For Private Circulation Only

POWER SCENE
THIRUVANANTHAPURAM

MONTHLY NEWSLETTER OF THE KSEB ENGINEERS' ASSOCIATION, THIRUVANANTHAPURAM UNIT

Vol. II | Issue : 102 | November 2011

Members are requested to give the articles to The Editor, Power Scene, Tvpm. Articles from family members are most welcomed. Articles may be e-mailed to ksebea@gmail.com

ENERGY CONSERVATION IN THE FIELD OF ELECRICITY

Conservation of Energy in the field of Electricity is significant and very much important in the present day power crisis situation. Moreover the sources of energy in nature are not limitless. By adopting energy conservation methods and thereby eliminating or at least minimizing the wasteful consumption, we will be able to meet the situation to some extent. Electrical energy was considered to be a cheaper source of energy in the past and hence the consumers especially the power intensive industries have not made any substantial effort to control its use. But the days of the cheap power are gone and now we are facing huge power shortage throughout the nation. Energy prices are soaring high and slowly the idea of electrical energy conservation is catching up in all areas across the nation. In recent years, proper utilization of electrical energy has gained considerable importance and the equipment output per unit electricity consumption has become an important factor.

Means of Energy conservation, improving energy efficiency and reducing energy costs can be achieved through :- (a) Proper design of power plants, Transmission and Distribution networks,

⇨

(b) Power factor correction, (c) Improved lighting practices, (d) Improved Motor and equipment selection and its effective utilization.

1. ENERGY CONSERVATION IN GENERATION.

In the field of generation, much can be done towards energy conservation.

In design stage, the availability of energy resources and our system requirements are to be considered for deciding the equipment rating and the number of machines for the efficient and economic operation of generating stations. Proper selection of correct and efficient prime movers, Generators etc.. are also important at this stage. Availability of fuel at reasonable rate is to be considered for Plants other than Hydro stations. Idling of Generation Plants and resources for long time will increase the maintenance cost and reduces the efficiency of the plant. Periodic and proper maintenance of machines and the condition of cooling system influences the output, availability and efficiency. Energy auditing and proper scheduling of maintenance of different units and stations also will help in ensuring efficient management.

1(a) Selection of Generating units.

The load on a Generating station is seldom constant; it varies from time to time. Obviously a single generating unit will not be an economical and efficient proposition to meet this varying load. Efficiency of an alternator is maximum at nearly 75% of its rated capacity so a single unit will have very poor efficiency during the periods of light loads on the power station. Therefore, in actual practice a number of generating units of different sizes are installed in a power station. The selection of number and size of units are decided from the annual load curve of the station such a way that they will correctly fit the station load curve. By this method or principle, it is possible to operate the generating units at or near the point of maximum efficiency.

It may be noted that the generating units can fit load curve more closely if more units of small sizes are employed. However, using more number of units increases the investment and maintenance cost per KW of the capacity, and the overall mechanical and other generation losses of all generating units will become more than the electrical energy saved by this method.

Thus by selecting the proper number and sizes of units, the generating units can be made to operate near maximum efficiency. The problem associated with optimum allocation of generators (Units) at each generating station at various station load levels is called **unit commitment problem.**

1 (b) Distribution of load between Power Plants.

The total load on a power system consists of two parts; base load and peak load. In order to achieve overall efficiency, the more efficient plant is used to supply base load and is known as base load power station. Then for further increase in load the next most efficient plant would start to feed power to the system, and a third plant would not be called upon until the point of maximum efficiency of the second plant was reached. Finally the less efficient plant is used to supply the peak loads. In addition to the efficiency factor for deciding a station as a base load station or Peak load station, storage capacity (In Hydro electric plants), Warm up time or Startup time for each station, Cost of generation, Cost of energy purchase and allocated share etc. are also considered.

The problems associated with optimum allocation of generation to each station for various system load levels is called the **load scheduling problem.** ⇨

1 (c) COGENERATION

Considering the tremendous amount of waste heat generated in thermal power generation, it is advisable to save fuel by the simultaneous generation of electricity and steam or hot water for industrial use or space heating, now called Cogeneration. Such systems have long been common here and abroad. Currently there is renewed interest in this topic because of the overall increase in energy efficiency.

Cogeneration of steam and power is highly energy efficient and is particularly suitable for chemicals, paper, textiles, food fertilizer and petroleum refining industries. Thus these industries can utilize the wasted energy and solve energy shortage problem in a big way. Moreover they will not have to depend on grid power and they can sell the extra power to the utilities or other institutions.

There are two ways of cogeneration of heat and electricity (a) Topping cycle and (b) Bottoming cycle. In Topping cycle fuel is burnt to produce the Electrical energy or Mechanical power and the waste heat from the power generation provides the process heat. In Bottoming cycle fuel first produces the process heat and the waste heat is used for Power generation.

