

Energy Conservation in Air Conditioning and Refrigeration Systems

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Abstract

Conservation of energy refers to the elimination of practices which waste energy. Conservation also includes using technology to eliminate waste and loss of energy. Energy is one of our most important resources. Our energy consumption could increase a great deal in the year ahead. Power officials estimate the energy consumption could almost triple during next twenty years. We could reduce our use of energy by conserving. Conservation must occur in Residential, commercial, Industrial and Transportation. Air- Conditioning and refrigeration constitutes up to 35% of total energy consumption used in various system .The potential of energy conservation varies depending on the design of the system, the method of operation, operating standard, maintenance of controlled system, monitoring of system and competence of user. This paper discussed regarding the energy conservation in ACR system by using above parameters. Implementation of maintenance plan, installing control and upgrading the equipment is the good way to save energy. Energy conservation is not only using less energy but also to use energy in responsible way. Good conservation practices today can help to ensure adequate energy supplies in the future

Keywords: Heat from Electric Appliances, Heat from Roof, Air- Conditioning and refrigeration

I. INTRODUCTION

With the increasing population, industrialization, transport and standard of living the demand of energy is increasing, diminishing. So it is an important to conserve the existing precious conventional sources of energy to meet the energy demand in the future. Energy conservation menace avoiding wastage of energy without disturbing the essential use of energy for productivity and comfort. Air conditioning is defined as a process, which controls the temperature, purity, and circulation and controls its moisture content (Humidity). Most of air-conditioning in India is about cooling i.e. removal of heat from an enclosed space. There are two types of heat which plays an important role are sensible Heat and Latent Heat. Any heat generated within the space to be conditioned forms a 'Load' on the system. The main heat generator within the space is people, lights and fans and other electrical appliances. Heat also enters from outside, such heat also contributes a significant load on air-conditioning system. Heat from outside can be through walls, Roofs, doors and windows.

II. HOW ENERGY CONSERVATION IS POSSIBLE BY REDUCING THE HEAT LOAD ON AIR CONDITIONING SYSTEM?

A. Orientation of Building:

Since the heat from the Sun is major source of load, the directional orientation of building can affect significantly on the heat load. As India lies between the Equator and Tropic of Cancer. Hence the heat from Sun enters in the building essentially from eastern and western direction. By 4 p.m. heat load within building reaches its peak. Hence the afternoon Sun seem for greater than the morning, by keeping the directional factor in mind so as to keep the effect of western heat to the minimum.

B. Use of Glazing Glass for Door and Windows:

As the west facing glass contributes as much as 25 times more heat than brick. For an example a room of 100 sq.ft. Brick wall facing the west, heat inflow is around 0.06T. If the wall is entirely made up of glass the heat inflow is 1.55t, which increases 2500%.

- 1) Hence to avoid glass wall unless absolutely necessary, however if glass is must, to minimize he Double glazing (double glass with air insulation in between)
- 2) Using tinted glass.
- 3) Providing Venetian blinds.
- 4) Using Sun film on glass, Sun film certainly reduces heat energy through glass (around 70%)

C. Heat from Roof:

If the roof is exposed to Sun, direct heat inflow in to the space is tremendous. For an example As much as 0.6 T of air-conditioning is wasted to compensate the heat inflow from 300Sq.Ft. ceiling. In such case, to avoid heat load from roof, the under-deck insulation is required to insulate the roof, The thickness of 2 inch insulation reduces the heat inflow by 80%.

D. Heat from Electric Appliances:

Every tube light adds 50 watts of heat. Hence to avoid artificial lighting wherever possible Natural lighting (but not from direct sunlight) is best for both the comfort and energy saving point of view. Wherever artificial lighting cannot be avoided seasonal variation of natural light can be used. This results in direct energy saving.

All heat generating elements like electric Stove, Coffee maker and water coolers place them outside the conditioned space to save the energy by reducing load.

E. Electronic Controls Are More Reliable and Long Lasting Than Conventional Knob and Switches and Also More Accurate and Efficient. Electronic Thermostat Are Precise, Hence For Cut Out And Cut In Of Compressor Occurs Precisely To Save The Energy.

III. ENERGY AUDIT OF CENTRAL AIR CONDITIONING PLANT OF BSNL ADMINISTRATIVE BUILDING

A project of Energy conservation was carried out for central air Conditioning plant of BSNL administrative building. A detailed study of various component and possibilities of energy saving can be taken during energy conservation project. Following steps were conducted.

A. Data Collection Of Existing System – The Detailed Information Of Each Component Can Be Carried Out.

- Water cooled chiller of 50TR
- Air cooled chiller of 40TR
- Chilled water secondary pump of 15KW
- Chilled water primary pump of 5KW
- Condenser pump of 3.5 KW
- Main AHU in ‘A’ wing 10TR
- Main AHU in ‘B’ wing 10TR
- FCU of 5TR - 35 Nos

B. Inspection and Study of Individual Equipment for Their Working and Performance:

- Physical inspection of each component.
- Recording the observations from various metering devices.
- Checking and verifying history sheets maintained for their recording.
- Working schedule of plant
- Recording the data in terms of DBT, WBT and RH.
- Verify the above parameters with reference to the instruction manual given by manufacturer.

C. Observations:

- During this project, it is found that the individual component is working satisfactorily.
- Almost for one and half year the system is working on its partial load (between 40 to 60%)
- VFD for secondary chilled water system is provided to reduce /increase the power consumption as per variations of load and they are working properly.
- DBT, WBT and RH. Measurement in al conditioned space of ‘A’ and ‘B’ wing are recorded and found within acceptable limit.

D. Potential for Energy Saving:

- Glass area provided in AHU - Glass area not at all desired in the AHU room, as there glasses contributes more heat gain. The heat load is unnecessarily increased by 4%.
- AHU room locking should be strictly followed. It is observed that the operator or any person can enter in AHU by just pushing the AHU door. Every time by opening and closing contributes around 0.4% heat gain due to outside air. AHU room normally opened 0 to 15 times in a day, which calls for more than 4% of heat load. So locking and restrictions are essential for opening the door.
- Thus in total 10% of heat gain can be saved by implementing the simple solutions of a such well-maintained air conditioned plant and can be saved approximate Rs. 550/- per day. And Rs.2.5 lacks per year.

IV. CONCLUSIONS

For efficient air conditioning, we need to

A. *Minimize the Entry of Heat of the Sun in To the Condition Space By:*

- Planting trees around the building
- Providing sunshades, awnings etc. o windows and doors.
- Using sun film, curtains or Venetian blinds on glass doors/ windows
- Insulating exposed roofs.

B. *Prevent Leakage of Cooled Air To the Outside:*

- All corners and edges around joinery (doors and windows) must be airtight.
- Close the doors and windows perfectly.
- Doors and windows are not unnecessarily and too often opened and closed.

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