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ENERGY AUDITING IN MSME CLUSTERS

Dr. S. Venkatanarayanan (Prof /EEE)[1], A N.Nagarjun[2], M.Prabhakar raj[3], S.Ram kailash[4], S. Vinoth kumar[5]

[1] *Prof /EEE, Department of Electricals & Electronics Engineering, K.L.N. College of Engineering, Tamil Nadu, India*
[2, 3, 4, 5] *UG Scholar, Department of Electricals & Electronics Engineering, K.L.N. College of Engineering, Tamil Nadu, India*

Abstract - Energy auditing in MSME clusters identifies energy inefficiencies, helping businesses reduce consumption and costs. By upgrading equipment and improving processes, MSMEs can save energy, cut expenses, and lower their environmental impact. Audits also offer access to government incentives, promoting sustainable operations and long-term savings..

Keywords- Energy auditing, MSME clusters, Energy inefficiencies, Consumption reduction, Cost savings, Equipment upgrades, Process improvement, Environmental impact, Government incentives, Sustainable operations

1.INTRODUCTION

Energy auditing in MSME (Micro, Small, and Medium Enterprises) clusters is a crucial process aimed at optimizing energy use, enhancing efficiency, and reducing operational costs within industries that are often resource-constrained. MSMEs, which form the backbone of many economies, typically operate with limited access to advanced technologies and often face challenges in managing energy consumption effectively. Given the growing concerns over energy conservation, cost management, and environmental sustainability, energy auditing has become an essential tool for improving the competitiveness of MSMEs while supporting their sustainable growth.

The energy audit process in MSME clusters involves a systematic examination of the energy use patterns across various industries, identifying areas of energy wastage, and recommending energy-efficient solutions. The audit encompasses evaluating existing energy infrastructure, machinery, lighting systems, heating, and cooling processes, as well as production methods. By applying analytical tools such as load analysis, energy modeling, and thermal imaging, the audit provides an in-depth understanding of energy usage and its impact on overall operational efficiency.

The main aim of energy auditing in MSME clusters is to promote the adoption of energy-efficient technologies and practices that lead to cost savings, reduced carbon footprints, and improved sustainability. In addition, energy audits enable MSMEs to comply with environmental regulations, access energy-saving incentives, and gain a competitive advantage in the marketplace. Despite the benefits, the implementation of energy-saving measures in MSMEs may face challenges such as financial constraints and limited technical expertise. Nonetheless, the importance of energy audits in driving operational efficiency and sustainability remains paramount for MSMEs aiming for long-term success.

2. PROPOSED METHOD

The proposed method of energy auditing in MSME clusters typically involves several key steps to systematically identify inefficiencies and optimize energy consumption. Here's a breakdown of the process:

2.1 Pre-Audit Preparation:

Data Collection: Gather historical data on energy usage, including electricity, fuel, and water consumption.

Objective Setting: Define the specific goals of the audit (e.g., cost reduction, efficiency improvement, carbon footprint reduction).

Team Formation: Form an audit team with experts in energy management, industrial processes, and sustainability.

2.2 On-Site Evaluation:

Walkthrough Assessment: Conduct a visual inspection of the facility, including machinery, lighting, HVAC systems, and insulation.

Energy Metering: Use energy meters to collect real-time data on electricity and fuel usage in various sections of the facility.

Interviews: Engage with employees and operators to understand energy-related practices and identify potential inefficiencies.

2.3 Energy Consumption Analysis:

Baseline Energy Profile: Create an energy baseline by analyzing current energy consumption patterns and comparing them with industry benchmarks.

Identify Key Energy Consumers: Pinpoint high-energy-consuming equipment or processes, such as motors, compressors, and heating systems.

Loss Identification: Identify areas where energy losses occur, such as in equipment malfunctions, improper insulation, or air leaks.

