iJRASET
International Journal For Research in Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 10 **Issue:** XII **Month of publication:** December 2022

DOI: https://doi.org/10.22214/ijraset.2022.47917

www.ijraset.com

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International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 10 Issue XII Dec 2022- Available at www.ijraset.com

Energy Conservation Techniques for Manufacturing Industries

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ARMIET Collage, Thane

I. INTRODUCTION

In today's world, energy is not only the future — it drives everything in the present. As a global society, we generate and use more energy than ever before, and the demand for energy is continually increasing. While we have been able to expand energy production to keep up with demand, there are physical, geographical, and economic limits to how much can be produced.

What's more, greenhouse gas emissions that accompany many forms of energy generation (such as using fossil fuels for electricity) are accumulating in the atmosphere, bringing the potential for climate-related consequences. This is especially true for fossil fuels, including natural gas.

Energy conservation has become a global phenomenon these days and you will know the significance it has acquired because we as a nation have a separate day dedicated to remind everyone how important it is to save energy. What we are talking about is the World Energy Conservation Day which is celebrated every year on the 14th of December.

A. Objective

Definition: Energy conservation is the practice of the decreasing the quantity of energy used for the same quality and quantity output. It may be achieved through efficient energy use, in which case energy used is decreased while achieving a similar outcome, or by reduce consumption of energy services.

In any industry the 3 top operating cost are often found to be energy (both electrical and thermal), Labour and material. Among three, energy has the highest potential for cost reduction.

1) To achieve and maintain optimum energy procurement and utilization throughout the organization.
2) To minimize energy costs/ waste without effecting the production and Quality.
3) To minimize the environmental effect.

B. What is Energy Conservation

Energy conservation means reducing the consumption of energy by producing or using less of it. This could be in the form of using fewer energy services or using devices that require less energy. Refraining from using services or products is one way to conserve energy, but this can also be done by using more energy efficient products designed to consume less energy than their standard counterparts. Energy conservation is a big part of sustainability and sustainable development.

II. LITERATURE SURVEY

Energy conservation means reduction in growth of energy consumption and is measured in physical terms. Energy conservation is the practice of decreasing the quantity of energy used while achieving a similar outcome of end use. (This practice may result in increase of financial capital, environmental value, national security, personal security and human comfort.) Energy conservation also means reduction or elimination of unnecessary energy used and wasted.

Fossil fuels like coal, oil that has taken years to form is on the verge of depleting soon. In last 200 years we have consumed 60% of all resources. For sustainable development we need to adopt energy efficiency measures. Today 85% of primary energy sources come from non-renewable and fossil sources. These reserves increasing consumption and will exist for future generations.

In these modern days humans' life are completely depends on the machines. The machine reduces human efforts and make the work fast and easy. The machine runs on external energy sources such as electrical, chemical, thermal etc. the Energy requirement is increases there are huge losses in the energy systems. In this paper we focused on the energy audits for conservation. A mix of new technologies and the existing ones can provide future references for saving energy. The process of energy management describes with an energy audit. With the help of these audits' society will be able to save lots of losses and reducing cost and increasing efficiency, then use energy conservation and audit.

The usage of energy resources in high amount in industry leads to environmental degradation by polluting the atmosphere. Examples of air pollution (SO2), (NOX) and (CO) emissions from boilers and furnaces, (CFC) emissions from refrigerants use, greenhouse effect etc.

The industrial sector uses about 50% of the total commercial energy available in India. Of the commercial sources of energy, coal, lignite, and oil and natural gas are mainly used. T

he Indian energy sector is highly energy intensive and efficiency is well below that of other industrialized countries.

Efforts are made on a regular basis to promote energy conservation in these countries as this will help reduce the cost of production.

There is considerable scope for improving energy efficiency in industries dealing with iron and steel, chemicals, cement, pulp and paper, fertilizers, textiles, etc. If such industries can promote energy conservation, it could lead to substantial reduction in their costs of production.

Energy management is very important as all well-planned actions can help reduce an organization's energy bills and minimize the damage it does to the environment.

The two main energy management strategies are conservation and efficiency. This requires the establishment of a system of collection, analysis, and reporting on the organization's energy consumption and costs.

In the industrial sector, the major consumers of energy are fertilizer, textile, sugar, cement, and steel. It has been estimated that the total conservation potential of this sector is around 25% of the total energy used by it.

