

**ENERGY MANAGEMENT KEY PRACTICES FOR UNIVERSITIES IN
MALAYSIA**

LOW SHEAU TING

UNIVERSITI TEKNOLOGI MALAYSIA

ABSTRACT

Energy management is essential to ensure the efficient energy usage, cut energy cost and improve environmental quality. However, without the list of phases and key practices of energy management, the facilities manager fails to implement energy management effectively. This has been confirmed through a preliminary study. In realizing that, the objectives of this research were to identify phases of energy management for universities in Malaysia and key practices of energy management for universities in Malaysia. The scope of this research is 29 public and private universities in Malaysia. The respondents of this research covers energy experts, facilities managers, and departments responsible for energy management in the universities. This study was conducted in four different stages, namely: preliminary study, literature review, expert review, and questionnaire surveys. Preliminary study was conducted to identify the issues of the study. The list of energy management phases and key practices was ascertained through literature search. Then, the list was reviewed by energy experts on its relevance in context of energy management and whether the key practices were appropriately distributed among the phases. The questionnaire was developed based on the revised list of energy management phases and key practices from expert review. Then, the questionnaire survey was conducted throughout the universities in Malaysia. Descriptive analyses were carried out to analyze the data gathered, including frequency analysis, mean analysis, and standard deviation. The results of the study indicate that there were three phases (Planning, Implementing, Monitoring and Evaluation) and 47 key practices of energy management. To show their degree of importance, the identified key practices were ranked accordingly to their mean values.

Keywords: Energy Management, Facilities Management, Energy Management Phases, Energy Management Key Practices

ABSTRAK

Pengurusan tenaga adalah penting bagi menjamin penggunaan tenaga dengan cekap, mengurangkan kos tenaga dan memperbaiki kualiti alam sekitar. Walau bagaimanapun, ketiadaan senarai fasa dan amalan utama pengurusan tenaga menghalang pengurus fasiliti untuk melaksanakan pengurusan tenaga secara berkesan. Ini telah disahkan melalui satu kajian awalan. Menyedari keadaan sebegini, objektif kajian ini adalah untuk mengenalpasti fasa-fasa pengurusan tenaga untuk universiti di Malaysia dan amalan-amalan utama pengurusan tenaga untuk universiti-universiti di Malaysia. Skop kajian ini meliputi 29 universiti di Malaysia termasuk universiti awam dan swasta. Responden kajian ini merangkumi pakar tenaga, pengurus fasiliti dan jabatan yang bertanggungjawab untuk pengurusan tenaga di dalam universiti-universiti berkenaan. Kajian ini dijalankan dalam empat peringkat, iaitu: kajian awalan, kajian literatur, semakan semula pakar, dan kajian soal selidik. Kajian awalan adalah dijalankan untuk mengenalpasti isu kajian. Senarai fasa dan amalan utama pengurusan tenaga telah ditentukan melalui kajian literatur. Seterusnya, senarai tersebut disemak semula oleh pakar tenaga dari segi kemunahsabahan dalam konteks pengurusan tenaga dan juga sama ada amalan-amalan utama itu selayaknya diagihkan di kalangan fasa-fasa. Borang soal selidik adalah berdasarkan kepada hasil semakan semula fasa dan amalan utama oleh pakar tenaga. Selepas itu, borang soal selidik diedarkan ke universiti-universiti di Malaysia. Analisis diskriptif dijalankan untuk menganalisa data yang dikumpul, termasuk analisis frekuensi, analisis min, dan sisihan piawaian. Keputusan kajian menunjukkan bahawa terdapat tiga fasa (Perancangan, Perlaksanaan, Pemantauan dan Penilaian) dan 47 amalan utama. Untuk menunjukkan tahap kepentingan, amalan-amalan utama adalah disusun berdasarkan nilai min.

Kata kunci: Pengurusan Tenaga, Fasa Pengurusan Tenaga, Amalan Utama
Pengurusan Tenaga, Pengurusan Fasiliti

TABLE OF CONTENTS

CHAPTER	TITLE	PAGE
	DECLARATION	ii
	DEDICATION	iii
	ACKNOWLEDGEMENTS	iv
	ABSTRACT	v
	ABSTRAK	vi
	TABLE OF CONTENTS	vii
	LIST OF TABLES	xi
	LIST OF FIGURES	xiii
	LIST OF APPENDICES	xvi
1	INTRODUCTION	
	1.1 Introduction	1
	1.2 Problem Statement	3
	1.3 Research Objectives	8
	1.4 Significance of Study	8
	1.4.1 Energy Manager	8
	1.4.2 Facilities Management Professional	8
	1.4.3 Energy Auditor (Internal / External)	9
	1.4.4 Top Management	9
	1.5 Scope of Research	10
	1.6 Research Methodology	10
	1.6.1 Stage One: Preliminary Study	10
	1.6.2 Stage Two: Literature Review	10
	1.6.3 Stage Three: Expert Review	11

