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A Review on Energy Consumption Monitoring and Analysis System

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Abstract - ***The energy audit may start from a basic walk through survey at one extreme to one that may span several phases. These phases may include a basic walk through survey, followed by monitoring of energy use in the industry services, and then model analysis using computer simulation of industry operation. Energy audit has an important role in identifying energy conservation opportunities in the different industrial area, while they do not provide the final answer to the problem; they do help to identify possible potential for energy conservation and induces the companies to concentrate their efforts in this area in a focused manner. The complexity of the audit is therefore directly related to the stages or degree of sophistication of the energy management program and the cost of the audit exercise. Remote monitoring and control system refers to a field of industrial automation that is entering a new era with the development of wireless sensing devices. Remote monitoring of different industries sensors, machineries, energy or the power panels are the most demanding products and many organizations are working on it. The paper discusses the available solution in the industrial area and different research going through in order to improve the system.***

Keywords: *EMS1,Remote Monitoring2.*

1. INTRODUCTION

The energy audit in a industry is a feasibility study. For it not only serves to identify energy use among the different services and to clarify opportunities for energy conservation, but it is also a crucial first step in establishing an energy management program. The plan of audit will produce the data on which such a program is based. The study should known to the owner, manager, or management team of the industry the options available for reducing energy waste, the product costs, and the benefits achieve from implementing those energy-conserving opportunities (ECOs).

The energy management programmed is a systematic going through strategy for controlling a building's energy consumption scenario. It is to minimize waste of energy, power and money to the minimum permitted by the climate the industry is located, its functions, occupancy timing, and other factors. It establishes and maintains an efficient balance between a building's annual functional and structural energy requirements and its annual actual energy consumption.

Monitoring of electrical parameters is a main element in any Energy approach. Implementation of monitoring equipment is the first step of this kind of approach, as it makes an conclusion of the actual situation possible, before determination of the most relevant solutions. Due to monitoring it is possible to quantify the Energy Efficiency improvement actions.

As the Energy Efficiency is concern, auditing of electrical energy is of course number one. Active energy (in kWh or MWh) is generally the measure component of the electricity bill. For an accurate analysis measurement of active energy is recommended at different places in the installation, preferably at every workshop station. The measurement period should be limited, one week being a reasonable in order to compare periods with similar activity levels.

Any measure increase of energy consumption should be carefully analyzed, if it is not the result of a planned increase of activity level. The ideal situation should be a forward and extended decrease of energy consumption. Measurement of the supply voltage is also very important in terms of Energy Efficiency. Three different aspects should be analyzed:

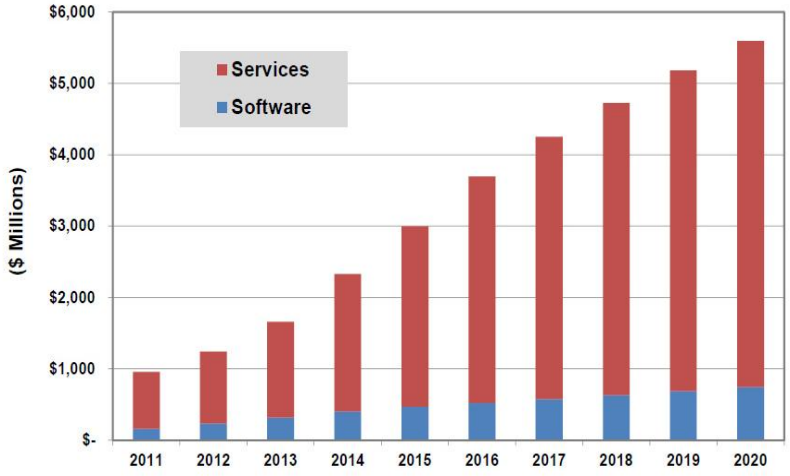

Chart -1: Industrial energy management software and service spending in United States.

