

Energy Audit-Way of Energy Conservation

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Abstract

Energy audit is an important factor that enables the energy management programmer of any firm for controlling its energy costs. The Scenario of energy storage is compelling the adoption of energy conservation measure that describes the less energy for same level of activity. Energy audit basically controls the energy cost and increase the energy efficiency. Energy audit in business practice gaining continuous attention due to its vital role. This paper presents our motives of identifying the energy efficiency by practicing actual energy audit and finding how energy is being used in the facility. It also presents the ways of identifying the potential issues within building envelop thereby implementing the energy efficient technologies in lowering energy losses prominently with effective presentation of existing building model and its suggestive measures.

Keywords: Energy Scenario, Efficient, Energy Management.

Introduction:

The need of energy saving is quite evident in today's increasing energy demands of industry, commercial building etc. We need to identify the opportunities of energy auditing in this sector. It involves collection (from in-site measurements) and processing of data and full examination of installed energy systems of building/unit, which will compose through energy. In this paper we are proposing the effective usage of renewable energy in the premises of educational institution Shri Siddheshwar Women's Polytechnic, Solapur, where 30kW solar roof-top project is installed in order to control the expenses of institution over electrical energy. It is clearly shown that the payback period is coming out to be quite less and benefits of renewable energy access are remained for long term. It further involves the conservation of energy by installing energy efficient devices/equipment floor-wise in institute.

Need of Energy Audit:

- ✓ Energy audit helps to perceive all the information related to Energy use in specific area such as-
- -process of energy & fuel use
- -Possible areas of unnecessary excess use of energy
- -Pinpoints where the scope for implementation exists.
- Energy audit program helps to keep to keep the track of-
- -Disparity in Energy costs.
- -Imbalance in availability and reliability of energy supply.
- -Addition of new energy conservation installations and equipment.

- ✓ The primary objective of energy audit is to determine ways to reduce energy consumption per unit of product output or to lower operating costs.
- ✓ Energy audit provides a “bench-mark” for managing energy in the organization.

Steps for Energy Conservation using energy audit:

Visual inspection and data collection

- Observations on the general condition of the facility and equipment and quantification
- Identification / verification of energy consumption and other parameters by measurements
- Detailed calculations, analyses and assumptions.
- Validation
- Potential energy saving opportunities

Proposed methodology and Procedure:

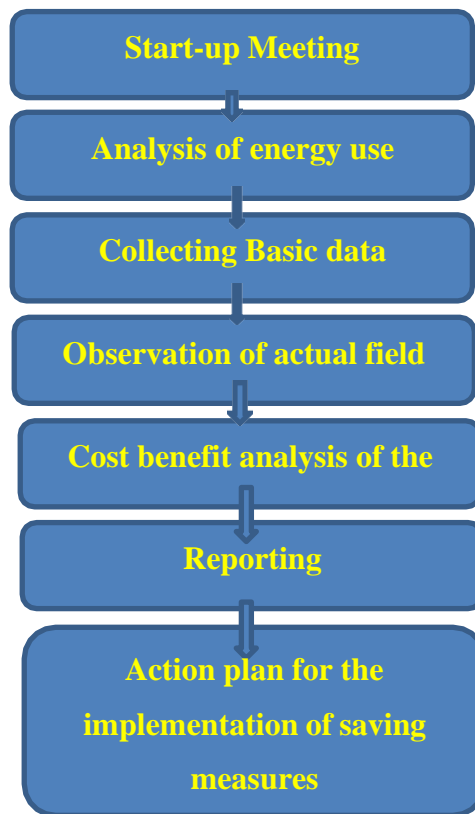


Fig. 1. Flowchart for proposed methodology

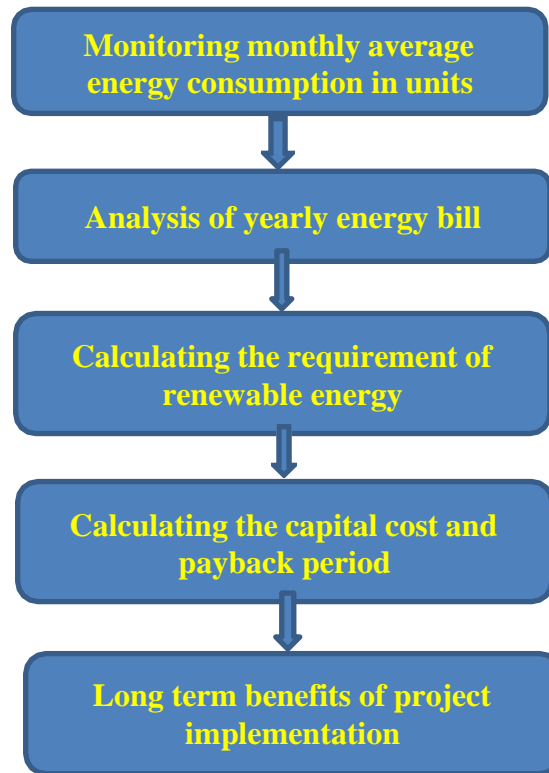


fig. 2. flowchart for installing the solar PV for energy audit cells over the roof of the building

