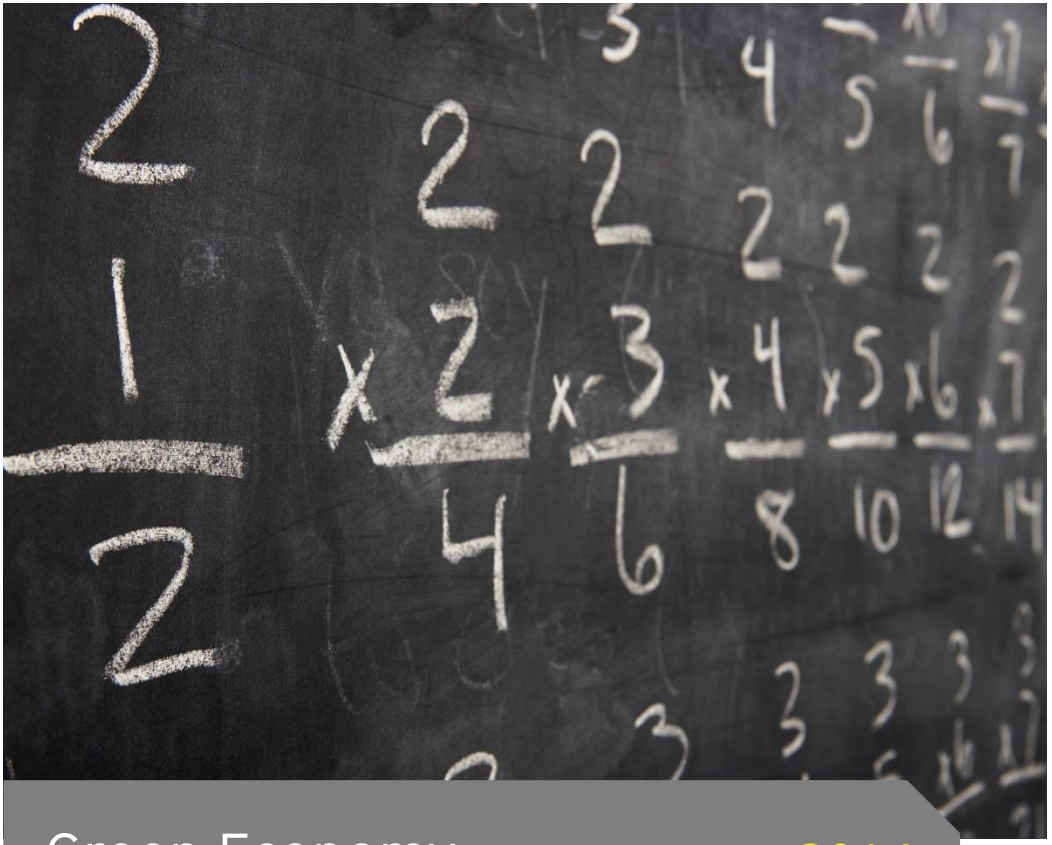

Green Economy Guideline Manual

2014

Building a better working world

Education

ISKANDAR REGIONAL DEVELOPMENT AUTHORITY

ISKANDAR MALAYSIA

Invest, Work, Live & Play

MEET ISKANDAR MALAYSIA

Since its inception in 2006, Iskandar Malaysia has experienced unprecedented growth in the development of projects that not only create new values, enhance societal well-being and induce multiplier effects but also those that challenge conventional wisdom, making it the hive of activity in Malaysia.

Taking the role as one of South East Asia's main gateways, Iskandar Malaysia invites you to experience the region that is envisioned to be a Strong & Sustainable Metropolis of International Standing where a host of opportunities to Invest, Work, Live and Play awaits you.

To learn more about Iskandar Malaysia, visit www.iskandarmalaysia.com.my

Electrical and Electronics

Oil, Gas & Petrochemical

Food and Agro processing

Education

Healthcare

Tourism

Logistics

Creative Industries

Financial Services & Real Estate

http://facebook.com/Iskandar.My

@iskandarmsia

Foreword

Malaysia's commitment to sustainable development is articulated through its national development plans including the "Tenth Malaysia Plan, The New Economic Model" which underlines the long term development framework for Malaysia. At the Earth Summit in 1992, Malaysia pledged to keep at least 50% of its land area as forest cover, and has maintained its commitment with forest cover in 2012 being at 56.4% of total land area.

Leaders of governments at the United Nations Conference on Sustainable Development (Rio+20, Rio di Janeiro, 2012) resolved to act on addressing challenges in achieving sustainable development through the development of 'Green Economy' in their countries. The Government of Malaysia at Rio+20 re affirmed its commitment to sustainable development, and its voluntary reduction commitment (announced at the15th meeting of Conference of Parties, Copenhagen, 2009) of greenhouse gas emissions intensity of GDP by up to 40% by 2020, compared to 2005 levels. Our Prime Minister has also launched our Low Carbon Society Blueprint (at the 18th meeting of Conference of Parties, Doha, 2012) as our commitment to building a green economy at Iskandar Malaysia.

Climate change is no longer a myth but a reality that affects all of us. The Intergovernmental Panel on Climate Change (IPCC) Fifth Assessment Report (AR5) has stated that an increase of 0.85°C in the global average surface temperature could wreak havoc upon our environment. Earlier in 2014, Malaysia experienced one of its worst dry spells, triggering the Malaysian cabinet to consider calling a state of emergency in 15 areas in Malaysia that had not experienced rainfall in more than 20 days.

We have developed this Green Economy guidelines (GEG) manual which provides a checklist for businesses to address areas of procurement, operations and supply chain management in order to minimize impact on the environment. The development of these guidelines included consultations with ministries and government agencies, business associations, local bodies, international agencies and IRDAs own business teams.

The goal of the GEG manual is to help businesses and industries to study, evaluate, adopt and inculcate environmentally sustainable economic behavior leading to building a prosperous, resilient, robust and globally competitive green economy in Iskandar. This is in line with IRDA's vision of becoming a

"Strong and Sustainable Metropolis of International Standing". The LCS Blueprint has 3 main themes – Green Economy, Green Community and Green Environment. This manual is an output of the first theme and focuses on the **education industry**.

We hope businesses in Iskandar in the education industry will find these guidelines relevant and useful in evaluating and adopting more innovative and sustainable practices, contributing to Green Economy in Iskandar.

In closing, I would like to thank and congratulate all parties involved in the production of this manual. I would also like to make a special mention of the advice and support given by the Working Group to the IRDA team and consultant Ernst & Young's Climate Change and Sustainability Services team in putting together this manual.

Y. Bhg. Datuk Ismail Ibrahim
Chief Executive IRDA

Table of Contents

Glossary

BBC	British Broadcasting Corporation
BEMS	Building Energy Management Systems
CAGR	Compound Annual Growth Rate
CFL	Compact Fluorescent Lighting
CHP	Combined heat and power
ESG	Environmental, social and governance
GBI	Green Building Index
GDP	Gross Domestic Product
GGP	Government Green Procurement
GHG	Greenhouse gases
HRV	Heat Recovery Ventilation
HVAC	Heating, Ventilation, and Air-Conditioning
ICT	Information and communications technology
IM	Iskandar Malaysia
IRDA	Iskandar Regional Development Authority
ISO	International Standard Organization
KeTTHA	Malaysia's Ministry of Energy, Green Technology and Water
LCD	Liquid crystal display
LED	Light emitting diode
LEED	Leadership in Energy and Environmental Design
LEP	Light emitting plasma
NKEA	National Key Economic Areas
NUS	National University of Singapore
UTM	Universiti Teknologi Malaysia
UN	United Nations
VOC	Volatic organic compound

Education Sector

1. Industry Overview

Education can be divided into three major categories: primary education services, secondary education services and tertiary education services. The sector plays a crucial role in fostering economic growth, personal and social development, as well as reducing inequality (World Trade Organization, 2014).

The share of public expenditure on education as a percentage of Gross Domestic Product (GDP)[1] has remained fairly constant since 2003, fluctuating between 4% to 5% (Figure 1), and the sector's contribution in a country's economy is significant, accounting for 6.1% of global GDP in 2012 (GSV EDU, 2012; World Bank, 2014). As the sector is forecasted to reach 6.4 trillion dollars in 2017, expanding at a compound annual growth rate (CAGR) of 7% from

[1] "Public expenditure on education includes government spending on educational institutions (both public and private), education administration, and transfers/subsidies for private entities (students/households and other private entities)" (World Bank, 2014).

USD4.5 trillion in 2012, its contribution to GDP is expected to grow further (GSV EDU, 2012).