Official website of the Bureau of Energy Efficiency, Govt. of India,[1] They are mentioned Tips for Energy conservation for Industries in Mechanical, Electrical, HVAC areas.

In 2009, Mrs. Nisha V Vader & Mrs. R U Patil -NATIONAL CONFERENCE ON RECENT TRENDS IN ENGINEERING & TECHNOLOGY [4] in this Paper we are refer Case study about the Thane Municipal Corporation-List of Energy conservation Techniques adopted.

In 2012, Rudra Narsimha Rao, presented paper on Energy Efficiency in Industrial sector.[16] in this paper we are refer Technology assessment studies on energy conservation as well Increased investment in energy efficiency.

In 2013, Vijaykumar Kulkarni, Pradip Katti, 'Policies and Strategies for the Improvement in Energy Efficiency in Industries Indian Experience' [15] they are attention towards the energy efficiency strategies for Indian Industries.

In 2015, Mallikarjun. Hudedmani & Vishwanath M. Soppimath, Paper on INDIAN ENERGY SCENARIO AND ENERGY CONSERVATION OPPORTUNITIES IN DIFFERENT SECTORS. [13] in this they are mentioned Energy conservation and opportunities in Domestic Sector, Industrial sector, Transport sector, commercial sector.

In 2017, Girish Sethi, TERI, Delhi, Seminar on Industrial Energy Efficiency, Workshop on SDG7: Affordable and Clean Energy. Organized by NITI Aayog, New Delhi [6] in this paper we are refer many opportunities in Buildings, Municipal, Agriculture and Transport sector.

In 2019, Mr. Kedar Laxman Gaikwad & Madhura Nithin Kolhapure- Case Study- Energy Conservation and Audit [5] in this paper we are refer why energy conservation is important and what are the benefits for energy conservation.

III. WHY ENERGY CONSERVATION IS IMPORTANT

1) Energy conservation result in increase of financial capital, environmental value, national security and human comfort.
2) Individual and organization that are direct consume of energy in order to reduce energy costs and promote economic security.
3) Industrial and commercial users may want to increases efficiency and thus maximum profit.
4) Energy conservation is also how we protect our ecosystem. Humans are exploiting nature in every way possible; climate change is impacting the whole world and, in this scenario, the silent sufferers are other species.
5) Fossil fuels like coal, oil that has taken years to form is on the verge of depleting soon. In last 200 years we have consumed 60% of all resources. For sustainable development we need to adopt energy efficiency measures. Today 85% of primary energy sources come from non-renewable and fossil sources. These reserves increasing consumption and will exist for future generations.
6) Energy survey conducted by Ministry of Power in 1992 reveled that there is requirement of improvement in energy generation efficiency, improvement in energy transportation (transmission & distribution systems) and enhancing the performance efficiency of use end apparatus.

   Study of 'Energy strategies for Future' evolved two things - efficient use of energy, energy conservation and use of Renewable Energy. Energy conservation emerges out to be the first and least cost option.

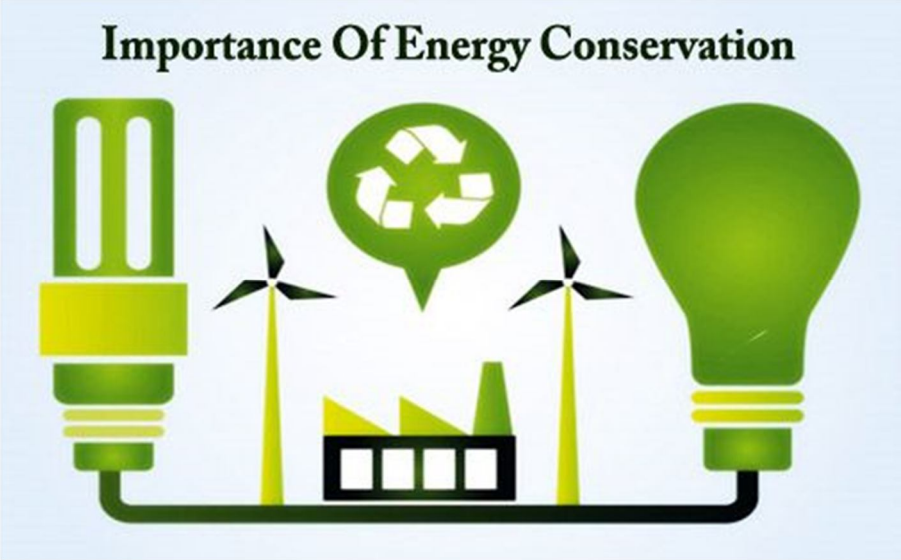

Fig:01

IV. WHAT ARE BENEFITS FOR ENERGY CONSERVATION

There are benefits that you will experience in the long run if today you contribute towards the cause of energy conservation. Given below are some points which will familiarize you with the benefits of saving energy:

