



Global Conference on Business & Social Science-2014, GCBSS-2014, 15th & 16th December,
Kuala Lumpur

Critical Success Factors for Sustainable University: A Framework from the Energy Management View

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Abstract

Malaysian Higher Education Ministry insisted that all universities to conserve energy. Energy wastage in universities is related to inefficiency and awareness. Universities took initiatives towards sustainability through various energy projects and research. However, most universities are still not realizing the significant of sustainability due to inability to tackle the barriers. Focusing on the importance of practicing energy management (EM) effectively, this paper discusses the Critical Success Factors (CSFs) towards sustainable university. It also shows detail of theoretical framework identifying CSFs and Key Performance Indicators (KPIs) relationship which are measured based on 10-point action plan in Talloires Declaration towards sustainable university.

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Peer-review under responsibility of GLTR International Sdn. Berhad.

Keywords: energy management; sustainable university; critical success factors; key performance indicators; theoretical framework

1. Introduction

Buildings are important contributors to a large energy consumption which represent 40% of energy usage (Ryghaug and Sorensen, 2009), and has led to environmental problems (Bhargava, 2006; Al-Mofleh, Taib, Abdul Mujeebub, & Salah, 2009). Energy consumption in Malaysia is relatively high compared to other middle income developing countries (Choong, Chong, Low, & Mohammed, 2012). Malaysian university buildings are not exempted from the issue of high energy consumption.

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University buildings are high consumers of energy in the category of commercial buildings due to its activities and population (Sohif Mat, Kamaruzzaman Sopian, Mazlin Mokhtar, Baharuddin Ali, Halimaton Saadiah Hashim, Abdul Khalim Abdul Rashid et al., 2009; Najihah, Bakar, Hassan, & Rahman 2013). A survey done has shown the energy consumption in Universiti Teknologi Malaysia and International Islamic University Malaysia has led to more than ten million ringgit annually due to increment of students' population almost every year (Choong, Chong, Low, & Mohammed, 2012), and this has received a serious attention from many parties.

The statistic of Malaysia Ministry of Higher Education (MOHE) shows the building users are more than 1 million people at any given time which include the public and private universities, colleges and polytechnics. Table 1 shows total of students and academic staff for year 2010 (MOHE, 2011). The energy consumption due to the population and various activities has given the impact on the environment either directly or indirectly (Sohif Mat, Kamaruzzaman Sopian, Mazlin Mokhtar, Baharuddin Ali, Halimaton Saadiah Hashim, Abdul Khalim Abdul Rashid et al., 2009).

Table 1. Number of Students and Academic Staff in Higher Education Institute for Year 2010

Energy users in higher education institute for year 2010	IPTA	IPTS	Polytechnics	Community Colleges
Student	437,420	509,556	86,471	17,279
Academic Staff	28,571	33,613	6,741	2,259
Total	465,991	517,369	93,212	19,538
Grand Total of student and academic staff in IPTA, IPTS, Polytechnics and Community Colleges			1,096,110	

*Note: IPTA - Institut Pengajian Tinggi Awam (Public Institute of Higher Learning); IPTS - Institut Pengajian Tinggi Swasta (Private Institute of Higher Learning)

In spite of this, many universities have been forced to anticipate and propose a comprehensive approach to reduce the energy consumption (Choong, Chong, Low, & Mohammed, 2012). In line with the efforts, many plans towards sustainable university have been organized by MOHE to ensure the usage of energy in university can be well-managed. Typically, university is a place which well-suited for strategic EM where it involves people at all levels (Taylor & Narel, 2012). A study by the UK Carbon Trust stressed the importance of engaging the people working within the facility along with technological changes to achieve meaningful and lasting for energy consumption savings. As illustrated in Fig. 1, four facilities have implemented a different approach to EM. It was found that engaging both people and implementing energy efficient technology resulted in energy savings of 23%. This compared with energy savings of only 16% when EM did not include technological changes.