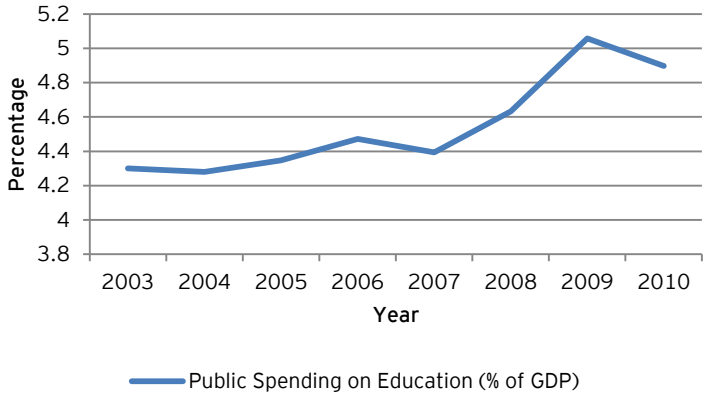

Figure 1: Public spending on education as a percentage of GDP (World Bank, 2014)

As a result, the government is committed to developing the industry by facilitating investment in the industry. In the Tenth Malaysia Plan (2011-2015), the government outlines its strategies to boost investment in key economic growth engines or the National Key Economic Areas (NKEA), of which the education industry is part of, to become a high-income economy by 2020. To achieve this goal while maintaining a sustainable fiscal environment, 92% of total investments in NKEA are expected to be contributed by the private sector (PEMANDU, 2010).

Iskandar Regional Development Authority (IRDA) actively pursues investments in the education industry because IRDA, too, recognizes the industry as key economic pillar that enables growth. The industry contributes to the development of human capital resources, leading to the improvement in industry capabilities. Therefore, IRDA takes a more extensive approach in its commitment to the education industry.

Enrollment in private higher education accounts for almost half of total enrolments of both public and private higher education institutions. Furthermore, it is growing rapidly at 15% per annum between 2006 and 2009. In line with Malaysia's vision to become center of excellence for higher education by 2020, IRDA identifies private education institutions, both basic education and higher-level education, and specialized skills training centers as priority sub-sectors for Iskandar Malaysia (IM) (Iskandar Regional Development Authority, 2011).

In addition, the government, plays an active role in promoting investments in the education industry by offering financial assistance. For example, the government has allocated RM400 million for registered companies to tap on for employee training programs (EY, 2013). In IM, Excelsior International School has opened on 2 September 2013 and as at September 2013, a total of RM1.56 billion has been pledged for the education industry (Low & Kasmuri, 2013).

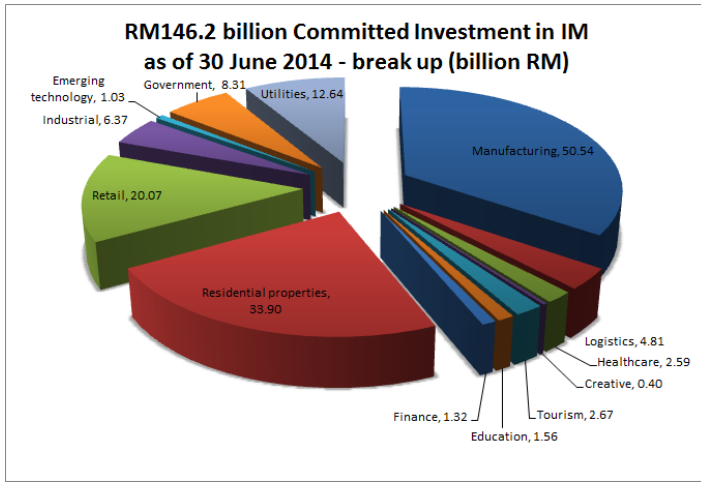

Figure 2: Cumulative investment in IM (Low & Kasmuri, 2014)

1.1 Environmental Concerns

Globally, buildings are responsible for "more than 40% of global energy use and one third of global greenhouse gas emissions both in developed and developing countries" (UNEP, 2009). The absolute figure is rising fast due to construction booms especially in countries such as China and India. Immediate action is required as buildings can make a major contribution to tackling climate change and energy use (WBCSD, 2008).

Looking at the energy intensity of educational institutes in the overall commercial building sector, according to EIA (EIA, 2007), these facilities are the third highest energy consumer in the US

(Figure 3).

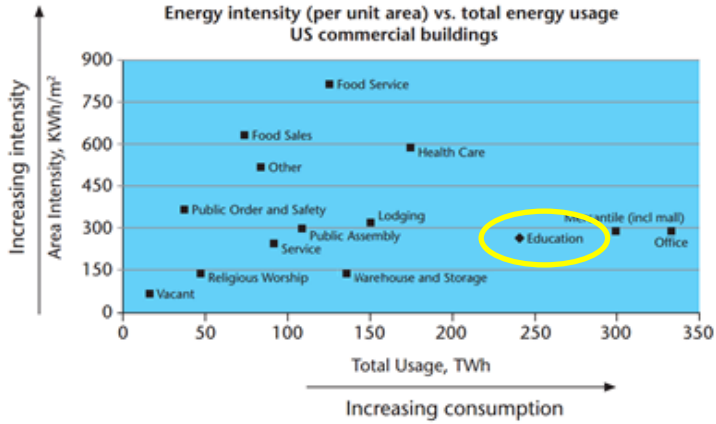

Figure 3: Energy use and intensity of different building types (EIA, 2007)

Considering the energy use and widespread distribution of institutes of learning, there is a role for the education sector. Reducing building energy use is essential, considering its contribution global energy use and operating costs for the institutions themselves.

2. Identifying Green Opportunities

In order to reduce energy use from the education sector, institutions may adopt various measures from technological upgrades, monitoring to awareness increasing programs. It is critical from both an economic and environmental standpoint for schools to actively reduce their impact on the environment and the use of energy on a day to day basis.

This guideline firstly looks at the breakdown of energy use (Figure 4) in order to identify areas for intervention.

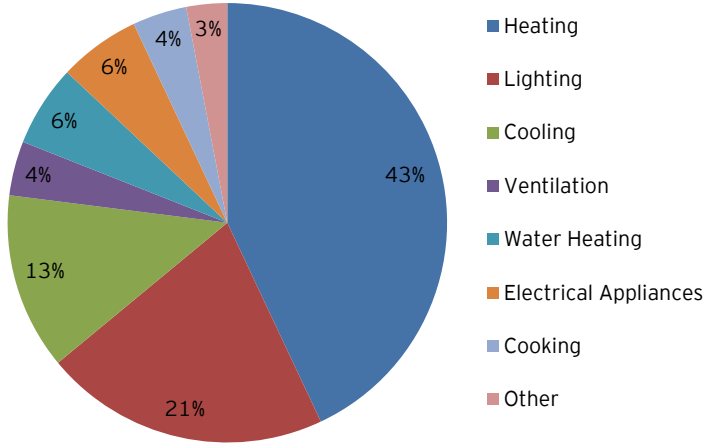

Figure 4. Breakdown of annual school energy use (Illinois Smart Energy Design Assistance Center, 2009)

Figure 4 demonstrates a breakdown of energy usage typically observed in institutes of learning. Although variations exist from data to data (due to weather conditions, air conditioning requirements etc.), heating, cooling and lighting are the major contributors to energy use. Looking at the statistics adopted from US, percentage of energy use heating, cooling and lighting account for nearly 76% of energy consumption (Figure 4).

This guideline will provide actions to reduce energy use across all energy consuming areas, from heating to energy management. These actions will comprise of technological improvements, new installations, upgrades, maintenance and behavior change. This guideline suggests the following actions for education sector:

Areas for Intervention	Recommended Actions
Energy consumption of educational facility	1. HVAC efficiency (Heating, cooling and ventilation) 2. Lighting efficiency 3. Thermal efficiency 4. Electrical Equipment 5. Catering Equipment 6. Measurement of environmental indicators
Resource management and renewable energy	7. Water 8. Food 9. Renewable energy

Education	10. Education

Table 1: Summary of Actions

3. Recommended Actions for Strategic Direction and KPIs

Improving facility efficiency can be achieved by implementing a range of technologies, from improved Heating, Ventilation, and Air-conditioning (HVAC), lighting efficiency, monitoring (enabled by Building Energy Management Systems (BEMS) and Smart Metering) to implementing sustainable building designs. Table 2 shows the recommended temperatures and humidity levels that such systems should aim to achieve so that students, researchers and staff are able to study, live and work in a conducive environment.

Types	Temperature (in degrees Celsius)	Relative Humidity Levels
Offices	19 – 24	55 – 70 %
Workshops	16 – 19	55 – 70 %
Teaching Buildings	19 – 21	55 – 70 %
Stores	15	55 – 70 %
Residential Accommodation	19 - 24	55 – 70 %

Table 2: Recommended Temperatures and Humidity (CIBSE, 2006; Department of Standards Malaysia, 2007)

3.1 HVAC Efficiency

Improving the HVAC system can significantly reduce energy consumption in schools considering its significance in both energy use. Heating and cooling related energy usage contributes more than 43% of total energy consumption incurred in schools (Figure 4).

Action: Installing efficient HVAC systems

According to Carbon Trust (CarbonTrust, 2002), a 1°C decrease in internal building temperature results in 10% energy consumption savings which would automatically lead to decrease in GHG emissions.

