



## On electricity consumption and economic growth in China



Chi Zhang<sup>a,b</sup>, Kaile Zhou<sup>a,b,\*</sup>, Shanlin Yang<sup>a,b</sup>, Zhen Shao<sup>a,b</sup>

<sup>a</sup> School of Management, Hefei University of Technology, Hefei 230009, China

<sup>b</sup> Key Laboratory of Process Optimization and Intelligent Decision-making of Ministry of Education, Hefei University of Technology, Hefei 230009, China

### ARTICLE INFO

#### Keywords:

Electricity consumption  
Economic growth  
Relationship  
China  
Statistical model

### ABSTRACT

The invention and application of the electric power technology triggered the second industrial revolution in human history, which marked the human society entered the age of electricity. Electricity provides the sustainable power for economic and social development. With the rapid development of economy, the electricity consumption is also increasing. The increase of electricity consumption has further promoted the progress of the industrial economy. In order to achieve the goal of improving the level of economic development while reducing energy consumption, it is necessary to reveal the relationship between electricity consumption and economic growth. This study is an extensive overview of the literature surrounding this topic. In this paper, we focus on the relationship between electricity consumption and economic growth in China. We first analyze the general situation of China's electricity consumption and economic development. Then we explore the relationship between China's electricity consumption and economic growth from three dimensions, i.e., the time dimension, the regional dimension and the industrial dimension. Finally, we study the key issues in the research of the relationship between electricity consumption and economic growth, including variable selection, model construction and results discussion. This work suggests that the nature of the nexus in China should and can be explored from a wider perspective, by developing a suitable integrated methodological framework.

### 1. Introduction

In the past decades, the world's energy demand and consumption have maintained a steady growth [1]. Emerging markets and developing countries are accelerating economic development. Rapid population growth and urbanization have become the main force of the world energy consumption growth [2–4]. However, the growing energy consumption, especially the consumption of non-renewable energy in large scale, has brought a lot of serious influence on the environment. The sustainable development of the economy and the human society have been under the threats of regional environmental pollution and large-scale ecological destruction [5,6].

Since the reform and opening up in 1978, China has been experiencing a rapid economic development, triggered by the industrialization, informatization, urbanization and agricultural modernization. The rapid development of industrial economy is supported by the increasing energy consumption. As the dominant energy forms, coal, oil, natural gas and other fossil energy consumption have increased rapidly in China. The British Petroleum “BP World Energy Statistics Yearbook 2014” [7] showed that China is the major contributor of global energy demand growth. The energy demand of China has surpassed that of the EU in 2007, the United States in 2010, and the

entire North America in 2013. However, China's energy structure is very unreasonable. The proportion of coal in China's national energy structure has reached to 67%. Though China's natural gas consumption grew by 10.8% in 2013, the proportion of natural gas in total energy consumption was only 5.1%. Other clean energy sources, such as renewable energy, nuclear power and hydropower, accounted for only a small proportion. The large-scale development and utilization of fossil energy in China has created a great material wealth. It has also led environmental pollution and ecological destruction, which directly threatened the sustainable development of China's economy and society [8–10]. China's increasingly serious energy and environmental issues are closely related to China's coal-dominated energy structure [10,11].

Though China's economy has maintained a rapid development in the past decades, its economic growth mode is still extensive. It is an indisputable fact that, the energy and resources utilization rate is low in China. This has brought enormous pressure to the sustainable economic development. Energy efficiency is the ratio between the actual GDP output and energy consumption. Although China has sufficient fossil energy, its energy efficiency is relatively low [12]. According to European Union (EU), “energy efficiency has a fundamental role to play” [13]. In the process of development, processing, conversion and

\* Corresponding author at: School of Management, Hefei University of Technology, Hefei 230009, China.  
E-mail address: [zhoukaile@hfut.edu.cn](mailto:zhoukaile@hfut.edu.cn) (K. Zhou).

utilization, energy efficiency is the key in reducing energy consumption per unit of GDP. Therefore, improving energy utilization efficiency has beneficial influence on reducing energy consumption, the share of coal consumption, and greenhouse gas emissions [14]. High energy efficiency also brings economic benefits and enhances the overall competitiveness of the economy.

As a typical kind of secondary energy, electricity is obtained from primary energy conversion after processed. It is a kind of basic energy resource closely relates to the national economy and people's livelihood. Electricity is an important driving force to promote the economic and social development. The increasing electricity consumption, especially industrial electricity consumption, is an important symbol of a country's economic development level. With the rapid development of China's economy, electricity demand is also growing rapidly. The production and consumption of electricity have a direct impact on the quality and speed of economic growth. It is believed that the amount of electricity consumption is a real-time reflection of the economic development situation, but the relationship between them is not precise one-to-one. For example, during the Asian Financial Crisis (1997–2000) and the Global Economic Crisis (2007–2010), the growth rate of electricity consumption deviated from economic growth rate [15]. Fully understanding and in-depth study of the relationship between electricity consumption and economic growth have important theoretical and practical significance for improving energy efficiency, promoting energy-saving and emission reduction, and further promoting the sustainable development of the economy and society.

