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ELECTRICAL ENERGY AUDIT OF "SANJEEVAN KNOWLEDGE CITY"

Abhijeet Sharad Patole[1], Kapil Hari Patil[2], Chinmay Umesh HIremath[3] , Abhishek arun Jadhav[4], Priti Dilip Sankapal[5], Shweta Sanjay Mole[6], Swati Bandopant Jadhav[7], Prof. V.T. Metkari[8]

[1]Student, dept. of Electrical Engineering, Sanjeevan Engineering & Technology institute, Panhala, Kolhapur
Asst. Prof. Dept. of Electrical Engineering Sanjeevan Engineering & technology institute, Panhala, Kolhapur

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Abstract - A sincere effort has been made in this report to conduct an energy audit at Sanjeevan Knowledge City and estimate the amount of energy used every day, week, and month. A thorough energy audit was conducted to identify the areas of energy waste and estimate the potential for energy savings throughout the entire campus. A thorough analysis of the data gathered is also performed, and cost-effective measures to increase energy efficiency are suggested. Each suggested action has an estimated cost of implementation. The outcome and important data produced by these actions are documented. The energy auditing is a consumption indicator that normalizes the current energy crisis by encouraging saving.

1.INTRODUCTION

An electrical energy audit is a systematic evaluation of the energy consumption, efficiency, and utilization of electrical systems and equipment in a facility or organization. It involves a detailed analysis of electricity consumption patterns, power distribution, and energy management practices. The goal of an electrical energy audit is to identify opportunities for energy savings, improve overall energy efficiency, and reduce operating costs. During an energy audit, trained professionals assess various aspects of the electrical system, such as lighting, HVAC (heating, ventilation, and air conditioning), motors, appliances, and control systems. They measure energy consumption, analyze equipment performance, identify energy ENlosses, and evaluate the effectiveness of energy management strategies. The audit findings provide valuable insights into areas of energy wastage, inefficiencies, and potential upgrades or retrofits that can lead to energy savings. Recommendations may include adopting energy-efficient lighting, optimizing motor systems, improving insulation, implementing power factor correction, or utilizing renewable energy sources.

2. METHODOLOGY

There are generally three types of electrical energy audits:

1.Preliminary Energy Audit: Also known as a walk-through audit, this type of audit involves a visual inspection and basic data gathering to identify obvious energy-saving opportunities. It provides a preliminary overview of energy consumption patterns and identifies areas for further investigation.

2.Detailed Energy Audit: A detailed energy audit involves a comprehensive analysis of energy consumption, equipment performance, and system efficiency. It includes extensive data collection, measurements, and analysis using specialized equipment and techniques. This audit provides a detailed understanding of energy usage, identifies specific energy-saving measures, and calculates potential cost savings.

3. Investment-Grade Energy Audit: An investment-grade energy audit is a highly detailed and rigorous audit conducted to support investment decisions in energy efficiency projects. It involves precise measurements, detailed engineering analysis, and financial modeling. The audit provides accurate cost-benefit analysis, energy performance projections, and return on investment calculations to help justify and prioritize energy efficiency investments.

3. ENERGY AUDIT TASK

During an electrical energy audit, various tasks are typically performed to assess energy consumption, identify inefficiencies, and recommend energy-saving measures. Some common tasks include:

1.Data Collection: Gathering relevant data on energy consumption, such as electricity bills, equipment specifications, operating schedules, and occupancy patterns.

2. Site Inspection: Conducting a physical walkthrough of the facility to observe and identify areas of energy wastage, such as inefficient lighting, equipment left on when not in use, air leaks, or inadequate insulation.

3. Load Analysis: Analyzing the energy load profile of the facility to understand the distribution of energy usage across different equipment and systems.

4. Energy Measurements: Conducting measurements of electrical parameters, such as voltage, current, power factor, and energy consumption, using specialized equipment like energy meters and data loggers.

5. Equipment and System Assessment: Assessing the performance and efficiency of electrical equipment, including motors, lighting systems, HVAC systems, and control systems. This may involve evaluating equipment condition, conducting efficiency tests, and identifying potential retrofit opportunities.

Energy Loss Identification: Identifying areas of energy losses, such as transmission losses, power factor penalties, or inefficient utilization of energy, and recommending corrective measures.