Recommended actions that can improve energy efficiency include (University of Twente, Unilever, 2013):

- Insulation: If some rooms are too hot or too cold, inadequate air sealing or insufficient insulation could be the cause. Cavity wall insulation is used to reduce heat loss by filling the air space with material that inhibits heat transfer. It is often used in doors, which are the primary culprits of air leaks in the school. Adding additional insulation (double-glazing) around the interior of the building and installing air curtains will also contribute to reducing energy usage.

- Infrared Assessment: To identify areas of energy wastage,

infrared imaging is a valued tool in identifying problems related to energy loss, inadequate insulation, inefficient HVAC systems, radiant heating, water damage on roofs, and much more. Conducting an infrared inspection on leak tightness and coldness infiltration can detect potential areas for additional insulation. Professional energy auditors can be employed to carry out this process.

- Heat Recovery Ventilation (HRV): HRV is an energy recovery ventilation system which uses heat exchangers to heat or cool incoming fresh air, recapturing 60-80% of the conditioned temperatures that would otherwise be lost. Instead of opening a window for ventilation, the HRV system is able to provide fresh air without any heat loss or gain. In climates such as Malaysia with warm, humid weather, HRVs can also remove humidity before it enters the air ducts to keep the interior comfortable and prevent the HVAC system from having to work harder.

- Upgrade controls: Sensors and start controllers are the two popular technologies adopted for promoting efficient temperature control. A sensor or compensator automatically sets temperature based on weather by sensing outside temperature or humidity. A start controller "learns how quickly the building reaches the desired temperature and brings the heating or cooling on at the

optimum time prior to building occupancy", depending on the weather (Carbon Trust, 2012). A sensor can also eliminate overlap between heating and cooling caused by the wide gap of temperature change throughout the day.

- Green façade and roofs: Vegetation or plant cover on roofs over a water-proof membrane is known to reduce building heating and cooling needs. In addition, it can retain rainwater for other uses if an efficient drainage system is installed. This measure qualifies for Leadership in Energy and Environmental Design (LEED) points. Heriot-Watt University is taking the lead by building Malaysia's first purpose-built green campus in Putrajaya with a 300 metre long, 30 metre wide green roof. Integrated in as well is a rainwater harvesting system (Heriot-Watt University Malaysia, n.d.).

Action: Maintaining efficient HVAC systems

Dirt and neglect are the top causes of heating and cooling system inefficiency and failure. It is important to have a qualified technician perform regular maintenance on the HVAC system every year. Maintenance activities include (US EPA, 2009):

- Lubricate moving parts. Electrical devices that lack lubrication can cause friction in motors and increase the amount of electricity consumption. Lack of lubrication can

also cause equipment to wear out more quickly, requiring more frequent repairs or replacements.

- Check the condensate drain in the air-conditioner. If plugged, stagnant water in the drain may affect indoor humidity levels, and breed bacteria and mold.

- Inspect, clean, or change the air filter in the central air conditioner. A contractor can demonstrate how to do this for the school's maintenance staff to do so on a more regular basis.

- Clean the air-conditioner blower components and coils. Proper airflow over the coils allows the system to run efficiently, reducing energy costs and lengthening equipment lifespan.

- Check the central air conditioner refrigerant charge and adjust it if necessary to ensure it meets manufacturer specifications. Too much or too little refrigerant charge can damage the compressor, reducing the shelf life and increasing costs.

Action: Glazing

Transparent and clear glass panes used in buildings are prone to increase the heat gain inside buildings and hence additional air conditioning (higher capital and operating costs) becomes necessary.

Proper selection of glazing properties helps improving energy efficiency in buildings as a good glazing will reduce solar heat gain from both direct and diffuse solar radiation (Building Energy Efficiency Technical Guideline for Passive Design, 2013). Better glazing efficiencies can be achieved by taking into consideration the following key factors (and other considerations as deemed appropriate for the building)

- Choosing the glazing with appropriate visible light transmission, low solar heat gain coefficient
- Single and double glazing low-E value coatings
- Reduction of glazing area, where possible

Action: Installing Wall Insulation

Malaysia has a mild climate with outdoor dry bulb temperatures reaching 26.9^{0}C during day time and 24^{0}C during night time. Heat is both conducted from the outside into the building and as well as from inside of the building to the outside. While the impact of insulation on building energy reduction may not be very significant, the effect on reduction in peak cooling load is certain. A feasibility study on the economics of insulation materials should be done before embarking on the installation of insulation systems (Building Energy Efficiency Technical Guideline for Passive Design, 2013).

Action: Installing Roof Insulation

Energy efficiency brought about by different types of roofs varies for each type, operating hours and the space immediately below the roof. Ideally an insulated roof during day time to prevent heat gain and non-insulated roof during night time to cool the building would be the most appropriate one for Malaysian climate. However, building needs (laboratories, lecture theatres, and classrooms), occupant comfort, wind velocity, rains, etc. are the key decisive factors in determining the roof type and materials used. A simulation study carried out while developing *The Building Energy Efficiency Technical Guideline for Passive Design (2013)* suggests that provision of 25mm of insulation provided maximum incremental savings. Keeping in mind that electricity tariffs in Malaysia are bound to increase with time, institutes of learning need to evaluate energy consumption, return on investment and operations before proceeding with roof insulation.

Action: Zoning and Infiltration control

Zoning is the process of positioning air-conditioned spaces in a building in a coherent fashion such that wastage of conditioned air is minimized. In general it is done by locating rooms according to the leakage flow of air-conditioned air from the coldest room will benefit other spaces before it completely escapes out of the building.

Zoning the most air-conditioned areas at the core of the buildings

surrounded by comparatively lesser air-conditioned areas, optimizing window areas, converting glazed areas to opaque, etc. are among the widely practiced techniques to achieve energy efficiency.

Infiltration is the process of out-door air entering the air-conditioned space introducing sensible and latent (moisture) heat into the building, which increases the energy requirements. Sealing cracks in walls, window panes, controlling window/door operation with sensors, door pumps, and air curtains could be adopted to minimize infiltration losses. Please refer the *Building Energy Efficiency Technical Guideline for Passive Design (2013)* for case studies on various scenarios of simulation conducted for more information on avoiding infiltration losses.

Action: Using external (natural) temperature to minimize energy consumption

Using external temperature can have significant impact on energy consumption. Night cooling and natural cooling are two cost-effective systems that maximize use of natural temperature. Collecting chilled air at night to cool buildings can save usage of fuel-run air conditioning system. Using normal airflow to cool the building is also possible with appropriate openings of windows and vents.

Oxford University avoids air conditioning as much as possible with

the use of natural temperature. By using night cooling method, school's energy efficient buildings received excellent rating in air conditioning efficiency (Oxford University, 2012). Columbia University is continuously working to improve heating and cooling systems that are both environmentally and economically beneficial. Improvement project includes upgrading equipment, expanding chiller plant, and building centralized and combined heat and power system with potential of 30% energy saving in heating and cooling system (Columbia University, 2011).

3.2 Lighting Efficiency

According to Carbon Trust, 21% of total energy consumption (Figure 4). Energy savings from lighting can be achieved through simple and easy behavioral changes as well as using appropriate lighting equipment with effective maintenance and updating controls.

Action: Daylight harvesting

Malaysia being located close to the equator, with lesser seasonal variation has reliable day light available for about ten hours a day. Natural daylight harvesting is amongst the most efficient method to improve energy efficiency in buildings because diffused light is not much affected by the sun appearing in the sky/hiding behind the clouds. To achieve better utilization of daylight harvesting, appropriate tropical climate daylight harvesting techniques need to

be deployed to gain the optimum benefits.

- Utilizing daylight to combine with artificial lighting is a simple, efficient way to reduce lighting.
- Analyzing the location, layout and orientation of windows (west / east), Incorporating skylights into roofing and utilizing transparent weather-resistant material that can maximize natural light passage is one of the key measures to maximize use of daylight.
- Skylights that can be operated to open and close can additionally lead to savings in energy used for ventilation or cooling.
- Solar heat gain minimization, glare protection, deep daylight penetration, uniform daylight distribution, etc., needs to be investigated thoroughly, and addressed before implementation of a well-designed daylight harvesting system to optimize performance.

Action: Switching to energy-efficiency lighting

In 2010, the British Broadcasting Corporation (BBC) carried out a quantitative energy analysis and identified solid-state light-emitting plasma (LEP), light-emitting diode (LED) and fluorescent lighting as the most energy-efficient sources without compromising on

performance for television productions (BBC, 2011). The appropriate applications of the different TV production lighting technologies studied are as shown in Table 3.

Type of Lighting	Applications
Solid-state LEP	Key lighting Moving lights Follow spot
White LED matrix	Key lighting Soft lighting
White LED chip	Key Lighting
Colour LEDs	Cyclorama effects Set dressing
Fluorescent	Soft lighting Cyclorama

Table 3: Applications of Production Lighting

LED is one of today's most energy-efficient and rapidly-developing lighting technologies. LEDs are "directional" light sources, which mean they emit light in a specific direction unlike traditional light sources which emit light and heat in all directions. For this reason, LED lighting is able to use light and energy more efficiently in many applications. Residential LEDs use at least 75% less energy, and last 25 times longer, than incandescent lighting (US Department of Energy, 2014).

