International Journal of Scientific & Engineering Research, Volume 8, Issue 3, March-2017
ISSN 2229-5518

Review Paper On Energy Consumption in Industrial Sector

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I. ABSTRACT

Population growth, the modernization of lifestyles, higher electrification rates and rapidly growing gross domestic product (GDP) in India drive a large increase in energy demand and put pressure on the security, reliability and affordability of energy supply, all of which are strongly linked to economic stability and development.

Energy consumption in Industrial sector is on a rise with increase in GDP but as energy is itself not only costly to produce but the resources used in producing energy are scarce it is important to ensure that various steps are taken in Industries in order to conserve energy while improving productivity.

II. LITERATURE REVIEW

In energy economics literature, there are wide range of studies those deal with establishing the relationship between energy consumption and economic growth, the demand for energy in households, demand for energy in industries, and establishing the relationship between energy consumption and climate change. For example, Nguyen-Van (2008) has tried to find out the relationship between energy consumption and economic growth using semi-parametric panel data analysis. The findings suggest that energy consumption in developing countries would rise more rapidly than expected. Further, the result suggests that there will be serious challenges to economic and environmental problems in developing countries such as; rapid augmentation of greenhouse gas emission due to energy use, excessive pressure on the provision of energy resources, etc. The finding does not confirm the Environmental Kuznets Curve (EKC3) hypothesis. In addition, the study also depicts rapid increase in fossil fuel use in developing countries; also represent growing contribution to the increase in local and regional air pollution as well as atmospheric concentrations of greenhouse gases such as carbon dioxide (CO2).Studies dealing on energy demand in production sectors can be divided in two broad categories. The first category focuses on the demand for various types of energy, which yields information about substitution possibilities between energy inputs say electricity and coal. The examples are Halverson (1977), and Pindyck (1979). The second category focuses on substitution possibilities between energy and other factors like labor, capital, and materials. The examples include Griffin and Gregory (1977) and

Berndt and Wood (1975). In both the categories the models are typically estimated by a system of factor demand equations derived from cost minimization of firms using transom cost function. Using generalized Leontief functional form, Andersen et al. (1998) obtained price elasticity at -0.26for the manufacturing sectors energy demand and the aggregate elasticity for various industrial sub-sectors ranging between -0.10 and -0.35.Woodland (1993) used cross-section data for about 10,000 companies from 1977-85 for Australian state of New South Wales. This study uses a transom system with coal, gas, electricity, oil, labor, and capital included as factors of production. Woodland (1993) observes that only a minor share of the companies have a typical energy pattern where companies use all four types of energy. Woodland estimates a separate transom function for each observed energy pattern assuming that these patterns are exogenous due to technological constraints. Kleijweg et al. (1989) used panel of Dutch firms from 1978-1986 using transom functional form in estimating the aggregate energy demand. The long-run price elasticity of energy for the whole manufacturing sector in their study is found to be -0.56, while the long-run output elasticity is obtained at 0.61. Kleijweg et al. (1989) subsequently analyzed subsets of data divided by firm size, energy intensity, and investment level. They found that own price elasticity of energy increases with firm size and level of investments.

III. INTRODUCTION

In today's power scenario, India is facing a major power crunch. Due to demand and supply imbalance, transmission and distribution losses go on increasing, grid frequency decreased as well as plant load factor decreases. Fluctuation in state grid frequency is harmful to plant equipments. Due to peak demand, strain on power generation and utilization equipment increases which result into increases in energy cost. The industrial sector is the major energy consuming sector in India and uses about 50% of the total commercial energy available in the country. The main reason for higher specific energy consumption in Indian industries are obsolete technology, lower capacity, utilization , causal metering and monitoring of energy consumption, lower automation, raw material quality and poor handling, operating and maintenance practices.

