ECA

Energy Efficient Technologies in Electrical System

WHY ENERGY EFFICIENCY ???

- As global energy demand continues to grow, actions to increase energy efficiency will be essential. The technical opportunities are myriad and potential savings real, but consumers and utilities have so far been slow to invest in the most cost-effective, energy-efficient technologies available.

- The energy efficiency of buildings, electric equipment, and appliances in use falls far short of what is technically attainable. Electric utility energy efficiency techniques have great potential to narrow this gap and achieve significant energy savings. Some of the recent trends in energy efficiency technologies that have been successful and also used widely worldwide are:

1) Energy efficient motors
2) Soft starters with energy saver
3) Variable speed drives
4) Energy efficient transformers
5) Electronic ballast
6) Occupancy sensors & Energy efficient lighting controls
7) Energy efficient Lamps.

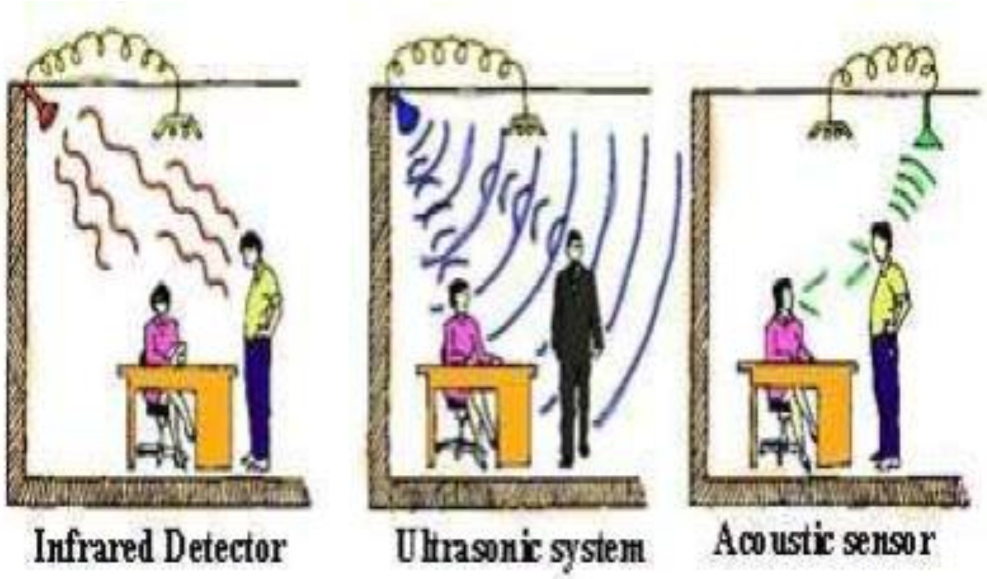
Energy Efficient Lighting Controls

Occupancy Sensors

–Occupancy linked control can be achieved using infra-red, acoustic, ultrasonic or microwave sensors, which detect either movement or noise in room spaces. These sensors switch lighting on when occupancy is detected, and off again after a set time period, when no occupancy movement detected. They are designed to override manual switches and to prevent a situation where lighting is left on in unoccupied spaces.

TYPES OF OCCUPANCY SENSORS

- Passive Infrared Sensors detect movement and/or increased heat in an area caused by natural increase in movement and heat as people enter the area.
- Ultra-Sonic Sensors emit ultra-sonic waves that bounce off objects in a room with an echo sent to the sensors. The sensitivity of the sensors recognizes movement in the room and responds accordingly.
- Micro-Phonic Sensors listen to irregular sound patterns to detect motion in a room.



Occupancy Sensor Technologies

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- **Localized Switching--**Localized switching should be used in applications which contain large spaces. Local switches give individual occupants control over their visual environment and also facilitate energy savings. By using localized switching it is possible to turn off artificial lighting in specific areas, while still operating it in other areas where it is required.