As a cheaper alternative, high efficiency Compact Fluorescent Lighting (CFL) consumes only 25% of the energy of an incandescent bulb and lasts nine times as long, or up to 7 years (Tufts University, 2014). Aside from its lower cost, CFL bulbs are known to be versatile. They can be applied nearly anywhere where incandescent lights are used, and are particularly suitable for area lighting.

Figure 5: Comparison of Lighting Types

Action: Optimizing lighting performance

Many minor steps can be taken to improve lighting performance. For example, regular cleaning of light bulbs can also improve energy efficiency, as two years' worth of accumulated dust can reduce luminosity by as much as 50% and increase operating costs by 15% (Carbon Trust, 2007).

Utilizing daylight in combination with artificial lighting is another simple yet efficient way to reduce energy costs. Analyzing the location, layout and orientation of windows (west / east) can maximize the natural light passage.

To supplement this, motion sensors can also help to optimize lighting usage in a facility. Sensors switch off lights when an area is not occupied, and may also dim lights according to the required output (University of Twente, Unilever, 2013).

Princeton University uses a variety of lighting controls to manage energy consumption. Lighting controls used by Princeton University include control systems, energy metering, occupancy sensor, microprocessor, daylight sensor and LED lighting. Institution benefits from energy savings and reduced maintenance requirement (Princeton University, 2014).

Action: Installing shading system

Shades are primarily used to reduce solar heat gain, widely practiced across the world and Malaysia as well. External shades are being replaced by advancements in glazing technologies and internal shades are still the most economical solution (but with regular maintenance/replacement). Different types of horizontal and vertical shades are utilized, however thermal comfort, brightness control, glare protection, privacy, view out, durability are the key factors that need to be considered before the installation of shades.

Please refer the *Building Energy Efficiency Technical Guideline for Passive Design (2013)* for more information on application of shades, various pros and cons.

Action: Applying for building certifications

Industry associations can play a vital role in providing guidelines and standards on building energy measures. In Malaysia, institutes of learning can consider applying for the Green Building Index (GBI), which assesses new and existing buildings for their environmental performance according to a range of key criteria.

Iskandar Malaysia has set out in its Green Building Road Map to utilize the GBI as a rating tool for buildings in the region to promote sustainability in the built environment. Universities in Malaysia such as the University College of Technology Sarawak are to achieve GBI "Platinum Index" ratings by making concerted efforts to incorporate planning, design and green architecture to create a conducive teaching and learning environment (University College of Technology Sarawak, 2014).

Key Performance Index

Key Performance Index	Objective	Ease of implementation
Energy savings from measures to increase efficiency	Higher	Easy
Cost savings from measures to increase efficiency	Higher	Easy
Amount and % of reduction in carbon emissions in weight	Higher	Moderate
Building certifications (e.g. GBI)	Lower	Moderate

3.3 Thermal Efficiency

Energy use from producing hot water accounts for more than 6% of total energy consumption in schools (Figure 4). Potential options include insulating water tanks and pipelines and efficiency use of hot water.

Action: Installing insulated hot water storage tanks and pipeline used for distribution

Insulating water storage tanks for space heating and pipeline used for distribution will keep temperatures high, minimizing heat loss.

Adding extra insulation to hot water tanks saves approximately USD1.50 per week (Department of Education and Early Childhood Development, 2012). The major purpose of this insulating water tanks and pipeline is to reduce energy use from reheating water.

Action: Using hot water efficiently

Checking if more water is heated than required, ensuring that water is heated only during the working hours, setting temperature at comfortable level, and maintaining proper level of usage are needed. Setting the hot water temperature on storage units to 60°C is recommended to inhibit the growth of legionella bacteria reduces waste of energy (Department of Education and Early Childhood Development, 2012). Minimizing use of hot water, for instance, during summer seasons can reduce energy used for heating water.

Key Performance Index

Key Performance Index	Objective	Ease of implementation
Energy used for heating water	Lower	Moderate
% of pipeline (by length) or tanks (by number) insulated	Higher	Easy
Amount of hot water used (in volume)	Lower	Moderate
Hot water temperature	Constant	Easy

3.4 Electrical Equipment

Increase in the use of IT equipment in schools, especially in universities, is making significant contribution to energy use and cost (Carbon Trust, 2012). Figure 4 suggests that electrical appliances contribute 7% of energy use and cost. Office equipment such as computers, monitors, multi-functional devices, projectors, and vending machine and laboratory equipment like fume cupboard and kiln also make significant contribution. Potential options include enabling shut-down or power-down mode, using the most efficient equipment to the task, and relocating heat-emitting equipment.

Action: Shutting down or power down mode

Switching off electrical equipment which are not in use and applying power down modes help reducing energy consumption and heat production. Most PCs have an in-built standby mode and therefore the PC can power down to a low energy mode when not in use but still be left on. Activating the standby mode will significantly help reducing energy use. For instance, average power consumption of PC monitor is 100 watts and photocopier is 400 watts when in use, where standby energy consumption is 1/6 watts and 103 watts, respectively (Carbon Trust, 2012).

Action: Using the most efficient settings and equipment

High specification PCs with large screens and fast processors with

superior performance use more energy. Upgrading existing PCs with newer and energy efficient components is recommended. For instance, using flat screen liquid crystal display (LCD) monitors can reduce monitor energy use by over 65% (Carbon Trust, 2012). Furthermore, schools and universities should consider purchasing energy-efficient appliances which are certified, for instance, by ENERGY STAR or Malaysia's MyHijau green label.

Action: Relocating heat-emitting equipment

Placing heat emitting equipment such as printers and photocopiers in a separate, naturally-ventilated area with good airflow helps preventing overheating of equipment and reduces energy required for cooling.

Action: Install energy-efficient equipment

Energy-efficient equipment contributes significantly to the cost-savings in business operations. As explained above, energy-efficient equipment, such as HVAC equipment and servers, stands to reduce energy consumption of up to 75%. This energy savings definitely translates into cost savings for businesses.

However, energy-efficient equipment is not limited to only instruments like HVAC equipment and servers. Significant energy consuming equipment such as escalators, elevators, motors and pumps are also potential areas for cost-savings.

Example of energy-efficient escalator

Hitachi's VX Series escalators have automatic switch-off system that switches itself off when not in use. It also has a load detection system that promptly adjusts its conveyor speed to optimize usage. The combined energy-saving features enable the escalator to register up to 48% in energy savings when compared to conventional escalators (Hitachi, 2014)

There are many ways to identify energy-efficient equipment in the market. One of the easiest ways is to look for energy-efficient marker in the equipment, such as the ENERGY STAR tick marks. Energy-saving certifications, such as ENERGY STAR, assure consumers of the energy efficiency of the product. However, consumers should still conduct due diligence on the value proposition and energy savings of equipment before any purchase.

Key Performance Index

Key Performance Index	Objective	Ease of implementation
Energy use from electrical appliances	Lower	Moderate

% of electrical appliances with energy saving modes	Higher	Easy
% of electrical appliances with energy saving certifications	Higher	Easy

3.5 Catering

Catering consumes 4% of total energy in schools (Figure 4). Efficient use of catering facilities can be promoted by behavior changes from catering staffs and managers and upgrades in kitchen equipment.

Action: Avoiding turning the switch on too soon

Turning on ovens and hobs long before actual use wastes energy as modern cooking devices normally preheat and reach optimum temperature within 10 minutes. By labeling pre-heating time requirements and educating the kitchen staffs, inefficient energy use can be reduced. Assigning responsibility on an individual staff or on kitchen sectors would also be effective. Another important habit is to turn off the devices immediately after use.

Action: Energy saving through effective use of refrigerator

Fridge and freezers could save a large portion of energy cost since they are operated 24 hours. First of all, doors should be closed well

and quickly after opening so that the system does not waste cool air on lowering the kitchen temperature. In order to minimize opening time or frequency, the devices should be labeled and organized well to locate the contents in short time.

Secondly, leaks should be minimized. Bubbles on sight glasses indicate leaks in the system and although most common areas of leaks are seals, joints and mechanical valves, whole system should regularly be inspected. Failure in managing leaks will lead to environmental costs as more power is needed to keep the temperatures down. Also, ensuring that suction lines and door seals are adequate can minimize warm air entering and cold air escaping the equipment.

Thirdly, air exchanges can account up to 30% of the total heat load as the cool air escapes and warm air enters (Carbon Trust, 2012). Ice build-up on storeroom walls are indicators of air exchange. Doors should remain closed and strip curtains or self-closing doors can mitigate any loss.

Finally, when the device is not in use, such as weekends or holidays, kitchen managers should consolidate food resources into a minimum number of equipment. This is because freezers operate more effectively when they are operating at full capacity and can allow some freezers to be powered off during the period.