1) We know that in the process of producing energy, a lot of harmful gasses are emitted which are harmful to humans if consumed. It leads to several breathing problems like asthma. So, by energy conservation, you will also be able to create a better living space for yourself. Therefore, enhancing your quality of life.

2) It will help us get back to the natural equilibrium. Climate change will be tackled and issues like global warming could be brought under control.

3) You can ensure by saving energy that your coming generations won't suffer in the lack of energy resources.

4) It will reduce your living expenses. It's true that the process of energy conservation could be expensive but once you are done with it, your average cost of energy consumption will be reduced.

Fig: 02

ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
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V. ENERGY SAVING IN DIFFERENT INDUSTRIAL AREAS

The industrial sector uses about 50% of the total commercial energy available in India. Of the commercial sources of energy, coal, lignite, and oil and natural gas are mainly used. The Indian energy sector is highly energy intensive and efficiency is well below that of other industrialized countries. Efforts are made on a regular basis to promote energy conservation in these countries as this will help reduce the cost of production.

There is considerable scope for improving energy efficiency in industries dealing with iron and steel, chemicals, cement, pulp and paper, fertilizers, textiles, etc. If such industries can promote energy conservation, it could lead to substantial reduction in their costs of production.

Energy management is very important as all well-planned actions can help reduce an organization's energy bills and minimize the damage it does to the environment. The two main energy management strategies are conservation and efficiency. This requires the establishment of a system of collection, analysis, and reporting on the organization's energy consumption and costs.

In the industrial sector, the major consumers of energy are fertilizer, textile, sugar, cement, and steel. It has been estimated that the total conservation potential of this sector is around 25% of the total energy used by it.

A. Electrical System

Tips for Electrical Energy saving:

1) Improve power factor by installing capacitor to reduce KVA demand charges and also line losses within plant.
2) Improvement of power factor from 0.85 to 0.96 will give 11.5% the reduction of peak KVA & 21.6% reduction in peak losses.
3) Avoid repeated winding of motors, observation show that rewound motors practically have an efficiency loss up to 5%, this is mainly due to increases no load losses.
4) Use variable frequency drives and fluid coupling for variable speed applications such as fans, pumps etc. helps in minimizing the consumptions.

a) Lighting:

Fig:03

A Lumen is the measurement of light output from lamp, often called a tube or bulb. All lamps are rated in lumens. For example, 100 w incandescent lamp produce about 1750 lumens. Another lighting terms is efficiency, which is the ratio of light output from a lamp to electric power it consumes and measured in LPW (lumens per watt) Energy saving Techniques in Lighting system:

- Use electronics ballast in place of conventional chock save energy up to 20%.
- Use LED/ CFL lamps instead of GFL lamps save energy up to 70%.
- Clean the lamps and fixture regularly, illumination levels falls by 20 to 30% due to collection of dust.
- Use of 36 W tube light instead of 40 W tube light saves the electricity by 08 to 10%
- Use of sodium vapor lamps for area lighting in place of mercury vapor lamps save electricity up to 40%
- LEDs use less power (watts) per unit of light generated (lumens)
- LEDs have a longer lifetime
- LEDs have less impact on the environment and human health
- LEDs are more robust
- LEDs offer greater cost savings
- Long Lifespan, Energy Efficiency, Improved, Environmental Performance, The Ability to Operate in Cold Conditions. No Heat or UV Emissions.

b) Electric Motors: The electric motors are used to provide the motive power to equipment such as compressor, pumps, blowers etc. It is important that industrial user define their need accurately to enable proper selection of a motor for particular applications. Of the total electricity consumes in the industrial sectors, electric motors account for approximately 70%.

