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Energy Management Techniquies For Improvement Energy Efficiencies For Energy Conservation At District Energy Disdtribution Centers

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ABSTRACT:*The fundamental goal of energy management is to produce goods and provides services with least cost and least environmental effect. The objective of Energy Management is to achieve and maintain optimum energy procurement and utilization throughout the organization.*
The primary objective of Energy Audit is to determine ways to reduce energy consumption per unit of product output or to lower operating costs. This paper focuses on a case study for local energy Distribution Company urban division was taken and 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. Testing and calibration of all the major equipments under the jurisdiction of urban division Kolhapur is studied. Energy auditing will assist in profit center approach at each level as indicated Level of auditing, Distribution Transformer, Zonal level, District Level, Circle Level. How there should be effectively application of Modernization of Distributions is studied. Also how there should be digital automation of distribution for Better quality of power, Better supply continuity, Stability in the voltage, Lower system losses, Minimize outage time and Better customer service is explained in the case study.

Keywords: -
Energy Audit Methodology, Energy manager duties and responsibilities, Energy Accounting, Transmission and distribution losses, Technical Losses, Modernization of Distribution system.

1. Introduction:-

In every country, there are opportunities for more efficient energy management of the government's own facilities and operations. Improving efficiency at all levels of government can result in lower energy cost to public agencies, reduced demand on capacity-constrained electric utility systems, increased energy system reliability, and reduced emissions of greenhouse gases and local air pollutants. In addition, the government sector's buying power and visible leadership offers a powerful, non-regulatory means to stimulate market demand for energy-efficient products and services.
The fundamental goal of energy management is to produce goods and provides services with least cost and least environmental effect.
" 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 optimum energy procurement and utilization throughout the organization and:-

• To minimize energy costs / waste without affecting production & quality
• To minimize environmental effects.
A case study for local energy distribution company urban division Kolhapur was taken. Kolhapur City, blessed by existence of Goddess Shri Mahalaxmi Devi, is Headquarter of Kolhapur District. The electrical distribution network for the entire city is looked after by O & M Urban Division, Kolhapur. In addition, two numbers of surrounding villages viz. Kalamba and Shiroli with M.I.D.C. Shiroli area are also attached to this Division. This division started functioning with 20,000 numbers of consumers way back in the year 1966 and presently it is looking after 1,43,589 numbers of consumers of various categories, spread over 150 Sq.Kms.[7]

2. Body of Paper:-

NEED FOR ENERGY AUDIT:-

The Energy Audit would give a positive orientation to the energy cost reduction, preventive maintenance and quality control programmmes which are for production and utility activities. Such an audit programme will help to keep focus on variations which occur in the energy costs, availability and reliability of supply of energy, decide on appropriate energy mix, identify energy conservation technologies, retrofit for energy conservation equipment etc.

In general, Energy Audit is the translation of conservation ideas into realities, by lending technically feasible solutions with economic and other organizational considerations within a specified time frame.

Detailed Energy Audit Methodology

A comprehensive audit provides a detailed energy project implementation plan for a facility, since it evaluates all major energy using systems.

This type of audit offers the most accurate estimate of energy savings and cost. It considers the interactive effects of all projects, accounts for the energy use of all major equipment, and includes

detailed energy cost saving calculations and project cost.

In a comprehensive audit, one of the key elements is the energy balance. This is based on inventory of energy using systems, assumptions of current operating conditions and calculations of energy use. This estimated use is then compared to utility bill charges.

Detailed energy auditing is carried out in three phases:

Phase I – Pre Audit Phase
Phase II – Audit Phase
Phase III – Post Audit Phase

Measurements- 1) 100% metering at consumer end , DTC , FEMS EA ,Division EA

Ensure proper functioning and calibration of instrumentation required to assess level of energy consumption directly or indirectly. He has to decide whether master or standard calibrator is required or not. --- Instruments performance (accuracy and sensitivity) decides the Energy manager has to decide the frequency of testing and calibration of instruments, which are important in measurement of energy consumption. e.g. yearly, half yearly, quarterly etc. Maintenance and calibration of all feeder meters & instruments on yearly basis by testing division,

Further detailed survey of present energy consumption levels of various individual auxiliary, unit, department/ services and overall. --- Yearly, half yearly, quarterly, monthly, daily etc.was carried out .

Methodology how to accurately calculate the specific energy consumption of individual auxiliary, unit, department/ services and overall of the company.was worked out

Table 1:- Statistical data under urban division, Kolhapur. [5]

Descripition	Notations	2007-08	2008-09
Energy Input (MU)	A	473.57	482.17
Metered Energy (MU)	B	436.88	445.20
Billed Energy (MU)	C	437.24	445.20
Revenue Billed (Rs. Crores)	D	200.73	206.24
Revenue Realised (Rs. Crores)	E	200.72	211.74
Revenue Realised (MU)	F= R	437.22	457.07
ARR (Rs/Unit)	G=(E/A)x 10	4.24	4.39
No of 11 KV feeders	H	70.00	74.00
DT failure rate (%)	I	1.20	0.79
AT & C Losses (%)	J= 100x((A-R)/A)	7.68	5.21
Energy Loss (T&D)	K=(A-C)/A x 100	7.67	7.67
Metering Efficiency	N=100 x (B/A)	92.25	92.33
Billing efficiency	O=100 x (C/A)	92.33	92.33
Collection efficiency	P= 100 x (E/D)	100.00	102.67
ARR	Q= E/A	0.42	0.44
Realized energy	R=(C x P)/100	437.22	457.07
LT Loss		12.83	12.46