Action: Investing in new energy-efficient equipment or system

It is more efficient to replace conventional ovens with microwave ovens if possible since they are faster and energy-saving. Moreover, conventional induction hobs can be replaced with halogen or gas hobs which heats up and cools down much quicker. Investing on equipment with automatic power off systems could save more than 25% of energy cost (Carbon Trust, 2012).

Applying sub-metering systems to monitor energy usage of equipment could optimize energy consumption. In particular, for schools outsourcing catering services could use sub-metering systems to generate competition among other catering companies or to use this as an index for financial incentives for energy saving, for the kitchen managers (Carbon Trust, 2012).

Another way to save energy is to apply the heat recovery system. Approximately 50% of the warm heat coming out from the kitchen could be recovered. By using the air-to-water recovery device, institutions can reduce significant energy used for heating by generating warm water without using electricity (Carbon Trust, 2012).

Key Performance Index

Key Performance Index	Objective	Ease of implementation
Energy use from catering equipment	Lower	Moderate

3.6 Measurement of Environmental Indicators

Action: Development/ adoption of green technologies.

Technology, especially Information and communications technology (ICT) can be an enabler of stimulating sustainability. This guideline encourages development and adoption of technologies that can promote sustainability.

The ICT-enabling effect involves the introduction or improvement of ICT to reduce environmental impact and/or greenhouse gas emissions. For instance, the development of video conferencing has reduced the need for business air travel as meetings can be done through video conferences.

Development towards sustainable business models and capabilities such as live-streaming of concerts/shows and online galleries/catalogues do reduce the need for travel of audience and cuts down carbon footprint and consumption. An analysis by Global e-Sustainability Initiative found that ICT is crucial to mitigating

climate change and could enable emissions reductions of 7.8Gt CO_2e, or 15% of GHG emissions (GeSI, 2008). Adopting and developing ICT can help with environmental initiatives and cutting costs.

Action: Monitoring usage

BEMS is a computer-controlled automation system which aims to create the safest, most comfortable environment possible at the lowest possible cost. On average, BEMS save about 10% of overall annual building energy consumption, and more than half of all buildings in the US larger than 100,000 square feet have one (Brambley, 2005). This is achieved through:

- Building system automation: This can be done according to time, type of day, or environmental conditions. For example, BEMS can control lighting to avoid unnecessary use of energy outside normal working hours or when ambient daylight levels are adequate (Sustainable Energy Authority of Ireland, 2014).

- Provide energy monitoring and management information. BEMS provides users with easily available data on energy flows, consumption, trends and overall building performance. Companies such as Siemens even have professionals at their operations center to evaluate the data collected and create comprehensive reports to identify ways

to improve energy usage and achieve additional savings.

Key Performance Index

Key Performance Index	Objective	Ease of implementation
Number of records of energy consumption	Higher	Moderate

In this section, this guideline provides measures to reduce energy consumption in facilities and to lower greenhouse gases (GHG) emissions. Areas to target are HVAC and lighting, where most of the energy is consumed.

Facility efficiency is principal to a green economy, and this is acknowledged by both the Malaysian Federal government as well as IM. Malaysia follows the Low Carbon Cities Framework & Assessment System, developed by **the Ministry of Energy, Green Technology and Water (KeTTHA)**, which recommends specific carbon reduction solutions in buildings and infrastructure. Malaysia has also launched the **GBI** to rate commercial and residential buildings. Both buyers and builders of green buildings stand to benefit from this scheme. Some of the benefits that businesses could enjoy include:

- Investment Tax Allowance for purchase of Green Technology Equipment

Businesses could receive tax allowance of up to 100% of qualifying capital expenditure in relation to approved green technology projects or acquisition of green asset

- Income Tax Exemption on the use of Green Technology Services and System

  Businesses could receive tax exemption of up to 100% for a period of 5 years in respect of the use and provision of green technology services and systems

More information on incentives can be found at GBI website, KeTTHA website and Malaysia Budget 2015 speech by YAB Dato' Sri Mohd Najib Tun Abdul Razak. Relevant website links can be found at the end of the manual.

IM aims to be an internationally recognized sustainable metropolis, and has imposed a building rating system alongside GBI for their new developments to identify and monitor building sustainability. Businesses should refer to **IRDA's Low Carbon Society Blueprint** and **Actions for a Low Carbon Future** that promote adoption of green building designs and features. Some of the benefits that businesses stand to receive from the policies include:

- An adjustment to tax rate on fixed asset tax
- Tax incentives on green development
- Low interest loans for energy-efficient building projects

- Subsidy for adopting photovoltaic power (Iskandar Regional Development Authority, 2014)

More information on incentives available from IRDA can be found at www.irda.com.my.

Resource management and renewable energy

3.7 Water

Water availability is increasingly becoming a global issue. The United Nations Environment Program has identified water shortage as one of two major environmental issues that the globe is facing today (Monash University Malaysia, 2014). Water-rich Malaysia, too, is not impervious to this impact of climate change on water security. The *New Straits Times* has reported that the Klang Valley water rationing in June 2014 has affected 3 million consumers. This incident is not localized either; other areas, such as Gombak, Kuala Lumpur and Petaling, were faced with the same predicament.

As it is, Malaysia registers as one of the high water consuming populations in the region. At an individual level, *Business Insider Malaysia* has estimated that Malaysians use 226 litres per person per day. This is significantly higher than Singaporeans, who register 154 litres per person per day, and Thais, who register 90 litres per person per day. Malaysians need to reduce their water intensity level by 37% to achieve the recommended 165 litres per person per day.

Institutes of learning consume large amounts of water in its daily operations. Water is required for heating and cooling systems, restrooms, drinking water fountains, canteens, fields, laboratories and swimming pools. Water conservation measures include reducing

consumption through education and installing low-flow fixtures, re-using and recycling greywater.

Action: Installing sensors, switching equipment into low flow mode and other water-saving fixtures

In most schools, the majority of water used is for toilet flushing and washing purposes. Low flow fixtures installed on taps and showerheads and high efficiency dual flush toilets reduce water consumption. *The New York Times* has reported that Bayside is one of two New York City public schools in a pilot program to replace water-wasting toilets with new low-flow flushers. The new toilets send 1.2 gallons of water down the pipes each time they are used, a reduction from 3.5 to 4.5 gallons due to the improved bowl design, which allows for more efficient emptying (Edna Ishayik, 2013).

Action: Re-using greywater for flushing and irrigation

Greywater systems recycle water by collecting water that has been used for one purpose, and then using it for another, thus reducing the amount of fresh water required to operate a building, and therefore reduce the volume of wastewater produced by the building.

The Stanford Graduate School of Business installed a 75,000-gallon holding tank captures rainwater and collects greywater for irrigation

of fields. This helped in cutting potable water consumption for sewer conveyance by 80% (Stanford Graduate School of Business, 2014).

Key Performance Index

Key Performance Index	Objective	Ease of implementation
Water intensity	Lower	Easy
Utilisation of greywater	Higher	Moderate

3.8 Food

Food waste is a significant issue in schools as the embedded energy from growing, transporting, storing and preparing food is wasted: treating and disposing it. A study by Waste & Resources Action Programme estimates that up to half the weight of waste produced by schools are food waste (WRAP, 2011).

Action: Recycling food waste responsibly

Food waste can be recycled as compost and fertilizer, and can also be used to generate energy. A time tested treatment for food waste is biogas generation, leading to energy for use as fuel for cooking food waste disposers, which are commonplace in North America and

Australia, shred food waste to be sent to biogas plants located onsite or further away. At the plant, the waste undergoes the process of anaerobic digestion and generates biogas. After the biogas is treated and the carbon dioxide is removed, it can be used as a direct replacement for natural gas to generate energy (D'Souza, 2014).

260 schools in Thiruvananthapuram, India are aiming to be self-sufficient in organic food waste disposal. The idea is to produce a sustainable cycle in schools - the biogas produced would be used in the school kitchen while the slurry got as byproduct could be used as organic manure for the vegetable garden of the students. The vegetables in turn would go into the meals prepared in the school kitchen (The New Indian Express, 2014).

Universiti Teknologi Malaysia (UTM) encouraged users of its canteen to practice recycling and resource recovery. Leftovers generated in the canteen are left to compost in a dedicated food waste site for use in gardening (UTM , 2014).

Action: Increasing trayless dining

Simple measures like removing trays in canteens have cut down food waste by significant amounts as students are primed only to consume what they need. The University of Maine in Farmington reduced its food waste by 25%-30%, conserved nearly 290,000 gallons of water, and saved USD57,000 in resources normally

allocated to energy, water, cleaning agents and waste removal from removing food trays after students were given awareness of how this initiative could benefit the environment.

Key Performance Index

Key Performance Index	Objective	Ease of implementation
Food waste	Lower	Easy
Compost	Higher	Moderate

3.9 Renewable Energy

Action: Installing renewable energy technologies

There exist a number of renewable energy sources that can be utilized depending on the geographic location of the education institution. Some of the popular renewable energy sources are wind, solar, biogas, geothermal, etc. These alternative power sources reduce environmental impact by not only emitting less GHG but also using fewer sources that deplete and destroy natural resources.

