ENERGY EFFICIENCY AND THE REBOUND EFFECT: A STUDY OF INDIAN MANUFACTURING SECTOR

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Overview

India, one of the largest consumers of energy due to the sheer size of population and growth targets, is increasingly focusing on energy conservation. The guiding regulations in this regard are the Energy Conservation Bill of 2001 and the Integrated Energy Policy of 2006. Increasing energy efficiency is advised as the new paradigm for energy conservation through these policies. However, whether energy efficiency gains result in reduction of energy use is still debated as there is a possibility of rebound. The rebound effect occurs when a part of the energy savings that is expected to result from efficiency improvement is lost due to behavioral responses to it (Jevons (1865), Khazzoom (1980), Gillingham, Kotchen, Rapson & Wagner, (2013)). A backfire occurs when an energy efficiency gain does not result in a fall in the consumption of energy, instead raises the energy consumption. This happens when the rebound effect is more than 100%.

An energy efficiency gain implies that we now require lesser units of energy to maintain the existing levels of output (in case of industrial energy use) or consumption of energy services like household lighting or heating. Thus an efficiency gain is perceived as a decrease in the amount spent on energy or simply, a relative fall in the price of energy. This leads to an increase in consumption of energy, given the price elasticity of energy demand is non-zero and negative. This is often considered as the direct rebound effect (Greening, Greene, & Difiglio, 2000). Fall in relative price of energy also indicates that energy has now become cheaper relative to other inputs in the production process, say labor and capital. Thus energy demanded rises as it can now be substituted for other factors of production given that elasticity of substitution among inputs is non-zero. Additionally efficiency improvements can lead to long term behavioural changes in people's tastes and preferences leading to a macroeconomic rebound whichis harder to observe.

The portion of the rebound effect that results from the seeming fall in price of energy is measureable using the price elasticity of energy demand and this method is employed in this paper to estimate the rebound effect in the Indian manufacturing sector.

Methods

Time series data is used to empirically estimate the rebound effect. The data is collected for a period of 32 years from the year 1981-82 to 2012-13 from the Reserve bank of India and the Annual Survey of Industries.

Results

The rebound effect in the the Indian manufacturing sector is estimated to be around 21.9%indicating that 21.9%of the expected energy savings is not realized.

Conclusions

The study reveals that policies promoting energy efficiency in India, do not always achieve the expected energy savings. The Integrated Energy Policy of 2006 aims to incentivise efficiency improvements in energy with a view of *'creating a virtual source of energy'*. The national target is to increase energy efficiency to 20% by 2016-17 as per the Planning Commision of India (2006). If the efforts to increase energy efficiency are undertaken in the presence of rebound, it would not yield the anticipated reductions in energy use. It has to be noted that 21.9% of rebound is observed in the manufacturing sector alone. Other sectors of the economy as well as the domestic energy consuption are not considered in this study. Moreover the rebound values estimated here do not include the macro economic rebound, the estimation of which lies beyond the scope of this study.

References

Gillingham, K., Kotchen, M., Rapson , D., & Wagner, G. (2013). The rebound effect is over-played. *Nature*, 493, 475-476.

Greening, L., Greene, D., & Difiglio, C. (2000). Energy efficiency and consumption - the rebound effect - a survey. *Energy Policy*, 389-401.

Jevons, W. S. (1865). *The Coal Question; An Inquiry Concerning the Progress of the Nation, and the Probable Exhaustion of Our Coal Mines*. London: Macmillan and Co. .

Khazzoom, D. J. (1980). Economic Implications of Mandated Efficiency in Standards for Household Appliances. *The Energy Journal*, 21-40.

Planning Commission. (2006). *Integrated Energy Policy - Report of the Expert Committee*. New Delhi: Government of India.