

**PREFERRED STRATEGIES TO FOSTER ENERGY CONSERVATION
BEHAVIOR IN BATAM'S OFFICE BUILDINGS**

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*To my beloved,
Papa, Mama, Brother and You*

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ABSTRACT

Indonesia government has taking initiatives toward energy conservation behavior through regulation, policy and laws. However, the implementation of these laws is still lacking compared to other countries. Thus, Indonesia's government should start to promote the energy conservation through program or campaign that normally not involve large scale of investment. The identification of the right strategies to foster energy conservation is among the keys to a success program or campaign. This study aims to identify the preferred strategies in fostering energy conservation behavior among office building users in Indonesia. A total of 295 office building users from Bank X in Batam, Indonesia were invited to provide their preferred strategies. Choice based conjoint analysis is used to analyze the empirical data gathered from questionnaire. Seven strategies and eighteen sub elements to foster organizational energy conservation are identified. The strategies comprises of Customer, Cost, Convenience, Communication, Commitment, Cooperation, and Continuity. Communication and Continuity, which were identified as the strategies that will significantly affect organizational user to practice energy conservation in workplace. Surprisingly, Cost strategies was the least preferred strategy in motivating office building users to practice energy conservation which only gained 8.46% in average importance. This study suggests that Communication strategies should be emphasized by management office in designing energy conservation campaign or program in future.

ABSTRAK

Indonesia telah mengambil inisiatif ke arah perilaku penjaminan tenaga melalui peraturan, dan undang-undang. Walau bagaimanapun, pelaksanaan undang-undang ini masih berkurangan jika dibandingkan dengan negara-negara lain. Oleh itu, Indonesia harus bermula untuk menggalakkan penjaminan tenaga melalui program atau kempen yang biasanya tidak melibatkan skala besar dalam pelaburan. Pengenalpastian strategi yang betul untuk memupuk pemuliharaan tenaga adalah antara kunci kepada kejayaan program atau kempen. Kajian ini bertujuan untuk mengenal pasti strategi pilihan dalam memupuk tingkah laku pemuliharaan tenaga di kalangan pengguna organisasi di Indonesia. Seramai 295 pengguna organisasi dari Bank X di Batam, Indonesia telah dijemput untuk menyediakan strategi pilihan mereka. *Choice based conjoint analysis* digunakan untuk menganalisa data empirikal soal selidik. Tujuh strategi dan lapan belas elemen sub untuk menggalakkan penjaminan tenaga organisasi dikenal pasti. Strategi Terdiri daripada *Customer, Cost, Convenience, Communication, Commitment, Cooperation, dan Continuity*. *Communication* dan *Continuity* telah dikenal pasti sebagai strategi yang ketara akan memberi kesan kepada pengguna organisasi mengamalkan penjaminan tenaga di tempat kerja. Yang menghairankan, *Cost* adalah strategi pilihan yang paling rendah dalam memotivasi pengguna organisasi untuk mengamalkan tingkah laku pemuliharaan tenaga, yang memegang 8.46% dalam kepentingan purata. Kajian ini mencadangkan bahawa strategi *Communication* perlu ditekankan oleh pejabat pengurusan dalam bentuk program penjaminan tenaga bagi organisasi pada masa akan datang.

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CHAPTER ONE

INTRODUCTION

1.1 Introduction

Energy is the capacity of physical system to perform work. It exist in the form of heat, mechanical energy, lighting potential energy, electrical and other form. Energy plays an important role in our daily routine (Ng, 2012). Rapid economic growth, the usage electrical for the last two decade has increase rapidly in Indonesia. This might due to lack of awareness of the importance of energy and lack of appropriate energy use behavior. The importance of environmentally sustainable behavior has increasingly been recognized over the past decade, with a particular emphasis on conserving energy (Swim *et al.*, 2011).

To ensure the sustainability of finite energy sources and emission of CO², energy conservation is among the necessary step. According to Weerdenburg (1992) energy conservation is the cheapest way to reduce the energy consumption and emission of CO². Previous studies have acknowledged that energy conservation is among the cost-effective way to achieve energy efficiency.

In order to sustain the energy conservation behavior, behavioral change among the users is necessary. Social marketing, which applies marketing concept into social behavior, is proven to be an effective method to achieve sustainable behavior change. A set of strategies to foster desired behavior change should be tailored from the targeted audience's preference. Hence this study aims to identify an optimal set of preferred strategies to foster energy conservation behavior among staff in government office building.