Analysis of existing load:

The institute is of 3 storied building and the floor wise load calculation before the audit is shown. The classrooms, laboratories, seminar hall, library, director cabin, computer centre etc. everywhere the tubes of around 40 to 60 watt were fitted and load calculations were made accordingly. The overall floor-wise calculated load is shown in the following table :

Table 1: Existing load calculation before audit

Floor	Major load contribution	wattage
Ground floor	Machine lab, Measurement lab, Network lab, Library, Civil engglabs	22 kW
First floor	Electronics labs, computer center, director cabin, admin office	13 kW
Second floor	Computer and IT computer labs	18 kW
Third floor	All Classrooms	7 kW
Total		60 kW

Therefore, the total maximum demand of educational building is 60 kW. After studying the energy flow the detailed analysis is made and the opportunities of energy

conservation is identified. The extra wattage consuming of any equipment is identified using the multi-function meter installed in machine laboratory and power analyzer installed centrally.

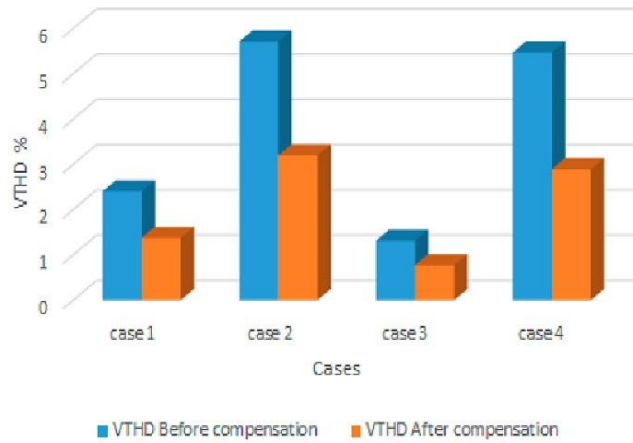


Fig. 3: Harmonic distortion

This measures the parameters such as True power, power factor, harmonics and efficiency in power inverters, motor drives etc. Power analyzers provide auditors to minimize the energy loss due to distortion, transient wave forms in power electronics [8].

All the 40 wattage tubes is been replaced with 20 W energy efficient LED tubes. In addition to it the old equipments also been obsolete. The energy loss due the flow of leakage current is also prioritized and firm earthing at 4 different locations is also practiced.

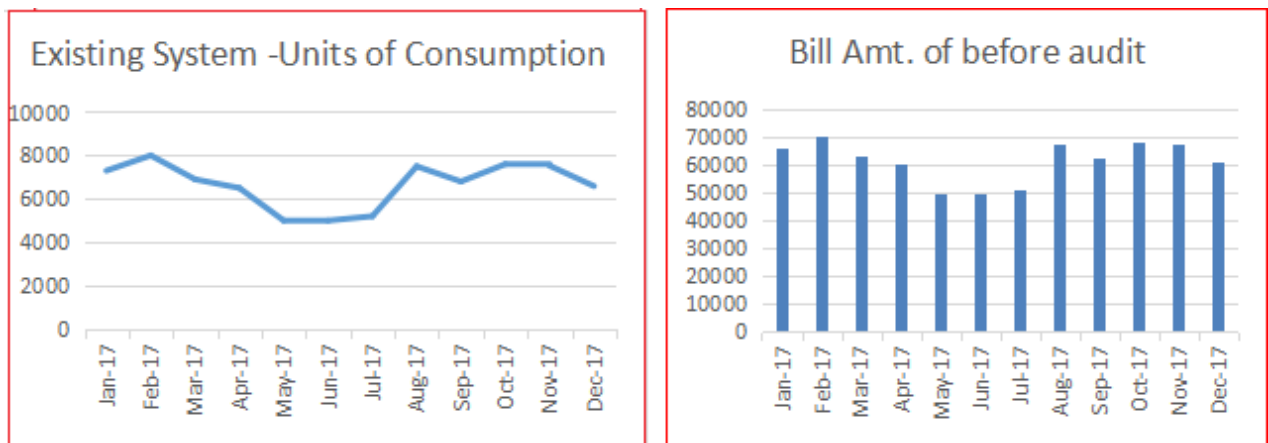


Fig. 4. Existing energy consumption in units and bill amount

End results of audit:

The change in the reduced maximum demand has been encountered majorly due to replacement of energy efficient lighting load going in all corners of the institute. That has also given benefits of intense illumination with reduced power consumption. This is the mainly cause of reduction in energy demands shown in table.

