The Management and Improvement of Electrical Energy Assets at The Electrical and Computer Engineering Department, Federal Polytechnic Bali Taraba State

Yusuf, Ibrahim
Electrical and Electronic Engineering Department
School of Engineering
Federal Polytechnic Bali,
P. M.B 05 Bali
Taraba State Nigeria.
E-mail: ibrahimyusuf226@gmail.com

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Abstract
Globally rising energy consumption is causing an increase in greenhouse gases (GHG) in the atmosphere, which is causing climate change. Countries are putting more emphasis on energy efficiency to lower emissions of greenhouse gases. The reduction of energy usage is significant for sustainability through lowering environmental impacts as well as for the long-term viability of industrialization. The study's goal is to assist commercial and industrial buildings in integrating energy efficiency into their management practices, which may involve streamlining production processes and enhancing the energy effectiveness of factories and plants. To mitigate the negative effects of rising energy use and global warming, the management of energy tactics and instruments is essential. As a foundation for attaining energy savings objectives, the ISO 50001 standard calls for a rigorous energy auditing process for figuring out SEUs and ENPIs.

Keywords: *ISO50001, SEUs, ENPI, Energy Management System, Energy Efficiency*

1.0. Introductions of the study

Climate change is still a serious issue for people throughout the globe. Since climate justice is distinguished across international, intra-societal, and intergenerational dimensions, the paper uses an intellectual foundation given by Schapper (2018) to persuasively categorise the various interpretations of the word. Contributions made throughout the higher-level portion of the event are examined through the prism of critical discourse analysis by their tales to identify which climate justice discourses are being utilised by distinct characters. The sample consists of 17 statements from different countries arranged into different alliances. Comparatively, the findings reveal that the Glasgow Pact recognises most discourses to some degree, but that it stands with industrialised nations due to knowledge claims, non-binding policy phrasing, and the absence of any discourse on historical accountability or the freedom to use fossil fuels. (Susan, E.2022).

Social unrest was spurred by increases in the cost of food and energy in 2007 and 2008. This can be largely ascribed to the high degree of global economic integration, which enables market shocks to spread between physically remote regions. Few studies have been conducted on these

international problems, despite the fact that many possible factors, including the production of biofuel, the price of crude oil globally, financial speculation, and the US currency exchange, are thought to be the main drivers of civil unrest in Africa. (Fukui, S., Tanaka, T., and Guo, J., 2022) The statistical model that has been developed incorporates a valuable toolbox for tracking and managing energy management practices in the dairy and food manufacturing industries. According to the best of the authors' knowledge, this proposed model was the first in the dairy industry to combine the LSS and ISO 50001 system techniques, and it led to successful outcomes, including a 46% decrease in CO2 emissions and a 36% decrease in thermal energy use. Due to a 35% reduction in annual energy expenses, the strategy had a beneficial financial impact. With the potential for CHP, steam displacement with hot water, and heat recovery, this study has shown how LNG can be used to replace fuel oil. (Trubetskaya, A., McDermott, O., and McGovern, S., 2023).

1.1. Background of Research

The Federal Polytechnic, Bali is a federally funded institution of higher education that is situated in Bali local government, Taraba State, Nigeria. The institution was granted permission to launch on March 14, 2007.

1.2. ISO50001

According to experts, this model's development and assurance, as well as its adherence to standards like ISO 50001, reduced greenhouse gas emissions and other harmful environmental effects. This strategy promises an energy cost reduction with a substantial degree of device conformance with Deming's work cycle-based ISO 9001 (i.e., management) as well as ISO 1401 environmental management requirements (Pourelmi, T. et al., 2023).

2.2.1. The Phases of ISO50001

The maintenance and development methodology for ISO50001 typically consists of five phases. The following is a description of each phase:

- **Energy Policy Phase**
- The initial phase of an ENMS, involving the development and implementation of a green energy policy is covered under ISO 50001.
- **Implementation**
- This phase involves incorporating and executing the developed plan from stage two.
- Activate energy management. action plans into action. This scheme is combined with
- **Plan**
- Conducting an energy assessment, establishing the basis, indications, aims, action plans, and objectives required to produce results that will enhance energy consumption in line with the institution's energy plan.
- Checking and monitoring
- Processes and key operational elements that have a bearing on the efficiency of energy usage should be tracked and measured about the energy strategy and goals, and the results should be reported.
- **Management Review**:

enhance energy efficiency and the global ENMS by taking suitable measures. A management evaluation of the adopted standards to make sure they are operating effectively is the final stage of the ISO 50001 standards.