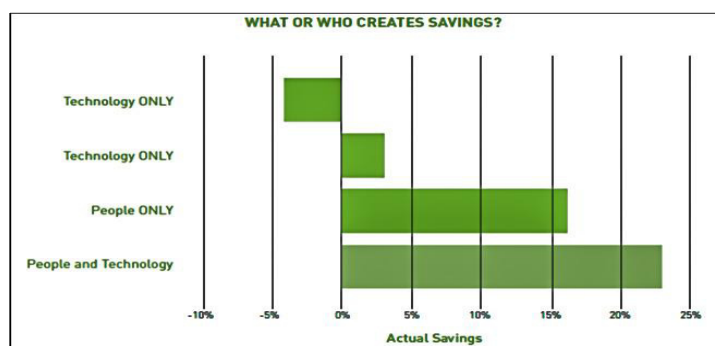


Fig. 1. Result in Energy Savings by Engaging both People and Technology in EM

A survey performed in Malaysian universities reveals that the level of energy awareness and energy usage behaviour among the university community is poor (Choong, 2008). Generally, the results show that the community

has poor energy knowledge and poor energy conservation behaviour as a matter of practice. Thus, many universities in Malaysia are called to initiate EM for better use of energy. The MOHE has urged all universities to save energy for expensive monthly electricity bill since year 2007 (Choong, Chong, Low, & Mohammed, 2012). EM is the best step to a solution to provide a roadmap to achieve the target of reducing energy consumption (Choong, Chong, Low, & Mohammed, 2012). The study of EM becomes crucial in developing countries. It can be proven by many studies have been done previously. For example of the previous studies related to EM are energy conservation program in government building (Kandar, Ahmad, & Syed Ariffin, 2009), study on the current status of energy consumption and various energy conservation in Malaysian environment (Al-Mofleh, Taib, Abdul Mujeebub, & Salah, 2009), energy efficient design of office buildings in Malaysia (Huat & Akasah, 2011), conceptual framework of energy awareness development process (Choong, Mohammed, & Alias, 2006), implementation of energy management key practices for Malaysia universities (Choong, Chong, Low, & Mohammed, 2012), sustainable Energy Management and its effect on energy efficiency index in university buildings (Najihah, Bakar, Hassan, & Rahman, 2013).

Mashburn (2009) claimed that a good strategy of EM can keep programs towards sustainable university. Therefore, to be a sustainable university, it is important to implement EM based on the sustainability concept which integrates environmental, economic and social that will be the catalyst to the success of the university's mission. The key question then ascended "How well an EM has been practiced towards sustainable universities without taking the Critical Success Factors (CSFs) into consideration". According to Mosakhani & Jamporazmey (2010), CSFs refer to something which must be implemented if any organization wants to be successful in a specific field. These factors should be controllable and measurable through reliable KPIs.

2. CSFs for EM towards Sustainable University

CSFs are originally defined as the limited number of areas in which results, if they are satisfactory, will ensure successful performance for the organization (Rockart, 1979). With the example of research exists on the CSFs, it is clear that CSFs are important and adopted by many areas. Although context-driven research may differ on the nature of focus, there are some common factors from the existing research on CSFs can be used for EM. However, the literature is still dominated by "laundry list" of CSFs rather than systematic and comprehensive by grouping the CSFs into cluster. Therefore, in this research, all variables of the CSFs identified from the international organizations and previous researchers are categorized according to cluster as shown in Table 2.

Table 2. CSFs for Implementing EM from International Organizations and Previous Researchers

		International Organizations and Researcher															
		IAU (1950)	ULSF (1990)	COPER-NICUS (1993)	UNESCO (1993)	Morris & Hough (1987)	Pinto & Slevin (1989)	Sanvido, Grobler, Pariff, Guvents, & Coyle (1992)	Pinto & Kharbanda (1995)	Belassi & Tukel (1996)	Cooke-Davies (2002)	Velazquez, Munguia, Platt, & Taddei, (2006)	Lozano (2006)	Xu, Chan & Qian (2011)	Choong, Chong, Low, & Mohammed (2012)	Manan (2012)	Yang (2013)
1) Top Management Support																	
<input type="checkbox"/>	Develop energy policy and guidelines	X	X				X	X		X	X	X	X	X	X		X
<input type="checkbox"/>	Leadership	X					X	X		X				X	X		
<input type="checkbox"/>	Create incentives by establishing an award					X										X	X
<input type="checkbox"/>	Allocation of sufficient resources	X	X	X						X				X	X		X
<input type="checkbox"/>	Training provision				X	X			X						X	X	X