Installing renewable energy system can be somewhat difficult due to investment requirements. It is important to consider financial and architectural issues when constructing renewable energy systems.

School buildings can incorporate solar panel roofing as its green

features. Harvard University is one of the leading institutions in installing and operating renewable energy plant within campus. Solar panels installed throughout the site generate 17% of total electricity used in the campus. (Harvard University, 2013).

Action: Utilizing combined heat and power system (CHP)

CHP provides opportunities in utilizing fuel for power generation and capturing heat to produce steam. As not all facilities benefit from the CHP system, it is important to carry out cost benefit analysis before implementing the system. CHP is a viable option if school requires significant heat and power. In 2013, Cambridge University invested jointly with the city of Cambridge to build CHP plant that would reduce carbon emission by up to 60% (COSPP, 2013).

Key Performance Index

Key Performance Index	Objective	Ease of implementation
Electricity generated from renewable sources	Higher	Moderate / Difficult

3.10 Promoting Education

Education is key in bringing across environment and it starts young. A generation of young people exposed to environmental messages will be the change makers for a more sustainable world.

Action: Raising awareness on environmental issues

Educating students and raising awareness is just as important as implementing various controls and systems that reduce energy consumption and waste. Increased recognition of environmental issues through education leads to behavioral changes which reduces burden on resources.

A group of students from the University of Nottingham Malaysia Campus organized the Earth Hour Carnival 2014 which featured a mini concert and exhibition on environmental awareness for the fourth year running. More than 400 attendees also pledged to adopt energy efficient habits in their daily lives such as turning off lights when facilities are not in use (The University of Nottingham Malaysian Campus, 2014).

The National University of Singapore has a dedicated Office of Environmental Sustainability to empower and encourage students to take on projects that benefits the environment. It is also part of a network of 10 leading institutes that promote campus sustainability through relevant environmental modules (National University of

Singapore, 2014).

Action: Including environmental education in curriculum

Education institutions of all levels should include environmental education in their curriculum. Tertiary institutions should have a compulsory module that all students have to go through, touching on concepts of climate change, long term sustainability and the role of man in impacting the environment.

Key Performance Index

Key Performance Index	Objective	Ease of implementation
Number of awareness campaigns or education sessions held	Higher	Easy

3.11 Compliance to Local Regulations

Like any organization / business entity, education institutions should as a first and essential requirement abide by the rules and regulations of the country. Compliance to regulations is a non-negotiable requirement before education institutions can fully benefit from this guideline to further improve on the sustainability and green initiatives of business operations.

Malaysia has numerous prevailing national standards and also

international standards that education institutions are encouraged to adopt. Compliance to authorized standards acknowledged by the Malaysian government is complementary to the recommended actions proposed in this manual. Some examples of recommended standards that businesses are encouraged to comply with are the MS1525, ISO14001, ISO18001 and ISO50001. In addition, education institutions can also look to disclose their GHG emissions performance through MYCarbon reporting.

The MS1525 is a code of practice pertaining to energy efficiency and use of renewable energy for non-residential buildings. Developed by the Department of Standards, Malaysia, this code primarily focuses on energy efficiency in buildings. In general, the code distinguishes between passive measures and active measures that building owners could adopt. Passive measures consist of recommendations relating to architectural and passive design strategies and the building envelope. Active measures correspond with lighting, power and distribution, air conditioning and mechanical ventilation and energy management systems. The adoption of the recommendations in MS1525 would help businesses to eventually reduce energy consumption and minimize use of non-renewable energy sources while maintaining a safe, healthy and comfortable environment for building occupants.

Education institutions may also adopt the international standards from the International Standard Organization (ISO) as an alternative

to the Malaysian Standards. The ISO is not only an independent non-governmental membership organization; it is also the world's largest voluntary developer of international standards, covering more than 19,500 standards across all industries. Common ISO standards that businesses adopt are the ISO 14000 (environmental management), ISO 18000 (occupational health and safety) and ISO 50001 (energy management system). This manual encourages education institutions to consult and consider the ISO standards in addition to the Malaysian Standards.

Education institutions could also seek disclose their GHG emissions performance through MYCarbon. The Ministry of Natural Resources and Environment Malaysia has instituted the MYCarbon Programme, which acts as the National Corporate GHG Reporting Programme for Malaysia. The advantage of engaging in a reporting exercise includes creating the awareness in business owners of the importance of measuring and reporting on emissions. This could also eventually lead to efforts put into management of the measureables, such as GHG emissions or energy use, creating better products, services and operations.

3.12. Case Study

3.12.1 National University of Singapore

National University of Singapore (NUS) is a leading university in Southeast Asia and ranked 24th globally according to the 2013 QS World University Ranking. However, not only does NUS excel in educating its students, as an education institution, NUS also sets a good example to the community by implementing sustainable practices in operating its education complex.

NUS dedicates a division in its operation, the Office of Environmental Sustainability, with a mission to "effect a total shift to environmental sustainability in all aspects of campus life by integrating sustainability into our operations, planning, construction, education, research, instruction, and public service." Along with this commitment, NUS has invested time, money and expertise into realizing this mission. Among the many initiatives that have been launched and that are being pursued, NUS's efforts are mainly concentrated into reducing GHG emissions, recycling and educating the community on environmental sustainability.

Reducing GHG emissions

The majority of NUS's GHG emissions (65%) can be attributed to electricity use. This high electricity consumption is due to the power demand by numerous chillers and other equipment that are required

to be operated round-the-clock for research purposes. Nevertheless, NUS is still committed to reducing this emission and has targeted a 23% GHG emissions reduction by 2020.

HVAC, lighting and Green Building certification

Air-conditioning contributes around 60% of electricity use in NUS. Therefore, in accordance with Singapore's National Environmental Agency, NUS has implemented the *One Degree Up – 25°C* policy since 2007. The policy mandates that air-conditioning units in NUS must be set at a default 25°C. This has resulted in 3.4Mt of CO_2-equivalent emissions prevented in the first 6 months of its implementation.

In addition, existing infrastructure in NUS is also being renovated in phases to make them more energy efficient. NUS has committed to ensure that exisiting buildings will exceed Singapore Building and Construction Authority's Green Mark Certified Rating Energy Efficiency Index by 15%. In order to achieve this, NUS retrofits the facilities and optimizes chiller plants through fine-tuning and repairs. NUS aims to complete optimization of HVAC systems by end 2015.

For future development, NUS targets an even stricter standard. New buildings have to exceed the Singapore Building and Construction Authority's Green Mark Certified Rating Energy Efficiency Index by 25%. As a result of this commitment, NUS has won the Green Mark Champion after winning 13 Green Mark Awards graded Gold and

above.

Monitoring of utility use

Not only does NUS implements strict standard on its HVAC and building standards, NUS monitors their performances as well. NUS has installed online metering and energy monitoring system in 2012. This system enables building managers to see the buildings' electricity, water and chilled water consumption. Consequently, building managers can identify hotspots or irregularities and take the necessary actions to solve the problem.

Recycling

NUS is big on recycling efforts on its campus. Recycling initiatives in NUS generally covers paper, plastics and aluminium cans, canteen wastes and electronic wastes, although ad hoc projects run by the Office of Environmental Sustainability together with student groups also involve recycling of pens, name card boxes and banners. It results in an average of 10% recycling rate from academic year 2006 – 2009 (Figure 6)

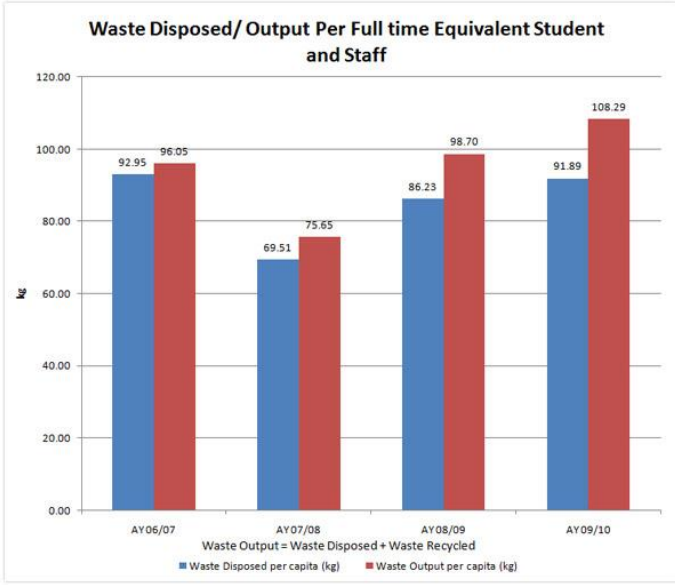

Figure 6: Waste Disposed / Output per Full time Equivalent Student and Staff (National University of Singapore, 2014)

Paper, plastics and aluminium cans

NUS adopts the spoke-and-hub system in collecting these materials for recycling. NUS designates recycling points where three bins, each for paper, plastics and aluminium cans can be deposited. NUS staff will then collect these wastes and send them to a centralized recycling center within the campus. NUS works with a recycling vendor to collect these wastes from the recycling centers.

