



KEMENTERIAN PENGAJIAN TINGGI  
JABATAN PENDIDIKAN POLITEKNIK DAN KOLEJ KOMUNITI

**POLITEKNIK**  
MALAYSIA  
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# e-Proceedings NCTS 2022

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# E-PROSIDING NATIONAL CONFERENCE ON TVET UNDERGRADUATE STUDENTS 2022

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**Published by:**

Politeknik Tuanku Syed Sirajuddin (PTSS)

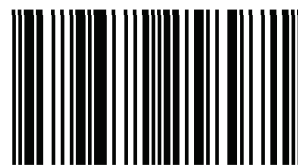
Pauh Putra, 02600 Arau, Perlis

Tel No. : 04-988 6200

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[www.ptss.edu.my](http://www.ptss.edu.my)

e ISBN 978-967-2258-97-1



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e-Proceedings NCTS 2022

## **STUDY ON EFFECTIVENESS OF ENERGY MANAGEMENT IMPLEMENTATION IN COMMERCIAL BUILDINGS**

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### **Abstract**

This current paper investigates the Effectiveness of Energy Management Implementation in Commercial Buildings. The aim of this research is to promote best practices in Energy Management aspects in Facilities Management Industry. Thus, identifying the guideline for energy management is a basic thing. The next step will be to ascertain the level of implementation of energy management to find new opportunities as a benchmark to track progress in making ongoing energy management because unwatched buildings become less efficient with time. To ensure the building remains effective and archive its maximum potential it is crucial to recommend the importance of energy management in the buildings. A questionnaire is distributed to a team that is involved in energy management. The sample of analysis used is easy-random because the population is homogenous Furthermore, the result confirms the implementation can preserve the building for a long period of time.

**Keywords: ISO Standard, energy audit, energy manager, energy management, energy waste**

### **1. Introduction**

Demand-side energy management is becoming increasingly important owing to concerns related to global warming and energy shortages (Kwon et al., 2022). The most striking result to emerge from the data is that commercial buildings are large and load. Consequently, optimal energy exchanges between them and microgrids can reduce the energy consumption cost, greenhouse gas (GHG) emission, and network load deviation (Raza & Malik, 2019). Surprisingly, energy management in the building was found to have attracted a wide range of interested parties over the past few years. Demand-side

management can compensate for this problem by exploiting a bidirectional information channel between utilities and customers to balance the demand with available supply. This includes both promotions of efficiency and conservation. The first possibility is to analyze energy utilization to improve the overall efficiency. This is normally implemented through energy audits, which can take place as surveys and interviews (Monacchi et al., 2015) ]. The fact that buildings are responsible for a large portion of the global energy consumption indicates a need for detailed investigation towards more effective energy performance of buildings.

This study has identified the need for an increase in the capacities of the device used in the buildings as another problem in energy management.(Castro-Camus et al., 2020). Everyone knows that saving energy is a good thing, but most people will only be motivated when you can demonstrate just how much energy they are wasting, and just how much potential it is for them to improve. However, the awareness among non-experts of how much energy is required by different activities and appliances is generally low, which can lead to wrong prioritizations (Halis & Halis, 2022). Therefore, the aim of this study is to see the effectiveness of the energy management implementation in a commercial building in Malaysia.

So far, however, there has been little discussion about the covid-19 pandemic, the fresh supply for closed spaces in the building brings a tremendous energy demand. Such energy demand causing more complicated energy management (Strielkowski et al., 2021). Based on previous study by (Alfaverh et al., 2020) brief about how energy demand that continues to increase. The Energy Information Administration's International Energy Outlook 2021 projects that global energy consumption and carbon dioxide emissions will increase by nearly 50 percent by 2050 due to population and economic growth. EIA expects electricity generation to increase by 68 percent by 2050.

It has previously been observed that, the industry concerns over grid reliability while adapting to an increase demand for renewable source of energy and consistently looked to technology solutions to help balance the supply and demand for energy while reducing costs (Vučković & Pitić, 2022). Today's world is looking for energy solution and alternative due to the threat of energy shortage, skyrocket energy price, unsecure of energy supply and the issue of enormous wastage. The world community should think globally and act locally to solve this issue by creating a long-term program in order to optimize the limited source of energy (Hasan & Trianni, 2020).

Finally, it has been stated that the need to raise public awareness of energy problems. Energy Management problems, associated with rapid social and economic development, have been of critical concern to both national and local governments worldwide for many decades (Mardani et al., 2017).

