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RAMINDER KAUR
PEC University of TechnologyChandigarh (UT) INDIA, raminder84@gmail.com

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RAMINDER KAUR

Deptt. of Electrical Engineering, PEC University of TechnologyChandigarh (UT) INDIA
Email:raminder84@gmail.com

Abstract: Economy of any country is dependent upon its Power Consumption. Hence, a large amount of power is required to make India a self reliant economic power. In India there is a huge gap between the Power generated and the Power required. It is not possible to realize this gap by increasing the installed capacity, as the resources are limited and also due to economic constraints. So, the energy being generated should be conserved to the utmost.

In this paper, the responsibility and the areas of the power sector in conserving the Energy being produced have been discussed in detail. This would definitely lead to marginalizing the gap between demand and supply.

INTRODUCTION

India has 16% of world's population, but less than 1% of the world's energy resources. There is a huge deficit in the demand and availability of energy. The total installed capacity is 207006MW and the present peak demand is 217000MW. The real challenge for the power sector is to narrow this gap. This can be done by increasing the installed capacity; which has its own limitations. Hence, going by the dictum Energy saved is Energy Generated. It's a big challenge for the Power Sector to save the energy to narrow the gap between demand and supply. There is a huge potential to save energy in various sectors of economy – industrial, agriculture and domestic up to 25% in each of them.

Energy conservation can be achieved by both, a promotional and a regulatory role by the authorities concerned. Promotional role includes awareness campaigns, education, training, demonstration projects and feasibility studies.

Regulatory role includes mandatory energy audits of large consumers, devising norms of energy consumption for various sectors and sub sectors, provision of fiscal and financial incentives and implementation of standards.

Areas of Energy Conservation

Supply Side

- Improving existing thermal power station performance
- Grid management
- Improvement in transmission and distribution system

Demand Side

- Industrial Sector
- Domestic Sector
- Commercial Sector
- Agriculture Sector

Supply Side

The major areas where energy conservation drive can be undertaken in a thermal power plant are

- Specific consumption of coal and fuel oil
- Optimum consumption of water
- Reduction in Auxiliary Power Consumption

Increase in PLF of existing Thermal Power Stations can be achieved by better utilization of existing equipments and conservation of energy. Thermal Power Plants consume about 74% of the coal as main fuel and overall efficiency of Thermal Power Plants is about 40%. The auxiliary power consumption in Thermal Power Plant varies from 8.5% to 11% of gross generation. The following causes lead to increase in auxiliary power consumption.

- Not running the unit at full load due to system problem.
- Improper size of auxiliary equipment.
- Running of drives in excess of requirement especially in cooling water pumps & cooling tower fans.
- Lighting and ventilation equipments not switched off when not required.
- Frequent start up of the units due to operation and maintenance problems.

Maximization of generation during peak-load hours can be achieved by following techniques

- Load curtailment equal to remaining deficit.
- Putting all generators on free-governor mode.
- Installation of capacitors to address low voltage problems.
- Absorption of VARs during off-peak hours.
- Incorporation of effective automatic load-shedding.

Transmission & Distribution Losses

Our Transmission & Distribution losses of 21-22% are exorbitantly high when compared to that of the advanced countries like USA and Japan, where they are around 7-8%.

If this lost energy is brought into the billing net, it will lead to additional revenue of several billion. Alternatively, it could save a capacity addition of about 10,000 MW operating at a PLF of about 70%.

The growing need for electricity has resulted in difficulty in meeting the peak demand. Increase of supply side in proportion to the demands is not feasible due to the depleting rate of resources. Hence energy conservation/reducing losses is now recognized to be the only viable option to balance energy. T&D losses can be broadly classified as

a) Technical Losses
b) Commercial Losses

Technical Losses

These losses occur due to flow of electrical power through transformer, transmission & distribution lines, cables and other equipments. The main reasons for high technical losses are

- Multiplicity of Transformations.
- Extension of T&D Network of 95,329 Ckt. km EHT, HT & low voltage lines.
- Growth of Rural Electrification.
- Inadequate reactive compensation and poor voltage regulation.
- Corona Losses
- Over loading of transmission lines
- Improper location of power & distribution transformers.
- Inappropriate rating of distribution transformers
- Inappropriate choice of voltages.
- Ratio of HT to LT lines
- Unbalanced loading of the transformer, transmission lines & LT system
- Over frequency of the system
- Low power factor and low system voltages
- Lack of system planning
- Lower conductor sizes
- Poor Construction and Maintenance practices.

The transformation losses can be reduced by using amorphous transformer and reduction in stages of transformation.

Amorphous Transformers:

Amorphous metal alloy having composition Fe-78 B-13 Si-19 used in amorphous core transformer possesses properties of high electrical resistivity, annealing temperature, low noise level and lower core losses. Due to these properties, no load losses are reduced by 60% to 70%.

Reduction in stages of Transformation:

Each level of transformation whether step-up or step-down entails transformation losses to the extent of about 1.0% to 1.5% in case of power transformers and a much higher level of losses in case of distribution transformers. The stages of transformation at each substation should be reduced to the minimum.