Canteen wastes

NUS's environmental efforts on canteen waste focus on recycling cooking oil and packaging of take-away food.

Since 2008, NUS collaborated with a local biodiesel producer and four of NUS's biggest canteens to recycle used cooking oil. Collected cooking oil is processed into biodiesel or fuel additives to reduce hydrocarbon emitted from diesel-powered vehicles. To promote the uptake of this voluntary recycling campaign, the biodiesel firm offers SGD30 per barrel of used cooking oil collected. Nevertheless, to support the initative, many of NUS's canteens still do it for free. Until the academic year of 12/13, NUS has recycled 21 tonnes of cooking oil. This amounts to 53 tonnes of CO_2 prevented from being emitted (Rochester Institute of Technology, n.d.).

In addition, since August 2009, NUS has also made away without styrofoam boxes. Instead, it replaces take-away boxes with more eco-friendly microwave-able food boxes which are certified Green Label Singapore. This box is chosen because it is made of renewable fibre, as compared to Styrofoam boxes, which are made of fossil fuels.

Nevertheless, despite being more environmentally-friendly, NUS does not promote the use of take-away packaging because it does not reduce wastages of used boxes. Other than charging a nominal amount for take-away boxes, NUS concurrently promotes the

ProjectBOX, which encourages students and staff to bring their own take-away boxes if they need to.

Finally, NUS also promotes the use of eco-friendly cutleries for campus-based events. NUS encourages food stall owners, staff and students, to use disposable cutleries and utensils made of corn starch. This material is completely biodegradeable after 180 days.

E-waste

NUS runs extensive campaigns to recycle handphones and print toners and cartridges.

Since 2008, NUS works with Nokia and TES-AMM to collect and recyle used handphones. Nokia will plant a tree for every handphone collected in Sebangau National Park, Indonesia. The exact location (latitude and longitude) of the tree will be sent to donors for them to monitor the growth of their tree. On top of that, a USD1 donation will also be made by sponsors to support environmental initiatives on campus. From 2008 – 2014, the initiative has collected a total of 332 handphones and 570 pieces of accessories.

NUS also works with cartridge recycling specialist to manage used cartridges from its vicinity. NUS sets up four cartridge collection points throughout its campus. For each cartridge taken out of the waste stream, NUS has saved 0.45 kg of plastics from being used. For each ink cartridge saved, NUS avoids using 0.07 litres of fossil

fuel. Meanwhile, for each toner cartridge saved, NUS avoids using 3.3 litres of fossil fuel. In the last academic year 2013/2014, NUS has recycled 155 cartridges, totalling 69.8 kg of plastics being recycled.

Educating the community on environmental sustainability

Other than taking active participation in directly reducing the carbon footprints of the university, NUS also engages with staff and students to create the awareness about environmental sustainability. Other than supporting and collaborating with student groups, such as *Energy Carta* and *Students Against Violation of the Earth*, NUS carries out awareness campaigns and launches environmental awards to recognize campus leaders in environmental initiatives.

One of the biggest campus-wide campaign is the *SustainABLE NUS*. The campaign aims to empower individuals to take action confidently towards building a sustainable campus. The campaign facilitates action with posters (Figure 7) around campus that provides facts and tips on how to work on specific environment index such as electricity- or water-saving.

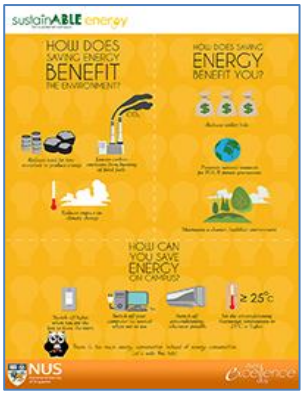

Figure 7: SustainABLE NUS posters

One of the most sought-after environmental awards in NUS is the *InterHall Environmental Awards*. This award specifically targets students that live on campus so that they make campus community living more environmentally sustainable. The award has been running since academic year 2011/2012 and has garnered numerous exciting projects implemented by students on their residences. The latest champion for this award, Temasek Hall, featured two initiatives on using solar energy to power water heater and on composting of their dining hall's food waste. Firstly, the students installed solar photovoltaic-thermal system on the residence's roof top to cogenerate electricity and hot water for their daily consumption. Secondly, the students use earthworms to process paper and pre-cooked food waste into organic fertilizer which they used on the gardens in their residence.

3.12.2. Universiti Teknologi Malaysia

UTM is Malaysia's oldest and largest public university located in the Kuala Lumpur with a satellite campus in IM. UTM is focused on campus sustainability, with a sustainability policy that includes, environmental, economic and socio-cultural aspects. There are four main environmental initiatives that UTM undertakes:

Green Office

UTM aims to create a sustainable office and learning environment for their staff and students as it recognizes that facility efficiency is a key area to mitigate climate change. Facilities are designed for maximum daylight harvesting with proper shading systems to prevent overheating of conditioned spaces and employees are encouraged to participate in green initiatives by switching lights and air conditioning off when not in use.

Resources are also used efficiently, where the use of paper is reduced by encouraging online, paperless technology for information transfer. UTM also discourages the consumption bottled water because it is extremely unsustainable.

Waste Management

UTM also focuses largely on waste management using the *3R's- Reduce, Reuse, Recycle*. UTM aims to reduce its packaging waste, by adopting "No Polystyrene" Day, "No Plastic Bag Campaign" Day and

other initiatives such as using biodegradable F&B containers and plastic bags. These initiatives focus on reducing the amount of waste produced.

UTM also looks to reuse materials and extend their life cycle. One example would be the sustainable arcade in UTM, where food waste is not disposed of, but is instead composted to be used as fertilizer. This not only reduces the amount of solid waste produced but also helps to green the campus.

Image 1: Composting of food waste in UTM's sustainable arcade (UTM , 2014)

UTM is also an advocate of recycling, with Mondays allocated as Recycling Day where mobile buy-back centres tour the campus to give cash rewards for proper mobile disposal. E-waste is a significant area that UTM looks into in terms of recycling, where e-waste is collected. UTM then works with partners such as Bursary Office to create a sustainable e-waste system.

Education

UTM students can take part in or lead green initiatives on their campus by applying to be any of the following: green squad, green manager, energy manager, college green club residential or eco-sustainable club. These areas give students and even faculty the opportunity to contribute more to the greening of UTM's campuses and operations.

For instance, the Jom Tapau Campaign is a campaign started by the EcoLestari Club from Kolej Rahman Putra, one of the residential colleges in UTM. It is a campaign to promote awareness amongst students in the college to reduce waste by bringing reusable box containers when buying food to-go. This reduces packaging waste and is especially important as takeout boxes are extremely unsustainable. A ticket is issued to all participants and participants obtain stamps for bringing their own reusable container. After 6 stamps, participants get RM2 as a cash rebate.

4. Social Responsibility

The promotion of sustainable practices, respect for human rights and transparency through disclosure are increasingly expected from every institution. Democratic freedoms, ethical behaviour and good governance, the rule of law, property rights and a thriving civil society create fertile conditions for private sector led growth. The absence of such safeguards takes individuals out of markets, reduces innovation, restricts access to opportunity and drives political instability and conflict.

Forbes has reported that human capital is an increasingly scarce resource in a global economy. It is deemed by many experts as the most important segment of a business' value chain. In the war for talent, institutions with excellent human rights track record are consistently ranked high on Employer Branding surveys. This helps in attracting and retaining this key resource, contributing to lower rates of staff turnover and higher productivity, and increasing employee motivation.

Businesses should also note that institutional investors, pension funds and equity firms are increasingly taking ethical factors such as human rights into account in their investment decisions. More than 1,260 signatories with USD45 trillion Assets under Management have adopted the United Nations (UN) Principles for Responsible Investment (www.unpri.org), including the Harvard University

Endowment. This represents an opportunity for businesses to highlight their human rights credentials in an increasingly enlightened and cautious market.

4.1 Human rights, labour standards and ethical behaviour

Respect for human rights is no longer a good to have but a prerogative of every aspiring country. Institutions that neglect human rights are also liable to boycotts, litigations and backlash by increasingly vocal and militant stakeholders. As reported by *Business Insider,* multinational corporations like Nike have been accused of exploiting low cost labour and have faced public pressure to introduce better working conditions and a minimum wage (Nisen, 2013). Businesses cannot ignore the impact that non-governmental organizations, civil society and social media can effect. Instead of being reactive, businesses should anticipate any aspects of their operations that may infringe on human rights and proactively work towards avoidance of such violations.

In line with the principles outlined by the United Nations Global Compact (www.unglobalcompact.org) and the International Labour Organization (www.ilo.org), IRDA fully supports international standards for human rights, enshrined in the charter of Ministry of Human Resources (www.mohr.gov.my).

International labour standards are aimed at promoting opportunities for women and men to obtain decent and productive work, in conditions of freedom, equity, security and dignity. In today's globalized economy, international labour standards are essential components in the international framework for ensuring that the growth of the global economy provides benefits to all.