Fig1:- Testing & Calibration Instrument

The Way Energy Flows:-

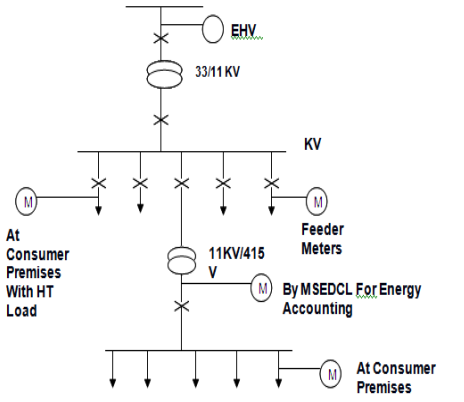

Fig 2:-The Way Energy Flow

Consumer Indexing

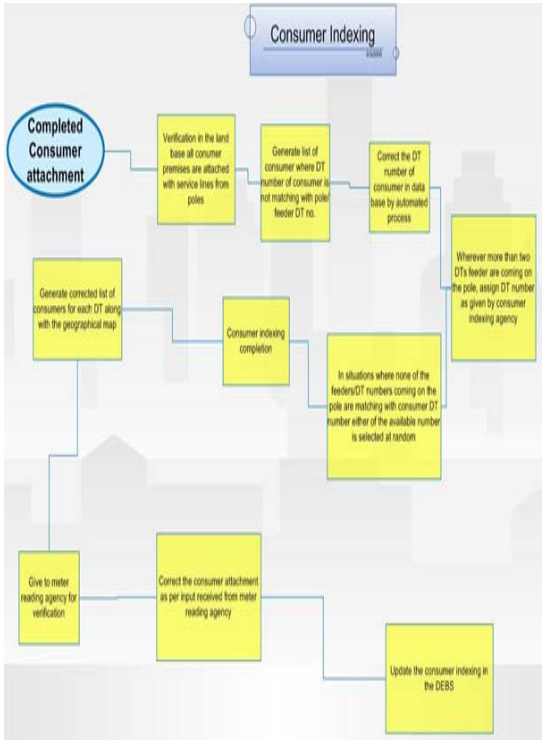

Fig 3:- Consumer Indexing

Table2:- Calculations of performance of different equipments.[3],[4]

Sr. No.	Particulars	Formula	Notation
1	**Transformer**	$\eta\ \% = (P_2 / (P_2 + (\text{No} - \text{load loss} + \text{Short circuit loss}))) \times 100$	Where, 1)P_2=Power delivered by transformer at full load at given power factor
2	**Current Transformer**	Total loss = $I_s^2 \times R_b$	1) Rb = Ohmic resistance of the burden. 2) Is = Load current of secondary.
3	**Potential Transformer**	Total loss = $I_s^2 \times R_b$	1) Rb = Ohmic resistance of the burden. 2) Is = Load current of secondary.
4	**Circuit breaker**	Total loss = $I^2 \times R$	1) R = Contact resistance of circuit breaker. 2) I = Rated average current
5	**Isolator**	Total loss = $I^2 \times R$	1) R = Contact resistance of Isolator. 2) I = Rated average current

33/11 KV, 5MVA Power transformer	Percentage Efficiency at 75 Deg. C	Load as Percentage of F.L.	100	75	50
		Unity Power factor	99.25	99.37	99.47
		0.8 Power Factor	99.06	99.22	99.33

CONCLUSION

Technical losses occurs in the system because energy is dissipated in the conductors and equipments used for the distribution of power. These technical losses are inherent in a system and depend on the design, maintenance and methods of operation of the distribution system. Technical losses cannot be eliminated entirely but should be brought down to an optimum level by proper system design and operation.

Transformers have high efficiency in the range of 98 to 99. The efficiency of large transformer is higher. The high efficiency is due to absence of rotating parts and perfection in the design of the magnetic and electrical circuit.

The circuit breaker and Isolator are only switching devices therefore losses occurring due to these devices are very less as compared to transformers. Hence losses occurring due to circuit breaker and isolator are neglected.

It is seen that, the load as percentage of full load increases percentage efficiency decreases. Also as power factor decreases than unity power factor then percentage efficiency decreases

The cost of electricity for the customers is rising day by day. Because of present serious financial constraints the correct tariff determination has become a must. The State Electricity Regulatory Commission (SERC) have determined the tariffs based on estimation of T&D losses in various states. The main problem in correct determination of T&D losses is unmetered consumption. Normally the unmetered consumers are given power supply at a reduced (subsidized rate) moreover, they use energy inefficiently.

On one hand new generating units are being delayed and the losses are increasing, it is really a very critical problem. The solution lies in metering all customers, in making tariff for all customers near the cost of supply, reducing the subsidizing tariff categories. For better results, of course, an attempt has to be made in keeping all energy meters in healthy condition, Replacement of faulty meters has

to be fast. It may be appreciated that measuring and reducing T&D losses is necessary for delivery of power efficiently and economically to the customers. There should be effectively application of Modernization of Distributions. SCADA is fully utilized if integrated with load controlled, AMR, fault location through sectionalize, TCM and facilities management. There should be digital automation of distribution for Better quality of power, Better supply continuity, Stability in the voltage, Lower system losses, Minimize outage time and Better customer service. To reduce loss effectively within limit there should be use of digital energy meters, Staggering of agricultural loads, Good construction and maintenance practices, Power factor correction should be done by providing capacitors near to the load centre, Re distribution of the load among various feeders ,Redistribution of feeders among various sub stations, Re routing of the feeders or adding of link lines , Ensuring proper tab setting of the inter connecting transformers, Shifting of the transformers near to the load center, Providing proper sectionalizing of the lines and using of higher size conductor for heavily loaded feeders

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