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Energy Optimisation in an Industrial Building; a Case Study of Henkel Anand India Pvt Ltd

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ABSTRACT : Energy is a scarce resource for developing countries like India.. Industrial energy consumption is on the rise. In times of fierce competition, it becomes imperative to save energy. Each industry if it is to stay in market should reduce its energy consumption thereby its energy charges to stay in market. This paper is an attempt to highlight the application of Building management system to an industry located in Himachal Pradesh, India. As the results would show small measures in implementing building management system have helped in substantial reduction in bills with attractive pay back periods.

I. INTRODUCTION

Increasing demand for electrical energy is enough to motivate for improvement of electrical efficiency. Reducing use of energy reduces energy costs and also results in a financial benefit of cost saving for the consumers, if there is any additional cost of implementation of energy efficient technology, same is compensated by the savings made. Reduction in usage of electrical energy or use of energy efficient machines is also seen as a way-out of reducing emission of greenhouse gases. According to the (IEA) International Energy Agency, the use of energy efficient techniques in the industrial building will reduce the overall emission of the gases responsible for green house effect and will reduce the need of world's energy by 33 % approximately.

1.1 Importance of BMS

Buildings now a day are fully equipped with electrical and mechanical machines, which have become necessary for maintaining basic facilities in the premises. In general efficient buildings should have provisions for more efficient and easy usage of electricity. For examples the building has to be equipped with proper air-condition and boiler system. Boilers are used to provide hot water inside the building for ease of living and necessary cooling equipments also has to be present in case of emergency. In order to fulfill this requirement, the management system should take full control the entire electrical and mechanical processes inside the building.

In order to control the building the most important part is its architectural plan. In order to get a best control strategy, we need to give attention towards the buildings' mechanical and electrical locations. This can be done by making an initial site visiting and making an effort to understand the type of construction in accordance with the type of material being manufactured, also we must try to discuss the plan with the experienced people all around the company to know the exact know how of all the details. During the site visit we have to pay attention toward some important information as follows.

(a) Floor plan: A proper floor plan is necessary to plan for implementation of building management system. We first drew the layout of the floor on a plain piece of paper with the details about the location of electrical and mechanical loads, supply lines, supply vents, etc.

(b) Load location: This involves to figure out the exact location of the loads on which distribution board it is connected and the actual distance between the load and the main distribution board. This is helpful for installation of the control circuits in the building. The details of load location at Henkel Anand were worked out

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(c) Basic information about the working: This involves general information like total number of employees in the building, working hours, shift timings, the amount of loads installed on the building, installation of fire alarms of the building and the existing building management system if any.
(d) Chiller information: Here we require the exact location of chiller, Manufacturing details, power rating of the chiller, operating time of chiller, the number of employees authorized to start the chiller, location of thermostat, backup chiller if there is one, intake and outcome of the air from the chiller.
(e) Temperature Sensor installation: For this we need to understand the work place to place the temperature sensor to get the exact value of the temperature with respect to the chiller output. This will be helpful to control the chiller based on the demand of temperature.
(f) Measurement of intensity of light: The intensity of light has different standards for workplace, offices, testing labs, which are as per the standards available . The intensity of light must be measured at different place using a Lux meter to enable an increase or decrease the no of tube lights, which may be beneficial.
(g) Controls installation recommendation: In order to install the control in the building, we need to find out the most suitable place for instillation of controlling switches and the PLC's in the building. It should be located on the central place to reduce the length of control wiring at different locations otherwise the control equipment are far away from the load.
(h) Strategy for load optimization: Based on the collected information, we need to set the control strategy to get the better optimization of floor and energy. This can be done with the help of proper load installation, checking power rating of the load, measuring room temperature and the location of the load.