2) Comprehensive Energy Management Team										
<input type="checkbox"/>	Conduct energy audit				X		X	X	X	X
<input type="checkbox"/>	Operations and maintenance			X	X		X		X	X
<input type="checkbox"/>	Management review and verification			X			X		X	X
<input type="checkbox"/>	Continuous improvement						X	X	X	
3) Stakeholders' Involvement										
<input type="checkbox"/>	Understanding of project vision and goal			X	X		X	X	X	X
<input type="checkbox"/>	Good communication among stakeholders	X	X	X			X		X	X
<input type="checkbox"/>	Knowledge and skills	X	X	X	X		X		X	X
<input type="checkbox"/>	Trust among stakeholders			X	X		X		X	X
4) Awareness										
<input type="checkbox"/>	Understanding the issues	X	X	X	X		X	X		X
<input type="checkbox"/>	Increase general energy awareness	X	X	X	X		X		X	X
<input type="checkbox"/>	Improve facility energy awareness								X	X
<input type="checkbox"/>	Education by R&D, learning and teaching	X	X	X			X	X	X	X
<input type="checkbox"/>	Community engagement and partnership	X	X	X			X	X		X
<input type="checkbox"/>	Energy information	X	X	X			X	X		X
5) Risks Management										
<input type="checkbox"/>	Identify the risks			X	X		X		X	
<input type="checkbox"/>	Assess the Risks			X	X		X		X	
<input type="checkbox"/>	Develop responses to the risks			X	X		X		X	
<input type="checkbox"/>	Develop a contingency plan for the risks			X	X		X		X	

3. KPIs towards Sustainable University

“To measure is to know. If you cannot measure it, you cannot improve it” (Thomson, 1907). It is equally true to say that what is not measured is not managed. KPIs are a tool for measurement that reflects the performance of any organization in the context of achieving its wider goals and objectives (Baker, 1995). Organizations all over the world expect to use KPIs to adequately capture the link between environmental, social and economic in achieving sustainability. KPIs are useful for monitoring progress towards specific goals rather than focusing solely on the goal (Phylipsen, 2010). According to Shriberg (2004), KPIs have to be critically considered on the context of organizational performance measurement. The choice of the right KPIs will initiate a discovery of where and how the organization is moving. Implementing KPIs successfully highly depends on their development (Galleto, Maisano, & Franceschini, 2007), as well as require a systematic approach. Filho (1999) ascertained that approaches to sustainability differ from campus to campus, country to country, policy to policy, and declaration to declaration. Yet there are common principles among the majority of institutional policies, national, and international declarations towards sustainable university as shown in Table 3.

Table 3. Common Principles of Sustainability in Policies and Declarations (Source: Wright, 2002)

Policy / Declaration	SPO	SR	EL	EMR	CUC	DI-DC	PGNI	PO
Stockholm Declaration			X	X				X
The Talloires Declaration	X	X	X	X	X	X	X	X
The Halifax Declaration			X	X	X		X	X
The Kyoto Declaration	X	X	X	X	X		X	X
CRE Copernicus Charter		X	X	X			X	X
Macalester College Implementation Plan	X	X	X	X	X	X	X	X
University of British Columbia Policy	X	X	X	X	X	X	X	X

*Notes:
SPO-

Sustainable Physical Operations; SR-Sustainable Research; EL-Environmental Literacy; EMR-Ethical and Moral Responsibility; CUC- Cooperation amongst Universities and Countries; DI-DC-Developing Inter-Disciplinary Curriculum; PGNI-Partnerships with Government, NGOs and Industry; PO-Public Outreach

From the Table 3, it shows that only 3 of policies and declarations fulfilled all the principles towards sustainable university, namely Talloires Declaration, Macalester College Implementation Plan and University of British Columbia Policy. The rationale of choosing Talloires Declaration 10-point action plan as a set of KPIs towards sustainable university resulted from Malaysia as one of 54 countries of which University of Malaya has signed this declaration. Malaysian universities have not established and adopted any KPIs for sustainability since 2010 onwards (Abdullah, 2012).

4. Theoretical Framework

A theoretical framework refers to how the researcher not only questions, but develops theories on what the possible answers could be, then this theories are grouped together into cluster that frame the subject (Sekaran, 2003). It is based on written documents such as literature, discussion, and logic reasoning. This framework contains two parts which are enablers and result area. Enablers and Key result areas (KRA) are identified based on the literature review. A series of structured interviews are conducted to validate the identified enablers (CSFs) and KRA (KPIs). Thus, Fig. 2 shows the cluster of CSFs with KPIs which have been validated by the experts to implement EM effectively. The arrows emphasize the dynamic nature of this framework, helping to improve enablers that in turn lead to improve the EM implementation.

