ENERGY AUDITING ON CAMPUS OUTDOOR AND ENERGY MONITORING USING IOT

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ABSTRACT

Energy is one of the major inputs for the economic development of any country. In the case of the developing countries, the energy sector assumes a critical importance in view of the ever-increasing energy needs requiring huge investments to meet them. For reducing cost and increasing efficiency, then use energy conservation, management and audit. The objective of Energy Management is to achieve and maintain optimum energy procurement and utilization, throughout the organization as To minimize energy costs / waste without affecting production and quality. To minimize environmental effects. Energy Audit is the key to a systematic approach for decision-making in the area of energy management. It attempts to balance the total energy inputs with its use, and serves to identify all the energy streams in a facility. The user can monitor the energy parameters of load using an android smartphone which will also work as a data logger to store Current, Voltage and power values.

Keyword : *Auditing*, Monitoring, *and Energy, etc….*

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1. INTRODUCTION:

Energy is the ability to do work and work is the transfer of energy from one form to another. Energy comes in different forms heat(thermal),light(radiant),mechanical,electrical, chemical, and nuclear energy. Coal and other fossil fuels, which have taken three million years to form, are likely to deplete soon. In the last two hundred years, we have consumed 60% of all resources. For sustainable development, weneed to adopt energy efficiency measures. Today, 85% of primary energy comes from non-renewable and fossil sources (coal, oil, etc.). These reserves are continually diminishing with increasing consumption and will not exist for future generations In this paper we study energy conservation and energy efficiency by how to reduce energy demand to reasonable minimum Cost, recover

and re-use heat where possible and also study use of energy efficient equipment to supply remaining energy demand, and provide a means to manage use of energy and also study energy and environment and study how to carry out energy audit.

The main goal of our project "Smart home energy monitoring and management system" is to develop a system such that it will be capable to keep a track of each and every appliance in the home and the user will be able to acquire all appliance energy consumption parameters. Along with this, the energy consumption parameters of each individual appliance will be sent to gateway where an intelligent algorithm will be running to manage all the appliances as per user requirements.

1.1 Energy Scenario and energy sources:

Energy can be classified into various types based on following criteria..

- Primary and Secondary energy
- Commercial and Noncommercial energy
- Renewable and Non-Renewable energy

Primary energy sources are those that are either found or stored in nature. Common primary energy sources are coal, oil, natural gas, and biomass (such as wood). Other primary energy sources available include nuclear energy from radioactive substances, thermal energy stored in earth's interior, and potential energy due to earth's gravity.

Secondary energy sources like steam, electricity are derived from primary energy sources like coal, oil & gases & are suitable for transportation, distribution and control.

Commercial Energy sources that are available in the market for a definite price are known as commercial sources that are available in the market for a definite price are known as commercial energy. Commercial energy forms the basis of industrial, agricultural, transport and commercial development in the modern world.

Non-commercial energysources that are not available in the commercial market for a price are classified as Noncommercial energy. Example: Firewood, agro waste in rural areas; solar energy, animal power, wind energy.

Renewable energy sources are those that are essentially inexhaustible, like wind power, solar power, geothermal energy, tidal power and hydroelectric power

Non-renewable energy is the conventional fossil fuels such as coal, oil and gas, which are likely to deplete with time.

Energy conservation:

Energy is defined as the ability to do a work and work is transformation of energy from one form to another and also the energy can neither be created nordestroyed.It includes any behavior that results in the use of less energy.

Examples : Shut lights off , Don't leave water running, Recycle (bottles, can, papers, glass, etc.) ,Walk or ride a bike ,Open a window in the summer instead of turning on the air conditioning ,use public transportation.

2. Energy efficiency:

It involves the use of technology that requires less energy to perform the same function. A compact fluorescent light bulb that uses less energy to produce the same amount of light as an incandescent light bulb is an example of energy efficiency. The decision to replace an incandescent light bulb with a compact fluorescent is an example of energy conservation.Driving the same amount with a higher mileage vehicle is an example of energy

3. Need of Energy Conservation:

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. 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. Electrical system is a network in which power is generated using non-renewable sources by conventional method and then transmitted over longer distances at high voltage levels to load centers where it is used for various energy conversion processes. End user sector are identified as three major areas -Power Generating station, Transmission & Distribution systems, and Energy consumers. Consumers are further classified as Domestic, commercial and Industrial consumers.