2. ENERGY CONSERVATION IN TRANSMISSION AND DISTRIBUTION.

Power loss in the Transmission and Distribution network has to be reduced to minimum possible limits as it accounts for a major part of the wasteful consumption in our system. It is true that Power cannot be transmitted and distributed to the load centers through Electrical conductors and equipments like Transformers, Circuit Breakers and isolators without loss, but the system has to be planned and maintained so as to keep the loss within reasonable limits.

Contributing factors for high system losses are long transmission lines, Improper conductor size, Line touching, Low maintenance, Improper selection of Substation and Transformer locations away from load centers, Low power factor, Unbalance loads and defective installations, Corona loss, etc.

Long Transmission lines cannot be eliminated particularly in Kerala where the hydel stations are away from the load centers and due to highly scattered load conditions. But the losses can be minimized by suitable interlinking and selection of source based on Load flow study. In distribution sector improper selection of Transformer rating and locations, over loading of lines and transformers, Under loading of transformers, Un balanced loading, substandard workmanship like improper joints, loose connections, and inadequate maintenance are the major part of the loss.

For the same power transmission , if the Voltage is increased then the current carried by the system is reduced and the T&D losses are reduced. So the suitable selection of Voltage levels in Transmission, Sub Transmission and the Distribution network and the length of the lines used in each Voltage levels are of great importance. High ratio of Distribution network circuit length to Sub Transmission network circuit length is not advisable from the energy conservation point of view and it should be reduced to the reasonable minimum value considering Financial, Operational and Safety factors.

Low Power factor and Unbalance loading in Electrical network will reduce the utilization of the full rating or capacity of equipments like Generators , Transformers, Transmission and Distribution Lines and increase the various system losses. Unbalanced loading can be minimized to some extent by load rearrangement. Mostly in power system the Power factor is in ⇨

inductive in nature due to the use of Chokes, Motor loads etc. For improving power factor to unity, Capacitor banks are to be used near the load centers to compensate the reactive load which is inductive in nature. In KSEB network the Active Power (MW), Reactive power (MVAR), Current, Bus Voltage and Frequency are monitored through SCADA system at State LDC, Kalamassery and at SubLDC, Thiruvananthapuram. Considering these system parameters, Reactive Power (MVAR) control is carried out throughout the state from SubLDC,TVM by switching the capacitor banks at various Substations.

3. ENERGY CONSERVATION – AT CONSUMER END.

Electrical motors contribute to a major component of electrical energy used in the industrial sector. Proper selection of motors and the associated control can result in substantial saving of Electrical energy. Often it is seen that, the motor selected to drive a load may run at part load. The motor efficiency and power factor are poor at part load. Hence the motor selected should be such that, it runs at near full load during normal operation. Moreover, supply used for operation of a three phase AC motor, should be a balanced one or care should be taken to see that they are supplied though a properly regulated network as the motor performance like efficiency and power factor are otherwise affected adversely. A 3.5% unbalance of supply voltage can cause 20% extra losses in the motor.

3 (a) Better Operating methods.

Better operating methods also minimize energy losses in particular cases. When there are more than one transformer in an industrial installation and the load factor is low, meet the load with a single trans- former and isolating the other transformers from the system will definitely yield considerable saving. It is worthwhile to install a separate transformer of small capacity to cater lighting and single phase equipments, needed for round the clock operation, so that the higher capacity transformers can be kept off during non working hours of plant and thereby losses can be reduced. Similarly, capacities of welding equipments, Ovens, Furnaces, Compressors etc. must be selected in such a way that there is flexibility of capacities to handle jobs of different magnitude and varying requirements.

3 (b) Improved lighting practices.

Lighting is the most visible form of electricity consumption. In industries although plant lighting is hardly a few percentage of the total plant load, it has been found that, up to 30% to 40% economy in energy consumption is generally possible in plant lighting. The effectiveness of a good lighting design is the value of specific wattage per illumination level index. The improvement of this index can be achieved by use of more efficient lighting source suitable to the specific visual task. Now a variety of less energy consuming and highly efficient CFL and LED type lamps are available in the market. By proper selection, maintenance and automatic scheduling of the lamp groups we can save a considerable amount of energy. Energy consumption can be reduced through proper architectural design of buildings to utilize the day light to the maximum extent.

The following are some house keeping or maintenance techniques that can be used to improve the efficiency of one's present lighting system.

- ❖ Turn out lights when they are not required.
- ❖ Maintain lighting equipment in good order.
- ❖ Make greater use of natural light.
- ❖ Turn off lights near windows when there is sufficient light from outside.