1.2 Problem statement

In recent years, concerning of environmental impacts, availability and security of energy supplies has led to heightened interest in order to reduce the energy use in buildings. (Littleford *et.al.*, 2014). Previous studies have found that the increasing of global energy consumption has led to serious energy problems such as depletion of energy resources and climate change. (Hui, 2000; Iwaro and Mwashu, 2010). According to International Energy Agency (2015), Southeast Asia's energy demand has increased by more than 50% between year 2000 and 2013, which caused by the growth of economic and urbanization. Building is the biggest contributor in energy consumption and account for about 40% of total final energy consumption. (United Nations Environment Programs, 2013). According to Nbs.China statistic Yearbook (2013), total of energy consumption of the building throughout the China was nearly 380 million tons of equivalent (Mtoe), and average growth of energy demand has reached 5.7% per year. In United States the energy consumption of the building sector was reached 39% and 38% of the carbon emission (Becerik *et.al.*, 2014).

Commercial building is one of the main concerns in many countries to control the energy consumption. For example, in Malaysia, the commercial buildings have become the second largest consumer of energy which account of 32% of the country's

energy consumption of (Yin and Aliagha, 2013). Thus, the government has been promoted the energy efficiency in commercial sectors. For example, secretary of environment of Hong Kong has launched the energy saving charter 2016 that invited building and property management sectors to reduce electricity consumption on air-conditioning during the mid-summer by maintaining their temperature between 24 and 26 degrees Celsius. (News.Gov, 2016). In additional, government of Singapore has been launched the energy saving campaign which called eco-office that focusing on how to reduce the energy consumption in office building by distributed the eco-kit that contained the materials to help company to rise their awareness and habit of energy saving. (Singapore Environment Council, 2013). However, energy consumed by the office building are not reducing. According to Yang *et.al.* (2008) energy consumption in China's office building is about 70-300 kWh/m² which is 10-40 times higher compared to residential buildings. The same scenario also appears in Southeast Asia's country, for example, energy consumption in commercial building in Brunei Darussalam has increased in recent year of which building sector account for 44% of the country's energy consumption in year 2009 and increased to 52% in 2013, it is the biggest energy consumer compared to other sector (IEC statistic, 2013; BCA-CSB, 2013). Meanwhile, as stated by the Ministry of Energy and Mineral Resources of Indonesia (2013), the consumption of the energy in Indonesia has been increased since 2000's. It supported by Indonesia's energy outlook (2014) that energy consumption in office building has increased 10.1% per year where in 2010 the energy consumption was 49.8% but it increased dramatically 73.4% in 2013.

According to Perez-lombard et-al (2008), the energy consumption in building is concern to increase due to the growth of population, the demand of comfort level is increased and also the time spent in that building. It supported by Outlook energy Indonesia from National Energy Council, Ministry of Energy Mineral Resources (2014), where the energy demand from the commercial building in Indonesia is increasing from 3.1 million TOE in 2003 become 5.5 million TOE in 2013. According to Kamilaris *et.al.* (2014), miscellaneous electric load (MELs) involves all the electric load in office and it consumes more than one fifth of the energy used in office buildings.

In considering that energy consumption in commercial sector contributing to large amount of country's energy use, it is important to emphasize on the energy conservation. As stated by Gardner and Stern (2002), energy conservation and secure of energy supply has become global concern. Improving the energy efficiency is defined as the best strategies to reduce the energy consumption in buildings. Improving building's energy efficiency could be through energy conservation that can achieve the sustainable energy development. (Gerber-Becerik *et.al.*, 2014)

Energy conservation is action taken to reduce energy consumption such as finding alternative uses that require less energy, willingness to purchase the green product including the electrical appliances, and also the improvement of the energy use behavior. According to Low (2012), energy conservation approach can be divided into two, which are structural energy conservation and non-structural energy conservation approach. The structural energy conservation approach also known as technology approach, where the technology was applied in achieving energy reduction. It usually involves large scale of capital investment while non-structural energy conservation emphasizes on energy user's behavior improvement in order to achieve energy reduction. Some studies have found that the structural energy conservation often provides a solution to reduce energy consumption, but it does not necessarily as a perfect solution to reduce the energy consumption. Nowadays people tend to use the appliances that labelled by energy saving. However, the efficiency of the appliances to reduce the energy consumption are depending on how often the appliances was being used. (Peattie and Peattie, 2009).

