

TIPS FOR ENERGY SAVING IN COOLING TOWER

- * Follow manufacturer's recommended clearances around cooling towers and relocate or modify structures that interfere with the air intake or exhaust.
 - * Optimise cooling tower fan blade angle on a seasonal and/or load basis.
 - * Correct excessive and/or uneven fan blade tip clearance and poor fan balance.
 - * On old counter-flow cooling towers, replace old spray type nozzles with new square spray ABS practically non-clogging nozzles.
 - * Replace splash bars with self-extinguishing PVC cellular film fill.
 - * Install new nozzles to obtain a more uniform water pattern.
 - * Periodically clean plugged cooling tower distribution nozzles.
 - * Balance flow to cooling tower hot water basins.
 - * Cover hot water basins to minimize algae growth that contributed to fouling.
 - * Optimise blow down flow rate, as per COC limit.
 - * Replace slat type drift eliminators with low pressure drop, self extinguishing, PVC
 - * Restrict flows through large loads to designs values.
 - * Segregate high heat loads like furnaces, air compressors, DG sets, and isolate cooling towers for sensitive applications like A/C plants, condensers of captive power plant etc. A 1°C cooling water temperature increase may increase A/C compressor kW by 2.7%. A 1°C drop in cooling water temperature can give a heat rate saving of 5 kCal/kWh in a thermal power plant.
 - * Monitor L/G ratio, CW flow rates w.r.t. design as well as seasonal variations. It would
 - * Monitor approach, effectiveness and cooling capacity for continuous optimization
 - * Consider COC improvement measures for water savings.
 - * Consider energy efficient FRP blade adoption for fan energy savings.
 - * Consider possible improvements on CW pumps w.r.t. efficiency improvement.
 - * Control cooling tower fans based on leaving water temperatures especially in case of small units.
 - * Optimise process CW flow requirements, to save on pumping energy, cooling load, evaporation losses (directly proportional to circulation rate) and blow down losses.
-
-

TIPS FOR ENERGY CONSERVATION IN PUMPS

- * Ensure adequate NPSH at site of installation
 - * Ensure availability of basic instruments at pumps like pressure gauges, flow meters.
 - * Operate pumps near best efficiency point.
 - * Modify pumping system and pumps losses to minimize throttling.
 - * Adapt to wide load variation with variable speed drives or sequenced control of multiple units.
 - * Stop running multiple pumps - add an auto-start for an on-line spare or add a booster pump in the problem area.
 - * Use booster pumps for small loads requiring higher pressures.
 - * Increase fluid temperature differentials to reduce pumping rates in case of heat exchangers.
 - * Repair seals and packing to minimize water loss by dripping.
 - * Balance the system to minimize flows and reduce pump power requirements.
 - * Avoid pumping head with a free-fall return (gravity); Use siphon effect to advantage:
 - * Conduct water balance to minimise water consumption.
 - * Avoid cooling water re-circulation in DG sets, air compressors, refrigeration systems, cooling towers feed water pumps, condenser pumps and process pumps.
 - * In multiple pump operations, carefully combine the operation of pumps to avoid throttling
 - * Provide booster pump for few areas of higher head
 - * Replace old pumps by energy efficient pumps
 - * In the case of over designed pump, provide variable speed drive, or downsize / replace impeller or replace with correct sized pump for efficient operation.
 - * Optimise number of stages in multi-stage pump in case of head margins.
 - * Reduce system resistance by pressure drop assessment and pipe size optimisation
-
-