Figure 1 illustrates the plan-do-check-act cycle, which is a four-section cycle made up of the parts and tasks that must be completed at each level of the ISO 50001 EnMS.

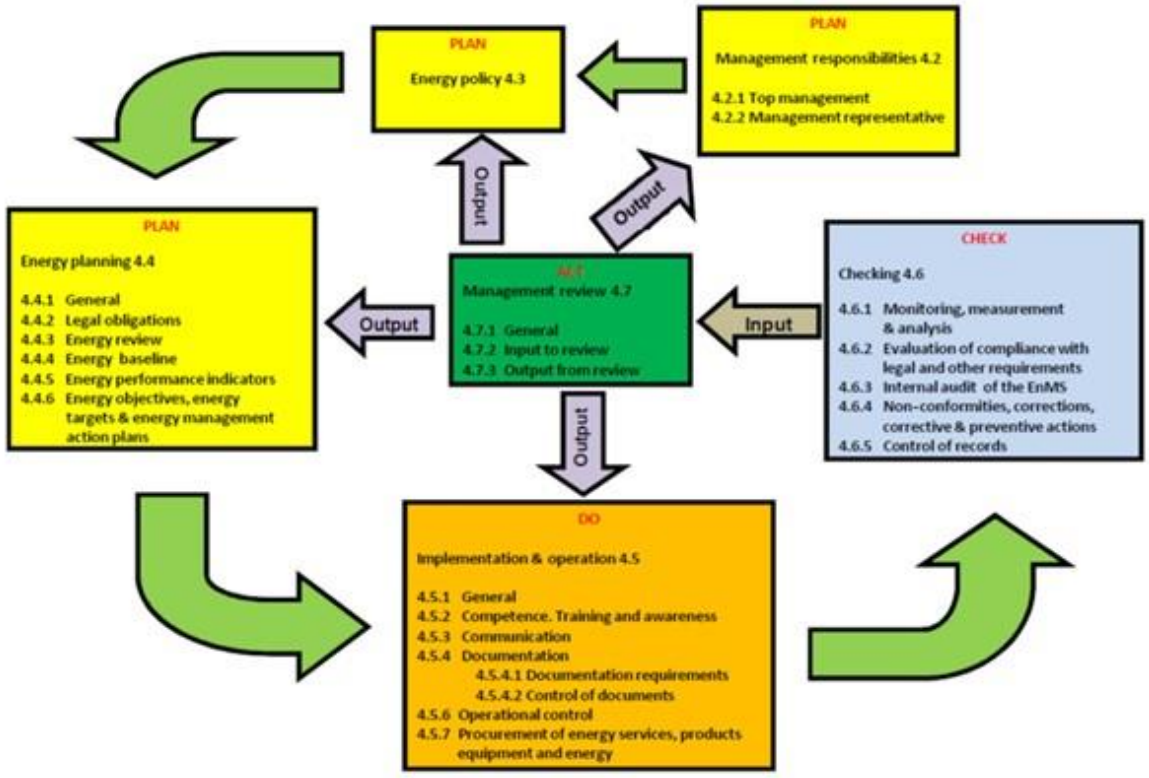

Figure 1: Cycle of Plan-Do-Check-Act (Lewry, A., 2013)

3.0. Methodology

The overall objective of the ISO 50001 Impacts Methodology is to help decision-makers assess the local, regional, national, and worldwide effects of implementing ISO 50001 in the industrial and commercial (service) sectors. Software called the ISO 50001 Impacts Estimator Tool (IET 50001), which makes use of the methods described in this specification (EMWG, 2016b), The term "service" is used in both the accompanying methodology descriptions and IET 50001 to denote the commercial sector to be consistent with IEA data sources. We should consider both concepts equally for the sake of this essay. (McKane, A. et al., 2017)

To guarantee that changes are made over time, top management should evaluate the PCDA cycle and each of its components. Implementing the standards will depend heavily on EnMS's sustainability energy plan.

To properly establish a system for managing energy at Electrical and Computer Engineering Building (ECEB) of the Federal Polytechnic in Bali, the protocols listed below must evolve.

evaluation of the institution's use of any other systems of management or current requirements of ISO.