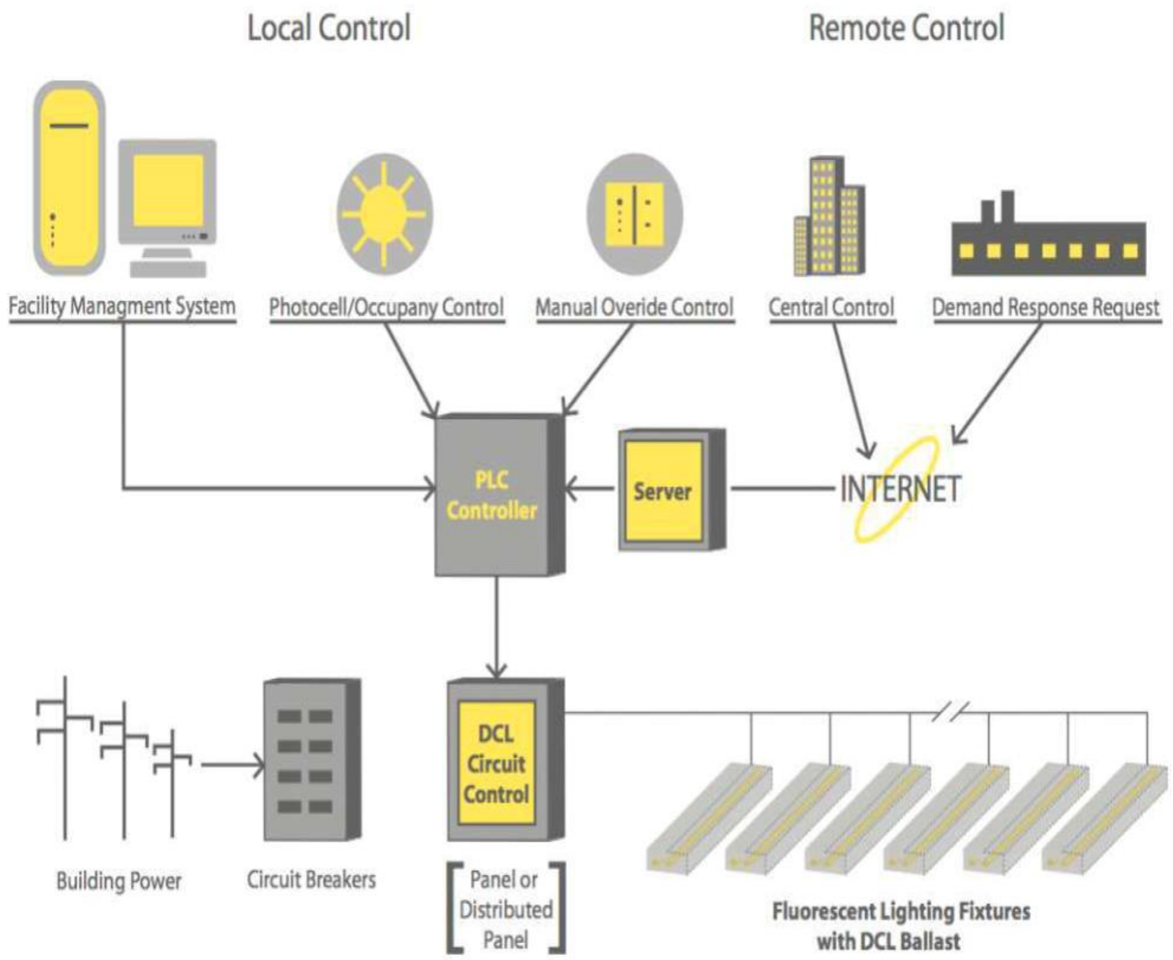
  A situation which is impossible if the lighting for an entire space is controlled from a single switch.

- **Daylight Linked Control--**Photoelectric cells can be used either simply to switch lighting on and off, or for dimming. By using an internally mounted photoelectric dimming control system, it is possible to ensure that the sum of daylight and electric lighting always reaches the design level by sensing the total light in the controlled area and adjusting the output of the electric lighting accordingly. If daylight alone is able to meet the design requirements, then the electric lighting can be turned off. The energy saving potential of dimming control is greater than a simple photoelectric switching system.

How It Works…

- When the occupancy sensor is active (i.e., the room is occupied), then the photocell will determine how much artificial light is necessary to maintain the ideal level of illumination within the room. When there is no natural light, the photocell signals the ballasts to operate at their pre-programmed maximum level. When the photocell detects natural light, the ballasts will be dimmed by an equivalent amount so that the total illumination of the room does not change. This process is called **Daylight Harvesting**.