- Motors should Energy efficient
- Convert delta to star connection for light loaded motors
- Install variable voltage frequency (VVVF) drives for speed control of motors.
- Install multi speed motors
- Optimize operating voltage level of motor for lightly loaded motors.
- Provide interlock for electric motors for idle running
- Avoid frequent rewinding of motors, greater the rewind the lesser the efficiency.

Advantage of Energy efficient motors:

- Reduce operating cost
- Less Heat losses
- Extended winding lifespan
- Lower waste heat output
- Longer insulation and bearing life's
- Optimized and uniform air gap between stator and rotor.
- Negligible maintenance, longer warranties, low failure rates.
- Voltage fluctuations in input supply side have less effect on energy efficient motor.
- They are having high acceleration and high retardation capabilities.
- They are having more length of core with higher quality and thinner steel laminations.

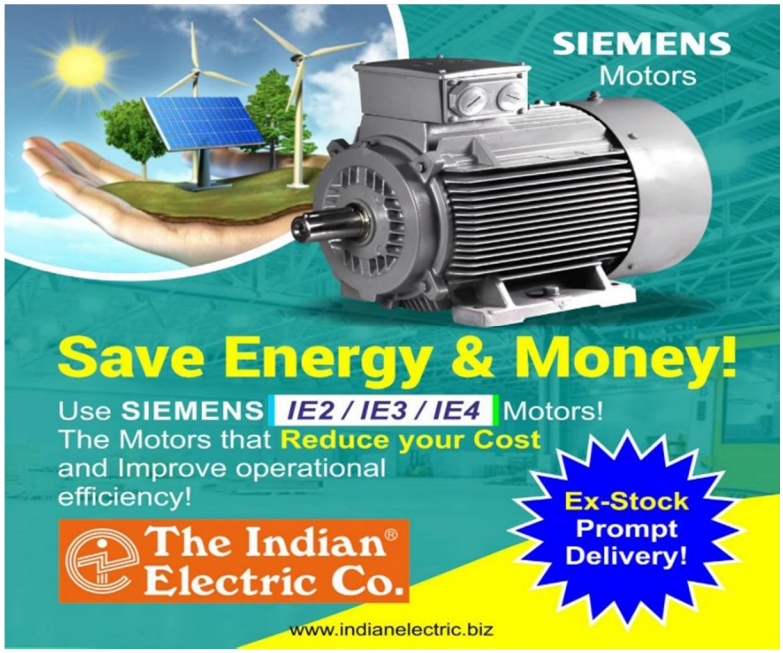


Fig: 04

B. Mechanical System

Mechanical engineering is the art of using problem-solving techniques and applying them to the design and manufacturing of an object. Essentially, a mechanical engineer uses creative design and analytical knowledge to turn a concept into something real.

Without mechanical engineering, we would not have things like engines, generators, elevators or even air conditioning. While we might not even realize it, we most likely use something that has been mechanically engineered every day.

Mechanical engineering plays a critical role in manufactured technologies, from cars to airplanes to refrigerators. It enables you to do many daily activities with ease, as it brings helpful technologies to our modern society. It is one of the most important subdivisions of engineering, because without it, many of the technologies we use every day would not be available.

1) Air compressor

Fig: 05

Compressed air is used in almost all types of industries and accounts for a major share of electricity used in some of the plants. It is utilized for a variety of end uses such as pneumatic tools and equipment, instrumentation, conveying, etc. and is preferred in Industries because of its convenience and safety.

- Compressed air is very energy intensive. Only 5% of electrical energy is converted to useful energy. Use of compressed air for cleaning is rarely justified.
- Ensure low temperature of inlet air. Increase in inlet air temperature by 3°C increases power consumption by 1%.
- It should be examined whether air at lower pressure can be used in the process. Reduction in discharge pressure by 10% saves energy consumption up to 5%.
- A leakage from a *1/2"* diameter hole from a compressed air line working at a pressure of 7kg/cm2 can drain almost Rs.2500 per day.
- Air output of compressors per unit of electricity input must be measured at regular intervals. Efficiency of compressors tends to deteriorate with time.
- Consider variable speed drive for variable load on positive displacement compressors.
- Use a synthetic lubricant if the compressor manufacturer permits it.
- Be sure lubricating oil temperature is not too high (oil degradation and lowered viscosity) and not too low (condensation contamination).
- Change the oil filter regularly.
- Periodically inspect compressor intercoolers for proper functioning.
- Use waste heat from a very large compressor to power an absorption chiller or preheat process or utility feeds.
- Establish a compressor efficiency-maintenance program. Start with an energy audit and follow-up, then make a compressor efficiency-maintenance program a part of your continuous energy management program.