- the institution's present state in relation to ISO50001 EnMS
- gap evaluation to identify areas for improvement
- Utilising the ISO 50001 Foundation

- Consumption of energy and benchmark estimates are provided.
- The potential areas for increasing energy utilisation are highlighted.
- Making an energy indicator of effectiveness calculations
- Ongoing development through energy-saving measures and techniques

3.2. Analysis Gap

Utilising a checklist with queries adapted from ISO50001 specifications, an analysis of gaps is performed. Every requirement is assessed using a rating system ranging from 0 to 3, with 3 being the highest level of satisfaction. Three are full, two are somewhat full, one is not, and zero (0) is not of use. The inclusion of a comment section enables a deeper understanding of each criterion. The study of the energy plan is shown in Table 1 below. Table 1: An analysis of energy strategy

Energy Strategy	Equal	Remarks
Is an approach to enhancing energy resource utilisation and effectiveness over time included in a written energy policy?	II	Despite the lack of standalone energy legislation, the Health, safety, and Environment (HSE) regulation has provisions that address the consumption of energy.
Does the legislation demonstrate a dedication to accomplishing energy efficiency objectives?	I	There are no specific objectives.
Anyone can access the rules and regulations, right?	III	Everybody has access to the health and safety regulations.

Even though, under the present circumstances, health and safety legislation recognises the significance of energy efficiency at a certain level, there are currently no structured energy resource approaches. So, a portion of the need for an energy strategy is met. Instead of combining the present HSE plan, an independent approach to energy needs to be developed. An institution's efforts to enhance its indirect and direct systems of administration can be summarised in a review of gaps (Semih and Selin, 2007). To implement ISO 50001 EnMS at its location, a variety of associated tasks will be carried out using Polytechnic Electrical and Computer Engineering Building (ECEB)'s daily operations. These steps make up the structure for deploying EnMS in an institution.

3.3. Analysis of utilities

The electrical energy utilities business provides power to Electrical and Computer Engineering Building (ECEB). Details on energy consumption and overall power demand are provided by metres and on the billed electricity each month. To comprehend the organisation's energy usage patterns, this data is analysed. The variance in consumption of electricity throughout the year is depicted in Figure 2.

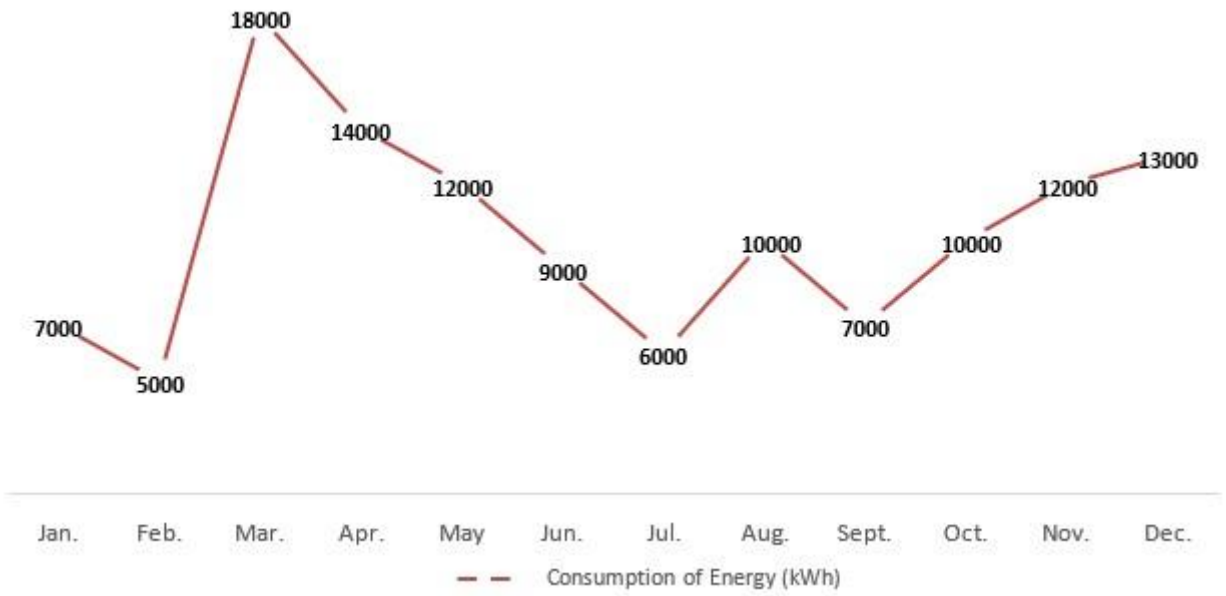

Figure 1: Monthly Electricity Usage:

There was a total consumption of 112,345 KWh between January 2022 and December 2022. At that time, the average power demand was 150 KVA. In July, demand peaked at 175 KVA. By using the overall energy consumption of 2022—112,345 KWh over 73.5 m^2 of floor space—a baseline for energy use will be established. Changes regarding energy consumption will be compared to this baseline. The established parameters were used to calculate the institution's energy intensity.

$$\text{Energy Intensity} = \frac{\text{Total Energy Consumption}}{area\ of\ floor}$$

$$= \frac{286}{64}$$

$$= 4.5 Gj/m^2$$

since: 1 kWh = 3.6mj

Expenses related to the institution's use of electricity are estimated. The rate for industries with HV maximum demand (11/33KV) is ₦15K/Wh when compared to the cost of power demand (₦45K/VA). The total power demand is 1,936 KVA.

cost of electricity = electricity tariff × electricity consumption

= 112,345 × 15000

= ₦ 16,851.75

Power Demand Cost = Power Demand Cost × Total Power Demand.

= 1936000 × 45000

=₦8,712

Energy's overall cost (₦) = 16,851.75 + 8,712

= ₦25,564

0.4 kg of carbon dioxide is discharged for every kilowatt hour of electricity generated throughout Nigeria (Enerdata, 2020). The institution's annual CO2 emissions from electricity use can be calculated.

112,345 × 400, or 44.2 t of carbon dioxide (CO2), is the emission intensity.

3.3.2. Energy Use Goal

With a projected overall energy consumption of 112,345,000 Wh in 2022, the goal is to reduce energy use by 10% by 2024 and another 20% by 2026.
2024 Energy Use Goal: 0.9 × 112,345 = 101,111 kWh
2026 Energy Consumption Target: 0.8 ×101,111 = 80,888 kWh

3.4. Significant Energy Uses

The study's significant results suggest that there is little correlation between trade openness and CO2 emissions. Furthermore, Nigeria's CO2 emissions are increasing, and its trade openness has varied from the last periodic assessment, showing a high susceptibility to outside shocks. (Oyeranti, O.A., 2023)
Figure 3 shows the institution's top energy consumers.

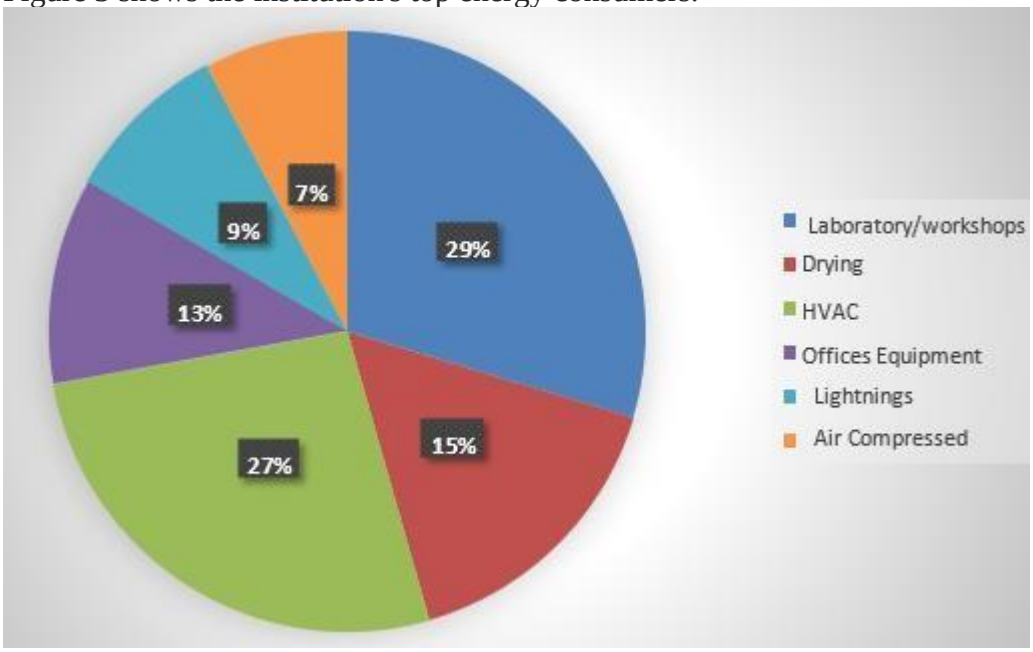

figure 1: significant energy uses

SEUs can be located by sorting the lowest components of each important energy consumer. SEUs for several major energy consumers are shown in Table 2.
Table 1 Major energy user