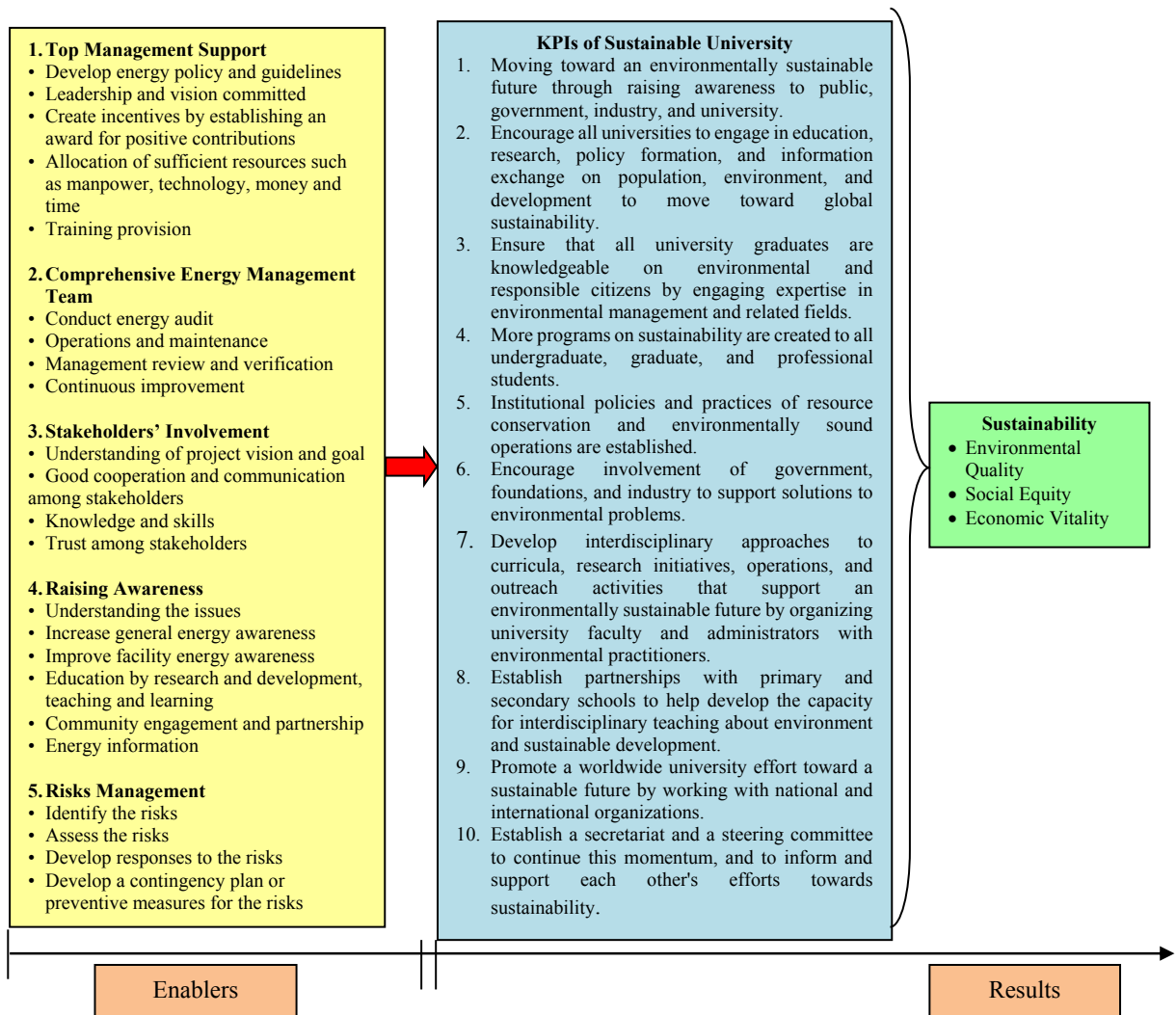


Fig. 2. A Theoretical Framework of CSFs to Implement EM towards Sustainability by Using the Talloires Declaration 10-Point Action Plan as KPIs

As the CSFs for EM towards sustainable university has not yet been explored, thus this framework can help to hypothesize that there is a significant relationship amongst the CSFs identified with KPIs in respect to performance and universities' strategy by performing test using PLS-SEM. By testing this hypothesis, it could prove a theory is true or not in the context of the study.

5. Conclusion

Five clusters consisting of 23 CSFs are identified namely, i) top management support, ii) comprehensive energy management team, iii) stakeholders' involvement, iv) awareness, and v) risks management. The 10-point action plan of Talloires Declaration is selected as KPIs towards sustainable university. By identifying these CSFs and relate to KPIs to ensure the Malaysian university achieve sustainability, this paper is able to fill the knowledge gap in the literature where the CSFs for EM has not yet been explored beside it has a potential to provide an understanding and explore a new findings. In practical, this research can assist the management of university in deciding the priority and direction to ensure the EM is practiced effectively.

Acknowledgements

This paper is sponsored by Malaysian Ministry of Higher Education. The authors are thankful to all those who contribute in completing this paper.

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