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Energy Conservation in India: Challenges & Achievements

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Abstract: The gap between supply and demand of energy is continuously increasing despite huge outlay for energy sector since independence. Further the brining of fossil fuel is resulting in greenhouse gases which are detrimental to the environment. The gap between supply and demand of energy can be bridged with the help of energy conservation which may be considered as a new source of energy which is environment friendly. The energy conservation is cost effective with a short payback period and modest investment. There is a good scope of energy conservation in various sectors, viz industry agriculture, transport and domestic, This paper will give overview of energy conservation in Indian scenario.

Introduction

India today has a vast population of more than 1.20 billions out of which nearly 75% are living in rural areas. Energy and development are inter-related. In order to have sustainable growth rate. It is imperative to have sufficient energy for systematic development in various sectors. Energy sector has received top priority in all Five year pains so far. During seventh Five Year plans 30% of the plan outlay was allotted to this sector. The installed capacity of electric power has increased from 1362 MW. At the time of independence to a staggering 70,000 MW. Despite such achievements, the gap between demand and supply of electrical energy is increasing every year as power sector is highly capital-intensive. The deficit in installed capacity was nearly 10,000 MW, by the and of eleventh five year plan. It is estimated that in 2011 alone India has lost above 10.0 billion US$ in manufacturing productivity because for power is projected to grow by 7 to 10% per year for the next 10 years. The working group on power had recommended capacity addition program of 46,645 MWduring the twelveth plan period along with the associated transmission and distribution works at a cost of Rs. 12, 26,000 corer. With this capacity addition there would have been a peak power shortage of 15.3 percent by the end of the 12th plans.

The proven reserves of fossil fuel in India are not very large. A major share of scarce foreign currency is earmarked for importing petroleum products. The bill of which is continuously increasing coal reserve likely to be exhausted by the middle or centaury. Thus a bleak scenario awaits India in future unless absolutely new strategies are adopted. In spite of huge plan outlay of energy sector in last 60 years, most of the rural population has not yet been able to reach the threshold of enough energy to meet their basic human needs. There appears to be something basically wrong in planning. The planners have adopted the western model of centralized energy system without necessary modification to suit Indian condition.

In future the energy conservation would assume more significance globally on the basis of the effect of burning fossil fuel on environment, particularly the global warming rather than the depletion of fossil fuel reserves and other consideration.

Sector wise energy consumption:-

Sector	%power consumption
Industry	49%
Transport	22%
Residential	10%
Agriculture	5%
Others	14%

THE SCOPE AND POTENTIAL

The developing countries like India are obliged to maintain a certain growth rate for which energy is a basic ingredient. Failure to meet the energy demand for the basic needs of the economy will cause inflation unemployment and socio economic disorder. The major energy projects are capital-intensive and result in the degradation of the environment and ecology. Energy efficiency and conservation in the past have been neglected

on the assumption of continuous availability of fossil fuel.

Energy conservation is the strategy of adjusting and optimizing energy using systems and procedures to reduce energy requirements per unit of output without affecting socio-economic development. Energy conservation means going with what is available, while in developed countries 1% increase in G.N.P. needs barely 0.6% increase in energy consumption in whereas in India the corresponding increase in energy consumption is nearly 1.5%

1. Transmission and Distribution Losses

India has a complex transmission and distribution network. The Transmission and distribution (T & D) losses in Indian Power Systems are rather high. According to Central Electricity Authority (CEA) statistics, on all India basis the losses are around 20 percent. According to the estimates of a few other independent agencies, the real T&D losses may be even higher than this figure power systems with those of more developed

In order to estimate the cost effectiveness of the various modern techniques available for reduction of T&D losses in the context of Indian environment, it is essential to have an idea regarding the energy losses taking place at the various stages of transmission and distribution of power as well as a further break—up of the line losses and transformation losses. The T&D losses can be divided in to two parts, namely. Extra-high voltage (EHV) /High Voltage (HV) transmission and low voltage distribution. Out of total 15% T&D losses targeted to be achieved.

2. Long Term Objectives of Energy Conservation

1. To bring attitudinal changes in all energy users so that they strive for maximum energy efficiency in all products, projects, buildings, processes, domestic and commercial use, agricultural and transport use in consistent with economic considerations.

