Energy Saving Culture - The Guidelines

1.0. Objectives

i. To highlight the potential of energy conservation with low-cost approaches
ii. To create an efficient energy management system.
iii. To reduce energy-related operating costs
iv. To increase awareness of energy saving throughout the campus
v. To develop research related to energy saving culture
vi. To improve UM reputation as a green and sustainable campus

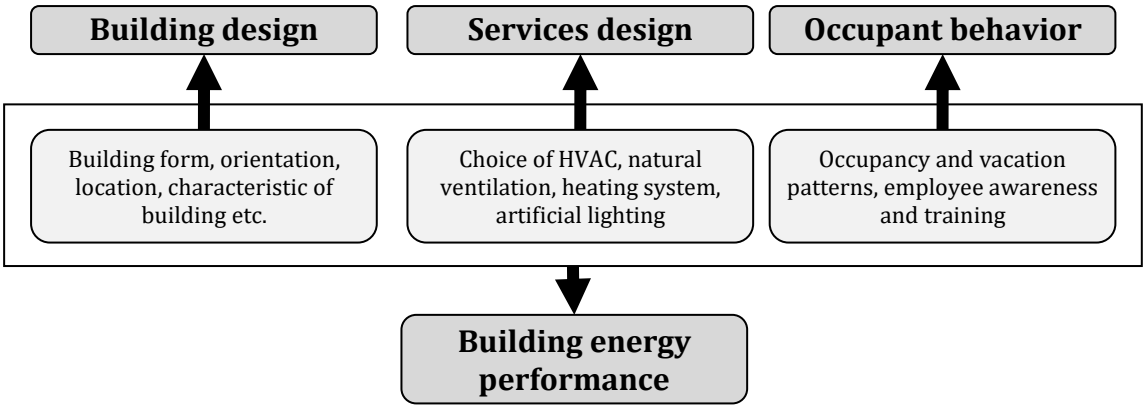
2.0. Definition

Energy Saving Culture

Energy saving culture is where people make intentional choices to save energy not because they are told to but because they want to.

Energy Conservation

Energy conservation is the act of saving energy by cutting back the usage and involves any behaviour that results in the use of less energy. Energy conservation can be achieved by the efficient use of energy. Energy conservation in a building can be achieved in many ways but in the holistic manner, it should be started from the source itself; building's design and structure.



Source: Al-Mofleh et al. (2009)

Figure 1 : Interrelated factors in achieving building energy efficiency

Building and service design:

Holistic approach as it starts from the source. Nevertheless, in the existing building, it requires high cost when comes to retrofitting and renovation. The successful of building and service design are relying on occupant behaviour and needs which always change over the time.

Occupant behaviour:

Occupant behaviour as it is a low-cost approach with long term effect. Occupant behaviour can be in the form of occupancy and vacation patterns, employee awareness and training. Not easy to be controlled and maintained but it is a low cost approach with long term effect especially with developing of an Energy Saving Culture. Integration with operation and technological actions/building & services design leads to optimal results of energy conservation.

Energy Efficiency

Energy efficiency is the application of advances in science and technology to provide services and products that require the use of less energy to perform the same function. By paying less, the usage of electricity is reduced while at the same time enjoying the same amount of amenities for the purpose of protecting the environment.

Energy efficiency is an organisational commitment that is achieved by changing the way everyone views and consumes energy especially 'individual actions on a daily basis'.

3.0. Malaysia's Potential in Energy Conservation

Located in the equatorial region, Malaysia has a high potential in energy conservation because she only has a little seasonal variation with a consistent annual average of temperature and humidity. The climate in Kuala Lumpur is hot and humid all year long and is only affected by the weaker Southeast monsoon from April to September.

The average temperature is 23-32°C and the average rainfall reaches up to 190mm. The wind direction is mainly from the north-west to the south-west throughout the year. The Malaysian climate is generally described by Ahmad (2008) as the following;

- The daytime maximum temperature of 30-35°C, warm all year around.
- The range of average monthly temperature is about 1-3°C.
- The average diurnal temperature variation is about 8°C.
- The annual mean temperature is about 27°C.
- The annual precipitation is greater than 1500mm.
- Coastal area high with the wind when inland areas are wingless, leads to thermal stress during the day.
- Solar radiation intensity varies widely with cloudy conditions.
- Only have two seasons, a wet season and a dry season.