II. IMPLEMETATION OF BMS AT HENKEL ANAND

In order to enhance the energy efficiency of the industry, the complete site has to be observed keenly. There is a chance that already some of the machines like boiler, motors, fans and chiller may malfunction. Also the energy may be wasted by dirty filter; damaged equipment; compressed air leakages.
The opportunities for energy saving at Henkel Anand are as follows:
1) Cooling tower fan motor.
2) Electrical Geysers in washrooms.
3) Electric HPSV streetlights.
4) Tube lights in offices and conference room.
5) Manual air-conditioning system of the company.

III. ENERGY SAVING MEASURES

It was found that:
1) The cooling tower with a motor of 2 hp connected with the fan keeps on running 24 hours.
2) Two washrooms with a electrical geysers of 50 liters each remains on for 24 hours.
3) 4 HPSV street lights of 250w each on for an average of 10hrs are being used in the company.
4) Tube lights of 40w (24 no.) & 20w (21 no.) in the offices, laboratory and conference room being used.
5) Offices and shop floor has manual controlled air conditioning system.

IV. LOAD OPTIMIZATIONS

During analysis of the energy pattern of the major equipments and it was found that there are some opportunities for energy saving, energy could be conserved and the monthly electricity bill may be reduced, So it was suggested them a few changes which are as follow:
1) Automatic temperature control for cooling tower fan motor using plc.
2) Solar water heater in the workers washroom in place of the existing electrical Geysers.
3) Electric streetlights to be replaced with solar Street Lights.
4) Saving By Using LED's Bulb in Plant.
(Proposed to replace all the 40W tube lights by LED lights which will show substantial savings without compromising the quality.)
5) Installation of Demand controller to limit Demand over-drawl.

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6) To install PLC controlled electrical and air-conditioning system for the company which can easily be monitored by maintenance engineer.

4.1 Automatic temperature control for cooling tower fan motor.

Henkel Parwanoo is using a chiller to cool down the water which is further used to cool the hot dried material in the dryer which is a part of their process,

It was observed that the cooling tower fan keep running all the time despite of the particular temp is being reached or not. It was suggested to install a temperature sensor which in turns controls the fan of cooling tower and shuts the same down when the temp of the chiller is less than the predefined limit which saves a lot of energy.

4.2 Solar water heater in the workers washroom in place of the existing electrical Geysers.

As Henkel Anand India Pvt. Ltd., Parwanoo is making a product with the use of carbon black powder it becomes necessary for the workers to take a bath before they leave the premises of the building, so the company has installed two electrical geysers of 50 liters each in the two washrooms which is specially for the workers to take a bath before leaving.

The existing geysers (water heaters) were replaced with the solar water heaters, with a payback period of 1.7 years

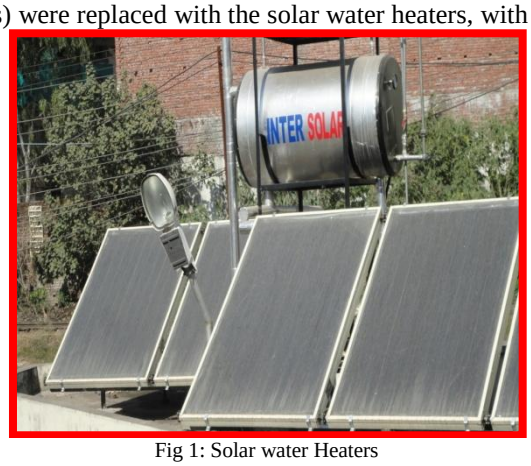

Fig 1: Solar water Heaters

Benefits

- Cost Saving, Reduction in monthly electricity bill.
- Solar energy is always cheaper and a standalone system.
- Renewable form of energy.
- Environmentally friendly energy.
- Clean form of energy.
- Government subsidy on the usage of solar panels.

4. 3 HPSV streetlights Replace with solar Street Lights.

There were 4 street lights in different area with a load of 250W HPSV each which were replaced with solar powered LED lights.

