Advance in Electronic and Electric Engineering.
ISSN 2231-1297, Volume 3, Number 8 (2013), pp. 1045-1050

http://www.ripublication.com/aeee.htm

Energy Exploitation, Conservation and Management: A View from India

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Abstract

India has made rapid strides towards economic self-reliance over the last few years. Impressive progress has been made in the fields of industry, agriculture, communication, transport and other sectors necessitating growing consumption of energy for developmental and economic activities. If India is to achieve the targeted growth in GDP, it would need commensurate input of energy, mainly commercial energy in the form of coal, oil, gas and electricity. However, India's fossil fuel reserves are limited. The known reserves of oil and natural gas may last hardly for 18 and 26 years respectively at the current reserves to production ratio. India has huge proven coal reserves (84 billion tonnes), which may last for about 200 years but the increasing ash content in Indian Coal as well as associated greenhouse gas emissions are the major concern. Energy being an important element of the infrastructure sector has to be ensured its availability on sustainable basis. On the other hand, the demand for energy is growing manifold and the energy sources are becoming scarce and costlier. Among the various strategies to be evolved for meeting energy demand, efficient use of energy and its conservation emerges out to be the least cost option in any given strategies, apart from being environmentally benign. This paper brings out the strategies and plan for management and conservation for Indian sub-continent.

Keywords: India, Energy, Distribution, Exploitation, Conservation, Management.

1. Introduction

India has made rapid strides towards economic self-reliance over the last few years. Impressive progress has been made in the fields of industry, agriculture, communication, transport and other sectors necessitating growing consumption of energy for developmental and economic activities. If India is to achieve the targeted growth in GDP, it would need commensurate input of energy, mainly commercial energy in the form of coal, oil, gas and electricity. However, India's fossil fuel reserves are limited. The known reserves of oil and natural gas may last hardly for 18 and 26 years respectively at the current reserves to production ratio. India has huge proven coal reserves (84 billion tonnes), which may last for about 200 years but the increasing ash content in Indian Coal as well as associated greenhouse gas emissions are the major concern. Energy being an important element of the infrastructure sector has to be ensured its availability on sustainable basis. On the other hand, the demand for energy is growing manifold and the energy sources are becoming scarce and costlier. Among the various strategies to be evolved for meeting energy demand, efficient use of energy and its conservation emerges out to be the least cost option in any given strategies, apart from being environmentally benign.

Energy is the driver of growth. International studies on human development indicate that India needs much larger per capita energy consumption to provide better living conditions to its citizens. But such growth has to be balanced and sustainable. Two important concepts here are energy management and conservation. Planning commission of India has estimated that India has conservation potential at 23% of the total commercial energy generated in the country. India's energy requirement comes from five sectors; agriculture, industry, transport, services and domestic, each having considerable saving potential. For example, energy costs amount to 20 percent of the total production cost of steel in India which is much higher than the international standards. Similarly the energy intensity per unit of food grain production in India is 3 – 4 times higher than that in Japan. Sustainable growth also implies that our energy management and energy conservation measures are eco-friendly and accompanied by minimum pollution, in particular minimum carbon emission.

1.1Energy Management

The fundamental goal of energy management is to produce goods and provide services with the least cost and least environmental effect. Energy management is a process that not only manages the energy production from different energy harvesting resources (solar, nuclear, fossil fuel) but also concerns optimal utilization at the consumer devices. Another comprehensive definition is "The judicious and effective use of energy to maximise profits (minimise costs) and enhance competitive positions".

1.2 Energy Conservation

Energy, irrespective of its form is a scarce commodity and a most valuable resource. However, if we look at the predicted future human population figures and consider the probability that the individual life expectation will increase, we see that energy could,

in the future, be in short supply. Unless that supply is increased, it will be a source of friction in human affairs.

Energy Conservation is the deliberate practice or an attempt to save electricity, fuel oil or gas or any other combustible material, to be able to put to additional use for additional productivity without spending any additional resources or money. Broadly energy conservation program initiated at micro or macro level will have the following objectives:

- To reduce the imports of energy and reduce the drain on foreign exchange.
- To improve exports of manufactured goods (either lower process or increased availability helping sales) or of energy, or both.
- To reduce environmental pollution per unit of industrial output - as carbon dioxide, smoke, sulphur dioxide, dust, grit or as coal mine discard for example.

1.3 What is Energy Conservation?

Energy conservation is achieved when growth of energy consumption is reduced, measured in physical terms. Energy conservation can, therefore, be the result of several processes or developments, such as productivity increase or technological progress. Energy conservation and Energy Efficiency are separate, but related concepts.

1.4 Energy Efficiency

Energy Efficiency is achieved when energy intensity in a specific product, process or area of production or consumption is reduced without effecting output, consumption or comfort levels. Promotion of energy efficiency will contribute to energy conservation and is therefore an integral part of energy conservation promotional policies.

For example, replacing traditional light bulbs with Compact Fluorescent Lamps (CFL), Light Emitting Diode (LED) lamps are also used for the same purpose.