⇨

- ❖ Use well designed energy effective lighting scheme. The right light at the right place at the right time should be the motto of all lighting designs.
- ❖ Increase the illumination, where necessary by painting the room or area with lighter and more reflective paints.
- ❖ Reduce exterior and parking lot lighting levels.
- ❖ In street lighting use photo electric cells to limit the burning time to the shortest time possible.
- ❖ Turn off or remove supplementary lighting such as office decorative lamps and table lamps unless it is required by the specific task.
- ❖ Keep the lighting fixtures clean.
- ❖ Reorient work stations. Group tasks which requires the same lighting levels, and adjust the output of the lighting system accordingly. Place work stations requiring the highest level of illumination near windows to take advantage of natural day light.
- ❖ Use more efficient lamps, in general the lamp that provides the most lumens per watt will be the most cost effective in the long run.

3 (c) Selection of equipments

In order to conserve precious electrical energy, efforts are being made to increase the efficiency of operation of all power equipment and allied components at every state, by reducing the power losses to a minimum. Identifying and quantifying the system equipment losses of the distribution system, plant and machinery is the first step. Energy parameters are to be incorporated in design and selection of equipments. Equipment losses are inherent part of plant power system components and scattered throughout the industrial plant. It may not be all that possible for working industries to take replacement action for inefficient or over specified components like motors. But at the time of ordering new systems for modernization, renovations, replacement etc. no matter how minor and insignificant they seem to be, equipments have to be chosen by considering high efficiency. Losses have to be evaluated for the life period of the equipment. Purchase decision ought to be taken after capitalizing the losses. Entry of inefficient components into power system can be eliminated by adopting right standards and conscious efforts in selecting equipments.

4. ENERGY AUDIT.

Energy audit in industrial sector aims at reducing specific energy consumption i.e. energy per unit output in processes and tasks and is regarded as a key to scientific approach to indicate the actual status of industrial facilities and systems with regard to energy utilization, efficiencies of different activities, equipment and processes and to suggest remedial measures to reduce wasteful use of energy in specified areas with well defined economic implications. The same is applicable to commercial establishments.

Energy audit means different things in different contexts. The type of energy audit to be performed depends on the function and type of industry or establishment and depth of final audit needed. They can however be broadly classified into two categories

1. Preliminary audit
2. Detailed audit.

Preliminary Energy audit.

This is conducted by collecting relevant information from available data/records, visual and other information. This gives a preliminary idea of the plant energy situations and forms the basis for detailed energy audit. ⇨

Detailed Energy audit.

This covers estimation of energy input for different processes, losses, collection of past data on production levels and specific energy consumption in the subject unit as well as in other systems.

Data collection.

The relevant data collected are

1. Maximum demand and KWH consumption for the last five years.
2. Production figures for the last five years.
3. Information regarding the existing energy recording scheme.
4. Functioning of controls.
5. Review of maintenance and records.
6. Instrumentation of equipment installed.
7. Capacities and efficiencies of all equipments.
8. Prescribed operating parameters of the equipment.
9. Present operating parameters.
10. Steps involved in the production process.
11. Overloading details.

Data analysis.

The data collected and listed below are analysed to identify

1. Energy wastage that can be prevented by the maintenance or operational action against.

- ❖ Equipment running when not needed.
- ❖ Equipment rated much higher than what is needed.
- ❖ Overloading.
- ❖ Substandard switchgears and wiring.
- ❖ Mechanical defects in the driven equipment.

2. Possibility of waste heat recovery to generate steam and additional electric power using steam turbines such as in cogeneration.
3. Possibility of eliminating or modifying production process to reduce energy usage.
4. Justification for replacing equipment with energy saving equipment.
5. Modernizing the plant to save energy.

Energy conservation scheme

Based on the data analysis and audit reports, energy conservation measures shall be prepared. The following procedures may be adopted.

1. Calculate energy saving for each equipment / feeder.
2. Calculate total cost of energy conservation measures and annual savings.
3. Evaluate pay back period, return on investment etc.
4. Assign priorities based on (3) above.
5. Select measures for implementation.

CONCLUSION.

In conclusion, it is felt that serious efforts are required to prevent loss and wasteful consumption of electricity so as to minimize the gap between demand and supply. Energy is a mission and challenge on which very well the survival of the human race itself may depend and concerted activities are required to achieve fruitful result.

Er. SANTHOSH.E

ഉർജ്ജ സംരക്ഷണം ശീലമാക്കുക.
വൈകുന്നേരം 6 മുതൽ 10 വരെ
വൈദ്യുതി ഏറ്റവും കരുതലോടെ
ഉപയോഗിക്കുക.