6. Energy Efficiency Recommendations: Providing specific recommendations for energy-saving measures, including the adoption of energy-efficient equipment, improvements in maintenance practices, insulation upgrades, lighting retrofits, and implementation of energy management systems.

7. Cost-Benefit Analysis: Assessing the financial feasibility of recommended energy-saving measures by calculating potential energy savings, payback periods, return on investment, and other financial metrics.

8.Reporting: Compiling audit findings, analysis results, and recommendations into a comprehensive report that outlines energy-saving opportunities, prioritizes actions, and provides a roadmap for energy efficiency improvements.

Monitoring and Verification: Recommending post-audit monitoring and verification procedures to ensure the effectiveness and sustained performance of implemented energy-saving measures.

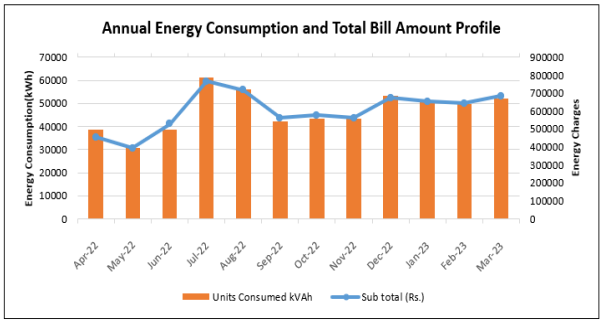
These tasks collectively form the core activities of an electrical energy audit, enabling organizations to optimize their energy usage and reduce operating costs.

4. ENERGY BILL ANALYSIS

Billing Month	Contract Demand (CD)	Units Consumed	Units Consumed	Billed Demand	Billed Power Factor	Energy Charges (EC)	Demand Charges	Electricity Duty	Sub total	per unit charge	Difference in kWh &kVAh	Difference in Rupees
	(kVA)	(kWh)	kVAh	kVA		(Rs.)	(Rs.)	(Rs.)	(Rs.)	rs/kvah		(Rs.)
Apr-22	240	38594	38749	156	0.996	270568	70824.00	70382	454591	11.73168	155	1818.411
May-22	240	30371	30616	156	0.992	225517.2	70824.00	62160.67	392192	12.81003	245	3138.458
Jun-22	240	38277	38508	156	0.994	273207.4	70824.00	82354.74	529030	13.73818	231	3173.521
Jul-22	240	61203	61325	156	0.998	421523.5	70824.00	118757	765820	12.48789	122	1523.523
Aug-22	240	55734	55957	156	0.996	389436.1	70824.00	111059.8	715680	12.78982	223	2852.13
Sep-22	240	41864	42201	156	0.992	291167	70824.00	86205.67	560930	13.29187	337	4479.359
Oct-22	240	43259	43564	156	0.993	301593	70824.00	88739.53	576616	13.23607	305	4037
Nov-22	240	43068	43284	156	0.995	290549.5	70824.00	85325.69	562507	12.99573	216	2807.077
Dec-22	240	53261	53421	156	0.997	358224.5	70824.00	102329.9	672676.4	12.59198	160	2014.718
Jan-23	240	50138	50340	156	0.996	346208	70824.00	100220.3	653430	12.98033	202	2622.027
Feb-23	240	49527	49726	156	0.996	340250.2	70824.00	98465.8	643600	12.94293	199	2575.643
Mar-23	240	51701	51909	156	0.996	357025.9	70824.00	102928.4	684781	13.19195	208	2743.926
Total	-	556997	559600	-	-	3865270	849888	1108930	7211853	154.7885	2603	33785.79
Average	240	46416.42	46633.33	156	0.995	322105.8	70824	92410.79	600987.8	12.89904	216.91	2815.483

Fig(A)

1. Contract Demand-240 kVA
2. Billed Demand (65% of Contract Demand)-156 kVA
3. Institute kVA consumption overall 60 to 75 kVA overall year that means only 40% to 50% of billed demand. Institute pay 65% billed demand amount in every month with is 70,824/- rupees. It can be reduced by reducing the contract demand.
4. Institute billing system is kVAh billing system so, keep capacitor bank healthy to P.F. maintained unity. Now, overall average P.F. 0.995 but still overall average 217 unit difference observed.