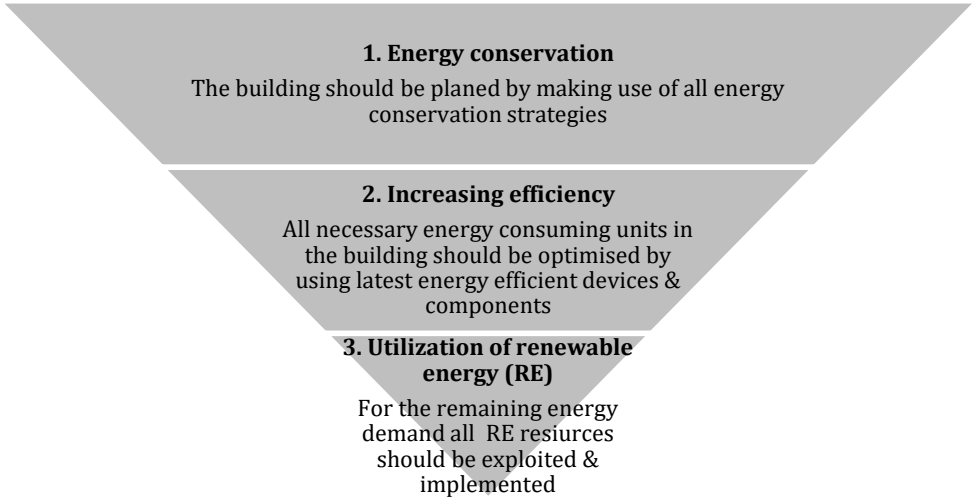
Daylight can be fully optimized while natural ventilation can be freely exploited for sustaining thermal comfort in the buildings; rather than using mechanical devices like artificial lamps and air conditioning systems.

Energy saving opportunity is even much greater in the countries where hot and humid climates are common all year around rather than countries with cold climates, Srivajana (2003).

4.0. Benefits of Energy Conservation and Efficiency

Energy conservation and efficiency are both equally important in order to reduce the dependency on fossil fuels and move towards sustainability. Minimize the utilization of non-renewable energy sources, pollution, and energy consumption whilst maintaining comfort, health and safety of the occupants (Kannan, 2006).

5.0. Energy triangle approach for a new building design



Source: Hasse and Amato (2006)

Figure 2 : Energy triangle approach for a new building design

The triangle approach focuses more on designing new buildings meanwhile the tools to achieve energy conservation in Malaysia proposed by Al Moflet (2009) are more relevant in achieving sustainable energy in existing buildings.

The proposed tools consist of the use of efficient electrical equipment; the application of passive energy technology in a building such as insulation, evaporative cooling, ventilation and solar heating; and support tools such as public awareness, energy codes, regulations, energy information and databases. The integration between the two ideas can improve the energy conservation efforts for both existing and new buildings.

6.0. Reasons to conserve energy

i. Reduce energy costs
ii. Differentiate your organisation
iii. Decrease carbon footprint
iv. Be a part of the community – sense of belonging
v. It's the right thing to do
vi. Research shows that up 30% of energy use can be recovered through behaviour.

7.0. Vampire Loads

Some electrical devices, when plugged in even though they are turn off, are still using energy. This Standby Power is known as Phantom or Vampire load. According to a joint study between U.S. Environmental Protection Agency and several environmental agencies, vampire load is approaching 10 percent of average household electric use. For example, when charging the charger, it uses electricity, but charger is still using small amounts of energy even when it is not connected to a device.

Electrical Device	Average* (watts)
Air conditioner	0.9
CD Player	5.04
Coffee Maker	1.14
Computer Monitor (LCD)	1.13
Computer Speakers	1.79
Copier	1.49
Desktop Computer	2.84
DVD Player	1.55
Fax Machine, Laser, Ready	6.42
Laptop Computer	8.9
Microwave oven, (Not Running)	3.08
Multi-function Printer, Inkjet	5.26
Multi-function Printer, Laser	3.12
Music Instruments	2.82
Modem, DSL	1.37
Phone, cordless	0.98
Printer, Inkjet	1.26
Printer, Laser	1.58
Scanner	2.48
Surge Protector	1.05
Television, CRT	3.06
Television, LCD	2.10
Tuner, AM/FM	1.12
USB Hub	1.44

**Lawrence Berkeley National Lab and ENERGY STAR (2014), denotes products being 'off'*

Figure 3 : Vampire load of some electrical devices

When considered the impact to the environmental too, Vampire loads are a real problem and will only continue to grow as the digital age advances. However, the dreaded Vampire load can be fought with vigilance and application of the recommendations below:

1. *Turn appliances off at the wall*
   Devices that don't need to be left on overnight, such as microwaves, TVs or laptop and get into the habit of turning them off at the wall before going to bed.