4.4 Saving By Using LED's Bulb in Plant.

Henkel Anand India Pvt. Ltd., Parwanoo was using 20 Watt tube lights at the different sections of the plant to lighten the area in order to facilitate the working of plant 24*7, the old tube lights were replaced with the LED'S to save the energy

Total wattage with tube lights	=1518
Total wattage with LED'S	=279
Saving in watts	=1239
Total LED'S used	=31
Saving per day	=73.7205
Saving per month	=2211.615
Saving per year	=26539.80

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4.5 Installation of Demand controller to limit Demand over-drawl.

Maximum demand controller was installed in the power supply room to limit the over drawl of the power by the company during the peak load timings as per directed by Himachal Pradesh Electrical Department. As during this timing if 1 kVA demand is over drawn the company has to pay Rs 300 as penalty and Rs. 10.25 per unit charges. This has resulted in substantial savings.

4.6 Install PLC controlled electrical and air-conditioning system

A Programmable Logic Controller (PLC) is a combination of hardware and software modules which gives us a liberty to control the electrical machinery as per a predefined programme. The programming for the PLC is done in the related software for the hardware module..

The overall system comprises a building management system that provides monitoring and controlling facility in three different modes:

(a) Manual mode
(b) SCADA control mode and
(c) User control through mobile/ GSM.

In this scheme a controller is required, which ensures that total lightning, air conditioning and other daily use equipments load plugged at any time instant should not kept on without any requirement and it should not cross maximum demand limit. The Energy Management System connected to PLC, SCADA and GSM transmitter module through RS-232 protocol. Henkel Anand India Pvt. Ltd., Parwanoo is already using PLC and SCADA software's to control the plant machinery during the manufacturing process for the movement of material as of material as per their prescribed format. The same system was modified for the control of lightning, air conditioning and other daily use equipments which can now be monitored from a computer screen by the maintenance engineer, while sitting in his own cabin, he can check the lightning system of whole building and if finds any of the equipment running without proper usage it may be turned for by simply turning it off by a click of mouse on the system screen, the company plant head was quite convinced by the idea of energy saving.

V. RESULTS AND DISCUSSUIONS

5.1 Cost saving using solar energy

The cost benefit analysis of using solar energy is presented below:

Total Costing: = 97680+78144 = Rs 175824
Total yearly saving days: = 55348.8 + 21717.5 = Rs 77066
Pay Back Period without rebate: = Total Costing/Total Saving Yearly = 2.28 years
Total Power Saving = 9302.32 +3650 =12952.32 Kwh

Table 5.1: Cost saving of combined solar water heater and Solar Street Lights

5.2 Cost saving- Temperature controller

Load of motor in HP	2
Load of motor in KW	1.5
In summers we assume that the motor shuts down for 6 hours during night (Approx).	
Summers from March to September	214
In winters we assume that the motor shuts down for 10 hours in a day (Approx).	
Winters from October to February	151
Savings in summer	11459.7
Savings in Winters	13476.9
Total	24936.45
Note* Cost of energy is Rs 5.95	

Table 5.2: Cost saving using Temperature controller

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VI. CONCLUSION

It is seen that small measures of building management system have helped the company to save a substantial amount on its energy charges thereby making it more competitive in the market.

REFERENCES

[1] Kaur Parminder Gill, "Energy efficient building educational institute using day light. A case study" M Tech Thesis GNDEC (2012).
[2] Singh Rajwinder, "Design of energy efficient building, A case study" M Tech Thesis GNDEC (2013).
[3] Khadidja Bouziane, Dris Korichi, Boubeker Azoui and Noureddine settou "Optimization of solar tracking system for photovoltaic power plants in saharian region ", Energy Procedia 50 (2014) 610-618, (2014).
[4] Zhonbo Xu "Supply demand coordination for building Energy Saving: Explore the soft comfort", Student member IEEE, IEEE transactions on automation science and engineering, volume 12, No.2, (April 2015)