50
2012	16498.00	286.23	10.07	584.88	652255.00
2013	20374.30	303.72	10.69	603.38	773435.00
2014	22155.50	229.91	36.24	539.43	732190.00

TABLE.III SHAANXI PROVINCE 2010--2014 CARBON INTENSITY

Years	Carbon emissions (GJ)	GDP (billion)	Carbon intensity
2010	$1.24 \times 10^{19}$	10123.48	$1.22 \times 10^7$
2011	$1.31 \times 10^{19}$	12512.30	$1.05 \times 10^7$
2012	$1.37 \times 10^{19}$	14453.68	$9.48 \times 10^6$
2013	$1.63 \times 10^{19}$	16205.45	$1.01 \times 10^7$
2014	$1.55 \times 10^{19}$	17689.94	$8.76 \times 10^6$

GDP and carbon emissions in Shaanxi Province are continually rising (refer with: Table 3), but the growth rate of GDP is significantly faster than the growth rate of carbon emissions, and therefore the carbon intensity that calculated from carbon emissions and GDP will downward trend, although there are floating trend in 2013, but by 2014, it also shows a downward trend. The long-run balanced relationship exists between economic growth and energy consumption in Shaanxi Province, the economic growth make an influence on the growth of energy consumption in the long term is more prominent, obviously higher than the influence that caused by the growth of energy consumption on the economic growth [7]. In general, the greater the amount of an energy consumption is the bigger, the carbon emission correspondingly is, but it is impossible that energy consumption and carbon emissions rank inconsistency [8]. However, from the above table we can see that the intensity of carbon emissions in Shaanxi Province in recent years shows a downward trend, which indicates that Shaanxi Province has been paying attention to the development of low-carbon economy, but the magnitude of the decline is not enough. At present, energy consumption in Shaanxi Province is still heavily dependent on coal, which will still lead to produce a lot of CO<sub>2</sub>. But if the decline in coal use in various fields is sharp, that will seriously affect economic growth in Shaanxi Province. Therefore, the reasonable use of coal savings are the basis for Shaanxi Province to reduce carbon emissions.

#### IV. CONCLUSIONS AND RECOMMENDATIONS

Through the above analysis, Shaanxi is a heavy type developing province, and a large part of its economic growth depends on the development of industry, and the development of industry relies on coal, which is the representative of fossil energy use. In the situation that resources are limited, it becomes an urgent task to break the bottleneck of economic development resources for sustainable economic development in Shaanxi Province [9]. The high carbon emissions of Shaanxi Province may come from the following aspects: (1) energy saving and emission reduction policies has lagged behind; (2) energy pricing mechanism is not yet consummate, some energy prices don't fully reflect the relationship between the level of rare and the supply and demand of market; (3) high energy consumption and high carbon emissions commodity tax system also exists disadvantages; (4) traditional use patterns of energy is still widely used, especially the direct combustion of coal use patterns [10]. It is necessary to maintain sustained economic growth of Shaanxi Province, but also to reduce its carbon emissions, so the paper comes up with the following suggestions based on the above analysis:

First, make full use of energy resources in Shaanxi Province, improve the availability of various energy sources and gradually increase the proportion of clean energy and new energy in production, establish a strict carbon emission monitoring and control system, and gradually reduce carbon

intensity.

Second, the key to reduce carbon emissions is to reduce coal consumption, so Shaanxi Province should strive to polish up the energy structure and economic structure, intensify the development of services and improve the proportion of tertiary industry [11]. They can also use historical environmental resources in Shaanxi Province to develop tourism.

#### ACKNOWLEDGEMENT

The paper was financially supported by the national "2015 Students' Innovation Projects" and the project number is C201505020.

#### REFERENCES

- [1] Xiao-hong Yan. Consumption and Its Grey Structure and Economic Growth in Shaanxi Province energy analysis [D] Xi'an: Northwest University, 2010 (In Chinese)
- [2] Yu-guang Liu. Emissions of carbon, Shaanxi Province study [D] and the future reduction potential Beijing: Tsinghua University, 2013 (In Chinese)
- [3] Xin Zhang. Science and Technology and Economy, 2014,26 (5): 90-94 (In Chinese)
- [4] Ni Zhu, Fan Yang. Geography, 2015,38 (4): 843-850 (In Chinese)
- [5] Xiao-dian Du, Er-fu Dai, Hua Fu. Shaanxi Province energy consumption and carbon emission analysis prediction [N] Capital Normal University (Natural Science), 2011,32 (5): 46-51 (In Chinese)
- [6] Shaanxi Provincial Bureau of Statistics, National Bureau of Investigation Corps Shaanxi Statistical Yearbook:.. 2010-2014 [Z] China Statistics Press, 2014-2016 Study (In Chinese)
- [7] Liu Gao, Western Financial, 2012 (5): 53-56 (In Chinese)
- [8] Chu Han, Xiao-hui Wang. Shandong Agricultural Sciences, 2015, 47 (1): 82-87 (In Chinese)
- [9] Jia-jun Li, Qian Zhang. Statistics and Decision, 2008 (5): 110-101 (In Chinese)
- [10] Wen-jie Wu. Empirical research [N] rebound effect of energy consumption Yang Yang, Shaanxi Province, Xi'an University of Petroleum (Social Science Edition), 2015,24 (3): 01-05 (In Chinese)
- [11] Hong-bin Dou, Peng-lin Li. Science and Technology Management Research, 2014 (11): 233-236 (In Chinese).