2. Take necessary steps to discipline those who fail to fall in line with the above changes.

3. To adopt policies which make energy conservation easy and attractive for being adopted by all energy users.

4. To take steps to prevent inefficient use of energy in future projects, buildings, products, processes etc. in every sector of energy use.

3. Areas of Energy Conservation

The main areas where conservation was possible are as follows:-

1. Improvement in power factor would result in reduction in actual maximum demand on the system.

2. Improvement in plant load factor results in optimum utilization of plant capacity and increasing production.

3.80% of the industrial electricity consumption is accounted for by induction motors which are mostly used for pumping and compressor application, etc.

4. Various furnaces, electrolysis baths and vessels operating at higher temperature are found to have inadequate insulation. Higher surface temperature means loss of electrical form of energy by radiation. This can easily be prevented by applying proper insulation to limit the surface temperature rise above ambient up to 20^0C.

New Concerpts in Energy Conservation

Energy Conservation offers a practical means of achieving development goals. It enhances the international competitiveness of industry in world markets by reducing the cost of production. It optimizes the use of capital resources by diverting lesser amounts in conservation investments as against huge capital investment in power sector. It helps environment in the short run by reducing pollution and in the long run by reducing the scope of global climatic changes.

Energy conservation is a decentralized issue and largely depends on the individual unlike decisions of energy supply which are highly centralized. The housewife, the car driver, the boiler operator in industry and every other individual who consumes energy in some form or other is requiring participating in energy saving measures.

In order to have energy efficiency strategies really effective some conceptual changes are imperative.

- Conservation must be recognized as a new source of Energy- “a benign and clean source”

- End use management of energy demand should not be met by increased supply only.

- Energy efficiency is the most cost effective way to bridge the gap between supply and demand.

- In the past the energy planning was based on continuous supply of fossil fuel. What matters to a consumer of energy is not energy per so but the services it provides cooking. Lighting, motive power etc. thus the true indicator of development is not the magnitude of per capita energy consumption, but the level of energy services provided. A stage has reached when developing countries need not to look at energy consumption per capita as a sign of development and growth.

- The economics of major power projects ignore the time value of money. The gestation period of the project is ignored. Thus the projects which yield physical benefits after many years are treated at par with projects that yield immediate benefits. Thus no attention is paid to when the returns are obtained.

ENERGY AUDIT AND FINANCIAL INCENTIVES

1) Energy Audit

The Energy Audit is an accounting tool, an analytical device to detect energy waste.. One series of entries consists of amounts of energy which were consumed during the month in the form of electricity, gas, fuel, oil, steam: and the second series lists how the energy was used: how much for lighting, air conditioning, heating, production processes and other activities. Energy Audit, therefore, is a crucial tool for energy management because it indicates the scope for conservation by identifying the waste areas.

Nearly 20-30 percent savings on energy can, at a conservative estimate, be easily achieved by any industry, if energy conservation measured identified by energy surveys are adopted. Moreover, at least 10 percent savings are possible simply by following good housekeeping practices which require no investment whatsoever. Even when a conservation measure demands investment, it is generally always paid back in less than two years.

2) Financial Incentives

Recognizing the importance of energy conservation projects by the Government and the financial institutions in terms of concessions/reliefs in income-tax, excise duties, customs duties, sales tax, subsidies, liberalization of licenses and loans at concessional terms. It is in this context that Industrial Development Bank of India (IDBI) has introduced to schemes, with a sharp focus on energy conservation objectives in industries. These schemes are (a) Energy Audit Subsidy Scheme, and (b) Equipment Finance for Energy Conservation Scheme. These Schemes which were initially in operation for a period of 2 years have been extended up to the end of the twelvth Five Year Plan. .

a) Energy Audit Subsidy Schemes

Assistance would be available under this scheme for preliminary as well as for detailed energy audit. The charges of the approved consultancy agency for carrying out the energy audit would be partly subsidized by IDBI which will bear 50% of the cost, the balance to be borne by the applicant company. For preliminary audit, the amount of subsidy available under this scheme per undertaking/company would be limited to Rs. 10,000 or 0.01 percent of gross fixed assets of the undertaking/company whichever is less. The limit of assistance for detailed energy audit would be Rs. 1.00 lakh or 0.05% of the gross fixed assets of the undertaking/company whichever is lower. Assets value shall be exclusive of revaluation reserves.

b) Equipment Finance For Energy conservation Scheme

For the purposes of EFEC scheme, equipment shall include plant machinery, miscellaneous fixed assets erection and installation charges, technical know-how fees for designs and drawings. Assistance under the scheme would be available only for installation of equipment for effecting energy conservation in the existing plants/processes and not for expansion or diversification of production capacities, even though, the same may also result in energy conservation. Assistance under the scheme would be in the form of term loan.