2. *Monitor device usage*
   Think critically about what appliances that we do or do not use and always be on the lookout to turn appliances off.

3. *Install LED lights*
   LED lights are 4-7 times more efficient than typical bulbs. Lights that use less power will naturally use less standby power, be kinder on the environment and monthly bills.

4. *Wash wisely*
   Washing machines are one of the biggest culprits of vampire load. Make sure to switch the machine off after use to avoid being charged for unused power throughout the day.

5. *Electrical boards update*
   Some modern electricity boards can sense when appliance has entered standby mode and will cut its electricity feed entirely. Not only will ensuring the electrical system is updated save money, but it is an important safety precaution for house and office too.

6. *Purchase energy efficient models*
   The more energy efficient an appliance is, the less electricity it will use on standby, the less expenses will be spent on electricity bills.

With these tips and tricks suggested, some efforts and investments are needed but considering the positive impact it will have on electricity bills and the environment, it is worth a try.

8.0. Energy audit

Typically involves in data collection & review, plant survey and system measurement, observation and review of operating practices, and data analysis.

Challenge

- define the system being considered/system's boundary.
- measure energy flows into & out of the system because it involves;
  i. collecting energy flow data from various sources.
  ii. estimating energy flows that cannot be directly measured, i.e. heat loss through a wall or in vented air

Usage

The information of the energy audit can be used to:

- identifies opportunities to improve efficiency
- decrease energy costs
- reduce GHGs emissions that contribute to climate change
- verify the effectiveness of energy management program/opportunities after they have been implemented

Types

- Level I : Walk-through/Preliminary (Basic)
- Level II : Standard/General (Intermediate)
- Level III : Computer simulation/Investment-Grade (Advanced)

Strategies of Energy Audit:

i. Interview with the Key Facility Personnel
ii. Document review
iii. Facility tour
iv. Facility inspection
v. Staff interviews
vi. Utility analysis/inventory energy use
vii. Identify/Evaluate feasible Energy Conservation Measures (ECM)
viii. Economic analysis
ix. Prepare a report
x. Review recommendations with facility management.

Utility analysis:

- Building Energy Performance, BEP = Energy Index, EI (known as normalised performance indicator)

$$\frac{\text{Total Building Energy Consumption, TBEC (kWh)}}{\text{Total Floor Area, TFA (m2)}} = \text{kWh/m}^2$$

- Energy Utilisation Index, EUI

$$\frac{\text{Annual Building Energy Consumption (kBtu or GJ)}}{\text{Total Floor Area (ft2)}} = \text{kBtu or GJ/ft}^2$$

Energy Audit Report

The report explains the existing conditions and recommendations to improve efficiency through improvements in operation and maintenance items as well as installation of energy conservation measures. The report should also effectively reach and understand by various audiences,

- CEO, COO, Administrator, Superintendents.
- Facilities/Plant Managers.
- Controller/Plant engineer.
- Operations/Maintenance Staff.

Basic components of well-organized audit report should include;

i. Executive Summary
ii. Building/facilities Information
iii. Utility Summary
iv. Energy Conservation Measures (ECMs)
v. Operation & Maintenance Measures (O&Ms)
vi. Appendices

9.0. What is AEMAS Energy Management Gold Standard (EMGS)?

EMGS is a program of sustainable energy management by ASEAN Energy Management Scheme (AEMAS) supporting by European Union and ASEAN Centre for Energy (ACE). Malaysian Green Technology Corporation (GreenTech Malaysia). Malaysian Green Technology Corporation (GreenTech Malaysia) is the body responsible for managing AEMAS in Malaysia which includes training, assessment and recognition of an organization.

The system of certification is based on excellent in energy management as shown in Table 1 below.