To the best of our knowledge, this is the first paper reviewing the relationship between electricity consumption and economic growth in China from the time, the regional and the industrial dimension comprehensively. At the same time, our objective is to study the key issues in the research of the relationship between electricity consumption and economic growth in different countries, including variable selection, model construction and results discussion. The paper aims to provide a better understanding of the development status of China's electricity consumption and economic growth, and make a contribution to explore the available methods to investigate the relationship between them. Further, it will be beneficial to propose suggestions for achieving China's energy conservation, energy efficiency improvement and sustainable economic growth.

The remainder structure arrangement is as follows. In Section 2, we briefly introduce the electrical energy consumption and economic development in China. A detailed analysis of the relationship between China's electricity consumption and economic growth is presented in Section 3 from the dimensions of different periods, different regions and different industries. Section 4 focuses on the key problems in the research on the relationship between electricity consumption and economic growth, including the indicator variable selection and statistical model construction. Finally, the Conclusion Section summarizes the full text of this paper.

## 2. Electricity consumption and economic development in China

It is generally believed that the economic development mode depends on the energy structure of a country, and the energy structure reflects the level of economic development conversely. Therefore, without changes in the energy structure, economic and social transformation will lack motivation and the development foundation will be unsustainable. In nowadays, constrained by resources and environment, the world is experiencing a new energy consumption transition from high carbon to low carbon.

### 2.1. Energy and electricity consumption in China

Since 1978, China's annual GDP growth rate has averaged around 10%. However, with the rapid economic growth, the demand of electrical energy in China has also grown rapidly and the problem of power shortage is becoming increasingly serious. In the past decades, the electricity demand and the economy growth have similar change trend [16]. Since 1978, China's energy supply and demand situation can be divided into three stages: from 1978 to 1996, the economy grew rapidly, and people's consumption needs were released. During this period, the serious insufficient energy supply hampered the vitality of the national economy. From 1997 to 2000, with the improvement of comprehensive national strength and the technical progress in energy production and management, the effective demand was relatively insufficient compared with the rapid increase in energy supply. The year of 2001 was a key point, and the energy consumption has showed a rapid growth since 2001. Nevertheless, the gap between energy supply and demand still existed in China [17].

From 1990 to 2013, China had experienced a rapid economic development. The gross domestic product (GDP) of China increased from 1866.7 billion yuan to 568845.2 billion yuan, increased 303.7% during 23 years with an average annual growth rate of 13.2%. Accordingly, the total energy consumption also grew from 987.03 million to 3.75 billion tons of standard coal, with an increase of 279.9% and an average annual growth rate of 12.1% [18]. Overall, the average annual growth rate of energy consumption is lower than the growth rate of GDP in China. The growth rates of China's energy and electricity consumption and GDP from 1990 to 2013 are shown in Fig. 1.

From Fig. 1, we can see that China's energy consumption growth rate was significantly lower than the growth rate of GDP before 2001. Though the growth rate of electricity consumption was higher than that of energy consumption, it also has been generally lower than GDP growth rate. The electricity consumption remained a consistent change with GDP. In 2001, China joined in the World Trade Organization (WTO), which further accelerated the process of China's economic globalization and trade liberalization. China's energy supply has being in a more open system configuration. The gap between electricity consumption growth rate and GDP growth rate is narrowing. In 2014, China's annual total energy consumption was 42.6 tons of standard coal, with an increase of 2.2% over the previous year [19]. China's

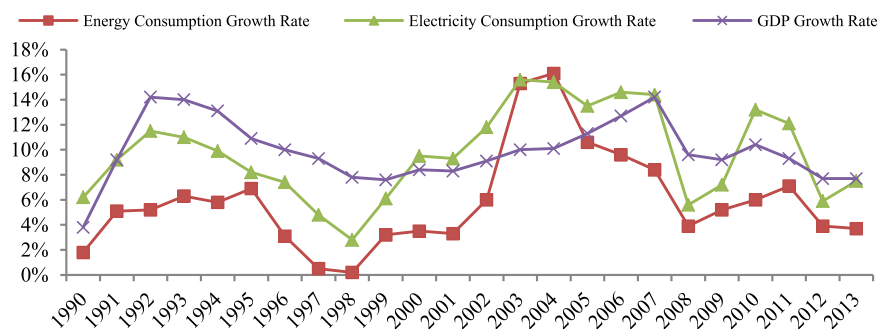


Fig. 1. Growth rates of GDP, energy and electricity consumption in China from 1990 to 2013 [18].

Download English Version:

<https://daneshyari.com/en/article/5482163>

Download Persian Version:

<https://daneshyari.com/article/5482163>

[Daneshyari.com](https://daneshyari.com)