



Confederation of Indian Industry

Dossier on Energy Saving Measures



All the measures suggested in this Dossier need to be fine tuned to suit the site conditions and needs of the individual homes, buildings and plants, before taking up for implementation.

Message from CII

Dear Friend,

At the outset, we at CII take this opportunity to thank you for being part of the 'Mission Energy Campaign'. This is a clear testimony that you and your organisation is committed to make a difference to Planet Earth.

As a token of our appreciation, we are pleased to share this Dossier on some of the Energy Saving Measures. We hope this Dossier will facilitate in further enhancing energy efficiency/ improvements in your organisation.

We at CII would be glad to assist you in addressing issues related to energy efficiency and management.

We wish you all the very best in all your pursuits & endeavors.

Together we will make the difference.

S Raghupathy
Executive Director
CII-Godrej GBC

Energy Saving Measures

Applicable for

- Homes
 - Manufacturing facilities
- Commercial establishments
 - Educational institutions

Lighting



- ❖ Switch to LED lighting from conventional sources to enhance energy efficiency. This also reduces the life cycle impact as LED doesn't contain mercury.
- ❖ Install lighting transformers and maintain voltage at 210-220V for lighting applications.
- ❖ Install light pipes for harvesting daylight and avoid artificial lighting during day time.
- ❖ Install occupancy sensors/lux level sensors.
- ❖ Replace the street lights (HPMV/HPSV) with solar powered LEDs.
- ❖ Optimize the operation of street lights with timer controls/lux level sensors.
- ❖ Optimize the operation of lighting in rooms with door interlock/entrance switch.
- ❖ Install neutral Compensator in lighting circuit.

Air Conditioners



- ❖ Use ceiling or table fan as first line of defense against summer heat.
- ❖ Prefer BEE 4 star/5 star rated appliances as they offer a significant reduction in energy consumption
- ❖ 3 to 5% less energy is used for each degree of air conditioner set above 22°C (71.5°F). So set the thermostat of room air conditioner at 25°C (77°F) to provide the required comfort at the least cost.
- ❖ You can reduce air-conditioning energy use by as much as 40 percent by shading your home's windows and walls. Plant trees and shrubs to keep the day's hottest sun off your house.
- ❖ A good air conditioner will cool and dehumidify a room in about 30 minutes, so use a timer and leave the unit off for some time.
- ❖ Keep doors to air-conditioned rooms closed as often as possible.
- ❖ Clean the air-conditioner filter every month. A dirty air filter reduces airflow and may damage the unit. Clean filters enable the unit to cool down quickly and use less energy.
- ❖ If room air conditioner is older and needs repair, it's likely to be very inefficient. Replace it with a new energy-efficient air conditioner.
- ❖ During the summer season, keep the window coverings closed during the day to prevent solar gain.

Refrigerators



- ❖ Use BEE 5 star rated refrigerator to reduce energy consumption.
- ❖ Make sure that refrigerator is kept away from all sources of heat, including direct sunlight, radiators and appliances such as the oven, and cooking range.
- ❖ Set temperatures at optimal level :
 - Food compartment between 3° and 5° C
 - Freezer between -17° and -15° C
- ❖ Refrigerator motors and compressors generate heat, so allow enough space for continuous airflow around refrigerator. If the heat can't escape, the refrigerator's cooling system will work harder and use more energy.
- ❖ A full refrigerator is a fine thing, but be sure to allow adequate air circulation inside.
- ❖ Think about what you need before opening refrigerator door. You'll reduce the amount of time the door remains open.
- ❖ Allow hot and warm foods to cool and cover them well before putting them in refrigerator. Refrigerator will use less energy and condensation will reduce.
- ❖ Make sure that refrigerator's rubber door seals are clean and tight. They should hold a slip of paper snugly. If paper slips out easily, replace the door seals.
- ❖ When dust builds up on refrigerator's condenser coils, the motor works harder and uses more electricity. Clean the coils regularly to make sure that air can circulate freely.
- ❖ For manual defrost refrigerator, accumulation of ice reduces the cooling power by acting as unwanted insulation. Defrost freezer compartment regularly for a manual defrost refrigerator