Table 1 : The requirement of EMGS

Rating	Description
	**Energy Management System in place** ▪ Certified Energy Manager(CEM). ▪ Motivation plan for the personal involved in the Energy Management system. ▪ Budget allocated for investment in EE measures. ▪ Procurement policies and internal investment criteria "EE-friendly".
	**Same as 1 star + (either one of the following):** ▪ Overall EEI improves by 5% (over 2 years). ▪ Overall energy consumption decreases by 5%. ▪ EEI improves by 1% on year-on-year basis over past 3 years. ▪ EE measures representing at least 50% of the total energy saving potential of recommended measures (internal audit) are implemented and achieving at least 1% overall energy savings. ▪ EE measures representing at least 50% of the total energy saving potential of recommended measures (external audit by AEMAS certified auditor and approved by senior AEMAS experts) and achieving less 1% overall energy savings are implemented (include cases where NO EE measures are implemented). ▪ Fuel-switching project implemented (using NG or RE). ▪ Projects involving self-generation of electricity implemented. ▪ One RE project implemented.
	**Open only for 2-star certified companies** Same criteria as for 2-star + Energy Manager must be PEM (not CEM) ▪ Renewal of 2-star provides 3-star.

The EMGS 1-Star rating is awarded to companies that have implemented the energy management system, upon an audit by AEMAS auditors. Such companies have an energy manager, a company-wide energy management committee, and have implemented the entire energy management system.

While, the Two Stars is awarded to companies that have shown improvement in their energy efficiency index resulting from implementation of energy conservation measures and the Three Stars goes to companies that have achieved and maintained their energy efficiency improvement of for at least 5% three years.

10.0. Activities and Products

Activities

- Program Penerapan Budaya Penjimatan Tenaga bersama Pasukan Eco-Squad SMK Damansara Utama. 3 October 2017 / 11.30 AM – 1.50 PM / DK Rimba Ilmu, UM (Appendix A).
- REEN Application Half Day Workshop. 13 October 2017 / 8.30 AM – 1.00 PM / Hospitality Lounge 1, KL Convention Centre (KLCC).
- Program Penerapan Budaya Penjimatan Tenaga bersama Pelajar SMS Seri Puteri. 17 November 2017 / 8.30 AM – 11.30 AM / Surau SMSSP (Appendix B).
- Ceramah Agama & Tenaga. 1 Mac 2018 / 7.00 PM – 9.00 PM / Surau Kediaman Kolej Kelima UM (Appendix C)
- Pertandingan Poster Pembudayaan Penjimatan Tenaga. October – November 2017 / Damansara.

Publication & Products

- Button Badge / Fridge Magnet / Postcard.
- Proceeding Paper / ISI Journal / International Referred Journal (Appendix D)

  Nurul Emy Idayu Zulkifli, Adi Ainurzaman Jamaludin, Zul Ilham, Rohana Jani, & Mohd Istajib Mokhtar. (2018). The daily practice of UM students on electricity usage towards energy conservation. In Awangku Hassanal Bahar Pangiran Bagul, Jainurin Justine, Andy Lee Chen Hiung, Mohd Rizwan Abd Majid, Andi Tamsang Andi Kele, Datu Razali Datuk Eranza, Huikeng Lau, Mohd Alif Anwar Abu Bakar, Rostika Petrus Boroh, & Tini Maizura Mohtar (Eds.), Climate Change and Campus Sustainability (Vol. II) - Proceedings of the 5th Regional Conference on Campus Sustainability 2018, Universiti Malaysia Sabah (pp.133-146). Sabah, Malaysia : Universiti Malaysia Sabah.

  Adi Ainurzaman Jamaludin, Hazreena Hussein & Ati Rosemary Mohd Ariffin. (2018, March). Performance of a residential college building with bioclimatic design strategies towards sustainable campus. Paper presented at the 5th Regional Conference on Campus Sustainability 2018 (5RCCS2018), Universiti Malaysia Sabah, Kota Kinabalu, Sabah, Malaysia.
- Social Media (Appendix E)

  Wartawan Kampus UOLS (2018, April 17). UM kongsi ilmu celik tenaga bersama pelajar SM Sains Seri Puteri. Sinar Harian. Retrieved from http://kampusuols.com/article/92636/Uni-Kita/AKTIVITI-KAMPUS/UM-kongsi-ilmu-celik-tenaga-bersama-pelajar-SM-Sains-Seri-Puteri

11.0. Challenges & Limitations

Abundant resources and inexpensive energy which is still reliable and affordable to the consumer make the issues of energy savings over a lifetime cost of a building have little meaning while the developers' philosophy of reducing initial cost and fast profit recovery often puts a full stop to the effort of energy conservation in building industry (Horvat & Fazio, 2005). Ryghaug and Sørensen (2009), there are three interrelated problems that failed the energy efficient construction in the building industry which are,

- deficiencies in public policy to stimulate energy efficiency *where this is closely related to tenant-owner dilemma; builders and building owners tend not to be so concerned with future energy cost, energy use and related aspects of the indoor environment because they will not use the building themselves.*