So monitoring industrial energy utilization on continuous basis and relating it to the production is the first step of energy conservation programme. Even a 5% saving in electricity will prevent the need to install power plants of a few thousand MW. With this regards, the government of India is formulating mandatory the "Energy Audit and energy conservation regulations". Considerable energy saving is possible through proper choice of equipment, and their effective use & involvement of conservation measures:**"**The Strategy and optimizing energy, using system and procedures so as to reduce energy requirements per unit of output while holding constant or reducing total costs of producing the output from these systems**",** Poor management practices along with the declining labor productivity and operating efficiency of manufacturing processes over the years lowered the profitability of many of these plants significantly, resulting in a slowdown of industrial activities. The pursuance of policies that encouraged import-substituting industrialization and the pessimism of planners about exports offered no market incentive for these firms to improve their performance over the long run With the gradual integration of the domestic markets with the global economy and growing concerns about the environmental implications of the industrial activities, there is now increasing pressure on domestic industry to improve its performance. The energy shortages coupled with increasing energy prices being witnessed in various states in India is forcing the industries now to look at ways and means for reducing their energy consumption and adopting technologies that result in lowering their energy intensity.

What do we really mean by energy efficiency?

Energy efficiency is a widely used term that suffers from issues of definition. This cane a cause of confusion. In a strictly technical definition, energy efficiency is simply useful energy output over energy input for any energy conversion device. For instance, in an internal combustion engine, the energy output will be the rotational energy at the driveshaft whilst the energy input will be the chemical energy contained within the fuel.

For a power station, the efficiency will be useful electricity out divided by the energy content of the fuel input. However, this technical definition is not what is usually meant by energy efficiency. Energy is used in two types of systems: conversion devices such as internal combustion engines, light bulbs or power stations, and passive systems such as buildings where useful energy is degraded to low-grade heat in return for providing useful services such as thermal comfort (Cullen 2009). We commonly use the term "energy efficiency" to cover both of these situations. In the case of passive systems it is technically incorrect as there is no (useful) energy output from a passive system such as a building, only useful services such as comfort. Here, a more accurate term than energy efficiency is energy performance.

So the all-encompassing term 'energy efficiency' really incorporates two concepts: technical energy efficiency (useful energy out/energy in) for conversion devices, and energy performance (energy in/useful output) for passive devices and systems.

Typical measures of energy performance include liters of fuel per 100 kilometers for vehicles, kWh per square meter for buildings to produce a certain temperature for a certain period of time, or kWh per 1,000 units of production in a factory. For practical purposes energy efficiency can be defined as follows: "Energy efficiency is measured as the ratio between the useful output of the end service and the associated energy input. In other words, it is the relationship between how much energy is needed to power a technology (for example, a light bulb, boiler, or motor) and the end-use service (for example, lighting, space heating, or motor power) that the technology provides".

Improving energy efficiency or reducing energy input for a given output is a process of technical and/or behavioral change that is driven by technological, financial, management, social and policy drivers and constraints. When we talk about energy efficiency in a macro policy sense we usually mean a process of improvement rather than status at a single point of time. The fundamental energy efficiencies of all technologies tend to improve over time due to improvements to existing technologies and the invention of new technologies. Energy efficiency policy should be aimed at increasing this rate of improvement. In the industrial context this means accelerating the rate of reduction in energy use per unit of industrial output.

Energy intensity and energy productivity

Energy intensity refers to the overall energy efficiency of an economy measured as energy usage per unit of GDP. It is typically measured in toe per USD 1,000 of GDP (in constant Purchasing Power Parity terms). The inverse of energy intensity is energy productivity. There is an increasing use of this term as a rallying point and focus for energy efficiency efforts. Energy productivity (measured in USD 1,000 of GDP per toe) is perhaps a more positive target as it emphasizes improving productivity which is a positive feature. It moves away from some of the negative connotations of energy efficiency which can still be associated incorrectly with a lowered standard of output.

It should be noted that energy efficiency is not the only driver of energy productivity as measured at a national level. This is also driven by the structure of industry and the economy as a whole. A shift in the economy to a greater proportion of services compared to industry, or a shift from heavy to lighter industry, will lead to an increase in energy productivity without necessarily an improvement in energy efficiency at the level of individual processes. Research shows that in general about 50% to 60% of improvements in energy productivity can be assigned to improvements in energy efficiency. In practice this will depend on a nation's economic structure and stage of economic development (Gerhardt-Martinez et al. 2008).

The potential for increasing energy productivity is high. Exploiting that potential is consistent with economic growth. According to "**The 2015 Energy Productivity and Economic Prosperity Index"** (Blok et al. 2015), the world's six largest countries were able to generate an average of 18% of their GDP in the last ten years due to energy productivity improvements.