Table 2: Reduced Maximum Demand after auditing

Floor	Major load contribution	Change in Wattagedue to LED tubes
Ground floor	Machine lab, Measurement lab, Network lab, Library, Civil engg labs and corridors	19 kW
First floor	Electronics labs, computer center, director cabin, adminoffice and corridors	10 kW
Second floor	Computer and IT computer labs, and corridors	14 kW
Third floor	All Classrooms	3 kW
Total		46 kW

Therefore there is nearly 20% of saving in cost on energy usage after replacing energy efficient devices. The another percentage of saving can also be possible by analyzing the working hours of institute. But that can becomes little complex to do so.

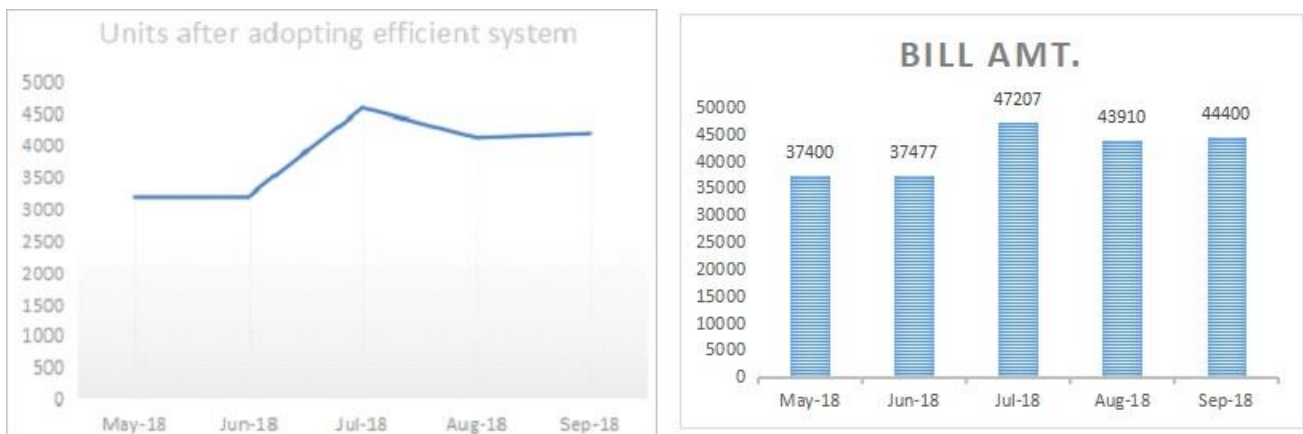


Fig. 5. Energy consumption in units and bill amount after audit

The comparison is also made by referring the fig.4 and fig.5 to identify the the extent of energy conservation.

Adoption of Renewable energy over the existing system to get additional benefit:

The country like India has an outstanding scope for the installation of solar PV systems to extract electrical energy from sun radiation (photons). Keeping this in the view we thought of going for installation of solar panels on roof of the institute. This could be a good thought for long term usage of renewable energy. But only required was large capital investment.

Selection of Solar PV capacity:

The average monthly energy consumption = 5000 to 5500 units (from energy bill)

1 kW of solar pannel energy generation = 5 units/day and for monthly = $5 \times 30 = 150$ units
 The required solar pv system in kW for institutional building = $5000 / 150 = 33.33$ kW
 Therefore a 30kW solar PV system was selected to install on the top of building.

The total capital investment made for 30 kW PV system = Rs. 24 lac (For 20 years)
 The avg. Monthly expenditure on energy in existing system = Rs. 50000

