

ENERGY AUDIT OF 3 KW SOLAR ROOFTOP SYSTEM

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ABSTRACT

Energy conserved is energy generated. Energy plays a pivotal role in our life. The demand can be met either by furthering the energy generation or by conserving the usage of energy. Generation of energy is an expensive affair; hence it is very important to conserve energy. In these paper the importance of the energy audit is been studied in detail. These audit survey is done at Ganesh Nagar Vidyalaya, Nagpur. The detailed analysis of the data collected is done.

Keyword: - ENERGY AUDIT, ENERGY EFFICIENCY, SOLAR PHOTO-VOLTAIC

INTRODUCTION

An energy audit is an analysis of a facility, indicating how and where that facility can reduce energy consumption and save energy costs. It also states that where the excess energy is being used. Its identifies the energy efficiency and conservation which lead to significant savings on the buildings utility bill. In several countries like India , where the electrical energy resources are scarce and production of electricity is so expensive, so the conservation of energy holds an important role. An energy audit is a survey analysis of energy flows, for energy conservation in a building, houses, to reduce the amount of energy input into the system. In commercial and industrial real estate, an energy audit is the first step in identifying opportunities to reduce energy expense. Residential homes uses smaller solar energy systems, usage of solar heating and daylight design strategies could be pleasant for essential environment. Thus using these different strategies for conserving the energy usage could lead us to met the need of future generation in appropriate way.

The determination of the energy requirement is a crucial step in realizing a solar photovoltaic installation. This is because it allows finding out the necessary peak power as well as the required size of the battery, the charge controller and the inverter, if the system is not connected to the national grid.

In these paper we have studied the different issues which were faced before and after the installation of the solar system at Ganesh Nagar Vidyalaya. And the problems are verified.

ENERGY AUDIT

Energy audit can be defined as an survey of the energy needs and efficiency of a building . In other words, an energy audit is an inspection, survey and analysis of energy flows, for energy conservation in a building. Process or system to reduce the amount of energy input into the system without negatively affecting the output. It shows where the power consumption is more in the given system. In commercial and industrial real estate, an energy audit is the first step in identifying opportunities to reduce energy expense and carbon footprints. Also an energy audit is a systematic analysis of energy use and energy consumption within a defined energy audit scope, in order to identify, quantify and report on the opportunities for improved energy performance. The level of detail of this evaluation determines the type of audit. An Energy Audit is an in-depth check carried out on a building or equipment to assess

the amount of energy being utilized & exploring opportunities for energy conservation without affecting the output . For conducting energy audit three steps must be followed:

1. Preparation: Before an audit one should gather the information about the place where the audit is to be conducted. Information including the energy bills , type of electrical equipment's .
2. The audit: Analyze the data which is collected and then the audit could be carried out on the particular place.
3. The report: All the data collected during the audit are encoded into a specialized software programmed.

IMPORTANCE OF ENERGY AUDIT

Energy plays a crucial role in day to day life. In our country India, being a developing country the consumption of energy is increasing day by day but the generation of energy is not sufficient to fulfill our demand. So a proper analysis or a survey of energy audit is important so as to fulfill the future needs and to meet the generation level. We could save large amount of energy by having the proper energy audit. Also it reduces the cost of energy consumption. Energy audits can be seen as a part of building condition surveys - surveys that are targeted on the energy performance of a building. Energy audits are a useful tool for long term building renovation planning. A building energy certificate and energy labeling of the building are easily produced based on the audit reports. They are valuable for example when a building is for sale. One outcome of an energy audit is a list of energy saving measures and ways to increase the energy efficiency of a building. A housing owner can reduce energy and other costs by applying these measures. Energy audit is used to minimize energy cost/waste without affecting production and quality , minimize environment effect , optimize utilization and procurement of energy for all organization , reduce energy requirement per unit of output. In fact the energy audit , it help to increasing your home efficiency and saving money. It gives low energy bills , improved comfort , environmental impact . auditing is important as it also protects the public from corrupt buisness procedure.

NEED OF AUDIT

Energy savings of the order of 5-20% are possible by optimizing use of energy with better housekeeping , low cost of energy measure and use of energy efficient equipment at the time of replacement , renovation, or up gradation . India industry consumes much more energy per unit production as compared to it's counterparts in the developed countries. Energy audit will help to understand more about the ways energy and fuel are used in any industry , and help in identifying the areas where waste can occur and where scope for improving efficient utilisation of resources. Energy audit provides a bench mark (reference point) for managing energy in the organization and also provides the basis for planning a more effective use of energy throughout the organization. Energy audit is an investment for realizing and preventing need less expenses in future. Also it helps to reduce the dependence on foreign energy sources.

BENEFITS OF ENERGY AUDIT

Financial benefits which contribute to a reduction in operating costs or an increase in the profits of an organization. Energy audit helps to generate independent energy means it's not dependent on the foreign energy source. Security of energy supply also increases in the process of energy audit. It reduces the damage to the environment and increases the life of equipment.

These must be assessed against the cost of implementation of the E.E. measures.