2) Boiler Package

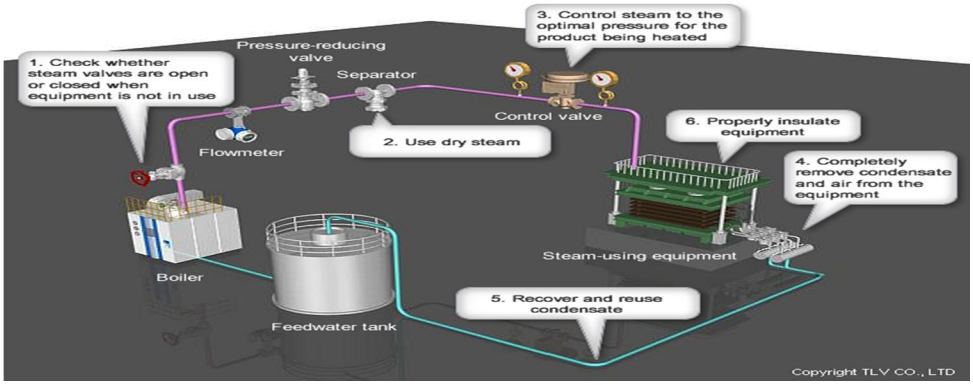


Fig :06

Boilers are used in various industrial units to convey heat for different process applications. Steam is commonly used as the heating medium mainly due to two reasons: one -it is generated from water which is usually available; and two-it is able to store a large quantity of heat at a temperature which can be conveniently used. Various types of fuels, namely; coal; oil, gas, biomass, etc. are used for steam generation in boilers depending on the availability of fuel and cost economics prevailing in the plant. The motive of the industry should be to generate the required quantity and quality of steam at minimum possible costs. This can only be achieved by reducing the various avoidable heat losses occurring within the boiler system, thus improving the efficiency of the same.

- All possible attention- should be paid to control excess air by monitoring oxygen level in flue gas and also by visual inspection of flame color.
- Remove soot deposits when flue gas temperature rises 40°C above the normal. A coating of 3mm thick soot on the heat transfer surface can cause an increase in fuel consumption of as much as 2.5%.
- Soot blowers can always be maintained in perfect working condition so that their regular and periodic use does not suffer.
- Recover heat from steam condensate. For every 6°C rise in boiler feed water temperature through condensate return, there is 1% saving in fuel.
- Improve boiler efficiency. Boilers should be monitored for flue gas losses, radiation losses, incomplete combustion, blow down losses, excess air etc. Proper control can decrease the consumption up to 20%.
- Use only treated water in boilers. A scale formation of 1mm thickness on the waterside increases fuel consumption by 5-8%.
- Stop steam leakage. Steam leakage from a 3 mm-diameter hole on a pipeline carrying steam at 7kg/cm2 would waste 32 kl of fuel oil per year amounting to a loss of Rs.3 lakh.
- Maintain steam pipe insulation. It has been estimated that a bare steam pipe, 150 mm in diameter and 100m in length, carrying saturated steam at 8kg/cm2 would waste 25 kl of furnace oil in a year amounting to an annual loss of Rs. 2.5 lakh.
- Preheat combustion air with waste heat (22 0C reduction in flue gas temperature increases boiler efficiency by 1%).
- Use variable speed drives on large boiler combustion air fans with variable flows.
- Add an economizer to preheat boiler feed water using exhaust heat. Recycle steam condensate.
- Study part-load characteristics and cycling costs to determine the most-efficient mode for operating multiple boilers