	1.6.4	Stage Four: Questionnaire Survey	11
	1.7	Chapter Outline	13
	1.8	Limitation of the Study	14
2		PHASES AND KEY PRACTICES OF ENERGY MANAGEMENT	
	2.1	Introduction	15
	2.2	Definition of Energy	16
	2.3	Definition of Energy Management	16
	2.4	Phases of Energy Management	18
	2.4.1	First Phase: Planning	19
	2.4.2	Second Phase: Implementing	20
	2.4.3	Third Phase: Monitoring and Evaluation	21
	2.5	Key Practices of Energy Management	23
	2.6	Conclusion	50
3		RESEARCH METHODOLOGY	
	3.1	Introduction	51
	3.2	Research Stages	51
	3.2.1	Stage One: Preliminary Survey	54
	3.2.2	Stage Two: Literature Review	54
	3.2.3	Stage Three: Expert Review	55
	3.2.3.1	List of Expert	55
	3.2.3.2	Instrument Designation	55
	3.2.3.3	Data Collection Method	56
	3.2.3.4	Data Analysis Method	56
	3.2.4	Stage Four: Questionnaire Survey	57
	3.2.4.1	Sampling	57
	3.2.4.2	Instrument Designation	58
	3.2.4.3	Data Collection Method	58
	3.2.4.4	Data Analysis Technique	58
	3.3	Conclusion	60

4	ANALYSES AND FINDINGS OF EXPERT REVIEW	
4.1	Introduction	61
4.2	Expert Review	61
4.2.1	Phases of Energy Management	62
4.2.2	Key Practices of Energy Management	63
4.2.2.1	“Planning” Phase	63
4.2.2.2	“Implementing” Phase	65
4.2.2.3	“Monitoring and Evaluation” Phase	67
4.3	Expert Review Output	69
4.4	Conclusion	71
5	ANALYSES AND FINDINGS OF QUESTIONNAIRE SURVEY	
5.1	Introduction	73
5.2	Responses	73
5.3	Study Analysis for Questionnaire Survey	74
5.3.1	Respondent Profile	74
5.3.1.1	Years of Experience in Energy Management	75
5.3.2	Analysis of Phases	75
5.3.2.1	“Planning” Phase	76
5.3.2.2	“Implementing” Phase	76
5.3.2.3	“Monitoring and Evaluation” Phase	77
5.3.3	Analysis of Key Practices	78
5.3.3.1	Key Practices for “Planning” Phase	78
5.3.3.2	Key Practices for “Implementing” Phase	79
5.3.3.3	Key Practices for “Monitoring and Evaluation” Phase	81
5.3.4	Ranking of Key Practices According to Phases	83
5.3.4.1	Ranking of Key Practices for “Planning” Phase	84

CHAPTER 1

INTRODUCTION

1.1 Introduction

Energy is vital for economic growth and development. Today, energy usage is expected to continue to increase rapidly in the twenty-first century, as mainly because of the expansion of the economies of developing nation (Lincoln, 2006). As the energy we use today is mainly from fossil fuels such as oil, gas and coal, the large demand on energy will causing carbon dioxide and other greenhouse gases released into the air causing serious environmental pollution problems such as acid rain and global warming when large volumes of these fuels are burned (Mongillo and Mongillo, 2004). The rapidly increased oil price in recent years also attracts global concern and leads to a call for the use of energy for sustainable development. According to Mohamed Rahmat (2003), an energy saving program is a welcomed solutions with the environmental concerns and the three-fold increase in cost of fuel since 1996.

“Today's facility manager must adapt to current trends and prepare for future problems”, this statement was stated in Facilities Management News (27 Aug 2007). The Facility Management Forecast 2007 listed down Eight Emerged Trends that promise to shape building design and facilities operations throughout the 21st century, they were: linking facilities management to strategy, emergency preparedness, change management, sustainability, emerging technology, globalization, broadening diversity in the workforce and aging buildings. Addressing these trends through consideration, education and preparation will arm

facilities managers with the tools they need to face the challenges ahead. Based on list of Facility Management Forecast (2007) by IFMA, one of the emerged trends is the sustainability, which includes issues such as energy wastage and limited resources. One of the solutions perhaps is energy management. It remains as the greatest long-term method of stretching limited resources. In truth, energy savings can be dramatically increased and maintained over time by adopting and implementing consistent energy management practices and recognized measurement and verification procedures (Gorp, 2003).

Energy management is increasingly being emphasized to address the problems of achieving sustainable environment in tandem with maintaining stability of the environment. Therefore, to succeed in developing a sustainable society, the pattern of energy usage should be monitored and managed as well as in universities. As indicated by William (2006), energy management provides considerable opportunities that assist large public institutions (universities, hospitals, municipal lighting etc) and high energy consumption private operations cut costs considerably. The dramatic increases in energy prices make energy conservation an unconditional imperative of modern educational management (Castaldi, 1982)

Energy management can be seen as one of the most satisfying aspect of estate management. Success in today's business environment requires a comprehensive plan for managing expenses enterprise-wide, and energy costs are no exception. By managing energy consumption, we could lower our operating costs. As suggested by Warner and Kelly (1994), the typical energy bill in the education sector is approximately 5 percent of the total expenditure for a college, if a saving of 20 percent of the energy bill is possible with simple improvements. By considered this, the facilities and energy managers in universities must play their role in managing the electricity consumption to ensure the energy usage is optimum and effective. Thus, it is important for universities to carry out energy management so that energy in universities can be used efficiently and unnecessary energy wastage can be avoided. In line with that, this project is to identify the phases and key practices of energy management for universities in Malaysia to aids towards an effective energy management program. This chapter begins with a brief introduction, followed with

problem statement, the objectives of this project, scope of project, significance of study, research methodology, and lastly, the chapter outlined.