- Operational benefits that assist the management of an industrial site or building improve the comfort, safety and productivity of its occupants or, otherwise, improve its general operation.
- Environmental benefits; these concern mainly the reduction of CO₂ or other (greenhouse gases) emissions, the reduction of national energy demand and the conservation of natural resources.
- Each of the benefits is likely to be realized progressively and to have a cumulative effect. The principal benefits may become available immediately from no-cost measures, or could involve some period before a return on investment is achieved. Others may only be realized when long-term plans are implemented

TYPES OF ENERGY AUDIT

An energy audit is a technique used to establish pattern of energy use; identify how and where losses are occurring; and suggest appropriate economically viable engineering solutions to enhance energy efficiency in the system studied. There are basically two types of energy audit

1) PRELIMINARY ENERGY AUDIT:

The Preliminary Energy Audit focuses on the major energy suppliers and demands usually accounting for approximately 70% of total energy. An analysis of account balances is such as; first meeting with a client, examining the overall business and its accounting system and operations before deciding on the extent of audit procedures that will be necessary. It identifies the energy conservation opportunities by determining what condition may be modified to reduce the energy input to the equipment. This level of detail, while not sufficient for reaching a final decision on implementing a proposed measures, is adequate to energy efficiency project and determine the need for a more detailed audit.

2) DETAILED ENERGY AUDIT:

Detailed energy audit includes a complete description of the facility, including an equipment inventory, an energy balance, detailed energy savings and costs associated with each low-cost and not-cost measure, financial analysis of each recommended measure, identification and rough estimates of capital project costs and savings. Energy savings and economic feasibility are determined as accurately as possible. The reports contain more detailed descriptions of the measures. It monitor and analyzed the progress of the energy conservation measures. And at last it finalize the report of the energy conservation measure to management and determine result to all the concerns. It is an accurate method for energy saving and audit. In this audit mainly two phases are involved:

- i. Pre-audit phase
- ii. Audit phase
- iii. Post audit phase

ENERGY AUDIT OF 3KW SOLAR SYSTEM

In these paper for energy audit we are consider 3 KW commercial system of government school before implementation of rooftop solar system , the energy bill for the 12 month was approximately 7708 units per year having the consumer number 410011437820 and billing unit number 4686 Nandanvan . According to the above unit consumption it is recommended to install 3 KW rooftop solar system which will generate 360 units per month approximately.

In the first scenario of energy audit, i.e. walk through audit is found that electrical wiring of the school was nearly 50 years old and the wires was decayed. Moreover it is also found that there are many taps leakages in the whole wires having 20 class rooms, 3 staff rooms with 2 labs and 1 library . The wiring was very in dangerous position which may create any electrical accident to the living beings.

The first step as a report of energy audit, it is recommended that to change the electrical wiring in phases.

The results for the energy consumption after recommendation are as follows:.

| MONTH | OLD UNITS/YEAR-2016-17 | NEW UNITS/YEAR 2017-18 |
|-----------|------------------------|------------------------|
| JANUARY | 460 | 148 |
| FEBRUARY | 515 | 129 |
| MARCH | 660 | 357 |
| APRIL | 841 | 349 |
| MAY | 691 | 0 |
| JUNE | 550 | 0 |
| JULY | 766 | 0 |
| AUGUST | 756 | 0 |
| SEPTEMBER | 924 | 608 |
| OCTOBER | 839 | 497 |
| NOVEMBER | 465 | 354 |
| DECEMBER | 443 | 116 |

Table 1: Energy bill for year 2016-17 and 2017-18

It is found that the energy losses in cu wires is reduced up to 2-3% .
In second step of audit it is recommended to change the old electrical equipment like fan , tube lights , bulbs, etc. which are nearly 15 years old .

PROBLEMS

Rooftop solar system mainly depend upon the energy availability from the main that is grid. In the area where the power outages is more the solar energy generation is less because the rooftops solar system inverter having the security system which will shut down by its own in the absence of AC power supply because of the net metering facility available by the government. In case it is not present the power will flow from solar system to the grid which may cause hazards. To prevent such accidents inverter are designed in such a way that it will shut down.

PROBLEM 1.

In the area of billing unit number 4686 Nandanvan the energy outages in the month of April to June is nearly 1-2 hours which affects the power generation. So it is recommended to install battery bank with a separate inverter system which will avail energy to the school premises.

PROBLEM 2.

Overvoltage condition: In the month of mid-week of June it is observed that grid voltage increases more than 15% and the grid voltage reaches the level of 260 volts rms. In such conditions the inverter also shut down itself to prevent from damages .in such scenario the power flow cannot be taken place since the voltage of generation is less as compared to grid voltages. So it is recommended to take the necessary action to prevent such incidences

PROBLEM 3.

Leakage current : Before changing the electrical wiring there was a huge leakage current in system due to which ELCB trips down frequently which affects the generation. After recommendation the electrical wiring is changed and the problem ids sort out.

PROBLEM 4.

Neutral and earth looping : while measuring the voltage between the phase to neutral and neutral and earth, at many points it is found that the voltage between neutral and earth is zero which itself explain the problem of looping between the neutral and earth, so it is recommended to clear the fault by changing the wiring system.

PROBLEM 5.

Earth pit : The soil of earth pit should contain some moisture, so it is recommended to pour water after every month, specially in the month of summer to maintain the earth resistance in range.

RESULTS AND CONCLUSION

The 3 KW system of Ganesh Nagar Kanya Vidyalay is analyzed by making audit report as above. It is found that after recommendations changes the system has good power generation as well as maintain the security system . **6.**

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