3) Thermal Energy

Tips for Thermal energy saving

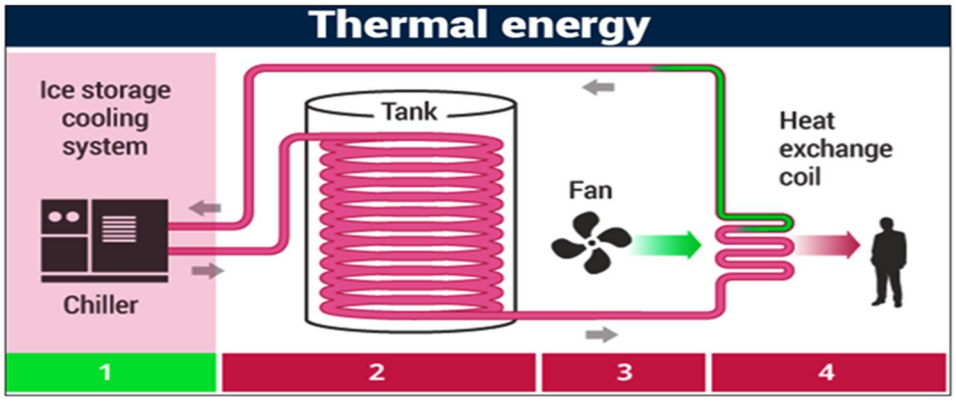


Fig:07

- Undertake regular energy audits.
- Plug all oil leakage as leakage of one drop of oil per second amounts to a loss of over 2000 Liters/year.
- Filter oil in stages. Impurities in oil affect combustion.
- Incomplete combustion leads to wastage of fuel. Observe the color of smoke emitted from chimney. Black smoke indicates improper combustion and fuel wastage. White smoke indicates excess air and hence loss of heat. Hazy brown smoke indicates proper combustion.
- The maintenance in plant should follow the **"zero leak"** philosophy, particularly in the areas of steam and utilities so that loss of energy could be totally eliminated.

C. HVAC System

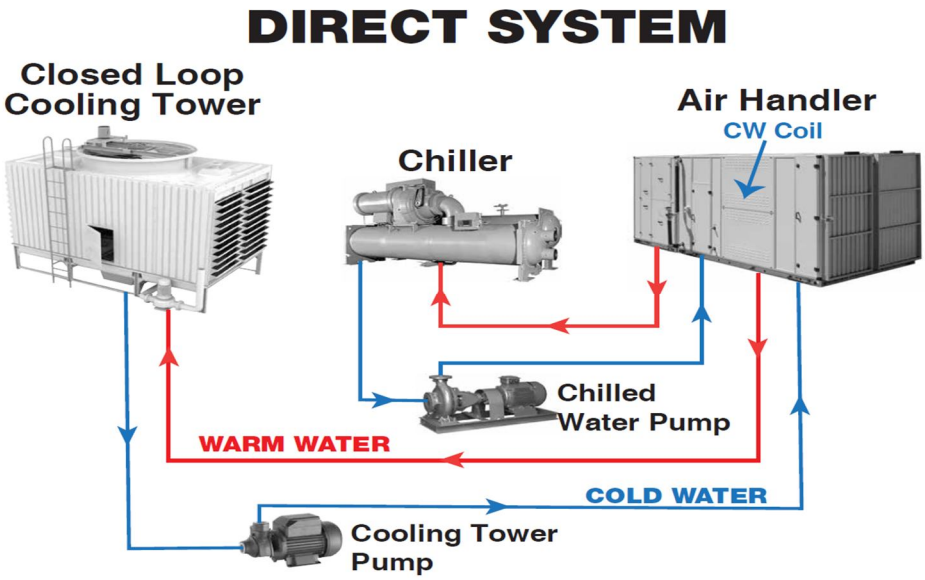


Fig: 08

Refrigeration is the process of removing heat at a low temperature level and rejecting it at a relatively higher temperature level. The items required for the make-up of a complete refrigeration and air· conditioning system are refrigerating equipment, fans, pumps, cooling towers, filters, air-handling units, and ducting. Depending upon the process, all or some of the items mentioned may be required.

- Close doors and windows while running the air conditioning. Don't use a window fan while the air conditioner is on, but do use a ceiling fan.
- Use of double doors, automatic door closers, air curtains, double glazed windows, polyester sun films etc. reduces heat ingress and air conditioning load of buildings.
- Maintain condensers for proper heat exchange. A 5°C decrease in evaporator temperature increases the specific power consumption by 15%.
- The compressor of the central air conditioner should be located in a cool, shaded place outside.
- Specific power consumption of compressors should be measured at regular intervals. The most efficient compressors to be used for continuous duty and others on standby.
- The duct system should be properly sealed. This could save 10 per cent to 15 per cent of the electricity into air conditioner.

Cooling Towers: A cooling tower is a specialized heat exchanger in which two fluids (air and water) are brought into direct contact with each other to effect the transfer of heat. In a spray filled towers, this is accomplished by spraying a flowing mass of water into a rain • like pattern, through which an upward moving mass flow of cool air is induced by the action of a fan.