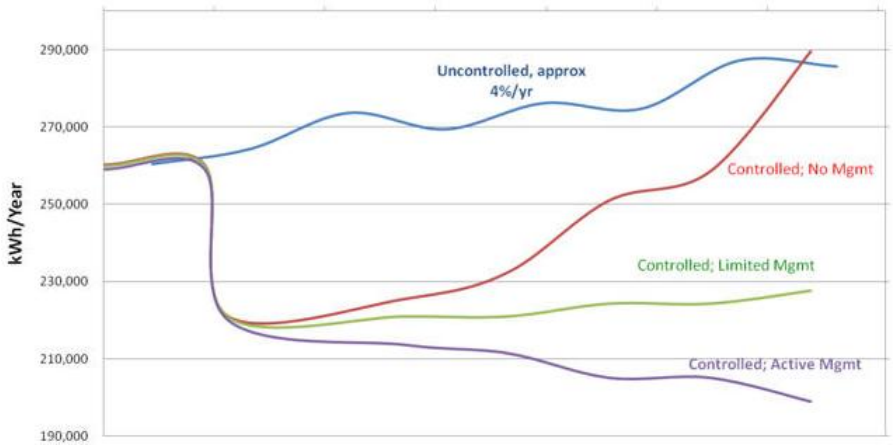

Fig -1: Advantages of Monitored and controlled active energy management

Amplitude should be measure for an optimum operation, the supply voltage should be maintained in a range of ±5% around the value specify by the Utility. Lower value means that some equipment like motors operate in deteriorated conditions. Higher value means increased in power losses and distortion in transformers, motors, lighting equipment. Voltage fluctuations are responsible for light flicker and vibrations in motor, even if the voltage amplitude remains within the contractual limits. Voltage distortion and interruptions are the most important phenomena in terms of Power Quality. Accurate measurement and dating can help to find the origin of the disturbance, and possibly facilitate negotiations with the Utility.

Current and Power absorbed at various points in the installation give the image of the instantaneous activity level. Observation of large distortion and fluctuations of current or absorbed power can direct actions in order to optimize equipment and accurate energy usage. Continuously large values of current and power mean that overload tripping is likely and low values means that rating of equipment may be high or unsuited.

Power Factor and Harmonic distortion are other important indicators of the way electrical installations are managed. If Power Factor has lower than 0.9, means that the supply current is un-necessarily increase, for a given power transmitted to the loads, and subject to a advance charge by the Utility. Power Factor Correction equipment should be implemented.

High harmonic voltage regarding distortion should be higher than 6 to 8%, may be the cause of disturbances and increased power losses. This observation may have triggered the implementation of harmonic mitigation equipment. For large interconnected networks, the power factor, frequency is maintained by

the Utilities within strict limits of 50 or 60Hz. There is nothing to be taken as consideration at the Distribution level. The only actions to be taken in case of measurement showing out-of-range frequency have to be preparing for interruption or black-out!

Voltage unbalance factor is another parameter which is commonly monitored and displayed without being under control. Fortunately, this is generally not an issue in most electrical installations.

1.1 Energy Management System

EMS is a pc-based platform technique used for the analysis and monitoring of your energy usage. The system enables you to observed and to analyze your power usage from various requirement by easy way. System features include energy use, users demand, Power W-VAR-VA and more. A multitude of reports can then be produced so as to fully understand and assess how can be power is used within your property.

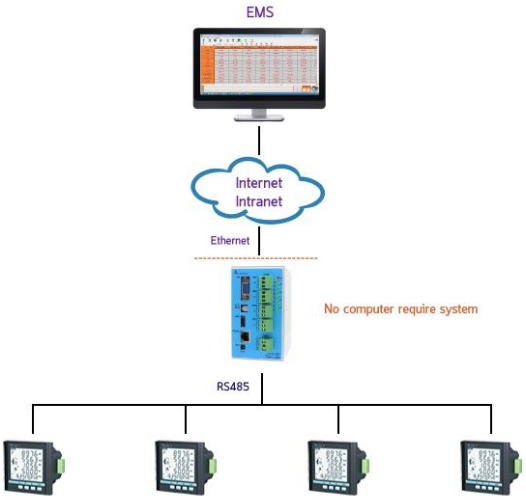

Fig -3: System diagram of EMS

Fig.3 describes the system diagram of EMS (Energy management system), where it present the flow of the system data transfers and the connection schematic. Complete EMS consisting following components,

- ***Multifunctional Energy Meter:*** these meters are specially designed for the industry requirements and it consist of micro processing capabilities which can calculate the different energy parameter like amps, watt, volts, etc from incoming phase. These meters can be communicated through different communication protocols like Modbus, serial to get the parameters values to system.

- ***Data Logger / Communicator:*** These components allow energy meter to transfer data over centralized system or communicate with remote system to share the data.

- ***Monitoring Software:*** These software will fetch the data from energy meter and allow user to monitor, plot graph or prepares an analysis report for future use.