1.2 Problem Statement

Energy use gains in human comfort and ease, it is useful for many things and makes modern life possible. Over the last several decades, there has been increasing interest and activity in the field of energy management. Improving energy efficiency and lowering the operating cost of facilities is the ultimate goal of every owner, engineer, operation managers, facilities managers, and energy managers. Energy managers have responsibility to improve performance and reduce energy consumption in their facilities during all economic conditions (Abouzelof, 2003). To ensure organization achieves its energy efficiency, an effective energy management is vitally needed today. The need for energy management can be discussed from three different perspectives, which are economic, sustainability, and environment.

One of the energy issues from economic perspectives that urging the needs of the energy management is the current sky high oil price. The ride on the roller coaster of energy prices has gotten pretty wild in the last two years. As reported by Sidhu in *The Star* (December 6, 2007), international oil price reaches near US\$90 per barrel after Organization of Petroleum Exporting Countries decided to keep output levels unchanged, rebuffing consumer country calls for more crude to rein in prices. The main cause of the increase was the existence of a tight market due to the small margin between production, high demand for oil by China, India and the United States (Economic Planning Unit Prime Minister's Department, 2005). The rise in world oil prices is a "serious matter" and could impact the country's development plans, said Datuk Seri Abdullah Ahmad Badawi (*The Star*, September 14, 2007). Malaysian is also affected as the price of petrol and diesel sought a new hike on February 28, 2006. In June 1, 2006, the electricity tariff in the peninsula rises by an average of 12% (*The Star*, May 25, 2006) as the cost of generating electricity has increases. This will be a great challenge for the energy managers in reducing the operating costs and electricity bill. One of the great solutions is through

implementing energy management as it serve as a roadmap to achieve energy policies and objectives.

Regarding energy sustainability, the well-known report “Our Common Future”, by the World Commission on Environment and Development (1987), defines sustainable development as “meets the needs of the present without compromising the ability of future generations to meet their own needs”. Relationship between ‘energy production and use’ and ‘sustainable development’ could be seen in two important features: (1) the importance of adequate energy services for satisfying basic human needs, improving social welfare, and achieving economic development- in short, energy as a source of prosperity, and (2) the production and use of energy should not endanger the quality of life of current and future generations and should not exceed the carrying capacity of ecosystems.

In overview, ‘Energy Sustainability’ refers to the continuous availability of energy in varied forms, in sufficient quantities, and at reasonable prices. It also means the availability of local and imported resources to meet, over time and at reasonable prices, the growing demand for energy (Khatib et al., 2001). Recently, the energy sustainability issue had once again risen as a global concern as people in developed country rely heavily on fossil fuels, including coal, petroleum, and natural gas. Taken together, these meet more than 85 percent of global energy demands. But the reserve of these fuels is not infinite, and scientists predict that within the next two centuries we will run out of these valuable resources (Kerski and Ross, 2005). Globally, energy consumption is expected to rise by 57% from a total primary energy use equivalent to that produced from 8610 million tones of oil in 1997 to that produced from 13529 million tones of oil in 2020 (Lincoln, 2006). The most conservative estimate that the world oil reserve can last only another 100 years or so. For this reason, sustainable supplement of energy in the coming future remain as a great challenges. Therefore, the single most immediate, cost-effective way is to reduce energy consumption, to make the present resources last as long as possible, through efficient use.

Today, the world is racing to find energy solution as worry about energy shortage, sky high energy price and serious energy-pollution. Not being excluded,

Malaysia as a developing country also need to confront the energy sustainability issue, estimation shows that when we move towards the year 2020, our total energy requirement is expected to increase to about 75,000 ktoe per annum. In Malaysia, fifty percent of the total energy supply is from oil while the other sources of energy supply are still too little. Although Malaysia is blessed with oil and gas deposits, however, there is a possibility that Malaysia would become a net importer of oil by the year 2014 since that our nation is still heavy dependence on oil as the primary energy supply (Malaysia Energy Outlook 2005). Soon or sooner, our country has to deal with oil shortage problems. Such scenario was urging the country towards energy saving practices to enhance country's energy sustainability for such, effective energy management practice.

From the perspective of environment, the need to conserve energy is essential as our global environment confronts serious degradation. The rapid pace of development, especially in Asia, makes environmental depletion of resources a growing concern (The Facility Management Forecast 2007). Environmental issues arises forefront towards global concern including greenhouse effects, climate change (global warming), acid rain, rise in sea-levels, increased of extreme weather events, etc. Green house gases such as carbon dioxide in the atmosphere released through the burning of fossils fuels (to generate energy) are increasing and causing greenhouse effects (Kerski and Ross, 2005). When the green house effect gets too strong, it can make the Earth warmer than normal and consequently create problems for people, plants, and animals (Williams, 2005). Since 65% of the greenhouse gas emissions of carbon dioxide are a result of electrical generation processes using carbon based fuels, it stands to reason that ourselves as energy users can reduce greenhouse gas emissions by reducing energy consumption (Johnson and Killingsworth, 2002).