- When the occupancy sensor detects that the room is unoccupied, then the photocell initiates a shut-down program. It begins with a dimming sequence with a field-adjustable time of 30 seconds. Power to the ballasts will decrease to 35% power for ten minutes. Then, the fixtures will turn off. This process is called **Dimming**. Should the space be re- occupied prior to the system timeout, the occupancy sensor would alert the PLC, and ballast output would immediately return to the level established by the photocell.



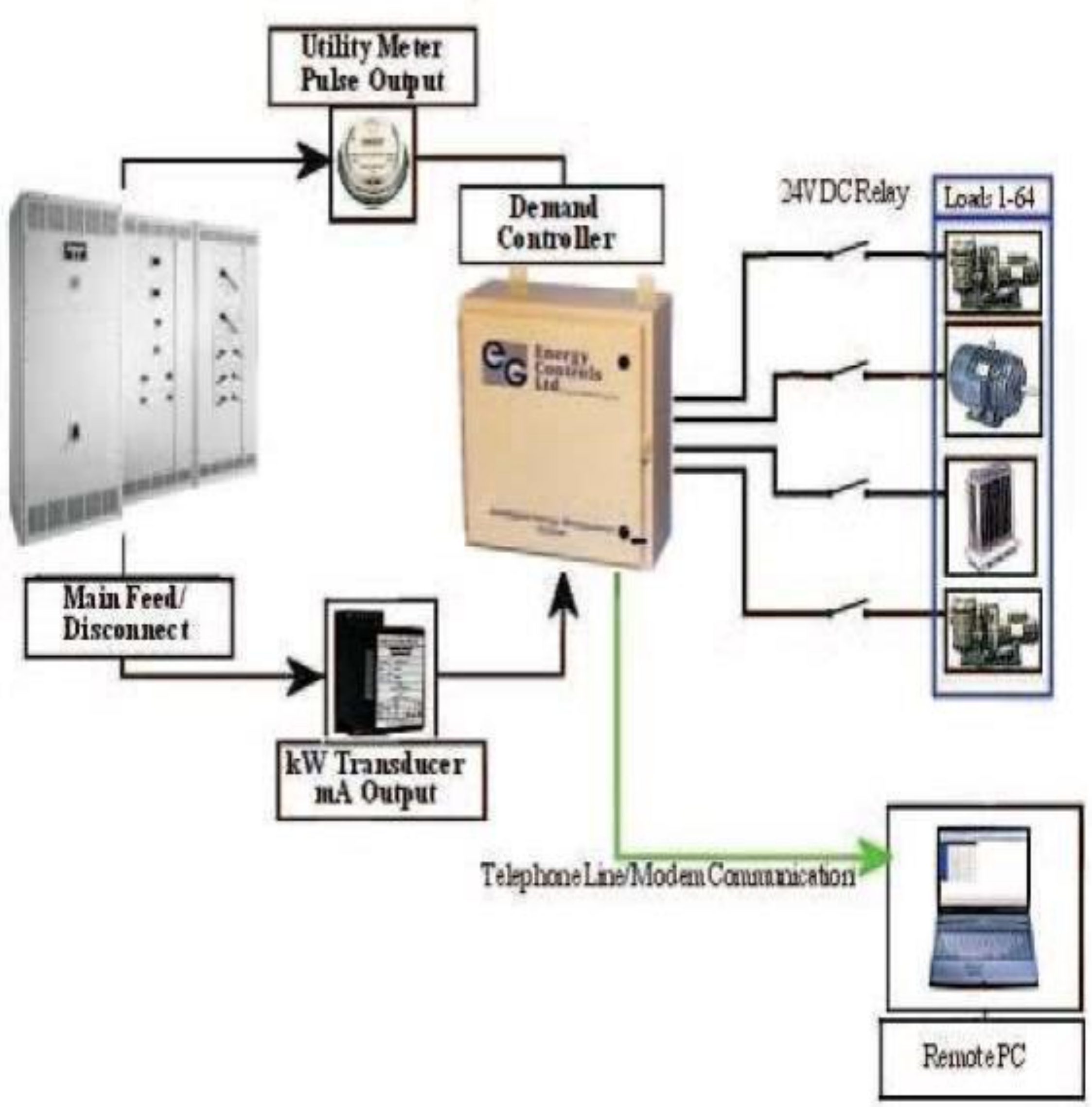
ENERGY SAVING LAMPS.