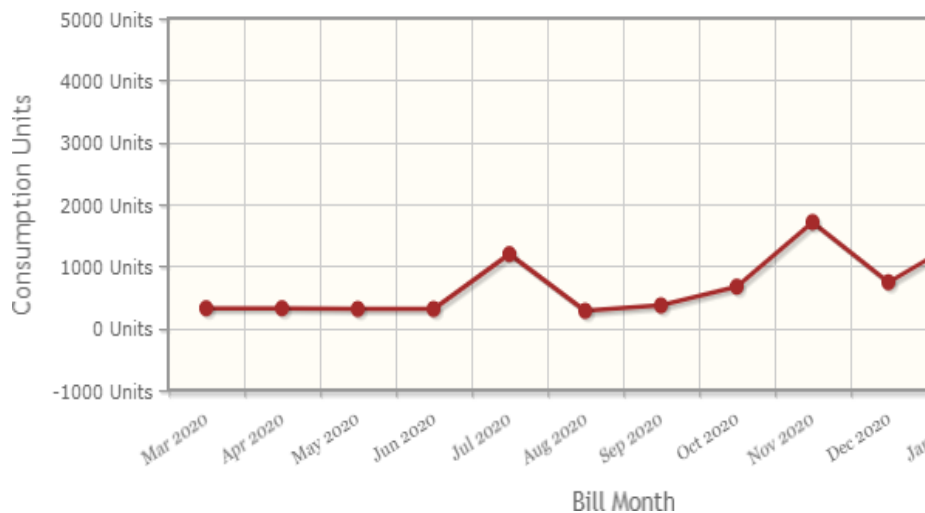
The avg. annual expenditure over energy consumption in the existing system = Rs. 6 lac

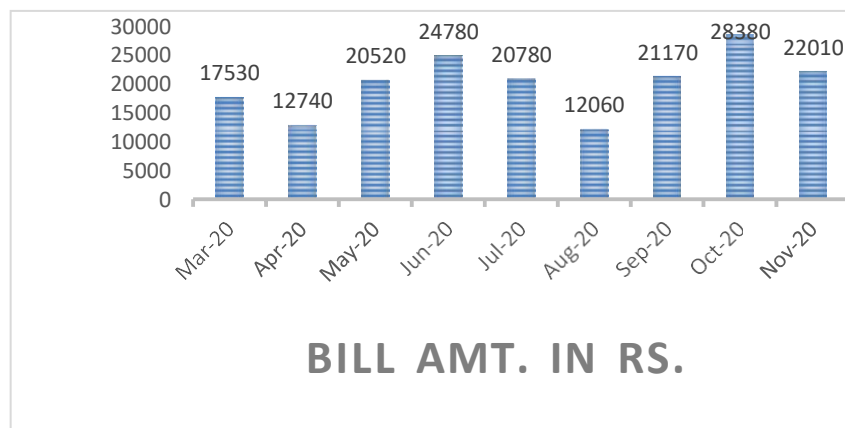
Annual Expenditure on Existing system	Capital investment on installing SolarPV system	Payback period
Rs. 6 lac per year	24 lac in year	4 years

In Nov-2018, on-grid 30 kW of solar roof-top project was installed and the import of electrical energy from state utility grid was reduced in large extent. The institute started to meet the energy demands in a day by it its own by generating 140 to 150 units of energy in a day. Due to this the monthly energy bill reduced. After six years of pay-back period the institution will be start to rip the the full benefit and large saving over energy bill.

This has been shown by taking real time monthly energy consumption in units for certain duration to indicate difference.

Energy consumption and billing history after installation of 30kW solar PV panels(renewable energy)





Conclusion:

Energy audit is an effective way in identifying and pursuing a comprehensive energy management. This paper helps in energy conservation by energy audit and installation of suitable renewable energy system. This proposed analysis helps to think in many ways of reducing the energy demands by adopting modern tools of energy audit.

The following facts have emerged from above analysis:

1. Energy demand reduced by 20%.
2. The cost on energy bill also reduced by installing PV system in addition.
3. The benefit over energy bill ripen for next 14 years after pay-back period just 6 years.

By implementing the recommendation as suggested in the project model will help in reducing the energy consumption. This is continuous process that every institution owing to adopt periodically.

References:

1. P.S.Magdhum & Mr.S.R.Lokhande,Mr.P M Maskar,Mr.I D Pharne,"A case study: Energy audit at Commercial and Educational Building",IEEE International conference on Power,control & Instrumentation Engineering(ICPCSI-2017)
2. Energy audit and analysis of an institutional building under subtropical climate in IJECE, Vol 8, No 2, April 2018, pp845-852
3. IOSR Journal of Electrical and Electronics Engineering (IOSR-JEEE) ISSN: 2278-1676 Volume 4, Issue 1 (Jan. - Feb. 2013), PP 23-37 Case on Sustainable Energy Audit, <http://www.environmental auditing> Instruction for energy auditor, Vol I & II U.S. Dept of Energy, Sept 1978 Integrated Energy Policy Report of the Expert Committee Government of India, http://planningcommission.nic.in/reports/genrep/rep_intengy.pdf.
4. Energy Conservation using energy audit, International Journal of Science Technology & Management, Volume No.04, Special Issue No.01, February 2015 IEEE International conference on power, control, signals, and instrumentation engineering (ICPCSI-2017)