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# POWER INTENSITY OF INDIAN ECONOMY: A STUDY OF SECTORAL VARIATION IN INPUT OUTPUT FRAMEWORK

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ABSTRACT

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## Introduction

Per capita consumption of energy is an important indicator of growth. Inter- County and inter – regional comparison of energy index constitutes an important tool of economic analysis, specially for studying levels of development and living standard. Inter-temporal comparison reflects movement of business/ economy and society along development path through time. Besides, technological *up gradation of production and improvement in living conditions also raise energy requirements*. Energy is the pivot of all economic activities. It is the driver of growth. As the economy moves from lower to higher stages of growth, energy requirements are enhanced also and energy use gets widely diffused over sectors, regions and groups. With the movement of Indian economy along its growth path, energy intensity of production across sectors of the economy and regions and consumption in the country have tended to rise, resulting in periodic shortages despite continuous growth of productive capacity. However, demand has been running ahead of supply. In India, demand for energy has actually been running much ahead of supply, making power emerge as an important constraint to growth. Attempts to generate energy for self use by users often escalate cost, diluting cost advantage of production sectors in Indian economy. This is irrespective of the nature of use. Power shortage has actually resulted in rapid growth of industries producing low capacity generators and invertors for domestic use. For households, cost of self generated energy reduces consumption of other goods, impacting on living standard.

The paper focuses on *the changing energy intensity in Indian Economy*. It examines the impact of technological change on the energy requirements of different production sectors of the economy. These changes have been analyzed in the input output framework. Technological change has been endogenised by the use of 2 different coefficients matrices, $A_1$ and $A_2$ relating to 1998-99 and 2003-04. The economy has moved rapidly during this period along its growth path. Rapidly rising income has resulted in substantial rise in living standards. This has raised demand for white goods, enhancing energy requirement for consumption. Each matrix embodies different technology which will capture the technology effect.

The study will also furnish the base for forecasting future energy needs of India. This will provide a bench mark for examining the plan programmers of energy development during the plans.

**Model**

But we have relied on Leontief Inverse rather than coefficient matrix, A. The input output model has been used to determine both direct and indirect energy needs of the economy. The model is given below:

$$X_1 = (I-A_1)^{-1} f_1 \qquad \ldots 1)$$

$X_2 = (I-A_3)^{-1} f_2$ …2)

Where X is gross output vector, f is final demand vector, having energy as the only non-zero element of final demand, $(I-A)^{-1}$ is Leontief Inverse. Each element $A_{ij}$ of the inverse expresses energy requirement per unit of final demand.

In order to isolate technology impact on energy requirement impound growth impact by following alternative models (See Prakash and Balakrishnan, 2008)

$$\hat{X}_1 = (I - A_2)\,\hat{f}_1 \qquad \text{…….3)}$$

$$\hat{X}_2 = (I - A_1)\,\hat{f}_2 \qquad \text{…….. 4)}$$

$\hat{f}_1$, $\hat{f}_2$ are special final demand vectors which contain non zero final demand of 4 energy sectors of the economy: Coal and Lignite, crude petroleum and products and electricity. Rest of the elements of these final demand vectors are zero.

Relation 4 impounds impact of technology effect in order to isolate growth impact, while relation 3 impounds growth effect in order to isolate technology impact on energy requirements of the economy.

**Data Base**

We have used 1998-99 and 2003-04 Input Output Tables of Central Statistical Organisation. The table of 1999 is 115x115, while that of 2003-04 is 130x130. The tables embody commodity by industry technology.

**Empirical Results**

The empirical results for 1998-99 highlight that

i) All 115 sectors of the economy use energy resources in production. This holds true for 2003-04 also.

ii) In 1998-99, maximum energy resources are required in the production of paddy though the requirement itself is as low as Rs. 0.06. The maximum energy resources are used in electricity sector. Energy demand of electricity sector itself is as high as Rs. 1.48 per rupee worth of final demand. Thus, the maximum requirement has increased multi-fold with growth and technology development. We may mention that the generation has been continuously diversified as there has been movement away from thermal to hydel, gas and solar.

iii) Minimum energy requirement per rupee worth of final demand has, however, not changed, it having remained at Rs. 0.06 in 1998-99 to 2004. In 1998-99,

minimum requirement is for ownership of dwellings. However, in 2004, renting of machinery emerges as least energy intensive sector.

iv) Average energy requirement has, however, declined from Rs. 0.183 in 1999 to Rs. 0.170 in 2004. This seems to be the outcome of entry of several low energy users which did not use energy earlier at all.

v) Energy requirement per rupee worth of final demand varies greatly among sectors in 1998-99. Value of coefficient of variation is 123 per cent.

vi) Inter sector variation of energy resources has, however, declined in 2003-04. The value of CV is 79.51 per cent. It seems that there is a convergence of demand for energy resources in production due mainly to induction of more advance technology across the sectors. This process is expected to have gathered further momentum in the years of more rapid growth of the economy after 2003.

vii) Most of the sectors of the economy have still low energy intensity of production which reflects low technological base and still lower the mature stage of development. It appears that the supply constraint has been acting as a stumbling block for inducting high energy intensive high-tech.

**References**

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