1.5 Importance of Energy Conservation and Management

In a scenario where India tries to accelerate its development process and cope with increasing energy demands, conservation and energy efficiency measures are to play a central role in our energy policy. A national movement for energy conservation can significantly reduce the need for fresh investment in energy supply systems in coming years. It is imperative that all-out efforts are made to realize this potential. Energy conservation is an objective to which all the citizen in the country can contribute. Whether a household or a factory, a small shop or a large commercial building, a farmer or a office worker, every user and producer of energy can and must make this effort for his own benefit, as well as that of the nation.

Energy has an important function. It is the central force behind our productivity, our leisure and our environment. There is a strong correlation between energy use per person and standard of living in each economy. Higher per capita energy consumption means a higher per capita gross national product. Energy is an indispensable component of industrial product, employment, economic growth, environment and comfort. Low cost energy was abundant in the past. Energy cost was only a very small

fraction of the cost of finished product. Use of low cost energy for home comfort became very predominant. The subsequent increase in oil prices increased the energy cost in every sector, domestic, commercial, industrial etc. The per capita energy consumption in India is very low as compared to that in advanced countries. However our energy resources are fast getting depleted. Thus energy saving or conservation is essential in developed as well as developing countries.

1.6 Meaning and Principles of Energy Conservation

Energy conservation means using energy more efficiently or reducing wastage of energy. It is important that any energy conservation plan should only to try to eliminate wastage of energy without in any way affecting productivity and growth rate. A small decrease in convenience or comfort can be tolerated. Energy conservation usually requires new investment in more efficient equipment to replace old inefficient ones. Thus energy conservation can result in more job opportunities, lower costs, cheaper and better products etc. There are two principles of energy conservation planning which are discussed below:

- **Maximum energy efficient**: A device, system or process is working at maximum efficiency when maximum work is done for a given magnitude of energy input. Only a part of the input energy is converted into useful work. The remainder is lost in energy conversion and transfer process and energy discharge.
- **Maximum cost effectiveness in energy use**: Implementation of energy conservation entails additional investment. This investment increases as more and more energy conservation measures are adopted. Because of implementation of these measures the fuel costs decrease as extent of conservation is increased. The total cost per unit output is the sum of annual charges on investment per unit output and fuel costs per unit output. Evidently maximum cost effectiveness in energy use is obtained when total costs are the least.

1.7 Energy Conservation Planning

Energy conservation planning can be divided into four steps:

- Specifying targets and preparing detailed plans: It is the first step in energy conservation planning. The targets should neither be too pessimistic nor too optimistic. The targets and plans can be divided into three categories viz. Programmes which do not require any additional investment, programmes which require small additional investment and need a year or so for implementation and programmes which require major changes and large investment.
- Identifying energy inefficient facilities and equipment: In this step the facilities and equipment which are energy inefficient are identified. The indices used for this purpose are energy efficient index EEI (energy quantity index) and energy effectiveness index (energy quality index EQI).

- Implementation of energy conservation measures: The energy conservation measures includes method of installation (i.e., recycling, retrofitting) and method of heat use (e.g. installation of equipment for waste heat recovery and utilisation).
- Evaluation of benefits: In this step overall costs and benefits of programmes are studied and calculated. A behaviour model and a cost function are used to evaluate costs and benefits.

The primary objective of energy management is to maximize profits and minimize costs. The main objectives of energy management programs include:

- Improving energy efficiency and reducing energy use, thereby reducing costs.
- Reduce greenhouse gas emissions and improve air quality.
- Developing and maintaining effective monitoring, reporting and management strategies for wise energy usage.
- Finding new and better ways to increase returns from energy investments through research and development.
- Reducing the impacts of curtailments, brownouts or any interruption in energy supplies.

1.8 Energy Conservation Legislation or Energy Conservation Act.

Many countries in the world have realized the importance of energy conservation measures. In some countries laws have been framed to make energy conservation, audit and demand side management mandatory for all utilities, industries, and government departments and public. Government of India has recently promulgated "Energy Conservation Act" to promote these activities. The important provisions of this act are:

- Mandatory energy audit for designated consumers.
- Creation of facilities for research and development in energy conservation technologies.
- Laying down of energy efficiency standards for energy consumption by different equipment.
- Mandatory display of energy efficiency labels on equipments.
- Phasing out the manufacture of inefficient equipments and prohibiting the manufacture and sale of such equipments.
- Laying down energy efficiency norms for buildings.
- Making available financial resources for institutional setup and promotion of energy conservation.
- Formulation energy conservation norms for large consumers especially in energy incentive industries.
- Devising strategies to create awareness among different categories of consumers.

1.8 Energy policy

A number of high level committees have been set up in the past by the government of India to examine in detail the various issues and suggest measures for ensuring development of energy sector for sustaining the economic growth and meting the basic needs of the people. The recommendations made by these committees are kept in view while formulating the five year plans. The strategy in energy sector adopted for all five year plans incorporates the changing needs of the economy and the society. India follows an energy policy which is divided into short term, medium term and long term measures.

2. Conclusion

Energy conservation is the only route that can get better mileage out of the available resources. The need is to consider the possibility of evolving an appropriate strategy for energy conservation measures in the country to achieve economical and environmental benefits.