2.4 Energy Efficiency Recommendations:

Process Optimization: Suggest improvements in production processes that reduce energy use (e.g., optimizing machine run times, reducing idle times).

Equipment Upgrades: Recommend energy-efficient alternatives for outdated machinery or lighting systems (e.g., LED lighting, high-efficiency motors).

Automation & Control Systems: Propose the installation of energy management systems to monitor and control energy consumption in real-time.

2.5 Cost-Benefit Analysis:

Investment vs. Savings: Assess the cost of implementing energy-saving measures against the expected savings over time.

Payback Period: Calculate the payback period for proposed investments and evaluate the return on investment (ROI).

2.6 Report & Implementation:

Audit Report: Provide a detailed audit report with findings, recommended measures, cost savings estimates, and implementation timelines.

Implementation Plan: Develop a step-by-step plan for applying recommended improvements, including prioritization based on cost, impact, and feasibility.

Monitoring & Review: Suggest periodic follow-up audits to track energy performance improvements and ensure continued efficiency.

3. HARDWARE IMPLEMENTATION

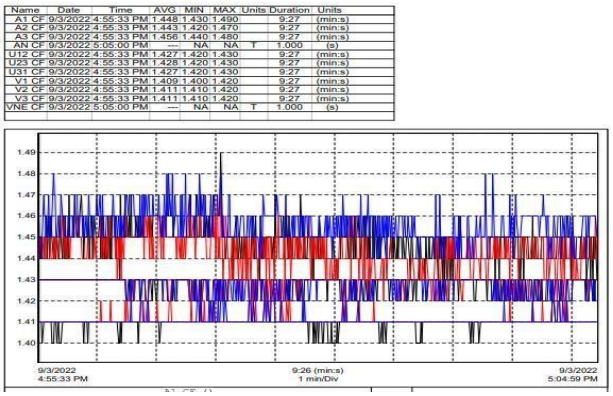
FIG 3.1KRYKARD ALM36

3.1 KRYKARD ALM36

The **Krykard ALM36** plays a crucial role in energy auditing by providing precise, real-time data and in-depth analysis of energy consumption patterns across various processes and equipment. During an energy audit, the system's ability to collect and monitor data on parameters like voltage, current, power factor, and load enables auditors to gain a comprehensive understanding of the overall energy usage in a facility. This continuous monitoring helps track energy consumption over different time frames, including peak and off-peak hours, which is essential for identifying high-energy-consuming areas and pinpointing inefficiencies.

Once data is collected, the ALM36's advanced analytics tools process this information to uncover energy wastage, equipment inefficiencies, and areas that require optimization. For instance, the system can highlight machines that use more energy than necessary, suggest improvements for power factor correction, or identify processes that could be streamlined to reduce consumption. This data-driven analysis enables auditors to target specific areas where energy-saving measures can be implemented, making the audit process more accurate and effective.

In addition to its monitoring and analysis capabilities, the ALM36 generates detailed energy reports, providing insights into energy usage trends, cost breakdowns, and areas of inefficiency. These reports become a valuable part of the energy audit documentation, helping businesses understand their energy consumption in greater detail. Auditors can use these reports to offer clear, actionable recommendations, such as equipment upgrades, process changes, or the adoption of energy-efficient practices, ultimately helping businesses reduce energy costs and improve overall efficiency.