APPROACHESAND CHALLENGES

Approaches

The various approaches of energy conservation may be divided into (i) short-term measures (ii) medium-term measures and (iii) long-term measures.

All the short-term as well as medium term measures for the energy intensive sectors may be taken up immediately so that their benefits can be realized during 12th plan itself. Further, the programmes for long-

term measures should also be initiated simultaneously during the 12th plan hey include:

1) Software components

These include: (a) Promotion, motivation education, dissemination of information, data bank and creation of national Energy Conservation centre (b) Promotion of R&D in technologies, equipment etc. (c) Promotion of studies on policies, economics of energy use, demand management, various types of survey etc. (d) Developments of standards. (e) Rectification programmes. They include:-

2) Hardware Components

The following are included under this category.

A. Energy efficient projects in all the sectors including co-generation.

B. Demonstration projects-Models of energy efficient appliances, demonstration centres etc.

C. Technology import/up-gradation-Acquisition of state-of-art technology through foreign collaborations.

D. Strengthening of Transmission and Distribution systems of various State Electricity Boards to reduce the system losses to 15% range.

E. Development of infrastructure such as improvement of transport systems, communication systems, electrification of railways etc.

2. Stages of Energy Efficiency

The different types of activities of energy efficiency could be put into four distinct categories. The first two types given below concern existing plants and equipment and latter two to new ones:-

- Soft or managerial Solutions
- Modest Investment
- New Technology of Production
- Technological Break through

Challenges

One important factor in achieving energy efficiency and conservation target is the response of the and-user. As often, the behavior of many end-users of energy may not be very cooperative as there is an information gap in these areas. The creation of a database and its scientific analysis is the backbone of any future planning and decision making. There are certain challenges in effective implementation of energy efficiency programmes. Some of them are given below:

- Technological
- Economics
- Motivation and Awareness
- Institutional and Legislation

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STRATEGIES AND ACHIEVEMENTS

In sixth Five Year Plan (1980-84) for the first time the significance of energy efficiency and conservation was realized. In the Seventh Five Year Plant document too the Planning Commission identified energy conservation and efficiency as thrust areas based on the recommendations of the inter Ministerial working Group (IMWG) (1983) on energy conservation. The Eleventh Year Plan document has also emphasized the implementation of rectification programmes for agricultural pump sets for achieving energy efficiency in the agricultural sector. Even though the Eleventh Five Year Plan realized the opportunity, potential and need for energy conservation it did not incorporate any concrete programmes, policies and budgetary provision in this regard.

The working Group on Energy conservation has recommended a comprehensive scheme for twelvth Five Year Plan period. This includes awareness programmes, training, development, research, energy audit, energy efficiency measures in various sectors, providing subsidies to implementing agencies and covering other aspects as well. The status of energy conservation in various sectors is as follows:

1. Agricultural Sector

The farmers in the country have installed about 18 million pumps operated by diesel/electricity. These roughly consume 30 billion kWh of electricity and 6 billion litres of diesel. It is necessary to provide the much needed irrigation to the crops but, unfortunately, the pumping systems adopted have remained inefficient and the consumption of electricity and diesel has been 50 to 100 percent more than what it should be. Regarding petroleum products, India produces hardly 60% of the

required crude oil indigenously, importing more than Rs. 15,000 crores worth of crude oil and petroleum products to meet the current demand. The excessively wasteful consumption of energy in the agricultural sector has to stop both for conserving energy per se and reducing the irrigation cost for the farmers.

There has been an increase in the absolute consumption of energy in agricultural sector. The electricity consumption has grown at the rate of 14.4% per annum whereas the oil consumption has increased at the rate of 10.1% per annum.

2. Transport Sector

The sector uses, nearly thirty two percent of the commercial energy. This sector is second only to industrial sector. Further, this sector is heavily dependent on petroleum products. Import of petroleum is nearly 35 percent of total expenditure on imports in India. Its consumption is increasing at an annual rate of 6 to 8 percent. Automobiles thus offer one of the most promising areas for major savings. There are tow modes of transport which are most common, viz. rail and road. Unlike the railway, the road sector is not wholly in the organized sector and hence its database is rather weak.