As indicated in the latest *Hu-man Development Report* by United Nations Development Programme (UNDP), Malaysia is the 26th largest source of greenhouse gases in the world, a position that places it within the ranks of industrialized nations. The effects of climate change could threaten human development and reverse progress in improvements in poverty reduction, health and education (The Star, November 30, 2007). Accordingly, it seems common sense to reduce energy

demands, fossil fuel burning and generation of carbon dioxide and other greenhouse gases by developing more energy efficient technologies (Lincoln, 2006). Furthermore, Malaysia government also encourage the country to use energy resources efficiently as in Ninth Malaysia Plan, the focus is on efficient utilization of energy resources and minimization of wastage particularly in the industrial, transport, and commercial sectors as well as in government buildings. Once again, there is a clear picture that there is a must to implement energy management in order to effectively and efficiently manage the energy usage consequently reduce the energy demand.

Today, our nation and our world are facing severe energy problems and there appears to be no simple answers. Energy is finite resource, therefore it must be treated as well as possible and putting efforts to ensure its sustainability. In Malaysia, government agencies, business, major energy corporations, and environmental groups are joining together to develop and provide a more sustainable energy system for the future. There were various types of incentives being offered by Malaysia Government for companies undertaking energy conservation services. The Ministry of Energy, Water, and Communications are also embarking on a program to reduce electricity consumption by 10 percent in all Government departments (Lim, 2006). Nowadays, facilities and energy managers are also hungry for guidance to help them develop a long term approach to energy and cost savings (Simon, 2003). By considering the consumers in the future may be unwilling to pay such high prices, many people consider that the key issue is to reduce demand by energy conservation (Kerski and Ross, 2005).

As indicated by Energy Information Bureau Malaysia, energy management can helps all level of society save energy costs and improve productivity. Time and again energy management has shown that it can substantially reduce energy costs and energy consumption. Although energy management cannot solve all the nation's problems, perhaps it can ease the strain on our environment (Capehart et al., 2006). In addition to these discouraging issues that come to the forefront of public concern, author strongly believe in reducing energy use through proper energy management can help minimize these problems. Therefore, this project paper is undertaken to identify phases and key practices of energy management for Malaysia Universities as

absent of the list of phases and key practices of energy management has prohibited the facilities manager to implement energy management effectively.

The Malaysia Ministry of Education has starts to urge all education centres to save energy (The Star, September 13, 2007) as the expensive monthly electricity bill has become the major concern of many parties in universities. Whether related to an actual lack of fossil fuels or through manipulation of supplies, high energy costs are a reality for a university's management. The increases of electricity tariff since Jun 2006 has a domino effect that affects operational costs of a university. As according to Edmund (1982), energy use could be cut through proper management, retrofit, and general energy conservation measures. While, as according to Capehart et al. (2006), an energy cost savings of 5-15 percent is usually obtained quickly with little to no required capital expenditure when an aggressive energy management program is launched. There is a great opportunity to conserve energy in university as it consisted huge area and involves a very large quantity of population.

The needs of this study were further enhanced through the preliminary study. In January 2008, a preliminary study was carried out in Malaysia Public and Private Universities. An open-ended questionnaire (refer Appendix A) was developed and distributed though electronic mail, fax, etc. Totally, there were eight universities responded, included Universiti Kebangsaan Malaysia (UKM), Universiti Kuala Lumpur (UniKL), Universiti Tenaga National (UNITEN), Universiti Malaysia Pahang (UMP), Universiti Malaysia Sabah (UMS), Universiti Teknologi Malaysia (UTM), Universiti Tun Hussein Onn Malaysia (UTHM), and Univesiti Utara Malaysia (UUM). Results revealed that all of them do not have a complete list of energy management practices. All respondents expressed that there is a necessary for university nowadays have such a list of phases and key practices of energy management to provide guidance towards an effective energy management program. Considered the concern stated above, researcher confirmed that there is a desperately need to identify the phases and key practices of energy management in aid of achieving an effective energy management practice as it may serve as a roadmap for facilities and energy managers to make clear on some important practices to achieve an effective energy management for universities in Malaysia.

1.3 Research Objectives

The objectives of this project are as followed:

1. To identify phases of energy management for Universities in Malaysia.
2. To identify key practices of energy management for Universities in Malaysia.

1.4 Significance of Study

The result of this project report would serve as an important guidance and provide useful information for those individual or organization which intended to establish or implement energy management program. The findings of this study would be useful to the following group of individuals:

1.4.1 Energy Manager

The energy manager is officer responsible to the energy management in an organization. The findings of this project report are vitally important for energy manager to understand those important phases and practices in the energy management program. Findings also would aids in enhancing the ability and capability of energy manager in implementing an effective energy management program.