Renewable Energy

- ❖ Installation of solar hot water system for meeting hot water requirements
- ❖ Biomass Gasifier System for Power Generation
- ❖ Solar PV Water Pumping for Industrial Process Applications
- ❖ Solar Water Heating System for Pre-heating Boiler Feed Water
- ❖ Biogas Generation from Canteen/kitchen Wastes for Cooking Applications
- ❖ Biomass Gasifier for Industrial Thermal Applications
- ❖ Installation of solar parabolic concentrating collectors and generating chilled water



Miscellaneous Energy Saving Tips:

- ❖ Check for holes or cracks around your walls, ceilings, windows, doors, light and plumbing fixtures, switches, and electrical outlets that can leak air into or out of your home
- ❖ Make sure your appliances and heating and cooling systems are properly maintained. Check your owner's manuals for the recommended maintenance
- ❖ Turn off kitchen, bath, and other exhaust fans within 20 minutes after you are done cooking or bathing; when replacing exhaust fans, consider installing high efficiency, low-noise models.
- ❖ To maximize savings with a laptop, put the AC adapter on a power strip that can be turned off (or will turn off automatically); the transformer in the AC adapter draws power continuously, even when the laptop is not plugged into the adapter.
- ❖ Turn off your computer and monitor when not in use.
- ❖ Wash only full loads of dishes and clothes

Energy Saving Measures

Applicable for

- Manufacturing facilities
- Commercial establishments
- Educational institutions

Electrical Systems

Electrical Distribution System & Transformers

- ❖ Install maximum demand controller to optimize maximum demand.
- ❖ Install automatic power factor controllers and maintain high PF.
- ❖ Avoid unbalance in Voltage- by proper distribution of load at the transformer secondary.
- ❖ Minimize overall distribution losses, by proper cable sizing and addition of capacitor banks.
- ❖ Optimization of distribution Transformer losses by loading the transformer between (40 %-60 %).
- ❖ If two or more transformers exist, check for the possibilities of parallel operation based on optimal loading.
- ❖ Isolate the primary of idle transformer.
- ❖ Reduce the tap setting of Power/Distribution transformer to reduce the voltage and maintain optimal voltage around 415 V.
- ❖ Install on-load tap changer (OLTC) for the main transformer and optimize the voltage.
- ❖ Improve the Power factor of transformer.
- ❖ Install energy efficient amorphous transformer for new installations.
- ❖ Increase the radiators size of Power transformer.



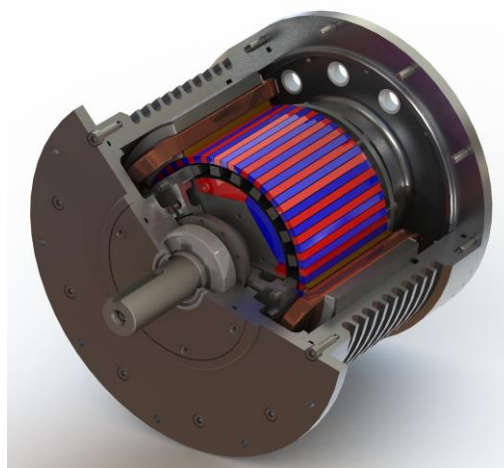
Variable Speed Drives

- ❖ Install VFDs for variable speed applications
- ❖ Replace eddy current drive with VFD for equipment speed control
- ❖ Use VFD for low / partial loads
- ❖ Install harmonic filters to reduce Total Harmonics Distortion and to compensate for the harmonics generated due to non-linear loads like VFD



Motors

- ❖ Replace old inefficient motors with energy efficient motors (IE2/IE3).
- ❖ Change the electrical connection from delta to star for lightly loaded Motors continuously loaded less than 40%.
- ❖ Install Auto-star-delta-star converters for variable and loads ranging from 30-60% loading.
- ❖ Install capacitor banks to improve power factor at the motor end.
- ❖ Replace the old rewind motors with Energy Efficient motors.
- ❖ Replace V-belts with synthetic flat belts/Cogged 'V' belts.
- ❖ Install Soft Starter cum Energy saver for lightly loaded motors.