Thus, previous studies have emphasized that behavioral approach is of the preferred strategies to reduce the energy consumption in the office buildings with minimal capital investment. It supported by Dietz *et.al.* (2009) that energy behavior is a key to achieve the energy consumption level and better understanding of occupants' energy behavior are critical factor for organization energy reduction (Intergovernmental Panel Climate Change, 2007). For example, office building using the technology that

can help them to reduce the energy consumption, but the technology become useless if the behavior of the occupant still not aware to reduce the energy.

In context of energy conservation in office buildings, the activities of the occupants affected the overall office energy consumption. It supported by foster *et.al.* (2012) that the impact of the occupants has been estimated to contribute to 20-50% of total building's energy use. Previous studies emphasized the importance of the occupant's energy use behavior as a key to achieve the energy conservation. For example, in commercial buildings like shopping complex the energy consumption are depending on electrical appliances and it relate to occupant behavior such as tenant and management. (Galvin and Terry, 2015). As according to Azar and Menassa (2014), action performed by the building user become significant factor to reduce energy consumption and significant energy reduction can be achieved by convincing them to practice energy conservation practices. Meanwhile, the behavior is about the value of ownership of the personal equipment such as desktop computers or other equipment are the devices used most during the office hours by the office workers (Mckenney, 2010).

In order to resolve the energy wastage issue, government from various country have set targets to reduce the energy consumption and lowering the energy demand within the office building by using the technologies approach and behavioral approach. For example, the National Environment Agency of Singapore has been promoted the energy savings through the eco-office program which distributing Eco-office kits that contained materials to help companies to raise awareness and cultivate environment friendly habits within the workers. (NEA, 2010). Meanwhile the Japanese Ministry of Environment has been introduced the cool biz campaign where encourage the public and private sector to set air conditioning at office around 28 degrees Celsius to reduce the electricity consumption (MOE, 2008). Thailand provides a good example that has implemented approach to reduce their energy consumption through its new integrated energy blueprint, which includes a target to reduce energy use and energy intensity by 30% in 2036 compared to 2010 through fossil fuel removal and increase the energy efficiency action. (IEA, 2015).

In addition, energy awareness and energy use behavior helps to increase the persistence of energy conservation program in Indonesia based on government regulation No.70/2009. Indonesia government also set out various long-term targets to be achieved. This can be shown by the national energy conservation master plan 2005-2025 which Indonesia government has committed to reduce energy intensity per year on average until 2025 and also to reduce the GHG emissions by 26% by 2020 on a business as usual (BAU) basis. In order to achieve energy conservation, Indonesia government has already made proposals to 1.003 entities within the building and industry sectors in energy conservation partnership programs. (BCA, 2013). There are some initiatives that have been taken by Indonesia Government to promote and regulate energy conservation. For example, Ministry of Energy and Mineral Resource and National Energy Commission have drafted a master plan for energy conservation by 2025, it called National Energy Conservation Master Plan (*RIKEN*) draft. According to *RIKEN* (2011), the energy saving target in final energy use for office building is 15% by 2025. In order to achieve the target, Ministry of Energy and Mineral Resource has set up the energy efficiency programs which defined in *RIKEN*. The draft of *RIKEN* identified 20 energy conservation programs that would implement 5 policy mandates. For example, increase sustained social awareness campaign on energy through the energy saving campaign, energy saving competition, and forum group discussion that focuses on energy conservation.

Despite the Indonesia government has been setting up the *RIKEN* draft to achieve energy conservation, Indonesia still lacking of programs or campaign to enforce the energy conservation compare to other country. For example, Malaysia has been promoting the energy conservation through nation campaign which called SWITCH. Although the Campaign was failed to attract the attention to office building occupants to energy conservation behavior, but it shows that Malaysia's government has been in line with their national energy policy with the several efforts to foster the energy conservation behavior. Unfortunately, this scenario did not happen in Indonesia, according to minister of energy and mineral resource, Sudirman Said on the national general energy master plan of national energy plan press conference (2016), "Indonesia still focusing on supply side, which is infrastructure and development of energy, it is

not synchronize with the policy and regulation that also emphasize energy conservation.”. Indonesia government has to work aggressively to achieve the energy conservation especially for office building.