Replacement of inefficient aluminum or fabricated steel fans by moulded FRP fans with aero foil designs results in electricity savings in the range of 15-400.-6.

➢ Install automatic on-off switching of cooling tower fans and save up to 40% on electricity costs.

D. Instrumentation System

BMS System

- Building management system (BMS), synonymous with building automation system (BAS), are computer-based systems that are used to automate controls throughout the building. The purpose of this system is to automate controls like ventilation, security, lighting and energy.
- A BMS typically consists of one of more control panels installed within a plant room which are wired to various sensors, valves and switches etc. within the building. This allows the BMS to monitor and control the building effectively. All manufacture a range of controllers used in building management systems.

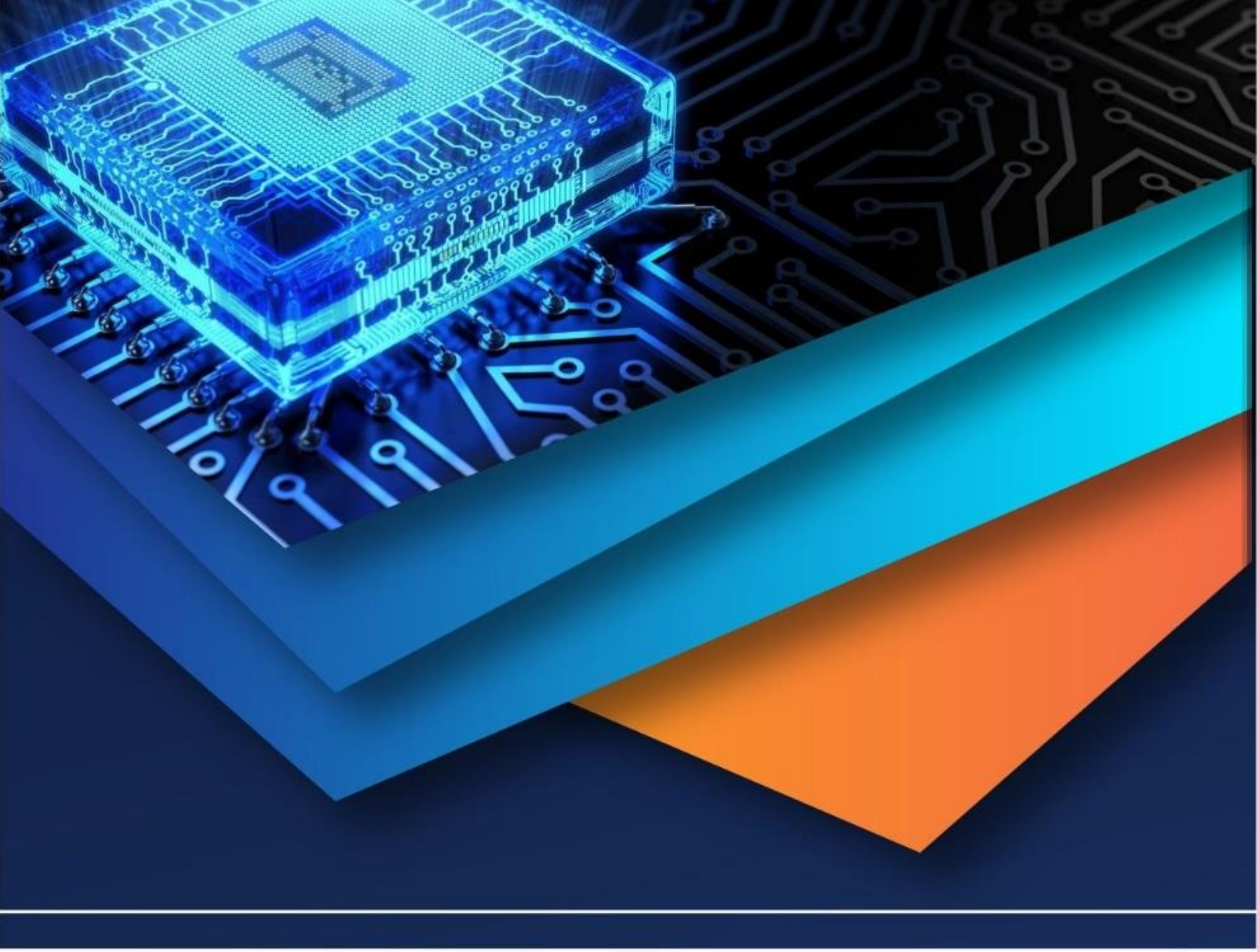
- A building management system (BMS), otherwise known as a building automation system (BAS), is a computer-based control system installed in buildings that controls and monitors the building's mechanical and electrical equipment such as ventilation, lighting, power systems, fire systems, and security systems.
- More specifically, a BMS can help you: Manage illumination (lighting) – Monitor electricity consumption and control lighting within your building. Cut energy costs – Manage electricity usage to different areas of your building. Maintain a comfortable atmosphere – Monitor climate, air flow and temperature