- CFL Lighting- Efficient, Less Expensive, Reduces Air and Water Pollution, High-Quality Light, Versatile.

- LED Lighting- Long-lasting, durable, cost-effective, more efficient.

Maximum Demand Controller

High-tension (HT) consumers have to pay a maximum demand charge in addition to the usual charge for the number of units consumed. The maximum demand charge often represents a large proportion of the total bill and may be based on only one isolated 30 minute episode of high power use. Considerable savings can be realized by monitoring power use and turning off or reducing non-essential loads during such periods of high power use.



Maximum Demand Controller

Maximum Demand Controller is a device design to meet the need of industries conscious of the value of load management. Alarm is sounded when demand approaches a preset value. If corrective action is not taken, the controller switches off non-essential loads in a logical sequence. This sequence is predetermined by the user and is programmed jointly by the user and the supplier of the device. The plant equipments selected for the load management are stopped and restarted as per the desired load profile.

Energy Efficient Motors

- Minimising Watts Loss in Motors Improvements in motor efficiency can be achieved without compromising motor performance - at higher cost - within the limits of existing design and manufacturing technology. Any improvement in motor efficiency must result from reducing the Watts losses. All of these changes to reduce motor losses are possible with existing motor design and manufacturing technology. They would, however, require additional materials and/or the use of higher quality materials and improved manufacturing processes resulting in increased motor cost.

- Simply Stated: REDUCED LOSSES = IMPROVED EFFICIENCY

Energy Efficient Transformers

- Most energy loss in dry-type transformers occurs through heat or vibration from the core. The new high-efficiency transformers minimise these losses. The conventional transformer is made up of a silicon alloyed iron (grain oriented) core. The iron loss of any transformer depends on the type of core used in the transformer. However the latest technology is to use amorphous material - a metallic glass alloy for the core with unique physical and magnetic properties- these new type of transformers have increased efficiencies even at low loads – 98.5% efficiency at 35% load.

- 1600 kVA Amorphous Core Transformer.

Electronic Ballast

- In an electric circuit the ballast acts as a stabilizer. The high frequency electronic ballast has following basic functions :-

1. To ignite the lamp 2. To stabilize the gas discharge 3. To supply the power to the lamp.

- One of largest advantages of an electronic ballast is the enormous energy savings it provides. First is its amazingly low internal core loss, quite unlike old fashioned magnetic ballasts. And second is increased light output due to the excitation of the lamp phosphors with high frequency. If the period of frequency of excitation is smaller than the light retention time constant for the gas in the lamp, the gas will stay ionized and, therefore, produce light continuously. This phenomenon along with continued persistence of the phosphors at high frequency will improve light output from 8–12 percent. This is possible only with high frequency electronic ballast

SOFT STARTER

- When starting, AC Induction motor develops more torque than is required at full speed. Rapid acceleration also has a massive impact on electricity supply charges with high inrush currents drawing +600% of the normal run current.

- Soft starter provides a reliable and economical solution to these problems by delivering a controlled release of power to the motor, thereby providing smooth, stepless acceleration and deceleration.

- Motor life will be extended as damage to windings and bearings is reduced.

Automatic Power Factor Controllers

- Various types of automatic power factor controls are available with relay/microprocessor logic. Ex-Voltage Control and kVAr Control.
- Voltage Control- Voltage alone can be used as a source of intelligence when the switched capacitors are applied at point where the circuit voltage decreases as circuit load increases.
- Generally, where they are applied the voltage should decrease as circuit load increases and the drop in voltage should be around 4–5 % with increasing load. Voltage is the most common type of intelligence used in substation applications, when maintaining a particular voltage is of prime importance.
- This type of control is independent of load cycle. During light load time and low source voltage, this may give leading PF at the sub-station, which is to be taken note of.