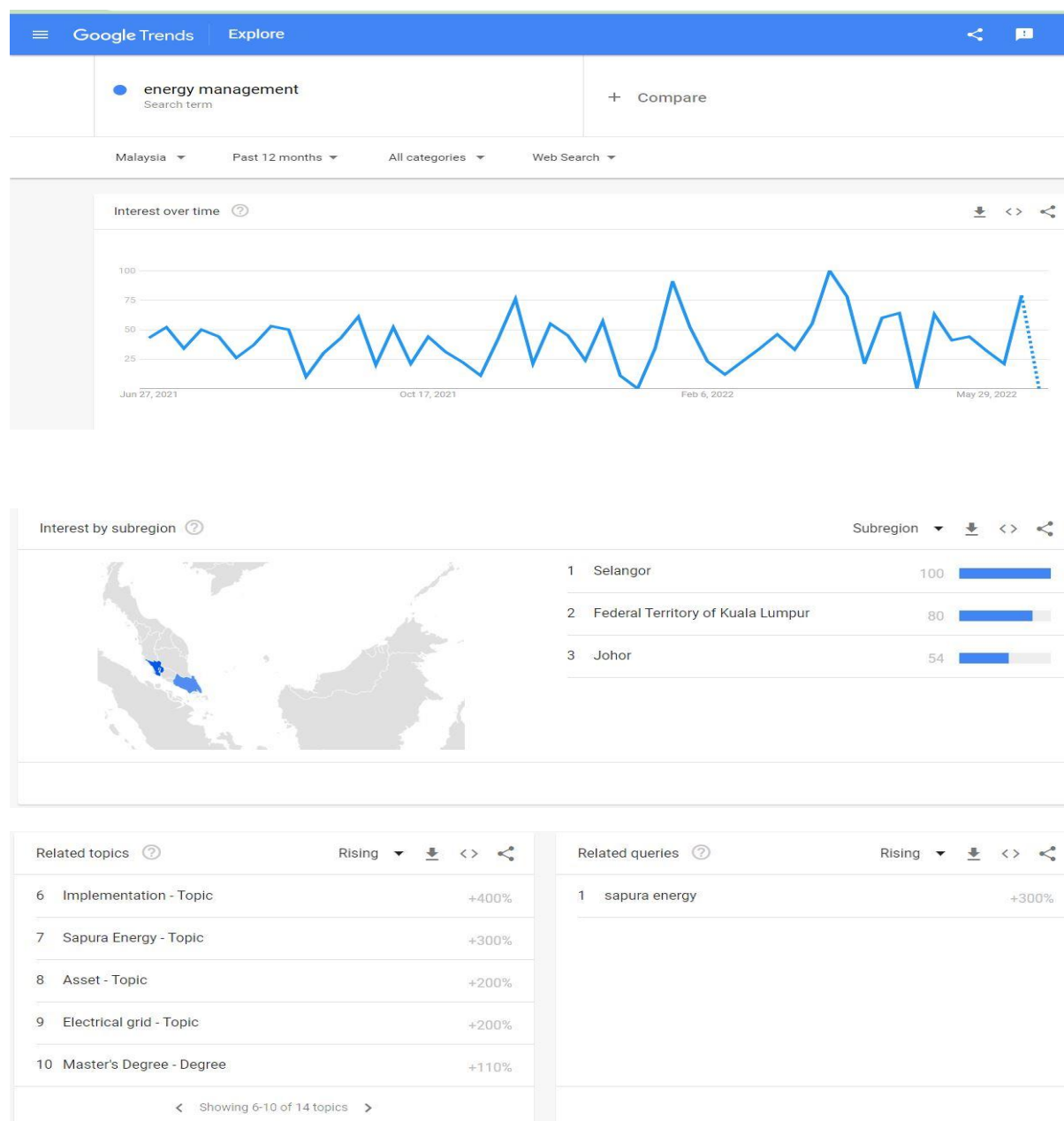
So that, this study was conducted to find a prove of the effectiveness of energy management.

## **2. Literature Review**

This topic is expanded and important until it involve a few factor that can bring benefit in return. The term “Energy Management” encompasses strategic planning and operation of energy generating and/or consuming units. It can be broadly defined as the systematic, organized, and proactive management of energy use in organizations, industries, or buildings to meet the economic and environmental necessities (Cho & Kim, 2019).

### **2.1 Google Trends**

Google Trends is a website by Google that analyses the popularity of top search queries in Google Search across various regions and languages. The website uses graphs to compare the search volume of different queries over time (Raubenheimer, 2021). It is a useful search trends feature that shows how frequently a given search term is entered into Google’s search engine relative to the site’s total search volume over a given period. Google Trends can be used for comparative keyword research and to discover event-triggered spikes in keyword search volume (Mavragani & Ochoa, 2019).