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U31 CF	9/3/2022	4:55:33 PM	1.427	1.420	1.430		9:27	(min:s)
V1 CF	9/3/2022	4:55:33 PM	1.409	1.400	1.420		9:27	(min:s)
V2 CF	9/3/2022	4:55:33 PM	1.411	1.410	1.420		9:27	(min:s)
V3 CF	9/3/2022	4:55:33 PM	1.411	1.410	1.420		9:27	(min:s)
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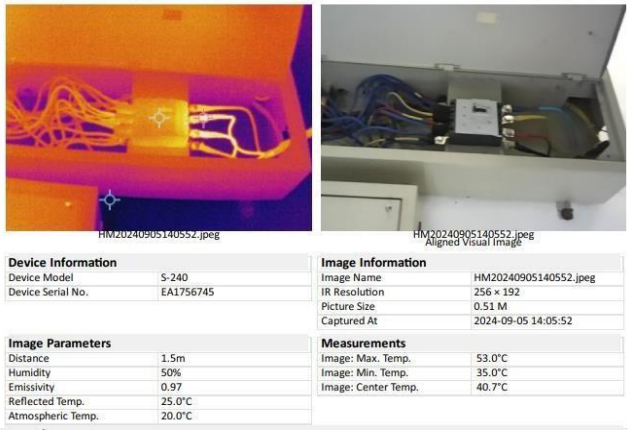
FIG 3.1.1 KRYKARD ALM36 GRAPH

3.2 THERMAL IMAGER:



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HM20240905140552.jpeg
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Atmospheric Temp.	20.0°C

Measurements	
Image: Max. Temp.	53.0°C
Image: Min. Temp.	35.0°C
Image: Center Temp.	40.7°C

FIG 3.2 THERMAL GRAPH

3.2.1 Infrared Radiation Detection:

All objects emit infrared radiation as a result of their temperature. Hotter objects emit more infrared radiation, while cooler objects emit less.

A thermal imager's **infrared sensor** detects this radiation, capturing the heat emitted by various surfaces in its field of view. The sensor is sensitive to the infrared energy in the wavelength range typically between 8 to 14 micrometers (the infrared spectrum).

3.2.2 Sensor Conversion:

The infrared radiation is absorbed by the detector array (a specialized sensor array), which is typically made of materials like gallium arsenide (GaAs) **or** amorphous silicon**.**

The infrared energy is then converted into an electrical signal. This step involves detecting the temperature variations of the scene, as infrared energy corresponds to the object's temperature.

3.2.3 Image Processing:

The electrical signals from the sensor are sent to a processor inside the thermal imager.

The processor then converts these signals into a thermal image (or thermogram), where different temperatures are represented by varying colors. The higher the temperature, the "warmer" the color (e.g., red, yellow, or white), and the cooler the temperature, the "colder" the color (e.g., blue or purple).

3.2.4 Displaying the Thermal Image:

The processed thermal data is displayed on the thermal imager's screen as a visual image, showing temperature variations across the scanned area.

Each pixel in the thermal image corresponds to a specific temperature reading in that area, creating a clear representation of heat distribution.

3.2.5 Temperature Measurement:

The thermal imager can also provide precise temperature measurements for specific points in the image. By placing a cursor or reticle over a spot on the thermal image, the device will display the exact temperature of that point.

3.2.6 Calibration and Adjustment:

To ensure accurate measurements, thermal imagers are calibrated using known temperature sources (such as blackbody radiation sources).

Some advanced thermal cameras offer emissivity adjustments, which account for the material type and surface finish of objects. Different materials emit infrared radiation differently, so emissivity calibration ensures accuracy across various surfaces.

4. STEPS FOR ENERGY AUDIT:

4.1 Steps of Energy Audit

Performing a business energy audit allows a company to take stock of its energy performance and to implement a set of essential actions to reduce its energy consumption. How does an energy audit take place? Here is an energy audit guide with all the steps to make your diagnosis as profitable as possible.

4.2 Identify Problems:

An energy audit can also help to identify any issues that your equipment might have. For example, the auditor could find small leaks in your compressed air system. These leaks would cost you a significant amount of money if you didn't know about them until a major problem presented itself later down the line.

4.3 Increased Employee Comfort:

During your audit, you might learn about changes that you can make regarding insulation and air sealing. Completing these enhancements will help create a more reliable and more efficiently cooled or heated space for you and your employees. In turn, more comfortable employees tend to be more productive, so not only will you save on energy costs, but you may also improve overall profit ability for your business.