The main reasons for high T&D losses are :

Incorrect selection of feeder cross-section:

Incorrect selection of feeder cross-section results in higher losses. The conductor material and the correct size plays an important role in reducing these losses. AAAC can be used instead of conventional ACSR. .

Over Loading of lines/feeders:

The over-loading of lines/feeders may be due to low power factor and low transmission voltage and also due to consumer's demand. Corrective measures are

- Vulnerable links should be strengthened by constructing additional parallel lines.
- Network reconfiguration through load flow studies i.e. to determine the minimum loss path of the transmission system through computer aided simulation.

Reactive compensation:

Installation of Shunt capacitors of suitable rating at the terminal end of the EHV lines or at bus or both with lines and bus. Switch type bus reactors or thyristor-controlled reactors should be used for highly inductive loads.

Series compensation:

The performance of a transmission system is characterized by the Voltage control at the feeding buses, Voltage regulation at all load taps, Power factor control at utilities end and Line/feeder losses. Series compensation provides the following:

- The sending end power factor is improved thus improving the voltage.
- Feeder losses are reduced.
- The power transfer capability of transmission link is increased.

Automatic voltage boosters/Regulators: The benefits of using AVR are:

- It improves the voltage profile. Voltage profile can be improved by 10% by using AVRs.
- It reduces losses in transmission system, improving the voltage profile.

Line length ratio:

The length of distribution lines/feeders should be reduced. Some of the SEB's have already developed system consisting of pure HV system. Consumers are directly fed by stepping-down from 11 KV to LT by a single phase transformer .

Corona losses:

In extra high voltage system, losses take place due to excessive corona. These losses can be reduced by using HVDC transmission for a minimum length of 250 km to 300km. **Commercial Losses:**

These losses occur mainly at distribution level. The main causes of commercial losses are

- Meter tempering
- Unauthorized connections
- Un-metered power supply

Meter Tempering

This is frequently done by some unscrupulous consumers and this can be done easily because very poor quality meters are installed at consumer premises. Also there is a lack of supervision and meters are not enclosed in metal/wooden boxes.

Unauthorized Connections

A huge amount of distribution losses occur due to unauthorized consumption of power through hooking and tapping.

This is a complex problem and can be tackled by following measures.

- Public awareness about the impact of theft on electricity tariff and quality of supply.
- Simplification of the procedures for giving temporary connection.
- Quick connection to prospective consumers by introducing "Tatkal schemes".
- Speed supply of meters should be ensured to all the prospective consumers, so that they are not tempted to adopt illegal means.
- Extensive help from the local police will have to be taken, to nab and punish the offenders.
- Theft/pilferage of electricity should be made a cognizable offence.

Un-metered Power Supply

Huge quantum of loss is occurring due to un-metered power supply to irrigation Pump sets and Public Lighting System. These losses can be overcome effectively by adopting following measures.

- No supply without a correct meter should be a policy decision.
- Higher accuracy electro magnetic meters.
- Installation of static energy meters.
- Introducing automatic metering for bulk consumers with computerized monitoring at manufacturer's end.
- The static energy meters for domestic and commercial metering should be temper proof, vibration proof and accurate under adverse loading conditions.

Demand Side:

Domestic & Commercial Sector

Though small amount of power is used in Domestic & Commercial Sector but it plays a vital role where energy can be saved. Energy savings in these sectors can be promoted by educating the consumer to use energy efficient equipments. Education in energy conservation should be introduced at school level. Some of measures are mentioned below

- Use of fluorescent tube and CFLs in place of incandescent lamp.
- Switching off light when not in use particularly during lunch hours and during leaving offices.
- Good quality of wiring and appliances.
- Frequent opening of fridge-door be avoid.

Agriculture Sector

The demand of energy in this sector is increasing rapidly. Energy Conservation in this sector can be promoted by following techniques.

- It is a fact that the motors and pumps used in this sectors are inefficient (i.e. 30% efficiency) whereas the recommended scope for operational efficiency is 55%.Mandatory regulations may be imposed on agricultural pump set owners to resort to modernization of their working systems so as to raise the overall efficiency not below 55%. Special jet pumps are one of the possible solution for tube wells.
- The main aspect of the flat rate tariff gives opportunity to the purchaser for buying big pump sets and user avoid switching off the power. Hence metered supply is essential.
- Shunt capacitors should be used to improve power factor.
- Periodical maintenance of transformers & use of proper size of fuse.

Industrial Sector

The pattern of energy consumption in this sector is around 40% and therefore this sector should be the priority area of energy conservation. Energy conservation in this sector can be promoted by following measures

- Avoid use of over size motors.
- Avoid non-standard welding set as it consumes more power.
- Avoid lower size/improper cable as it leads to increase in losses.
- Proper lubrication of motor
- Avoid pulley drive. Use of direct coupling is effective.
- Instead of shutting down the feeder as a whole, it is desirable to allot quota of units during power cut programme.

CONLUSION

A few of the methods and measures have been suggested in this paper at the Power Supplier and consumer end both to conserve the energy and hence enhance the net available power for consumption at the consumer end. If followed, these measures would definitely help to reduce the gap between demand and supply and also help the power

system operation economically by increasing the net billed energy.

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