The global average improvement was just 12%. The report's authors advised that to take advantage of the opportunities of producing more with less, "Policy makers should be prepared to set ambitious targets, use their power of persuasion and promote the benefits of transition on a consistent basis". The authors concluded: "All regions of the world could improve their energy-productivity performance dramatically based on more aggressive adoption of existing technology. For the developing world, there is a chance to "leapfrog" the developed world and move speedily towards cost-saving energy-productivity levels. For the developed world, we believe Europe alone could see an economic expansion of 35% by 2030 and cut its energy use to 30.1 exajoules per year, a 35% improvement on current levels even while the economy grows at a healthier pace. The forecast is based on current energy use in Europe, rapid deployment of existing technology and economic projections from the European Commission."

Energy conservation

Energy conservation is another term that became popular after the oil crises of the 1970s and is still sometimes used in discussions of energy efficiency. It most commonly refers to reducing or stopping an energy using activity, such as switching off a light or a machine or driving fewer kilometers. Although there are undoubtedly occasions where thesis a positive option, the term may still have negative connotations among non-specialists because of the implication that using less energy means doing less or making a sacrifice. These connotations are counter-productive when promoting the advantages of improving energy efficiency. The term should therefore be avoided.

Energy management and Energy Managers

Another term that we will use is energy management. Energy management is the set of management processes and tools to manage energy demand within enterprises, i.e. managing the process of improving energy efficiency, managing energy costs and managing energy risks. Since the 1980s, energy management has evolved as a separate management specialty. Strengthening energy management capacity within enterprises should be a major target of energy policies everywhere.

The relationship of efficiency to renewable

The use of renewable energy sources should not be considered to be energy efficiency at the level of individual facilities or processes. They are simply an alternative source of Energy Efficiency – What Does it Mean and what is the Potential in Industry? Energy supply which may bring economic and greenhouse gas emission-reduction benefits in particular situations and jurisdictions. Their use does not improve the underlying efficiency of any particular end-use process.

Nevertheless they can help to improve the overall efficiency of an energy supply system and help to tackle climate change. For example, this can come about when the use foreknowable such as solar in the electricity system has the effect of reducing peak loads (e.g. using distributed solar power in hot climates where there are high levels of air conditioning).

This avoids additional, and usually the least efficient, power stations being kept on hot standby and being ramped up to meet peak loads. But many studies have shown that improving end-use efficiency is cheaper on a price-per-energy-unit basis than installing renewable. Therefore energy efficiency should be implemented first.

Demand response and distributed generation

Two other areas related to energy efficiency are demand response and distributed generation. An example of distributed generation is Combined Heat and Power (CHP) (also called cogeneration). Demand response is the short-term shifting of electrical load to reduce stress on the electrical system, which in some jurisdictions is encouraged by incentive schemes. Again, strictly this is not energy efficiency but, like the use of renewables, the use of demand response may improve the overall efficiency of the electricity system by avoiding bringing inefficient power stations into operation for short periods to meet peak loads.

Recommendation for the Industry:

- Electrical Load Management and Maximum Demand Control
- Step By Step Approach for Maximum Demand Control
- Rescheduling of Loads
- Shedding of Non-Essential Loads

- Reactive Power Compensation
- Improving Power Factor
- Energy Conservation with Energy Efficient Lighting
- Enterprise Energy Management (EEM)
- Procurement management
- Demand response
- Identification of Energy Conservation Opportunities
- Approaches to Energy Conservation Using Ac Variable Drives

Limitations:

1) As one process is dependent on the other, very less load is available as a flexible load, hence there is much difficult in load management tech like brazing method.

2) TOD charges are not taken in to consideration because when load is constant average of TOD charges over 24 hours is zero.

3)All the motors & brazing oven both are running for 24 hrs .hence it is difficult to measure the speed of motor to study their performance.

4) System loss is assumed to be 1% and based on this annual cost saving is calculated.

IV. CONCLUSION:

As growth of industries increase power demand increase to limit the demand and cut energy bill get more output with maximum efficiency we need constant change in our consumption power system by adding new energy efficient technology. For that first identify over consumption and study optimum efficient technology with advance payback with great efficiency and reliability.

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