1.4.2 Facilities Management Professional

These findings are serves as useful information to the facilities management professional in making their contribution to the energy management program development. Over and above that, findings of this project report also to serve as

guidance for the organization to identify those essential elements or practices in order to improve its existing energy management program towards an effective energy management.

1.4.3 Energy Auditor (Internal / External)

Energy auditor will find the findings very useful and practical to them as the identified phases and key practices of energy management can be referred and tailored as a checklist on essential elements or criteria in an energy management program. It can be served as a basis for justifying some essential elements. In addition, the findings can also serve as a broad based guidance for energy auditor in advising their client on the vital energy management practices to take note of in implementing an effective and successful energy management program.

1.4.4 Top Management

These findings will provide the top management with a basic understanding on the essential or important practices to take note of in establishing and/or implementing an energy management program. The top management of an organization will benefit from the information provided as it serves as an important reference to assist which is interested to establish or undertake energy management in their organization. Therefore the top management would be able to make proper decisions to ensure its effectiveness.

1.5 Scope of the Research

This study focused on public and private universities in Malaysia. Totally there are 28 of them. This study was carried out by targeting the facilities and/or energy managers in Malaysia's Universities. Data collection was held between March 2008 and April 2008.

1.6 Research Methodology

The methodology of this study was consisted of five stages as explained below:

1.6.1 Stage One: Preliminary Study

In the beginning stage, a preliminary study was conducted with aims to identify the existence of the issue for this study, to find out whether universities in Malaysia needs the information regarding the phases and key practices of energy management for universities. An open-ended questionnaire was developed and distributed to the public and private universities throughout Malaysia.

1.6.2 Stage Two: Literature Review

In the second stage, a series of literature review on theoretical part has been carried out. Extensive and comprehensive literature search performed was intended to identify two constituent elements align with the project report's objectives. The first was regarding the phases of energy management and the second element was the key practices of energy management. All the related information and source were

mainly collected and gathered accordingly from appropriate articles, journals, books, newspaper, and so forth in the relevance body of knowledge.

1.6.3 Stage Three: Expert Review

In this stage, an expert review was carried out to review those phases and key practices that had been ascertained in the previous stage. A closed-ended questionnaire was developed and being reviewed by energy experts from the research and authority body. The purpose of doing so is to confirm the ascertained phases and key practices and to examine whether the key practices were appropriately distributed among the phases before it to be identified through questionnaire survey throughout the universities in Malaysia.

1.6.4 Stage Four: Questionnaire Survey

Based on the findings in Stage Three, a closed-ended questionnaire was developed in this stage. It was then directed to the energy managers, facilities managers, or related person in-charge for energy management in the university (Malaysia's public and private universities) in order to gauge their opinion on the essential phases and key practices of energy management for universities in Malaysia. Subsequently, the data collected from the questionnaires survey were subjected to frequency analysis, mean analysis and standard deviation. Appropriate statistical analysis methods were adopted during this section.

The research flow was illustrated in Figure 1.1 below:

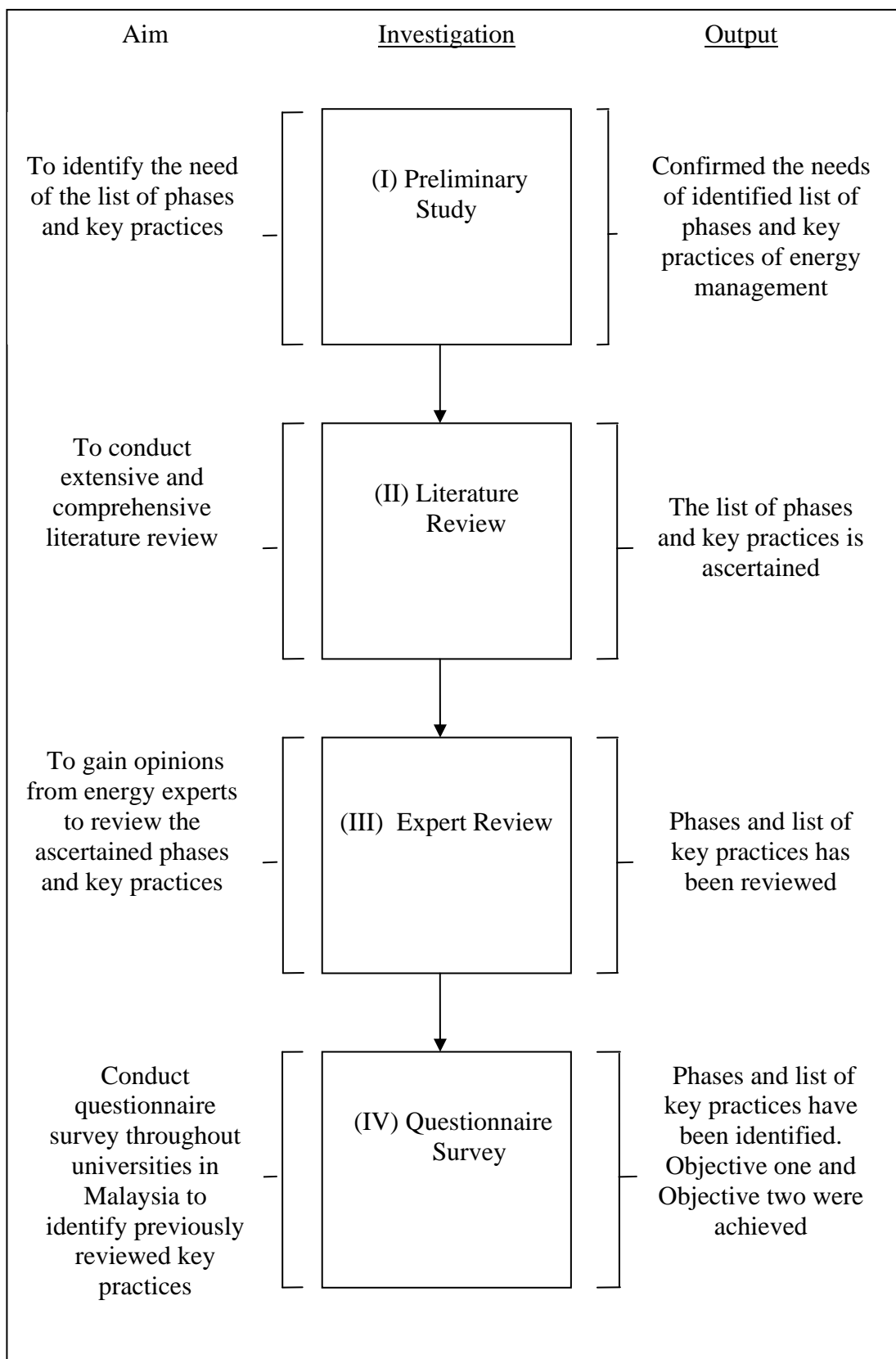


Figure 1.1 Research flow chart

1.7 Chapter Outline

This project report is organized and presented through six chapters.

Chapter One was the introductory part for this project report. This chapter outlines the research problems addressed by this study. In between, a preliminary study was conducted to confirm the needs of study. Then, it was followed by identifying the objectives that are fundamental to the study, the scope of the study, significance of the study, a brief discussion on the research methodology, and lastly, a chapter outline.

Chapter Two concerned about literature part on the phases and key practices of energy management. It establishes the theoretical basis for this project report. Ideas and theories from various disciplines were gathered, explained, and summarized to pertain a range of phases and key practices towards an effective energy management.

Chapter Three discussed on methodology to achieve the project report's objectives. The research approach adopted for this study such as methods and techniques in data collection and data analyses was explained in depth.

Chapter Four related to the analyses of data gathered from energy experts. It is to review phases and key practices that has been ascertained through literature review. Besides, it is also to examine whether the key practices given are appropriately distributed among the phases.

In Chapter Five, the reviewed phases and key practices from Stage Four are subject to the questionnaire survey throughout universities in Malaysia. This chapter presented the analyses of collected data and findings derived from the questionnaire survey. The key practices of energy management were identified through the questionnaire survey. Data collected was gathered and analysed using statistical analysis such as frequency analysis, mean analysis and standard deviation to achieve the project report's objectives.

Chapter Six is the last chapter of the study. A conclusion of the study based on the analyses and findings achieved in previous chapter was derived. Then, it was followed with limitations of study, recommendations, and suggestions for future study.

1.8 Limitation of the Study

This study was subject to the following limitations:

- (i) The results and findings was focused on the phases and key practices of energy management for universities in Malaysia and therefore it is best applied in this industry. Nevertheless, it could be used for other industry with appropriate modifications.
- (ii) The findings of this report does not provide sufficient technical nor theoretical development to answer all questions on any subject, but it does provide reader with enough information to successfully accomplish most energy management practices.
- (iii) The identified list of phases and key practices was limited by the perceptions of the recognized experts and the practitioners on energy management for universities in Malaysia.
- (iv) The conclusion for this study was based upon judgments of the recognized experts and the practitioners on energy management for universities in Malaysia.
- (v) The identified list of phases and key practices is dynamic and subject to change based on particular organization's future needs. Therefore, it is flexible for practitioners or administrators to modify the list according to their intended needs and requirements.

References

- Abouzelof, Y. (2003). Improving Energy Efficiency During Tight Budget Years. In. World Energy Engineering Congress and Buff, K. (Ed.) *Energy & high performance facility sourcebook*. Lilburn, GA: Fairmont Press.
- Arain, F. M. and Low, S. P. (2005). The Potential Effects of Variation Orders on Institutional Building Projects. *Journal of Facilities*. 23(11/12): 496 – 510.
- Baker, T.L. (1997). *Doing Social Research (Second Edition)*. New York: McGraw-Hill
- Baker, T. L. (1999). *Doing Social Research*. (3rd ed.). Boston: McGraw-Hill College.
- Blaikie, N. (2003). *Analyzing Quantitative Data: From Description to Explanation*. London: Sage.
- Bream, C. F. (1986). Energy Management In Buildings – Techniques and Priorities. In. Energy Management in Buildings Conference, and Sherratt, A. F. C. (Ed.) *Energy management in buildings*. (pp. 10-32) London: Hutchinson.
- Capheart, B. L., Turner, W. C., & Kennedy, W. J. (2006). *Guide to Energy Management*. (5th ed.) Lilburn, GA: Fairmont Press.
- Castaldi, B. (1982). *Educational Facilities Planning, Remodeling, and Management*. (2nd ed.) Boston: Allyn and Bacon.
- Coad, W. J. (1982). *Energy Engineering and Management for Building Systems*. New York: Van Nostrand Reinhold.
- Corbetta, P. (2003). *Social Research Theory, Methods and Techniques*. London: SAGE Publications.