4. Energy Conservation In Lighting system:

Good lighting is required to improve the quality of work, to reduce human's / worker's fatigue, to reduce accidents, to protect his eyes and nervous system. In industry it improves production, and quality of products / work.

5. Optimum use of natural light:

Whenever the orientation of a building permits, day lighting has to be used in combination with electric lighting. The maxim use of sunlight can be get by means of transparent roof sheets, north light roof, etc.

6. Replacing incandescent lamps by Compact Fluorescent Lamps (CFL's):

CFL's are highly suitable for places such as Living rooms, Hotel lounges, Bars, Restaurants, Pathways, Building entrances, Corridors, etc.

7. Replacing conventional fluorescent lamp by energy efficient fluorescent lamp:

Energy efficient lamps are based on the highly sophisticated technology. They offer excellent color rendering properties in addition to the very high luminous efficacy.

8. Replacement of conventional ballast by Electronic ballast:

Installation of high frequency (28 –32Mhz) electronic ballast in place of conventional ballasts helps to reduce power consumption up to 35%.

9. Installation of separate transformer for lighting:

In most of the industries, the net lighting load varies between 2 to 10%. If power load and lighting load fed by same transformer, switching operation and load variation causes voltage fluctuations. This also affects the performance of neighboring power load apparatus; lighting load equipment's and also reduces lamps. Hence, the lighting equipment has to be isolated from the power feeders. This will reduce the voltage related problems, which in turn provides a better voltage regulation for the lighting this also increases the efficiency of the lighting system.

10. Installation of servo stabilizer for lighting feeder:

Wherever, installation of separate transformer for lighting is not economically attractive and then servo stabilizer can be installed for the lighting feeders.

11. Control over energy consumption pattern:

Occupancy Sensors, Daylight inked Control are commonly used in commercial buildings, malls, offices, where more no. Of lights are to be controlled as per operational hours microprocessor based Light control circuits are used.

As a single control unit it can be programmed to switch on /off as per the month wise, year wise and even season wise working schedule.

12. Energy Conservation in Motors:

Considering all industrial applications 70% of total electrical energy consumed by only electric motors driven equipment's.

13. Improving power supply quality:

Maintaining the voltage level within the BIS standards i.e. with tolerance of +/6%and frequency with tolerance of +/- 3% motor performance improves and also life.

14. Optimum loading:

Proper selection of the rating of the motor will reduce the power consumption. If the motor is operating at less than 50% of loading (η<50%) significant power saving can be obtained by replacing with properly sized high efficiency motors. If the motor is operating at loads below 40% of it‟s capacity, an inexpensive and effective measure might be to operate in star mode.

15. Improving transmission efficiency:

Proper selection of power transmission means (belts, gears) will reduces transmission losses.

Stopping idle or redundant running of motors or lights will save 100% power.

16. By use of Soft Starter:

Soft starters are essentially stator voltage controllers; helps to overcome above problem. It helps to **restrict** starting current and also provide smooth start and stop operation.

17. By improving power factor:

For improving p.f.connect the capacitor bank, which will improve the p.f. of the system from installation to generating station. Maximum improvement in overall system efficiency is achieved, which also reduces Max. Demand of the system and that will reflect in energy bill.

18. Use of high efficiency or Energy efficient motors:

The energy efficient motors have reduced losses through improved design,better materials and improved manufacturing techniques. Generally motor life doubles for each 10 0C reduction in operating temperature. While selecting EEM, select with 1.15service factor, design for operation at 85% of rated load.

19. Energy Management:

The fundamental goal of energy management is to produce goods and provide services with the Least cost and least environmental effect.Or "The strategy of adjusting and optimizing energy, using systems and procedures so as to reduce energy requirements per unit of output while holding constant or reducing total costs of producing the output from these systems"

The objective of Energy Management is to achieve and maintain optimumenergy procurement and utilization,throughout the organization.