According to report from APEC in peering review on energy efficiency in Indonesia, the problem that Indonesia’s government facing to promote energy conservation behavior through programs and campaign is difficult to find the participant who want to participate the energy conservation program and also for intensive and continuous public campaign is costly to implement. Therefore, Indonesia become the largest of energy consumption among the ASEAN country (review on energy efficiency in Indonesia, APEC (2012) and it supported by the minister of energy and mineral resource that energy consumption in Indonesia still high which can be account from the energy intensity of Indonesia is still over 1.(Sudirman Said, 2016).

Among the principles in social marketing approach is to foster voluntary behavioural change the desired behaviour change can only be sustained for a long period if the behaviour is performed voluntarily (Low *et.al.*, 2013). Social marketing is seen to be an effective way to achieve the voluntary change behavior (Stead *et al.*, 2007) according to Lestari (2011), Indonesia has the most law and regulation in energy conservation. However, the implementation of these laws is still very less when compared with other countries. Thus, Indonesia’s government should start with the energy conservation by the non-structural approach which normally not involve large scale of investments. The approach could be start with the commitment of the organization to increase their staff behavior to practice the energy conservation. However, energy conservation behavior can be achieved via effective strategy of the social marketing. Thus, the strategy that facilitating change from user’s point of view should be identified. Offering the preferred strategy from the user’s point of view is critical factor in order to change the behavior. Those strategies able to improve the commitment among the building user to conserve the energy. Thus, the research question arises is what are the strategy to foster energy conservation behavior in office building.

1.3 Research Questions

The research questions in this study are:

- 1 What are the strategies to foster energy conservation behavior among user in Batam's office building?
- 2 What are the preferred strategies to foster energy conservation behavior among user in Batam's office buildings?

1.4 Research Objectives

The objectives in this study are:

1. To identify the strategies to foster energy conservation behavior among user in Batam' office building.
2. To identify the preferred strategies to foster energy conservation behavior among user in Batam's office buildings

1.5 Scope of study

The scope of study is office buildings located in Batam, Indonesia. The respondents are the office building user of Bank X (the name of the Bank is not permitted to disclose in any form) in Batam, Indonesia

1.6 Significant Of Study

The findings of this study are able to serve as a reference that guiding the social body, government and public to make the right decision in designing cost effective energy conservation program by targeting the strategies that potentially to effectively fostering energy conservation behavior among the users in office building.

1.7 Research Methodology

This research consists of five stages. The research methodologies are as follows:

1. Stage One: Literature Review

In the beginning stage, the author has done the selection of the topic. In determining the strategies to foster the energy conservation behavior, literature review was done by review the journals, articles, books, previous report, thesis.

2. Stage Two: Design Survey

This stage is to design survey instrument. It is include design of questionnaire and select the appropriate sampling technique. The survey instrument used in this study is the questionnaire is generated using Sawtooth Software.

3. Stage Three: Data Collection

The questionnaire generated is subjected to pre testing before distributed to all office buildings user of Bank X (the name of the Bank is not permitted to disclose in any form) Batam, Indonesia. This data collection stage is to collect empirical data on the preferred strategies that foster energy conservation behavior among the staff in Batam's office building.

4. Stage Four: Data Analysis

This stage is to analyze the raw data obtained from respondents. Choice based conjoint analysis assisted by Sawtooth Software is used to analyze the raw data gathered.

5. Stage Five: Conclusion and Recommendation.

This stage is the final stage of study. The conclusion is derived from the result and findings. Next, research limitation is presented and recommendation for future study is proposed.