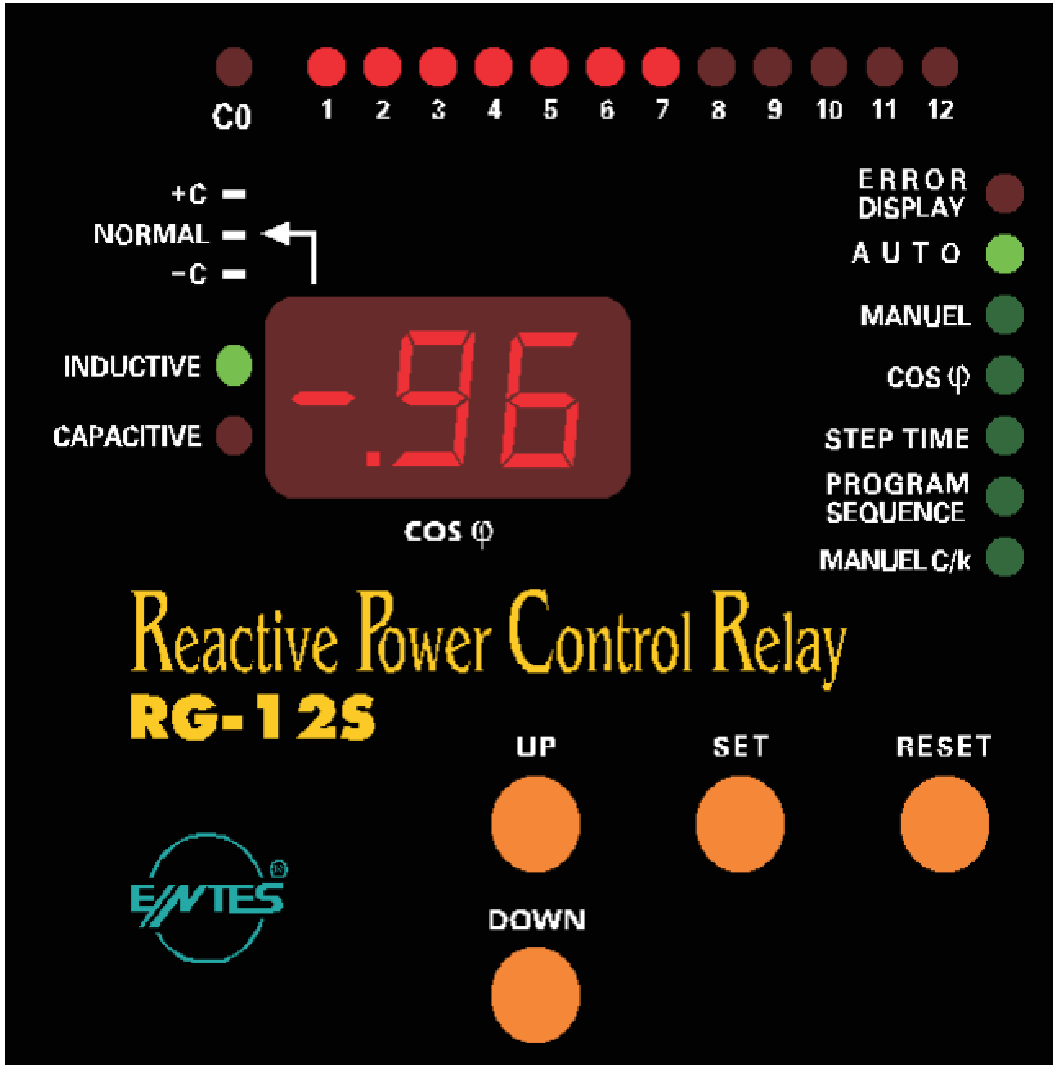
KILOVAR Control

- Kilovar sensitive controls are used at locations where the voltage level is closely regulated and not available as a control variable.

- The capacitors can be switched to respond to a decreasing power factor as a result of change in system loading.

- This type of control can also be used to avoid penalty on low power factor by adding capacitors in steps as the system power factor begins to lag behind the desired value.

- Kilovar control requires two inputs - current and voltage from the incoming feeder, which are fed to the PF correction mechanism, either the microprocessor or the relay.



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