Audit Phase

- To minimize energy costs / waste without affecting production & quality
- To minimize environmental effects.

20. ENERGY AUDIT:

As per the Energy Conservation Act, 2001, Energy Audit is defined as "the verification, monitoring and analysis of use of energy including submission of technical report containing recommendations for improving energy efficiency with cost benefit analysis and an action plan to reduce energy consumption".

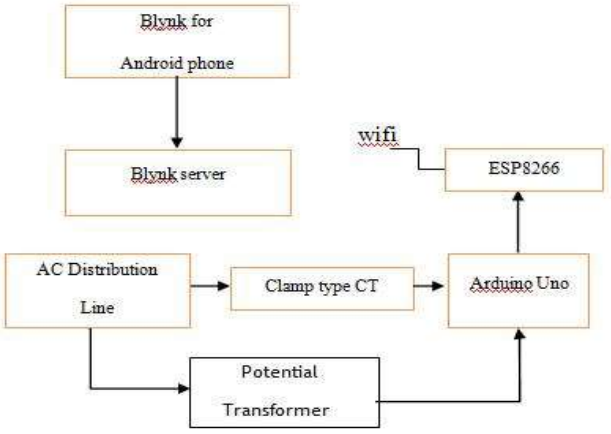
20.1 Aim of Energy audit (need):

- To minimize costs for energy.
- To minimize operational costs.
- To minimize costs for repairs and reconstruction to increase quality of environment that contributes to increased work productivity.

21. DEFINITION OF ENERGY MONITERING SYSTEMS:

Energy monitoring kit is electronic measurement device used by utilities to communicate information for billing customers and operating their electric systems. For over fifteen years electronic meters, have been used effectively by utilities in delivering accurate billing data for at least a portion of their customer base. Initially, the use of this technology was applied to commercial and industrial customers due to the need for more sophisticated rates and more granular billing data requirements. The use of electronic meters came into service to the largest customers of the utility and over time gradually expanded to all customer classes. This migration was made possible by decreasing cost of the technology and advanced billing requirements for all customer classes. The combination of the electronic meters with two-way communications technology for information, monitor, and control is commonly referred to as Advanced Metering infrastructure (AMI). Previous systems, which utilized one-way communications to collect meter data were referred to as AMR (Automated Meter Reading) Systems. AMI has developed over time, from its roots as a metering reading substitute (AMR) to today's two- way communication and data system. The evolution from AMR to AMI is shown in figure 1 with lists of stakeholders and benefactors for each step in Smart Meter evolution.

22. BLOCKDIAGRAM:



23. **WORKING:**

Energy Monitering System is a high-tech product developed in recent years on the basis of electronic meter. Its composition and working principle are very different from the traditional induction meter. The intelligent electronic meter is mainly composed of electronic components, its working principle is through the real-time sampling of user power supply voltage and current, and then use special electric energy meter IC Processing of sampled voltage and current signals, and converted into electrical energy and pulse output is proportional to the final processing, control through the microcontroller, display for electric pulsequantity and output.

We usually get smart metering of electricity when the A/D converter makes the pulse number called pulse constant, for intelligent electric meter, which is a more important constant, because the number of A/D converter pulse generated in a unit of time, will directly determine the meter measuring accuracy. The design principle of the current smart meter mostly adopts a A/D converter, but also some users of intelligent electric meter manufacturers with more households sharing a A/D converter, this measurement can only power the time to line up, will inevitably cause the decline of measurement accuracy, this work should be paid attention to the features of intelligent the meter smart meter not only adopted the design of electronic integrated circuit in the design selection, coupled with remote communication function, can connect with computer and the software control, so compared with the induction meter, smart meter no matter in the performance or operation function has a great advantage.

24. CONCLUSION:

Everything what happens in the world is the expression of flow of energy (Electrical) in one of its forms**.** In development process to cope with increasing energy demands, conservation and energy efficiency measures are two parallel paths.

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