Major energy user	SEU
Laboratory/Workshop Equipment	Generators, press drives, motors, etc.
Compressed Air	compressors
HVAC	Air conditioners, ventilators
equipment for offices	Set of computers, printers, photocopiers, etc.
Lightening	institution lights, security lights, exit lights

3.5. Prospects for Energy Improvements

3.5.1 Correction for Power Factor

The SR motors have a wide range of applications, including machines, wind turbines, and electric cars. The doubly prominent nature of the SR motor causes torque ripples, which affect

the power factor of the motor. **(**Preethishri, R.S. et al., 2023**)**. The polytechnic in Bali Electrical and Computer Engineering Building (ECEB) is equipped with old, low-power factor electric motors. It spends a lot of resources on inductive loads due to the poor power factor. Reactive power consumption can be decreased by connecting capacitors in parallel with a load or giving each motor a matching capacitor.
(James, H., Zammit, J.P., and Davidson, A., 2023). As a result, these motors will consume less energy. The network can improve efficiency and reduce greenhouse gas emissions.

3.5.2. Management of Machines Starting Up

When several advanced devices are started simultaneously, energy surges develop quickly. For energy savings, it is suggested to start with efficient devices first and gradually add other units.

3.5.3. Electric Motor Belt Drives

Several machines in the Electrical and Computer Engineering Building (ECEB) now use motors that transmit power via a V-belt, which causes slippage and unexpected energy loss. When ineffective drive belts are replaced with cogs, energy efficiency goes up.
The efficiency of the P0 system is optimised while considering the power loss map of the BDS in the novel ECMS approach presented in this paper. (Hegde, S., ET AL 2023)

3.5.4. Utilisation of Machines

Energy can be saved by switching off devices and machinery when they are not in use. The standard of energy audits varies depending on the auditor, but they are crucial for lowering energy consumption, prices, and emissions of carbon. (McLaughlin, E., 2023)

3.5.5 Light Retrofitting upgrading inefficient lighting and updating lighting systems to reduce energy usage.
To assess the quality of the current lighting in the academic faculty building, a lighting audit is carried out. (Zailan, R et al. 2023)

3.5.6. Measurements of Energy Performance

An effective method for helping institutional procedures adhere to the set of desired outcomes linked to energy consumption is the use of energy consumption signs. Table 3, lists the results for several institutional procedures.
Planning building energy efficiency retrofit projects with EPC is a win-win strategy that can reduce energy use and capital expenses. (Mohamad Munir et al., 2023)

Table 2: measurements of energy performance substrate

S/No	Procedure Category	Indicators
1	Energy consumption in production. ($\frac{Kw}{h}$) ton	$\frac{Electricity}{\text{consumed substrate}}$
2	Space cooling ($\frac{CDD}{m^3}$)	$\frac{Electricity\ consumed}{Cooled\ facility\ volume}$

Signs can be compared by management to assess how well energy goals are being met.

4.0. Implementations

The Electrical and Computer Engineering Building (ECEB) should inform staff members of their duties for energy efficiency, develop a series of workshops to communicate energy, energy awareness, policies, purposes, and related issues, and audit the EnMS at least every year. To identify any obstacles and make suggestions for changes, oversight reviews have to be done.

Manufacturing companies gain from industrial energy-efficiency audits, which also help local communities, states, and the federal government in terms of the economy and protecting the environment. (Shook, P., Choi, J.K., and Kissock, K., 2023)

5.0 Conclusions

Electrical and Computer Engineering Building (ECEB) has found ways to increase energy efficiency, which could result in a 20% reduction in current energy expenses. To aid with behavioural alterations, the governing body is giving grants of up to ₦60,000 to organisations that have earned their ISO 5000-1 certification.

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