Air Compressors

- ❖ Replacement of inefficient compressors with the high energy efficiency compressors
- ❖ Ensure air compressors are loaded to a level of 90%
- ❖ Set compressor delivery pressure as low as possible to deliver as per user requirement. The power reduction in air compressors can be achieved by operating the air compressor pressure close to the end user required pressure
- ❖ Monitor pressure drop across suction filter and after filter
- ❖ Segregate high pressure and low pressure users to avoid unnecessary energy usage in compressing air for low pressure users
- ❖ Complete overhauling of the reciprocating compressor / cylinder boring (this reduces the SEC by at least 0.03 kW/cfm)
- ❖ Minimize the pressure drop between the generation point & farthest end user point (Maintain $< 0.2 \text{ kg/cm}^2$ for 1.5 km distance line)
- ❖ Interconnect the compressors to avoid unloading
- ❖ Replace compressed air with blowers for aeration application
- ❖ Install blowers/ transvector nozzles for cleaning application
- ❖ Avoid cooling water flow in idle compressors
- ❖ Optimize the pressure drop across the oil filters / refrigerant dryer ($< 0.2 \text{ kg/cm}^2$)
- ❖ Replacement of purging type desiccant dryer or heated type desiccant dryer with heat of compression (HOC) dryer reduces the power consumption of the air dryer, because the HOC dryer does not require any power for its operation. (capacities above 500 cfm)
- ❖ Continuous monitoring minimizes the compressed air leakages. By following the red tag system reduces the percentage air leakage.
- ❖ Installation of cogged flat belt drives in place of conventional V- belt drives to reduce transmission losses
- ❖ Install auto drain valves and avoid venting of compressed air into the atmosphere



- ❖ Optimize the pressure band width by installing VFD to the compressors
- ❖ Installation of turbo blowers in place of LP compressors
- ❖ Possibility of installing centrifugal compressor in place of present reciprocating / screw compressors (SEC of centrifugal is lower than any other compressors, these are available from 2000 cfm onwards)
- ❖ Install intermediate controllers which create useful storage and isolates compressors from demand side peaks & troughs to provide a stable air supply at optimum pressure. Thus energy is saved through reduction in mass of air & reduction in load period of Compressors.

DG System

- ❖ Ensure loading on DG set is optimal (maximum 90%)
- ❖ Increase engine jacket temperature (max. 85°C) or as per engine specification
- ❖ Take turbocharger air inlet from outside engine room
- ❖ Replace multiple small size DG sets with bigger DG sets
- ❖ Use cheaper fuel for high capacity DG sets



Pumps

- ❖ Get a pump audit done. This is the ideal way to find out whether your pump systems are functioning efficiently. For pumps operating for more than 4000 hours in a year, the pump audit shall be mandatory to explore optimizing of energy used for pumps. A Pump Audit leading to the right sizing of the pumping system is the right way to conserve energy, reduce CO₂ emissions and save money.
- ❖ Avoid low flow or extreme flow of the pump as the absorbed power will either way increase up to 30-40% of full load power.
- ❖ Avoid impeller trimming (in case of cast iron or bronze impellers) which damage vane angle affecting the pump efficiency; Install the right pump to suit the site conditions.
- ❖ Avoid discharge throttling to increase artificial head at site as this lead to power wastage.
- ❖ Suction throttling need to be avoided which result in cavitation thereby energy loss.
- ❖ Ensure adequate pump suction submergence to avoid air entrapment (Result: low flow – usage of more power).
- ❖ Install multiple pumps with VFDs for fluctuating loads over longer period. Purpose designed pumps with inbuilt VFDs and controllers are extremely energy efficient with seamless sharing of loads and optimize the power usage.
- ❖ Use of efficient sensors and pump controllers which adjust the speed by on-line sensing of the flow and actual frictional losses at a given moment in the pipe-lines.
- ❖ Coating of Hydraulic passages in the pump casing
- ❖ Segregate high head and low head users and install booster pumps for high head users



Pumps, cooling towers and chilled water systems

- ❖ Explore the option of evaporative cooling by integrating the condenser with the cooling tower to achieve more efficient cooling
- ❖ Interlocking the cooling tower fan operation with return water temperature
- ❖ Optimization of range and approach
- ❖ Monitor the blow-down quantity of water in cooling towers and the quality of water. Blow down water may be taken from return water header and sent to other uses or to the sewer to reduce effluent treatment load.
- ❖ Install temperature indicator control (TIC) for cooling tower fans
- ❖ Replace aluminium blades with FRP blades at all cooling tower fans
- ❖ Convert the 2-well system to a single well system in the chilled water system, where ever possible
- ❖ Improve the insulation levels of the chilled water distribution system
- ❖ Optimize the operation of Chilled Water Pumps In Vapor Absorption Machine based on the head/capacity requirements of the system