The figure 2.1 shows the rising related topic in Google Trends

What stands out in the table is the rising topic regarding energy management. Which is implementation of energy management that rise until 400% compared to other topic such as Sapura energy 300%, Asset 200%, Electrical grid 200%, and master's degree 110%.

From this figure, we can assume that people still wondering about the implementation of energy management

## 2.2 Energy Performance Baseline

The purpose of developing energy baseline is to set a reference point for measuring energy performance improvements. The future energy use will be measured against the energy baseline to evaluate its energy performance. Normally energy baseline would be the total amount of energy in the year end before the EnMS is implemented (Hasan & Trianni, 2020). This study has been unable to demonstrate an energy baseline that be used to measure energy performance

## 2.3 International Standard (ISO 50001)

ISO 50001 is the latest energy management standard which is a successor of ANSI/MSE 2000 and EN 16001. The standard guides an organization to develop and implement a policy to identify significant areas of energy consumption and commit to energy reductions (Suruhanjaya Tenaga, 2019). Preliminary audit or walk-through is a process used to establish an overall picture the potential of energy saving through visual inspection of the premise including air-conditioning system, lighting, metering, building automation, building maintenance and other factors affecting energy consumption of the building (Ludin et al., 2019). The top management must demonstrate commitment to support implementation of the system and subsequently agree to continually improve it to ensure the EnMS will remain relevant and effective to bring benefits to the organization (Raza & Malik, 2019). However, this result has not fully described about the benefit gain from energy management implementation.

## 2.4 Energy Management Plan

From the article, Energy management measures involve actions or activities which bring results in energy efficiency improvement in the organization, hence continuous improvement in managing energy. The scope may cover from identification of priority areas for energy evaluation, conducting and completing electrical energy evaluation to

reporting and submission to Energy Commission. So, we should recommend energy management to the building's owner if the total energy consumption equal or exceeding 3,000,000 kwh over any period not exceeding six months.

### **3. Methodology**

This chapter reviews related concepts of research methodology and point out the proposed research design for this study (Snyder, 2019). Also referring research methodology as the theory of how research should be undertaken. Research can be stated as an activity that involves finding out, in a systematic way (Huang et al., 2020).

#### **3.1 Research Design**

Research design is used to collect the relevant data and technique to facilitate the smooth scaling of the various research operations making yielding maximal information. Research design is also provides backbone structure to researcher for planning of answering the research question or testing from hypothesis (Pawar, 2020). The development of a good research design permits us to obtain the best research data possible. In this chapter, researcher will explain related research methodology involve in finding result. Scientific research philosophy is a system of the researcher's thoughts. In other words, it is the basis of the research, which involves the choice of research strategy (Khan et al., 2018). Positivism is the name for the scientific study of the social world. A law is a statement about relationships among forces in the universe. In positivism, laws are to be tested against collected data systematically (Govindarajo et al., 2021). Interpretivist approach is based on naturalistic approach of data collection such as interviews and observations (Dudovskiy, 2019). This research uses a qualitative approach.

#### **3.2 Research Instrument**

- i. Pilot Study is broad. A pilot study also has a specific design feature; it is conducted on a smaller scale than the main or full-scale study (In, 2017). Pilot studies are a fundamental stage of the research process. They can help identify design issues



and evaluate feasibility, practicality, resources, time, and cost of a study before the main research is conducted.

- ii. Document analysis is used in this research. Form of qualitative research that uses a systematic procedure to analyse documentary evidence and answer specific research questions (Bowen, 2021). This is based on theory that disposition positivism.
- iii. Semi structured in-depth interviews are commonly used in qualitative research and are the most frequent qualitative data source (DeJonckheere & Vaughn, 2019) . This method typically consists of a dialogue between researcher and participant, guided by a flexible interview protocol and supplemented by follow-up questions, probes and comments.
- iv. In this research, a cross-sectional was conducted in 3 commercial buildings in Malaysia for the reason an open-ended questionnaire has set on five points Likert scale was to get a more accurate and reliable opinion from respondents to evaluate the satisfaction level. In this research, a cross-sectional was conducted in 3 commercial buildings in Malaysia for the reason an open-ended questionnaire has set on five points Likert scale was to get a more accurate and reliable opinion from respondents to evaluate the satisfaction level.

