China's Energy Intensity: a GDP Accounting Perspective

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Abstract

(1) Overview

Since China embarked upon its reform and opening-up policies in the late 1970s, it has made spectacular progress on the economy and society; including energy conservation. During 1978-2002, China's energy intensity (measured by energy consumption per unit of GDP) decreased by 70.4%. However, since 2002, contrary to most of previous predications, China's energy demand has increased sharply, and its energy intensity rose in 2002-2005. In 2006, the intensity decreased slightly owning to the government efforts.

Energy issues associated with their environmental consequences have become significant constraints to both China's economic and social development. In developing countries, such as China, energy issues are generally associated with social problems such as energy poverty and equity. In China, the income gap is widening between the urban and rural, between high and low income groups. What are the reasons to the rapidly rising energy demand? What should the government do to save more energy as well as reducing energy poverty and promoting energy equity? In this paper, from the perspectives of GDP accounting: production approach, expenditure approach and income approach, we attempt to answer the above questions.

(2) Methods

i) Production Approach: Sato-Vartia method (a discrete form of Divisia Index) is used to decompose China's energy intensity change into industrial structure effects and sub-sectoral energy intensity effects. Ii) Expenditure Approach: In order to explain why energy intensive industries expand rapidly, Input-Output Analysis is employed to investigate the Marginal Energy Demand (MED) for various final expenditures such as investment, rural and urban household consumption. Iii) Income Approach: To explain why investment increased sharply, statistical description and econometric analysis are used to examine the national income distribution among enterprise, rural and urban household, and so on.

(3) Results

At the three sector-divided level (primary, secondary and tertiary industry), industrial structure adjustment and sectoral intensity change accounted for 39.6% and 60.4%% to the energy intensity rising respectively during 2002-2006. It shows that industrial structure adjustment has no contribution to energy intensity decreasing.

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The input-output analysis results show that the MED for rural household, urban household consumption and investment are 10.2, 12.1, 13.9 tce/kRMB respectively in 2002 (1 tce equals to 0.7000 toe). It implicates that investment activities are the most energy intensive, and then the urban household consumption, and the rural one is the last. Compared to production approach, this is a further explanation for the reason why energy demand increase sharply during 2002-2006. In this period, China's GDP rose by 48.6% accumulatively, while its investment and consumption rose by 67.9% and 37.8% respectively, which are unbalance. It means that investment grow more rapidly than consumption. As a result, energy demand increased sharply. If we examine the household consumption, urban household consumption increased faster than the rural one. According to the official statistical data, the urban household increased by 51.3%, while the rural one only increased by 17.5%. In addition, the energy equity became worse in this period. In 2002, the energy consumption per capita induced by rural household was only 2.31 tce (including direct and indirect consumption); while the urban was 9.29 tce, more than four times of the rural. In our paper, we also examine the previous years compared with 2002.

The compensation of employees accounted for 47.8% of the GDP in 2002. While this figure fell to 40.6% in 2006. Contrary, the enterprise income (operating surplus and depreciation of fixed assets) accounted for 36.7% of the GDP in 2002 and it climbed to 44.8%. In the industrial enterprises, the profit accounted for 17.5% of its value added, while this figure climbed to 21.45. The more income in enterprise and the less income in resident, the more investment activities and the less consumption. and then the more energy demands. During 2002-2006, China's real GDP rose by 48.6%, while its real resident income rose by only 36.5%. The resident income relatively increases rather slowly. What's more, the urban resident income rose by 42.0%, where the rural only rose by 27.1%. Since the urban resident consumption is more energy intensive, it implicates more energy demand. Our econometrically analysis also validate that the high-income group is more energy intensive.

(4) Conclusions

Energy issues are associated with economic and social ones closely. According to our analysis based on GDP accounting perspective, to reduce China's energy intensity and save more energy, the government should try to optimize its national income distribution structure and raise the resident income especially the rural and the low-income group. Only does this, the investment rate may decrease and then hare of energy intensive sectors may decline. This is not only to energy conservation, but also to improve the energy equity and reduce energy poverty.

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