Boilers and steam systems

- ❖ Control excess air and avoid air ingress by maintaining recommended oxygen percentage at flue gas stack. (Coal – 4 to 5% O₂, Natural Gas/Methane based fuel – 2 to 3% O₂, Biomass – 3 to 4% O₂). Improve combustion efficiency of boilers by optimizing the combustion air supply,
- ❖ Monitor boiler blow down; use Chemical additives to correct the problems caused by boiler feed water which often contains impurities, which impairs boiler operation and efficiency
- ❖ Improving insulation in the pipelines and boiler
- ❖ Steam consumption can be reduced by making sure that the scales are removed.
- ❖ Recovering heat from flue gas to economizers and air-pre heaters
- ❖ Replacing inefficient burners by new efficient boilers
- ❖ Plug steam leakages, however small they may be
- ❖ Always avoid steam pressure reduction through PRVs. Instead, pass the steam through turbine so as to improve cogeneration
- ❖ Insulate all steam and condensate lines maintaining optimal skin temperatures. Regularly improving and maintain insulation to avoid heat loss.
- ❖ Monitor and replace defective steam traps on a regular basis. Monitoring steam traps automatically.
- ❖ In case coal has higher percentage of fines, ensure wetting is done
- ❖ Recovering flash steam and condensate.
- ❖ To enhance the efficiency of combustion the oil needs to be preheated to about 105° to 110°C at the burner tip.
- ❖ It is a more fuel efficient option to have parallel fuel oil pumps of smaller capacity than one larger capacity pump to avoid unnecessary re-circulation of huge quantity of the fuel.



Fans

- ❖ Avoiding damper loss
- ❖ Removing damper for fans with VFD
- ❖ Avoiding false air entry in casing, inlet cone
- ❖ Install VFD or adopt on/ off type control for cooling tower, shell cooling fans
- ❖ Replacing mutlilouvre dampers with slide gates
- ❖ Reducing fan inlet duct pressure drop by reducing velocity across it.
- ❖ Optimization of the aeration of air slides



P.S. All the above measures suggested in this newsletter need to be fine tuned to suit the site conditions and needs of the individual homes, buildings and plants, before taking up for implementation.

About CII

The Confederation of Indian Industry (CII) works to create and sustain an environment conducive to the development of India, partnering industry, Government, and civil society, through advisory and consultative processes.

CII is a non-government, not-for-profit, industry-led and industry-managed organization, playing a proactive role in India's development process. Founded in 1895, India's premier business association has over 7100 members, from the private as well as public sectors, including SMEs and MNCs, and an indirect membership of over 90,000 enterprises from around 257 national and regional sectoral industry bodies.

CII charts change by working closely with Government on policy issues, interfacing with thought leaders, and enhancing efficiency, competitiveness and business opportunities for industry through a range of specialized services and strategic global linkages. It also provides a platform for consensus-building and networking on key issues.

Extending its agenda beyond business, CII assists industry to identify and execute corporate citizenship programmes. Partnerships with civil society organizations carry forward corporate initiatives for integrated and inclusive development across diverse domains including affirmative action, healthcare, education, livelihood, diversity management, skill development, empowerment of women, and water, to name a few.

The CII Theme for 2013-14 is **Accelerating Economic Growth through Innovation, Transformation, Inclusion and Governance**. Towards this, CII advocacy will accord top priority to stepping up the growth trajectory of the nation, while retaining a strong focus on accountability, transparency and measurement in the corporate and social eco-system, building a knowledge economy, and broad-basing development to help deliver the fruits of progress to all.

CII - Sohrabji Godrej Green Business Centre (CII - Godrej GBC) is one of the 10 Centres of Excellences of the Confederation of Indian Industry (CII). CII-Sohrabji Godrej Green Business Centre offers advisory services to the industry in the areas of Green buildings, energy efficiency, water management, environmental management, renewable energy, Green business incubation and climate change activities.

The Centre sensitises key stakeholders to embrace Green practices and facilitates market transformation, paving way for India to become one of the global leaders in Green businesses

For any further queries/clarifications, please contact:

Mr S Raghupathy
Confederation of Indian Industry
CII-Sohrabji Godrej Green Business Centre
Survey no: 64, Kothaguda Post, near HITEC City
Hyderabad: 500084, Andhra Pradesh, India
encon@cii.in