4.4 Personalized Recommendations:

Working with an energy expert can help you learn about new energy-efficient technologies you wouldn't have otherwise known about. The professional will customize a plan just for your business, recommending which upgrades will give you the most return on your investment. These might include updated lighting systems, a new HVAC system,

4.5 Show Environmental Concern:

By taking steps to be more energy efficient, you will be showing your employees and clients that your company cares about the impact that you're making on the environment. This may help your each those customers who are looking to work with an environmentally conscious business.

Quality, and ease of availability. It is ideal for applications such as machine control applications, measurement devices, study purpose, and so on.

5. FORMULA:

5.1 The formula for calculating harmonic losses is

P=I^(2)R

Where,

P = Power loss in watts I = Harmonic current R = Conductor's resistance.

5.2 The formula for calculating Voltage is

Voltage(v)= IR Where,

V = Voltage I = Current R = Resistance

5.3 The formula for calculating Frequency is

Frequency (F) =1/T Where,

F = Frequency T = Period

5.4 The formula for calculating Power Factor is

Power Factor (PF) = P/S Where,

P = Active or real power in watts (W) S = Apparent

5.5 CHEPAS MEDICAL PVT LTD

FIG 5.5.1 SITE PHOTO

FIG 5.5. 2 SITE PHOTO

5.6 MDR MARINE PVT LTD

FIG 5.6.1 SITE PHOTO

FIG 5.6.2 SITE PHOTO

5.7 MK FIBER PVT LTD

FIG 5.7.1 SITE PHOTO

FIG 5.7.2 SITE PHOTO

6. SUSTAINABLE DEVELOPMENT GOAL:

SDG 7: Affordable and Clean Energy Target 7.1: Universal Access to Energy

Goal: Ensure universal access to affordable, reliable, and modern energy services for all.

Focus: Providing access to electricity and clean cooking solutions, especially in rural and underserved areas.

Example: Expanding the reach of renewable energy solutions, such as solar panels or biogas, to remote communities that lack access to traditional energy grids.

Target 7.2: Increase the Share of Renewable Energy

Goal: Increase the share of renewable energy in the global energy mix by 2030.

Focus: Encouraging the use of renewable sources like wind, solar, geothermal, and hydropower to replace fossil fuels.

Example: Supporting the transition to clean energy in industries, cities, and countries by investing in renewable energy infrastructure.

Target 7.3: Improve Energy Efficiency

Goal: Double the global rate of improvement in energy efficiency by 2030.

Focus: Reducing energy consumption while maintaining or improving performance in sectors such as industry, transport, and residential buildings.

Example: Implementing energy-efficient technologies in manufacturing and construction, like LED lighting, smart grids, and efficient HVAC systems.

Target 7.4: Enhanced International Cooperation Goal: Enhance international cooperation to facilitate access to clean energy research and technology, especially for developing countries.

Focus: Promoting knowledge-sharing, capacity building, and the transfer of energy-efficient technologies to countries that need them most.

Example: Providing financial support or technology transfers to developing nations to help them implement renewable energy projects.

Target 7.5: Expand Infrastructure and Technology

Goal: Expand infrastructure and upgrade technology for supplying modern and sustainable energy services in developing countries.

Focus: Strengthening the energy infrastructure in developing countries to improve energy access and reliability.

Example: Building or upgrading energy grids, establishing clean energy hubs, and providing support for decentralized energy solutions like microgrids.

7.CONCLUSION:

Overall, energy auditing in MSME clusters plays a pivotal role in fostering sustainable business practices, reducing energy consumption, and cutting operational costs. By identifying inefficiencies and implementing energy-saving measures, MSMEs can achieve significant financial savings, enhance their competitiveness, and contribute to environmental sustainability. Energy audits also support the achievement of global Sustainable Development Goals (SDGs), particularly those related to affordable and clean energy (SDG 7), responsible consumption and production (SDG 12), and climate action (SDG 13).

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