TIPS FOR ENERGY SAVING IN COMPRESSED AIR SYSTEMS

- * Ensure air intake to compressor is not warm and humid by locating compressors in well-ventilated area or by drawing cold air from outside. Every 40C rise in air inlet temperature will increase power consumption by 1 percent.
- * Clean air-inlet filters regularly. Compressor efficiency will be reduced by 2 percent for every 250 mm WC pressure drop across the filter.
- * Keep compressor valves in good condition by removing and inspecting once every six months. Worn-out valves can reduce compressor efficiency by as much as 50 percent.
- * Install manometers across the filter and monitor the pressure drop as a guide to replacement of element.
- * Minimize low-load compressor operation; if air demand is less than 50 percent of compressor capacity, consider change over to a smaller compressor or reduce compressor speed appropriately (by reducing motor pulley size) in case of belt driven compressors.
- * Consider the use of regenerative air dryers, which uses the heat of compressed air to remove moisture.
- * Fouled inter-coolers reduce compressor efficiency and cause more water condensation in air receivers and distribution lines resulting in increased corrosion. Periodic cleaning of inter-coolers must be ensured.
- * Compressor free air delivery test (FAD) must be done periodically to check the present operating capacity against its design capacity and corrective steps must be taken if required.
- * If more than one compressor is feeding to a common header, compressors must be operated in such a way that only one small compressor should handle the load variations whereas other compressors will operate at full load.
- * The possibility of heat recovery from hot compressed air to generate hot air or water for process application must be economically analyzed in case of large compressors.
- * Consideration should be given to two-stage or multistage compressor as it consumes less power for the same air output than a single stage compressor.
- * If pressure requirements for processes are widely different (e.g. 3 bar to 7 bar), it is advisable to have two separate compressed air systems.
- * Reduce compressor delivery pressure, wherever possible, to save energy.
- * Provide extra air receivers at points of high cyclic-air demand which permits operation without extra compressor capacity.
- * Retrofit with variable speed drives in big compressors, say over 100 kW, to eliminate the 'unloaded' running condition altogether.
- * Keep the minimum possible range between load and unload pressure settings.
- * Automatic timer controlled drain traps wastes compressed air every time the valve opens. So frequency of drainage should be optimized.

- * Check air compressor logs regularly for abnormal readings, especially motor current cooling water flow and temperature, inter-stage and discharge pressures and temperatures and compressor load-cycle.
- * Compressed air leakage of 40- 50 percent is not uncommon. Carry out periodic leak tests to estimate the quantity of leakage.

- * Install equipment interlocked solenoid cut-off valves in the air system so that air supply to a machine can be switched off when not in use.
- * Present energy prices justify liberal designs of pipeline sizes to reduce pressure drops.
- * Compressed air piping layout should be made preferably as a ring main to provide desired pressures for all users.
- * A smaller dedicated compressor can be installed at load point, located far off from the central compressor house, instead of supplying air through lengthy pipelines.
- * All pneumatic equipment should be properly lubricated, which will reduce friction, prevent wear of seals and other rubber parts thus preventing energy wastage due to excessive air consumption or leakage.
- * Misuse of compressed air such as for body cleaning, agitation, general floor cleaning, and other similar applications must be discouraged in order to save compressed air and energy.
- * Pneumatic equipment should not be operated above the recommended operating pressure as this not only wastes energy but can also lead to excessive wear of equipment's components which leads to further energy wastage.
- * Pneumatic transport can be replaced by mechanical system as the former consumed about 8 times more energy. Highest possibility of energy savings is by reducing compressed air use.
- * Pneumatic tools such as drill and grinders consume about 20 times more energy than motor driven tools. Hence they have to be used efficiently. Wherever possible, they should be replaced with electrically operated tools.
- * Where possible welding is a good practice and should be preferred over threaded connections.
- * On account of high pressure drop, ball or plug or gate valves are preferable over globe valves in compressed air lines.

ENERGY SAVING TIPS FOR LIGHTING

Installation of energy efficient fluorescent lamps in place of “Conventional” fluorescent lamps.

Energy efficient lamps are based on the highly sophisticated tri-phosphor fluorescent powder technology. They offer excellent colour rendering properties in addition to the very high luminous efficacy.

Installation of Compact Fluorescent Lamps (CFL's) in place of incandescent lamps.

Compact fluorescent lamps are generally considered best for replacement of lower wattage incandescent lamps. These lamps have efficacy ranging from 55 to 65 lumens/Watt. The average rated lamp life is 10,000 hours, which is 10 times longer than that of a normal incandescent lamps. CFL's are highly suitable for places such as Living rooms, Hotel lounges, Bars, Restaurants, Pathways, Building entrances, Corridors, etc.

Installation of metal halide lamps in place of mercury / sodium vapour lamps.

Metal halide lamps provide high color rendering index when compared with mercury & sodium vapour lamps. These lamps offer efficient white light. Hence, metal halide is the choice for colour critical applications where, higher illumination levels are required. These lamps are highly suitable for applications such as assembly line, inspection areas, painting shops, etc. It is recommended to install metal halide lamps where colour rendering is more critical.

Installation of High Pressure Sodium Vapour (HPSV) lamps for applications where colour rendering is not critical.

High pressure sodium vapour (HPSV) lamps offer more efficacy. But the colour rendering property of HPSV is very low. Hence, it is recommended to install HPSV lamps for applications such street lighting, yard lighting, etc.

Installation of LED panel indicator lamps in place of filament lamps.