- limited governmental efforts to regulate the building industry *when the authorities primarily focused on energy-economizing that energy should be used in an economically optimal way where deciding to increase energy standards when prices increase* and,
- a conservative building industry *where there are only focusing on short-term costs, lack of research and development, contract practices, the communication challenges of interdisciplinary coordination of building projects, and architects unsupportive attitude towards energy efficiency.*

Solutions

Introduction of new policies, better regulations and reformed practices in the industry itself (Ryghaug & Sørensen, 2009). Proper maintenance has to be carried out to fine tune the performance of the building while the occupants should continually be made aware of energy efficiency practices and do their part endlessly (Kannan, 2006).

12.0. Ownership and Collaborators

Energy Saving Culture UM Research Group

Science & Environmental Management Programme
Institute of Biological Sciences, Faculty of Science

13.0. Appendices

Appendix A - Program Penerapan Budaya Penjimatan Tenaga bersama Pasukan Eco-Squad SMK Damansara Utama.

Appendix B - Program Penerapan Budaya Penjimatan Tenaga bersama Pelajar SMS Seri Puteri

Appendix C - Ceramah Agama & Tenaga di Kolej Kediaman Kelima

Appendix D -Proceeding Paper

ABSTRACTS

PERFORMANCE OF A RESIDENTIAL COLLEGE BUILDING WITH BIOCLIMATIC DESIGN STRATEGIES TOWARDS SUSTAINABLE CAMPUS

ADI AINURZAMAN JAMALUDIN, HAZREENA HUSSEIN & ATI ROSEMARY MOHD ARIFFIN

(University of Malaya, Kuala Lumpur, Malaysia)

Abstract

A residential college building with the implementations of bioclimatic design strategies; including an internal courtyard, north-south of building orientation, transom, different type of windows, solar-control devices and highly vegetated landscape which encourage natural ventilation and daylighting, was selected for building performance evaluation. This residential building was acknowledged as a residential college building with the efficient use of electricity. The evaluation was done by measuring the temperature and relative humidity that influenced by the level of radiation and penetration of sunlight into the room. Initially, the recent implemented design strategies can be recommended in other buildings, especially at low-rise and naturally-ventilated residential buildings, to provide a comfortable living space for the residents in the dry season of Kuala Lumpur. The mean temperature and relative humidity in all selected unoccupied rooms were in the range of 28°C to 30°C and 66% to 75% respectively. Higher temperatures were recorded at the top level of the building and the condition of the room is more influenced by the vegetated landscape and a ceiling fan at the full speed of five, rather than the opening of windows and the orientation of the rooms.

Keywords: Bioclimatic design, Equatorial region, Internal courtyard, Residential college building, Thermal comfort

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The Daily Practice of UM Students on Electricity Usage towards Energy Conservation

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Abstract

Energy conservation among university students has become an increasingly important issue towards campus sustainability, climate action and environmental protection. However, the common short-termed approaches to promote energy conservation such as technology applications, tools and renewable energy require high capital investment. Therefore, for long term benefits, we take the students' practices on electricity usage that influence the energy conservation action into deliberation. A Set of questionnaires which based on a five points Likert scale has been distributed at selected residential colleges to explore the daily practice of students on electricity usage. Analysis on the correlation between practices and demographic variables, such as gender and background of study were conducted. Initial finding found positive daily practice on electricity usage among majority of the respondents. Significant association was found between gender and practise but not with background of study.

Keywords: Energy conservation, Practice, Usage, University of Malaya

Appendix E - Social Media

KAMPUS UOLS

HOME UNI KITA U 8tive U INOVASI U IN NEWS U KNOW U SHARE U INFO U COMPARE U DIREKTORI U ALUMNI Ur VIDEO Ur SAY

Uni-Kita > AKTIVITI KAMPUS > UM kongsi ilmu celik tenaga bersama pelajar SM Sains Seri Puteri

UM kongsi ilmu celik tenaga bersama pelajar SM Sains Seri Puteri

WARTAWAN KAMPUS UOLS 17 April 2018

Seramai 94 pelajar Sekolah Menengah Sains Seri Puteri (SMSSP), Kuala Lumpur telah dipilih untuk menyertai ceramah berkenaan tenaga, tenaga boleh baharu, isu-isu global serta impak

STAY CONNECTED

TAKWIM IPT/IPTA

28 Feb 2018 (Bpg-Zptg)
Pendaftaran Pelajar Baharu Semester Februari Sesi