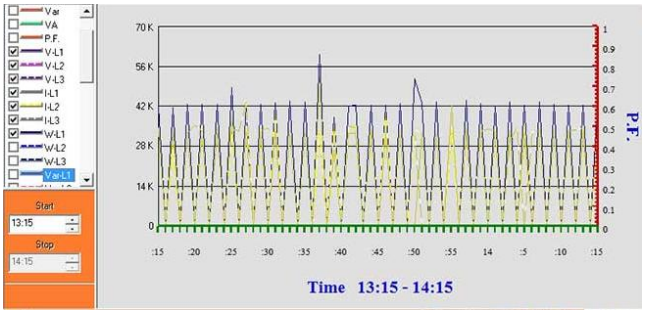

Fig-4 Analysis report

Fig. 4 shows the typical graphical representations of different energy parameter and it's values from specified node or the energy meter. These parameters value normally calculated by energy meter itself. Monitoring software will only log and represent those values.

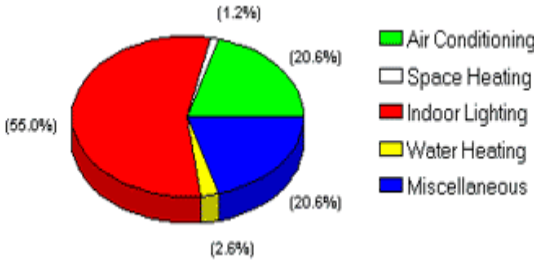

Fig. 5 Analysis report of individual device group energy consumption.

2.PREVIOUS WORK DONE

The access of Internet and Intranet technologies has been rapidly spreading and existing systems has been replaced with new systems based on these advance new technologies. At changing environment of the power system industry, in 1999 Toshiba declared a concept of new middleware for power system network control systems including energy management systems (EMS), supervisory control and data acquisition systems (SCADA), and distribution management systems (DMS). This new concept pattern is based on advance latest Internet and Intranet technologies, offering the real-time operation, high reliability and control management required for network control systems. Many systems are being manufactured, and some of which are already at the stage of production test.

P.Thamarai ,R.Amudhevalli [1]. Proposed a system which deals with problem in a simple and effective way by auditing the energy usage in different industrial sector. It checks power shut downs by knowing the large amount of energy wasted in industries by performing all this in an automated process. Energy Meters, PLC's and PC's SCADA- Supervisory Control and Data Acquisition of industrial management processes used for serial communication to facilitate communication between the programmable logical controllers and computer are used for performing its operations.

Hong-Chan Chang and Cheng-ChienKuo[2] proposed The energy management system (EMS) which uses the communication platform of ZigBee wireless sensor network device in combination with the energy parameters measurement and the control functions of safety protection and monitor, to achieve the objectives of energy saving, carbon reduction and safe power usage. The system structure design is consisted of the intelligent outlet module, wireless transmission module and central monitor and control module.

Adnan Rashdi, Rafia Malik, Sanam Rashid, Anam Ajmal,[3] presents the design and development of a GSM based energy system monitoring, profiling and control system. The system design integrates digital energy meters installed at consumer unit with an electric supplier company's energy monitoring system. Single phase or three phase digital electric meter can be used with intelligently developed add on transmission module, which takes the meter reading and utilizes the GSM network to transmit the energy reading using Short Message Service (SMS) back to the energy supplier. At the supplier end, an energy monitoring system is used to manage and control all received meter readings, compute the billing cost, update the database and maintain an energy consumption database profile for each user. Various alerts and control can also be generated by the supplier.

Anbarasu.M1, Rajendhiran.V2 [4] proposed a system which identifies the synergies between wireless sensor networks (WSNs) and electrical- signal-based motor signature analysis and proposes a scheme of applying WSNs in web based system and remote energy monitoring and fault diagnostics for industrial motor systems. The main function is to provide a system overview where the nonintrusive nature of the electrical-signal-based motor signature analysis enables its applications and features in WSN architecture. Special considerations in designing nonintrusive motor energy monitoring and fault diagnostic methods in such systems are discussed.

3. CONCLUSION

As the energy auditing is need of industries in order to save unnecessary energy consumption and to know the exact specification of requirement of every device or the machine, hence the proposed system is taking this development at next level by enhancing the term IoT (internet of things) for industrial remote energy parameter monitoring system. The advantages of wireless sensor node over traditional sensing have made them a promising platform for remote monitoring systems. The objective of energy audit is to identify the end use of energy in industry, and as a feasibility study leading to implementation of an energy management program. The audit procedures can be expanded as needed in the various phases of the energy program, with the application of each succeeding phase yielding more information on energy use, and more opportunities for raising energy efficiency.

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