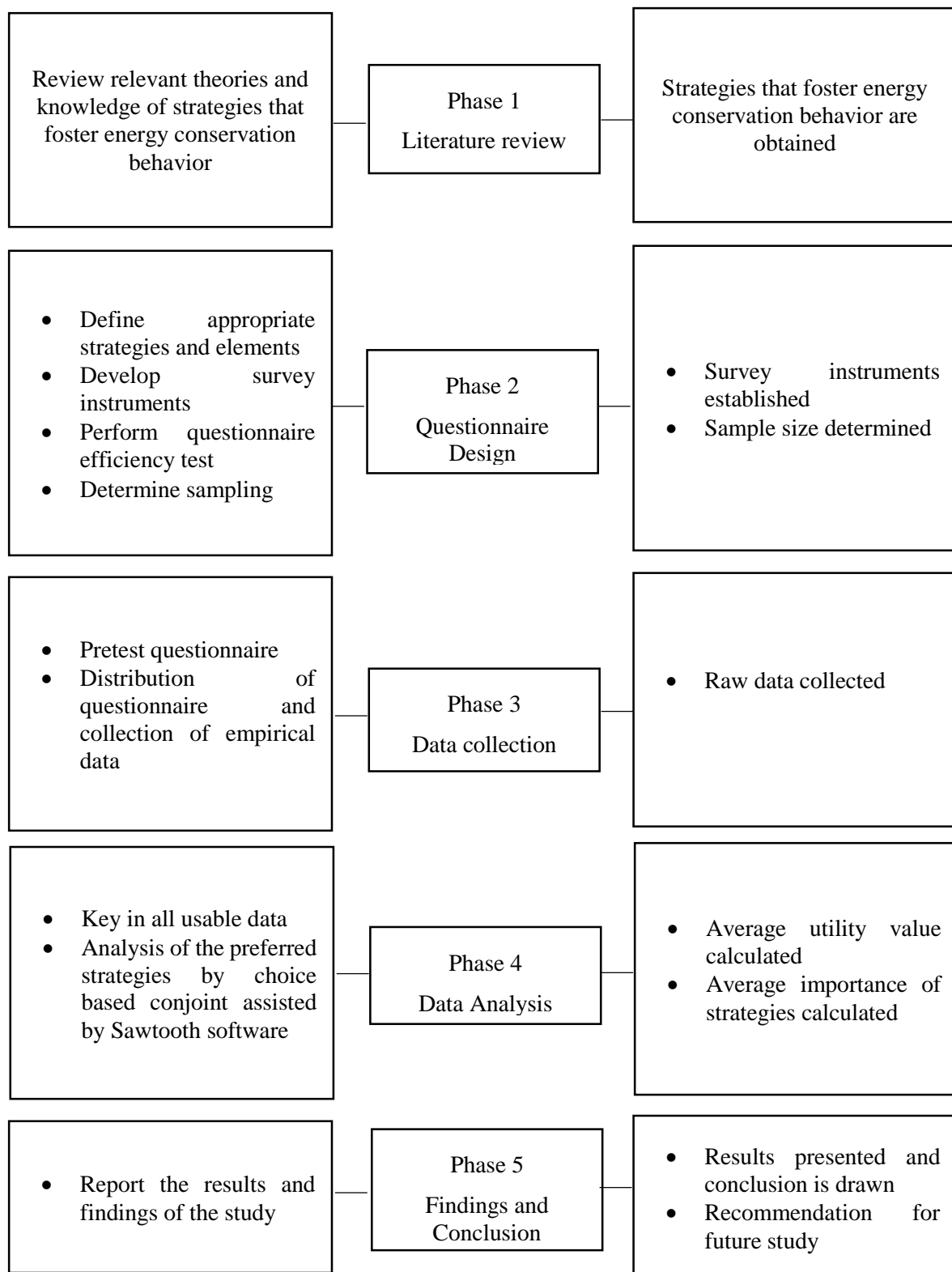


Figure 1.1 Research Flow chart

Source: Adapted From Low (2012)

1.8 Expected Result

The followings are expected results for each objectives:

1. To identify the strategies to foster energy conservation behavior among staff in office building.
 - Strategies to foster energy conservation identified

2. To identify the preferred strategies to foster energy conservation behavior among staff in office buildings.
 - The preferred strategies to foster energy conservation behavior among staff in office building identified.

1.9 Layout of Chapter

This dissertation consists of five chapters which are as follow:-

The first chapter has general context of the studies which includes introduction, problem statement, research objectives, scope of study, significant of the study, expected result, summary of methodology and chapter layout

Chapter two contains the literature review for this study. Literature review is gathered from books, journal articles, theses, report, and internet. This chapter explains the meaning of energy conservation, energy conservation approaches, energy conservation in Indonesia's office building and energy conservation strategies from previous programs.

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