Panel indicator lamps are used widely in industries for monitoring, fault indication, signaling, etc. Conventionally filament lamps are used for the purpose, which has got the following disadvantages:

- * High energy consumption (15 W/lamp)
- * Failure of lamps is high (Operating life less than 10,000 hours)
- * Very sensitive to the voltage fluctuations Recently, the conventional filament lamps are being replaced with Light Emitting Diodes (LEDs).

The LEDs have the following merits over the filament lamps.

- * Lesser power consumption (Less than 1 W/lamp)
- * Withstand high voltage fluctuation in the power supply.
- * Longer operating life (more than 1,00,000 hours)

It is recommended to install LEDs for panel indicator lamps at the design stage.

Light distribution

Energy efficiency cannot be obtained by mere selection of more efficient lamps alone. Efficient luminaires along with the lamp of high efficacy achieve the optimum efficiency. Mirror-optic luminaires with a high output ratio and bat-wing light distribution can save energy.

For achieving better efficiency, luminaires that are having light distribution characteristics appropriate for the task interior should be selected. The luminaires fitted with a lamp should ensure that discomfort glare and veiling reflections are minimised. Installation of suitable luminaires, depends upon the height - Low, Medium & High Bay. Luminaires for high intensity discharge lamp are classified as follows:

- * Low bay, for heights less than 5 metres.
- * Medium bay, for heights between 5 - 7 metres.
- * High bay, for heights greater than 7 metres.

System layout and fixing of the luminaires play a major role in achieving energy efficiency. This also varies from application to application. Hence, fixing the luminaires at optimum height and usage of mirror optic luminaries leads to energy efficiency.

Light Control

The simplest and the most widely used form of controlling a lighting installation is "On-Off" switch. The initial investment for this set up is extremely low, but the resulting operational costs may be high. This does not provide the flexibility to control the lighting, where it is not required.

Hence, a flexible lighting system has to be provided, which will offer switch-off or reduction in lighting level, when not needed. The following light control systems can be adopted at design stage:

*** Grouping of lighting system, to provide greater flexibility in lighting control**

Grouping of lighting system, which can be controlled manually or by timer control.

*** Installation of microprocessor based controllers**

Another modern method is usage of microprocessor / infrared controlled dimming or switching circuits. The lighting control can be obtained by using logic units located in the ceiling, which can take pre-programme commands and activate specified lighting circuits. Advanced lighting control system uses movement detectors or lighting sensors, to feed signals to the controllers.

*** Optimum usage of daylighting**

Whenever the orientation of a building permits, day lighting can be used in combination with electric lighting. This should not introduce glare or a severe imbalance of brightness in visual environment. Usage of day lighting (in offices/air conditioned halls) will have to be very limited, because the air conditioning load will increase on account of the increased solar heat dissipation into the area. In many cases, a switching method, to enable reduction of electric light in the window zones during certain hours, has to be designed.

*** Installation of "exclusive" transformer for lighting**

In most of the industries, lighting load varies between 2 to 10%. Most of the problems faced by the lighting equipment and the "gears" is due to the "voltage" fluctuations. Hence, the lighting equipment has to be isolated from the power feeders. This provides a better voltage regulation for the lighting. This will reduce the voltage related problems, which in turn increases the efficiency of the lighting system.

*** Installation of servo stabilizer for lighting feeder**

Wherever, installation of exclusive transformer for lighting is not economically attractive, servo stabilizer can be installed for the lighting feeders. This will provide stabilized voltage for the lighting equipment. The performance of "gears" such as chokes, ballasts, will also improved due to the stabilized voltage.

This set up also provides, the option to optimise the voltage level fed to the lighting feeder. In many plants, during the non-peaking hours, the voltage levels are on the higher side. During this period, voltage can be optimised, without any significant drop in the illumination level.

*** Installation of high frequency (HF) electronic ballasts in place of conventional ballasts**

New high frequency (28-32 kHz) electronic ballasts have the following advantages over the traditional magnetic ballasts:

- * Energy savings up to 35%
- * Less heat dissipation, which reduces the air conditioning load
- * Lights instantly
- * Improved power factor
- * Operates in low voltage load
- * Less in weight
- * Increases the life of lamp

The advantage of HF electronic ballasts, out weigh the initial investment (higher costs when compared with conventional ballast). In the past the failure rate of electronic ballast in Indian Industries was high. Recently, many manufacturers have improved the design of the ballast leading to drastic improvement in their reliability. The life of the electronic ballast is high especially when, used in a lighting circuit fitted with a automatic voltage stabiliser