Davies, A. J. and Kochhar, A.K. (2000). *A Framework for the Selection of Best Practices. International Journal of Operations & Production Management*. 20 (10): pp 1203 – 1217.

Economic Planning Unit Prime Minister's Department. (2005). *Oil Price and Subsidies: An Explanation*. Kuala Lumpur.

Edmund, D. Z. (1982). *A Comparison of Energy Efficiency of IOWA Public School Buildings*. Iowa State University.

Far-reaching effects of high oil prices. (2007, December 6). *The Star*. Retrieved December 6, 2007, from <http://www.thestar.com.my>

Gammon, R. B. (1986). The Australian Approach to Energy Management. In. Energy Management in Buildings Conference, and Sherratt, A. F. C. (Ed.) *Energy management in buildings*. London: Hutchinson.

George, D., & Mallery, P. (1999). SPSS for Windows Step by Step: A Simple Guide and Reference. *CONTEMPORARY PSYCHOLOGY*. 44 (1), 100.

George, D. and Mallery, P (2003). *SPSS for Windows Step by Step: A Simple Guide and Reference 11.0 Update*. (4th ed.) Boston: MA : Allyn and Bacon.

Gorp, V. C. J. (2003). Maximizing Energy Savings with Enterprise Energy Management Systems. In. World Energy Engineering Congress and Buff, K. (Ed.) *Energy & high performance facility sourcebook*. Lilburn, GA: Fairmont Press.

Government of Malaysia (2006a). *Ninth Malaysia Plan (2006-2010)*. Putrajaya. Economic Planning Unit.

Gravetter, F. J., & Wallnau, L. B. (2002). *Essentials of Statistics for the Behavioral Sciences* (4th ed.). Pacific Grove, CA: Wadsworth.

Hall, C. W. and Hinman, G. W. (1983). *Dictionary of Energy*. New York: M. Dekker.

Hansen, S. J. (2002). *Manual for Intelligent Energy Services*. Lilburn, Ga: Fairmont Press.

Heis, M. (1986). Energy management systems and programs – expectations, implementation and experiences. In. Association of Energy Engineers, and World Energy Engineering Congress. (Ed.) *Strategic Planning for Cogeneration and Energy Management*. Atlanta, Ga: Fairmont Press.

Henry, H. W., Symonds, F. W., Bohm, R. A., Gibbons, J. H., Moore, J. R. and Snyder, W. T. (1980). *Energy Management Theory and Practice*. Energy, power, and environment, 8. New York: M. Dekker.

Holsti, O.R. (1969). *Content Analysis for the Social Sciences and Humanities*. Reading, MA: Addison-Wesley.

International Facility Management Association. (2007). *Facility Management Forecast 2007: Exploring the Current Trends and Future Outlook for Facility Management Professionals*. Houston: IFMA

Johannsen, H., and Page, G. T. (1990). *International dictionary of management*. (4th ed.) Kogan Page.

Johnson, C. (1997). *Dictionary of management*. Kuala Lumpur : Golden Books Centre

Johnson, J. S. and Killingsworth, T. G. (2002). Leveraging Your Energy Management Resources: A Case Study With Nortel Networks. In. World Energy Engineering Congress and Sioros, D. (Ed.) *Integrated solutions for energy & facility management*. Lilburn, Ga: Fairmont Press.

Keeffe, G. and Grimshaw, B. (1994). Energy Management. In. Warner, D., & Kelly, G. (Ed.). *Managing Educational Property A Handbook for Schools, Colleges, and Universities*.(pp. 196-209). Buckingham [England]: Open University Press.

Kennedy, W. J., & Turner, W. C. (1984). *Energy Management*. Prentice-Hall series in energy. Englewood Cliffs, N.J.: Prentice-Hall.

Kerski, J. and Ross, S. R. J. (2005). *The Essentials of-- The Environment*. London: Hodder Arnold.

Khatib, H., Barnes, A., Chalabi, I., Steeg, H. and Yokobor, K. Energy Security. (2001). In. Goldemberg. J. (Ed.) *World Energy Assessment, Energy and the Challenge of Sustainability Overview*. United Nation Publisher.

Kopfle, J. T. (1989), The Energy Management Program at Southwire. In. Mashburn, W. (Ed.) *Managing energy resources in times of dynamic change*. Lilburn, GA: Fairmont Press.

Levin, J., & Fox, J. A. (2004). *Elementary Statistics in Social Research: The Essentials*. Boston: Pearson.

Lim K. Y. (2006). *The Utility Industries : Shaping The Future*. Ministry of Energy, Water, and Communications.

Lincoln, S. F. (2006). *Challenged Earth an Overview of Humanity's Stewardship of Earth*. London: Imperial College Press.

