POWER GENERATION, TRADE AND ENERGY EFFICIENCY: THE CASE OF CHINA

Jun Wu, Chongqing University, Phone +86 23 65122753, Email wujun@cqu.edu.cn
Feng Wang, Chongqing University, Phone +86 23 65122752, Email wangfeng2008@cqu.edu.cn
Zongyi Zhang, Chongqing University, Phone +86 28 87092000, Email zhangzy@vip.sina.com
Honghui Deng, University of Nevada Las Vegas, Phone +1 702 8951803 Email honghui.deng@unlv.edu

Overview

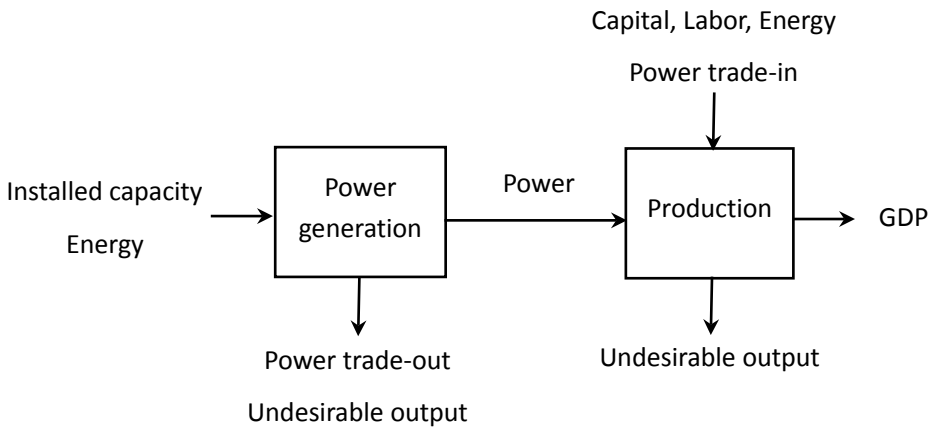
Power is the most important second energy supply for China economy. Improving the efficiency of power generation sector is of particular importance for saving energy and reducing carbon emission in China. Traditional efficiency measures consider the social production as the black box and cannot investigate inner links between the sectors in the economy. Power is most the important energy supply for the whole economy and relative independent from other economic sectors. And there are huge scales of power trade between the provinces in China. This paper analyzes energy efficiency of 30 regions in China mainland for the period of 2000-2012, considering the power generating and trading procedure as the first production stage in each province, the GDP production as the second stage. The network slacks-based measure (SBM) model of DEA is employed to measure the energy efficiencies of each stage and the whole production in China. The CO_2 emission, waste water and chemical oxygen demand are considered as undesired outputs in each stage. The results show that the energy efficiency of the country is improved with the economy development, but the traditional measures overvalued the energy efficiencies of the provinces which trade in large scales of power while undervalued those of the provinces trading out large scales of power. The China energy efficiency could be improved by rearranging the power generation and transportation between Chinese regions.

The paper is organized as follows. After the introduction, section 2 introduces the network slacks-based measure DEA model used to examine energy efficiency. Section 3 explains the power generation and trade between provincial areas in China and provides the descriptive data and statistics. An empirical study for the energy efficiency of regions in China is conducted in section 4. Section 5 gives the conclusion and some policy implication.

Methodology

Non-oriented Network slacks-based measure (SBM) model of DEA

Revised two-stage production considering the power generation and trade between provincial areas



Results

Previous literatures might ignore the fact that many provincial areas are trading in or out power. The results show that the energy efficiency of the country is improved with the economy development, but the traditional measures overvalued the energy efficiencies of the provinces which trade in large scales of power while undervalued those of the provinces trading out large scales of power. The China energy efficiency could be improved by rearranging the power generation and transportation between Chinese regions.

	Anhui	Beijing	Fujian	Gansu	Guangdong	Guangxi	Guizhou	Hainan	Hebei	Henan
2000	0.6028	0.0133	0.0045	0.0015	0.0493	0.0051	0.4698	1.0000	0.5104	0.0008
2012	1.0000	1.0000	0.0090	0.4729	1.0000	0.0005	0.5261	0.0193	0.0002	0.0006

	Heilongjiang	Hubei	Hunan	Jilin	Jiangsu	Jiangxi	Liaoning	Inner Mogolia	Ningxia	Qinghai
2000	0.0010	0.9145	0.0024	0.0013	0.0724	0.0035	0.0011	1.0000	1.0000	1.0000
2012	0.0007	0.6752	0.0010	0.5927	1.0000	0.0011	0.6409	1.0000	1.0000	1.0000

	Shandong	Shanxi	Shaanxi	Shanghai	Sichuan	Tianjin	Xinjiang	Yunnan	Zhejiang	Chongqing
2000	0.0055	0.6627	0.0017	0.6280	0.4689	1.0000	0.0028	0.5693	0.0008	0.0063
2012	1.0000	0.5364	0.5928	1.0000	0.6336	0.0344	0.0004	0.4442	0.0004	0.0009

Conclusions

Traditional measures overvalued the energy efficiencies of the provinces which trade in large scales of power while undervalued those of the provinces trading out large scales of power. The efficiencies of developing areas, such as Shanxi, gain a much higher average efficiency score in the study, because a large scale of power is generated and transported to other regions. So, the government should adjust the power generation and transportation between Chinese regions, and implement different energy policies according to different areas and regions.

References

Färe R., Grosskopf S., 2010, Directional Distance Functions and Slacks-based Measures of Efficiency [J]. European Journal of Operational Research, 200: 320-322.

Li Yongjun, Chen Yao, Liang Liang and Xie Jianhui, 2012, DEA models for extended two-stage network structures [J]. Omega, 40: 611-618

Mohtadi H., 1996, Environment, Growth and Optimal Policy Design [J]. Journal of Public Economics, 63, 119-140.

Rao X., J. Wu, Z.Y. Zhang, B. Liu, 2012. Energy efficiency and energy saving potential in China: An analysis based on slacks-based measure model [J]. Computers & Industrial Engineering, 63, 578-584

Tone K., Tsutsui M., 2009, Network DEA: A slacks-based measure approach [J]. European Journal of Operational Research, 197: 243-252.

Wei Y.M, Liao H. and Fan Y., 2007. An empirical analysis of energy efficiency in China's iron and steel sector. Energy 12, 2262-2270.