The road transport has increased very fast during last decade or so. One approach to achieve energy conservation is to shift a part of the traffic from road to rail. It is imperative to develop research and development activities in the direction of improving the fuel efficiency of vehicles and developing alternate energy sources.

According to the report of Advisory Board on Energy the conservation potential in transport sector is nearly 20% which can be achieved by an investment of Rs. 890 crores. Conservation measures would yield an annual savings of Rs. 765 crores and avoid an investment of Rs. 432 crores for creating additional energy capacity.

A series of measures including operation control, upgrading driver's skills training programmes to create fuel conservation consciousness and proper use of clutches, reduction of body weight, speed restrictions and improved over hauling practices has been recommended.

3) Domestic Sector

In domestic sector the maximum consumption of electricity is in lighting. It is, therefore, imperative to have energy efficient devices in this field. One such device is compact fluorescent lamp (CFL) This consumes much less power as compared to incandescent lamp and has a lifetime of nearly 10,000 hours. A new generation of light bulb known as E-lamp (electronic light) has been introduced recently in USA. This lamp is supposed to consume 75 percent less electricity than conventional incandescent lamp. Its lifetime is between 15,000 to 20,000 hours. The E-lamp has made its bid to become the "Compact Disc" of residential lighting, but events during the next few years may determine whether it will become a household word.

4) Industrial Sector

Industries consumes maximum energy. In general Indian industries are highly energy inefficient. However, during last 6 to 8 years some major industries have paid attention towards energy conservation medium and small scale industries are, by and large. indifferent to energy conservation.

1) Iron And Steel

Indian steel plants have full-fledged fuel economic departments for monitoring and controlling the plant performance. Of late, there is a growing concern as evidenced by the performance of steel Authority of India (SAIL) plants which have shown a reduction of specific energy consumption The industry has drawn an action plan for energy conservation in coke ovens, sinter plants, blast furnaces, reheating furnaces, utilities etc.

2) Fertiliser

During the last 6 to 7 years number of plants has taken measures to reduce consumption and have met with a good deal of success. The units have been allowed to retain the benefits of investments towards energy conservation for a period of six years. Energy saving to the tune of 5 to 10% has been reported by a number of units who have implemented short and midterm measures. Energy conservation potential in this sub-sector is estimated to be 10-15 percent.

3) Cement

A number of energy audit studies carried out by various agencies, have revealed the energy conservation potential to the tune of 10-15%. Thus, pre-calcinatory technology which can use coal with high ash content can reduce the specific energy consumption besides improving productivity in the range of 30 to 50% for cement plants.

4) Textile

Energy Conservation studies by textile research associations, national Productivity Council (NPC) and

others have brought out that there is a possibility of reducing the energy intensity in Indian Textile Industry by 20 to 25%.

5) Petroleum Refining

India is producing nearly 30 million tones of indigenous crude against the demand more than 50 million tones accounting for 60% indigenous production. The demand of petroleum products in growing at an average of 8% per year. Therefore, any effort of saving of precious petroleum products will help other development activities.

CONCLUSIONS

Some important conclusions are listed below:

1. The energy efficiency and conservation may be viewed as a new source of energy, benign and clean, having little investment and short payback period. This approach can go a long way in bridging the gap between demand and supply of energy.

2. It is absolutely necessary to bring attitudinal changes in all energy users in respect of energy efficiency. This can be achieved, to a large extent, by imparting energy education at school level itself.

3. A high power Apex Body at national level may be constituted to coordinate various activities in this field.

4. Energy efficiency standards should be setup for all major machinery, equipment and appliances. This single approach will go a long way in ensuring energy efficiency in various sectors.

5. The concept of energy audit, on regular basis, may be introduced in every industry. Energy audit should be given the same importance as the financial audit.

6. A comprehensive Act may be passed by the Parliament without further loss of time. The act should be simple in interpretation and effective in implementation.

7. Energy efficiency is to be given due importance at the planning stage itself of the new industries. The Financial institutions may be asked to insist on this aspect before sanctioning loans.

8. The government should provide more attractive incentives in terms of soft loans for purchasing energy-efficient machinery and subsidies for employing energy conserving measures. There should be a realistic tariff particularly for agricultural sector.

9. Last but not the least, the energy conservation should be developed as a mass movement like family planning, literacy drive etc.

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