### 3.3 Research sampling

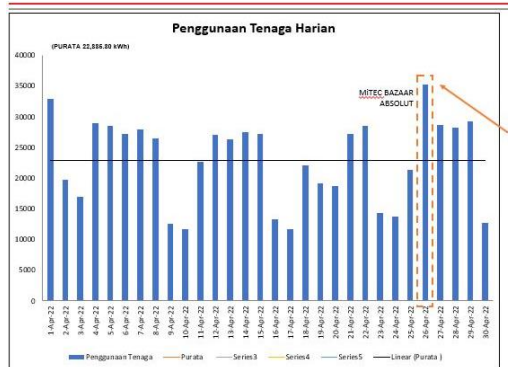
Sampling is the process of selecting a group of people, institutions, places, or phenomena from a large group or research. The sample in this study consisted of experts with experience in energy efficiency practices (Berndt, 2020). Snowball sampling or chain-referral sampling is defined as a non-probability sampling technique in which the samples have traits that are rare to find (Fitriani et al., 2018). Because it is important to find a right person at the right way and right time. So, it prevents the researchers from consume more time. 50 total questionnaire is distributed only 30 responses. Ibrahim (2017) between 30 until 50 respondent is ideal and enough. Isaac & Michael (1995) 10 until 30 can be accepted as respondent.

### 3.4 Validation

The validation is done by Energy Manager at SSRV company. He is a competent person that has knowledge of the requirement of the act and the regulations. Also, certification from REEM Malaysia and expert with experience in energy management implementation that fulfil an act EMEER 2008.

## 4. Findings

### 4.1 Preliminary audit



The highest kWh usage on  
 April 26, 2022

Figure 4.1(a) shows a trend daily usage by MATRADE building.

From the figure 4.1(a) shows the highest kWh usage is on 26 April 2022. The result from the event that occur on the point date.

### ELECTRICAL CONSUMPTION – EXCHANGE SQUARE



Increase due to :  
 1) Phase 1 project by M  
 2) Renovation works b

Increase due to:  
 1) Phase 1 project by NEC  
 2) Renovation by SIC.

Figure 4.1(b) shows the trend daily usage by Bursa Buildings

From the figure 4.1(b) the reason kWh become surprisingly higher is because contractor work due to Phase 1 project by KEC and Renovation Works by SIC.

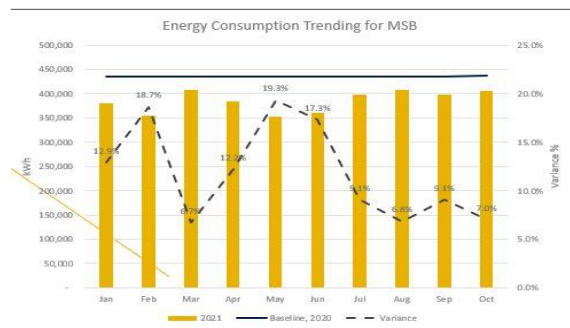


Figure 4.1(c) shows the trend daily usage by MSB buildings

From the figure 4.1(c) There are some increments in the Oct billing cycle due to PPN phase 3 moving to phase 4.

## 4.2 Conclusion

In a preliminary energy audit, readily available data are mostly used for a simple analysis of energy use and performance of the plant. This type of audit does not require a lot of measurement and data collection. These audits take a relatively short time, and the results are more general, providing common opportunities for energy efficiency. The economic analysis is typically limited to calculation of the simple payback period, or the time required paying back the initial capital investment through realized energy savings.

## 5. Summary

The implementation of energy management is important to an organization to control over the energy consumption cost. Thus, increase corporate image and credibility among stakeholders, regulators, customers, prospective clients and public. The organisation of the EnMS, however, enabled many of the critical issues to be overcome, thereby affording considerable advantages: an effective retrofit action plan, which implies a reduction in energy consumption estimated over three years by 15%, and the improvement in the comfort conditions of tenants. As provided by the EN ISO 50001 Standard, a monitoring

phase of retrofitted buildings was started; therefore, in the future, possible gaps between the estimations and real amounts of energy reduction can be investigated. As the facilities and building getting old, the investments towards them in terms of maintenance also increase. Therefore, proper monitoring and assessments should not be left out so the conditions of the facilities including equipment systems, and buildings are in good shapes.

## 5.1 Discussion

Energy efficiency is decisive for the success of any business. For this reason, the implementation of an Energy Management System is highly advisable. A key component of energy management is monitoring (Pierce & Paulos, 2012). Installation of an energy monitoring system (EMS) in some significant energy users to allow us to calculate the exact amount of energy used for each area or space.

A detailed analysis of the energy management systems standard ISO 50001:2011 was carried out from the viewpoint of sustainable development. The purpose of the analysis was to assess the effectiveness of its implementation, to identify the existence of gaps and to develop improvements capable of fulfilling the identified gaps (António da Silva Gonçalves & Mil-Homens dos Santos, 2019). Need to perform a Detailed Energy Audit (DEA) to enable energy individual profiling for each building and to identify areas of improvement in the future.

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