Fig(B)

5. Total Connected Load

Departments	Load (KW)
Electrical	16.291
Automobile	3.143
civil	31.344
computer	6.208
ENTC	8.018
Mechanical	22.635
Top Floor school	2.580
Diploma	2.482
First Year	10.770
Common	25.299
School CBSC board	25.105
School State Board	6.791
School Semi English	9.737
Junior collage	8.263
Total (KW)	168.586

Fig(C)

Fig(C) Shows the total connected load in Sanjeevan Knowledge city. It includes Electrical department, Automobile department, Civil department, Computer Department, ENTC department, Mechanical Department, top Floor school, Diploma, First Year, Common Area, School CBSC board, School state board, school Semi English, Junior collage. Total connected load is 168.586 KW.

6. Condition of Capacitor Bank

CAPACITOR BANK PANEL					
125 kVAr Capacitor MAIN TRASNFORMER ROOM					
Capacitor bank no.	Capacitor rating (kVAr)	Currents			Remark
		R	Y	B	
1	10	NOT WORKING			FAULTY
2	15	NOT WORKING			FAULTY
3	20	27.4	26.7	26.9	OKAY
4	20	26.9	27.1	27.8	OKAY
5	20	11.9	0	12.2	FAULTY
6	20	NOT WORKING			FAULTY
7	20	27.3	26.8	26.9	OKAY

Fig (D)

In the Capacitor Bank Panel total 7 capacitors are connected, 3capacitor is not working(faulty) condition, there are 4 capacitor of 20 KVAR, 1 capacitor of 15 KVAR, 1 capacitor of 10 KVAR are connected

7. SUMMARY & RECOMENTATION

1. It is observed that the voltage harmonics is within limit which range of 1.46 % to 58.76 %. As per IEEE 519:2014 standards as standard value of 5% is acceptable (voltage harmonics (VTHD %)

2. It is observed that Current THD is varies from 7.33% to 127.50% which is on higher side than standard value of 8% (Current harmonics (ITHD %) limit as per IEEE 519:2014 standards).

3. Poor house-keeping practice observed in most of electrical panel rooms.

4. Caution Notice and posters with first-aid guidelines for electric shock injury were not available near most of the electrical panels

5. Most of the DB's don't have cover plate and DB's kept open as shown in above image.

6. Cable glands not provided, possible danger of rodent entry in to the panels and corresponding hazards.

7. Provide Double body earthing to all Distribution boxes.

8. First aid boxes were not available in any of the electrical panel rooms.

9. Rubber mats confirming to IS 15652 shall be placed on floor in working area for electrical panels & DB's.

10. Hanging cables found in some electrical panel room – Cable trays shall be used for overhead cable laying.

11. Remove all unwanted/Unused cables and material from electrical panel rooms.

12. Wire dressing required for most of the distribution panels.

13. Telecom cables need to be properly dressed.

14. CEA Regulation 18- Danger notices were not fixed on the DB's. Fix the danger notice as per IS 2551 on all the panels exceeding 250V.

15. Separate earth pits are provided for lightning protection system, communication and power systems.

3. CONCLUSIONS

Based on the comprehensive energy audit conducted at Sanjeevan Knowledge City, incorporating the utilization of a power analyzer and analysis of the past 12-month energy bills, along with the collection of ground-level data, several significant findings and recommendations have been identified. This energy audit aimed to evaluate the energy consumption patterns, identify potential areas of energy wastage, and propose measures for energy optimization and cost savings.

REFERENCES

1. sheikh jellar rehman "ENERGY AUDIT IN TECHNO INDIA ENGINEERING COLLEGE, SALT LAKE CAMPUS" School of energy studies, jadavpur university, kolkata-700 032. 2008-2009.

2. Chikku Abraham, George Mel & Jose Victor "ENERGY AUDIT OF IIT-BOMBAY CAMPUS" IIT-BOMBAY, 2008.

3. Energy Audit Team "ENERGY AUDIT OF IIT-ROORKEE CAMPUS" IIT-ROORKEE, January 2010.

4. Gousia Sultana, Harsha.H.U, Electrical Energy Audit a Case Study, IOSR Journal of Electrical and Electronics Engineering (IOSR-JEEE) e-ISSN: 2278-1676, pISSN: 2320-3331, 10(3) Ver. III (May – Jun. 2015), PP 01-06.

5. R M Holmukhe, K. D. Deshpande, Energy Audit in Industry -A case study of Centrifugal Pumps, I·COS

Electronic & comll1unicmion proceedings 13·15 Jan2011.