VI. CONCLUSION

In this Paper we are focus on energy conservation techniques in industrial section and management of energy conservation. Energy efficiency has saved billions in energy expenditures by families and businesses, but it has also done much more: created millions of jobs, reduced climate emissions, enhanced public health, improved comfort and commercial productivity, and it continues to address the inequality in the financial burden of energy costs. Energy efficiency is the wave of the future. An energy efficient home is a personal step toward the direction of renewable energy, environmental protection, and sustainable living. Having such a home helps homeowners reduce their bills and provides an excellent investment. Energy plays a crucial role in modern societies. It has a vital input to all sectors (e.g., residential, transportation, and manufacture) and is essential to generate electricity. In other words, all societies require energy services to meet basic human needs such as lighting, heating, and mobility.

REFERENCES

[1] Official website of the Bureau of Energy Efficiency, Govt. of India, http://www.beeindia.nic.in.
[2] Guide Books of National Certificate Examination for Energy Managers and Energy Auditors, Book I General Aspect of Energy Management and Energy Auditing Book, Book II Energy Efficiency in Electrical Utilities, http://www.energymanagertraining.com
[3] Energy efficiency guide for industry in Asia, http://www.energyefficiencyasia.org
[4] Mrs. Nisha V Vader & Mrs. R U Patil -NATIONAL CONFERENCE ON RECENT TRENDS IN ENGINEERING & TECHNOLOGY, organised by Agnel Polytechnic, Vashi in association with IIE ZENITH – 2009 30 - 31st OCT –09, Paper presented on Energy Conservation in Electrical System.
[5] Mr. Kedar Laxman Gaikwad & Madhura Nithin Kolhapure- Case Study- Energy Conservation and Audit, IJSRD - International Journal for Scientific Research & Development| Vol. 7, Issue 02, 2019 | ISSN (online): 2321-0613
[6] Girish Sethi, TERI, Delhi, Seminar on Industrial Energy Efficiency, Workshop on SDG7: Affordable and Clean Energy. Organized by NITI Aayog, New Delhi 23 February 2017.
[7] ENERGY CONSERVATION GUIDELINES FOR INDUSTRIES, Bureau of Energy Efficiency, Govt. of India.
[8] Industrial Energy Management in Action. http://www.oit.doe.gov/bestpractices/pdfs/plantprofiles.pdf
[9] Energy Efficiency in Small to Medium Sized Enterprises. Tata Energy Research Institute. http://www.teriin.org
[10] The Compressed Air Challenge. http://www.knowpressure.org/ Available through http://www.kaesercompressors.com/resource.html#aids
[11] Kaeser Compressors Energy Savings in Compressed Air Systems — Achieving Significant Savings through Energy Management and Cost Savings with Compressed Air System Maintenance.
[12] Mallikarjun. Hudedmani & Vishwanath M. Soppimath, Paper on INDIAN ENERGY SCENARIO AND ENERGY CONSERVATION OPPORTUNITIES IN DIFFERENT SECTORS.
[13] Ramesh S P, M Emran Khan 'Energy Scenario and Energy Efficiency: Programme and Policies of Booming India', American International Journal of Research in Science, Technology, Engineering & Mathematics
[14] Vijaykumar Kulkarni, Pradip Katti, 'Policies and Strategies for the Improvement in Energy Efficiency in Industries Indian Experience' International Journal of Recent Technology and Engineering (IJRTE) ISSN: 2277- 3878, Volume-2, Issue-2, May 2013
[15] Rudra Narsimha Rao, Energy Efficiency in Industrial sector.



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