ENERGY CONSERVATION AND GLOBAL WARMING

Earth receives most of its energy called radiation from the Sun. This energy is electromagnetic radiation in the visible spectrum, with small amount of Infra Red (IR) and UV radiation. The incoming solar energy has a very short wavelength (Visible light) and passes through the atmospheric gases unaffected to reach the earth's surface. The earth's surface absorbs most (70%) of the solar energy and warms it. Some solar radiation (30%) is reflected (released) back to the atmosphere as IR radiation (heat). This IR radiation emitted by the earth is absorded by gases (green house gases) in the atmosphere and re-emitted (re - radiated) as heat back to the earth's surface. The effect of this is to warm the surface and lower layers of the atmosphere. This warming is known as green house effect. It is similar to what is taking place in green house / glass house. Global warming is the name given by scientists for the gradual increase in atmospheric temperature. We can reduce air pollution & global warming , and conserve energy by reducing the use of fossil fuels. Electricity is mainly generated by burning fossil fuels : coal and petroleum products (Non - renewable sources). It is also generated from hydro power, solar power / wind power (renewable Sources). **When energy in the form of electricity is used, it adds to global warming because that electricity obtained by burning fossil fuel has already emitted CO_2.** But if the electricity has been generated from non coventional energy source / renewable sources such as wind power, solar power, it does not add to global warming. Therefore an important step to energy conversation and carbon neutrality is to shift from coal power to renewable power. All electric or electronic items in our household contribute to CO_2 emission indirectly. Therefore, shift to use of green energy or renewable energy - energy from wind, sunlight, tide, biomass (Agricultural waste).

Reduce energy usage.

Replace standard lights with the energy saving light bulbs. eg. incandescent bulb is to be replaced by CFL (Compact Flourescent Light) and LED lamp. When building your house, take care to utilise natural ventilation effectively. Turn off all electric items when not in use - lights, televisions, radio, DVD player and computers. Don't leave your electronic equipments in standby mode. Switch them off. Unplug electronic equipments from the wall when you are not using them. Unplug your mobile phone as soon as it has finished charging. Even when turned off, things like hair dryer, cell phone charger and television use energy.

Energy is used to keep display clocks lit and memory chips working. Micro wave oven is an energy saver, since it consumes less energy to make a cup of tea than putting water on your stove. Do washing at 30^0C (not at higher temperatures) in washing machine. Fill the washing machine with full load - this will save water, washing powder and electricity. Hang out the washing to dry rather than tumble drying it. Replace the old fridge/ freezer (if it is over 15 years old) with a new one with good energy efficiency rating. Defrost the fridge/ freezer regularly. Adjust the thermostat of heater or cooler, just 2 degree down in winter and 2 degree up in summer. Buy fresh food instead of frozen food as it consumes 10 times more energy to

produce it. Buy local fruits & vegetables and avoid items that are made in distant lands.(to avoid energy spent on transportation) Reduce the consumption of meat. It could help slow global warming by reducing the number of livestock and thereby lowering the amount of methane emitted by them. Methane is the second most significant green house gas and cows are one of the methane emitters.Their grassy and multiple stomachs cause them to produce methane which they exhale with every breath. Energy is also spent to provide water to livestock. If you opt for beef, choose local grass fed beef. Most US beef is fed on corn, which requires more energy to produce. Buy organic food as much as possible. Production of fertilizers and pesticides are energy consuming process leading to CO_2 production. Purchase foods that could be eaten as raw food, since cooking expends energy. Do not buy bottled water if your tap water (Well water) is safe to drink. Avoid products with a lot of packing. Because packaging uses additional energy in packing, transporting and disposing. Buy recycled products. Recycling uses less energy. It takes 70 to 90% less energy to make recycled paper.

For short journeys either walk or cycle. use the bus or train rather than your car. Go for a run rather than drive to the gym. Share a ride with someone. Keep the vehicle properly serviced. Leave the lights off when you leave the office. Print your documents two pages to a side and double-sided. Turn the lights and air conditioners off when you leave your hotel room. Ask for your room towels to be washed every other day, rather than every day. Think carefully about the type of activities you do in your spare time and do things which do not add to carbon emissions.

YVPK

❋

PRESENTATION ON MANAGEMENT SKILLS

Er. V. Rajan (Rtd. Dy.CE) made a presentation on Management skills in the last unit meeting held on 3rd November 2011. He stressed the importance of Emotional Quotient (EQ) and Spiritual Quotient (SQ) in addition to the Inteligent Quotient (IQ) in the present day management skills.

ENERGY CONSERVATION DAY

STATE LEVEL PROGRAMME

on 15th December 2011

at Model Engineering College

Thrikkakkara, Ernakulam

CONCLUDING SESSION

in the presence of

Sri. Aryadan Muhammed

(Hon. Minister for Power)

&

Sri. K Babu

(Hon. Minister for Excise & Port)

All are requested to participate in this programme

Wish You All A Merry and Happy Christmas

Edited, Printed and Published by Er. Santhosh E. for and on behalf of KSEB Engineers Association, Thiruvananthapuram unit and printed at Bhagath, Pattom # 4017097