Low, S. P. and Sze, H. H. (2005). Research and Concepts: Strategic Quality Management for the Construction Industry. *The TQM Magazine*. 17(1): 35 – 53.

Malaysia a big source of carbon emissions. (2007, November 30). *The Star*. Retrieved December 4, 2007, from <http://www.thestar.com.my>

Mashburn, W. H. (1989). *Managing Energy Resources in Times of Dynamic Change*. Lilburn, GA: Fairmont Press.

Mashburn, W.H. (2005). Effective Energy Management. In Turner, W. C. (Ed.) *Energy management handbook*. Lilburn, Ga: Fairmont Press.

Mathaisel (2004). A Framework for Benchmarking, Classifying, and Implementing Best Sustainment Practices. *Benchmarking: An International Journal*. 11 (4): 403-417.

McFarland, D. E. (1974). *Management: Principles and Practices*. New York: Macmillan.

Mohamed Rahmat. (2003). *Malaysian Industrial Energy Efficiency Improvement Project*. Heveaboard Sdn. Bhd.

Mongillo, J. F., and Mongillo, P. (2004). *Teen Guides to Environmental Science. volume 5, Creating a Sustainable Society*. Westport, Conn: Greenwood.

Montana, P. J., & Charnov, B. H. (2000). *Management*. 3rd Ed. Hauppauge, N.Y.: Barron's.

Paulk, M.C., Weber, V., Garcia, M., Chrissis, B., and Bush, M. (1993). *Key Practices of the Capability Maturity Model, Version 1.1*. Carnegie Mellon University: Software Engineering Institute.

Pearson, M. (1986). Stressing the Human Factor in Energy Management. In. Association of Energy Engineers, and World Energy Engineering Congress. *Strategic planning for cogeneration and energy management*. Atlanta, Ga: Fairmont Press.

Portland Energy Conservation, Inc. (1999). *Fifteen O&M Best Practices for Energy-efficient Buildings*. O&M best practices series. Portland, OR: Portland Energy Conservation.

Schools hit by power bill woes. (2007, September 13). *The Star*. Retrieved December 5, 2007, from <http://www.thestar.com.my>

Simon, C. W. (2003). Introduction to Energy Master Planning: What It Is- And What It Isn't. In. World Energy Engineering Congress and Buff, K. (Ed.) *Energy & high performance facility sourcebook*. Lilburn, GA: Fairmont Press.

Smith, C. B. (1981). *Energy Management Principles Applications Benefits Savings*. Pergamon Press.

Spriddell, P.H. (1986). Fundamental Purposes of Energy Management. In. Energy Management in Buildings Conference, and Sherratt, A. F. C. (Ed.) *Energy management in buildings*. London: Hutchinson.

Statistical Package for the Social Sciences Inc. (2004). *SPSS Base 13.0 User's Guide*. Chicago, IL: SPSS.

Stebbins, W. L. (1986). Energy management attitudes: the psychology of getting people to do things. In. Association of Energy Engineers, and World Energy Engineering Congress. (Ed.) *Strategic Planning for Cogeneration and Energy Management*. Atlanta, Ga: Fairmont Press.

Thumann, A. (1992). *Energy Conservation in Existing Buildings Deskbook*. Lilburn, GA: Fairmont Press.

Thumann, A., & Mehta, D. P. (1997). *Handbook of Energy Engineering*. Lilburn, GA: Fairmont Press.

Thumann, A. (2002). *Plant Engineers and Managers Guide to Energy Conservation*. (8th ed.) Lilburn, GA: Fairmont Press.

Turner, W. C. (1993). *Energy Management Handbook*. Lilburn, GA: Fairmont Press.

Vogt, W. P. (2007). *Quantitative Research Methods for Professionals*. Boston, MA: Pearson/Allyn and Bacon.

Waite, M. (2004). *Oxford Thesaurus of English*. 4th Ed. Oxford: Oxford University Press

Warner, D., and Kelly, G. (1994). *Managing Educational Property a Handbook for Schools, Colleges, and Universities*. Buckingham [England]: Open University Press.

Wary of World Oil Price Hike. (2007, September 14). *The Star*. p. 12.

Watts Up! (2006, May 25). *The Star*. p. 1.

William, B. (2006). Africa's Evolving Investment Climate and its implications for Electricity (Energy) Financing. A speech given at Sheraton Hotel Tunis, Tunisia.

Williams, L. D. (2005). *Environmental Science Demystified*. New York: McGraw-Hill.

Williams, M. A. Initiating, Organizing, and Managing Energy Management Programs. (1993). In. Turner, W. C. (Ed.) *Energy Management Handbook*. Lilburn, GA: Fairmont Press.

World Commission on Environment and Development (1987). *Our Common Future*. New York: Oxford University Press.

World Energy Conference, and Malaysian International Chamber of Commerce and Industry. (1986). *Malaysian energy outlook, towards 2005*. Kuala Lumpur: Malaysian National committee, World Energy Conference.

Zeimet, D. E. (1982). *A Comparison of Energy Efficiency of Iowa Public School buildings*. University of Iowa State: Doctor of Philosophy Dissertation.