Malaysia too believes that everyone is entitled to their inalienable rights to invest, live, work, worship and play with dignity and respect. This is in accordance with IRDA's vision of building a "Strong and Sustainable Metropolis of International Standing".

Outlined below are the UN Global Compact principles for institutions to support and enact within their sphere of influence, applying the following 10 core values in areas of human rights, labour standards, the environment and anti-corruption.

Human Rights

- Principle 1: Businesses should support and respect the protection of human rights (enshrined in the Malaysian constitution, please refer to http://www1.umn.edu/humanrts/research/malaysia-constitution.pdf);
- Principle 2: ensure that they are not complicit in human rights abuses across their supply chain.

Labour

- Principle 3: Businesses should uphold the freedom of association and recognise the right of employees to collective bargaining;
- Principle 4: remove all forms of forced and compulsory labour;
- Principle 5: abolish the use of child labour; and
- Principle 6: eliminate all forms of discrimination in hiring and employment practices

Environment

- Principle 7: Businesses should adopt a precautionary approach to environmental issues;
- Principle 8: undertake initiatives to incorporate greater environmental stewardship in its operations; and
- Principle 9: encourage the development and diffusion of environmentally friendly technologies.

Anti-Corruption

- Principle 10: Businesses should work against corruption in all its forms, including extortion and bribery.

IRDA strongly encourages organizations to consider this important aspect and take an enlightened approach to adopt the framework in everyday business decisions and practices. Key office holders should come together to formulate a human rights policy for the institution to comply with and make it publicly accessible on mediums such as websites or on the annual report. Top management and HR professionals should take a proactive approach in educating every employee to abide by the values defined in the human rights policy.

4.2 Disclosure Requirements

Sustainability disclosure is the act of communicating organizational performance on financial, environmental, social and governance (ESG) activities. It is practiced by many leading businesses and universities to communicate their ESG progress to stakeholders and lend credibility to their commitments to sustainable development.

Across the globe, more enlightened stakeholders are raising concerns over institutions' non-financial performance and are demanding them to disclose their ESG performance with greater transparency and detail. In certain regions, such sustainability disclosure is a legal requirement. With effect from 31 December 2007, companies listed in Bursa Malaysia are required to include a description of the corporate social responsibility activities or a statement to that effect in their annual reporting (Listing Requirements of Bursa Malaysia Appendix 9C, Part A, Paragraph 29). Bursa Malaysia supports businesses by providing training for companies and offers guidance for sustainability reporting (Sustainable Stock Exchange Initiative, 2013).

Many businesses are accustomed to file mandatory sustainability disclosures such as annual reports and quarterly 10-Qs or in the form of non-financial reports such as pollutant and emissions reports for those in heavy industries. There are also established voluntary disclosure frameworks such as Global Reporting Initiative

and the Carbon Disclosure Project which businesses adopt in their corporate social responsibility or sustainability reports. There is also a trend of companies aligning financial and non-financial information in a single integrated report.

For institutions that are in their nascent stage of reporting their ESG impacts, they can get in touch with IRDA to learn more on disclosure requirements and report information on the basic triple bottom line performance. This ensures that the disclosed information is complete, consistent, useful and reliable.

The business expression, "If you can measure it, you can manage it" holds true. The process of developing a sustainability disclosure unlocks opportunities for a business to gain insights into its operations and supply chain, identify and mitigate risks and uncover potential cost savings and growth. Businesses that regular publish sustainability disclosures are recognised on established indices such as the Dow Jones Sustainability Index and FTSE4Good. Businesses that disclose ESG performance not only receive tangible and intangible benefits as mentioned, but also pave the way for a greener economy in Iskandar.

To achieve a more sustainable healthcare sector, we have identified the following indices that businesses should monitor:

- Initiatives and targets for environmental performance;

- Direct and indirect energy consumption
- Energy saved due to conservation and efficiency improvements;
- Initiatives to reduce indirect energy consumption and reductions achieved;
- Total direct and indirect GHG emissions;
- Initiatives to reduce GHG emissions and reductions achieved;
- Initiatives to mitigate environmental impacts of products and services, and extent of impact mitigation;
- Initiatives to improve public awareness on climate change issues

Requirements outlined above are based on the Key Performance Indices indicated in the above sections and aligned with the Global Reporting Initiave indicators. World-renowned universities, such as Harvard University, University of California Berkeley and University of Oxford, have all published Sustainability Report or its equivalent in recent years. In the region, Deakin University of Australia, is one of the early adopters of sustainability reporting.

4.3 Responsible Procurement

Responsible Procurement ensures that business commitment to good corporate responsibility is reflected in how they select and work with suppliers. Responsible businesses encourage other companies that they do business with to meet the standards of ethics, business integrity and environmental practice expected of them. This would include adherence to high standards on Health & Safety, Fair Business Practices, Environmental Protection, Human Rights, and Local Community Development.

Institutions need to develop a model to bring about meaningful change within the supply chain by way of identifying gaps in suppliers' ethical business practices, and collaborating with them to develop tangible improvements.

Internationally, leading countries have also embarked on sustainable procurement guidelines across their ministries to ensure that labour rights and environmental concerns are respected. Recognizing the importance of Government Green Procurement (GGP), the Malaysian government has taken initial steps to boost demand for green products and services.

As the long-term action plan laid out for Malaysia intends for GGP to be implemented at all levels of government by 2020, this sets an exemplary model for private sector companies to follow suit and

enjoy potential business opportunities.

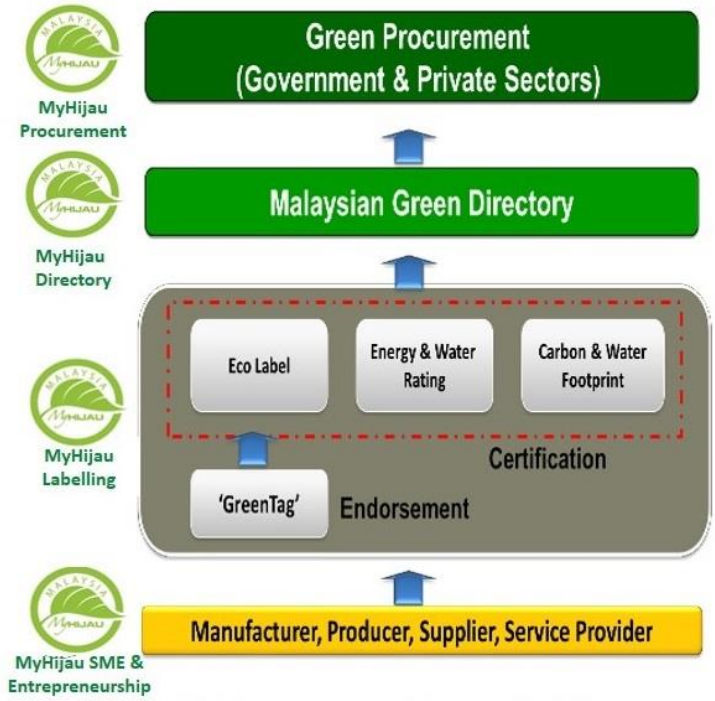

Figure 8: Malaysia Government Green Procurement (Greentech Malaysia, 2013)

Common products which companies and organizations have adopted green procurement policies for include recycled paper, renewable energy sources, VOC-free paints and adhesives, etc. Businesses can also cascade their procurement policy to suppliers/contractors to achieve a widespread effect of green procurement.

Leading firms are conducting life-cycle assessments to identify materials in their products that may pose significant environmental, health and safety risks. With this information, firms can re-design their products to prevent or mitigate such risks, which forms a logical part of effective supply chain management practices. Companies operating in Iskandar Malaysia could strive to have at least 10% of their purchases in the initial years, and move towards 100% green procurement in the years to come.

A series of case studies that describe how organizations from different countries have approached the verification of social criteria at various stages of the tender process is available at this link: http://www.sustainable-procurement.org/resources/tools-and-guidance/. Each study looks into how the compliance of direct suppliers is monitored and how this applies to the rest of the supply chain. Procurement professionals and other key stakeholders could learn from the experiences of their counterparts to develop or improve their systems.

Another similar report that provides an overview of responsible procurement in the private sector globally is the *Green Purchasing: The New Growth Frontier* by the International Green Purchasing Network (http://www.igpn.org/DL/Green_Purchasing_The_New_Growth_Frontier.pdf).

The ideas generated and lessons learnt from these cases can provide additional incentives and tools for other companies to further advance their environmental purchasing policies.

5. Conclusion

With the development of the education hub EduCity shared by eight international universities such as Newcastle University, University of Southampton and Netherlands Maritime Institute of Technology, Iskandar Malaysia is envisioned to be a key growth area poised to boost the region's economic growth and the education industry as a whole.

Considering the contribution of schools in water consumption, global energy use and emissions, the role for the education industry is significant. This guideline has provided several key recommendations for green opportunities in (1) energy consumption, (2) waste management and renewable energy, and (3) Education. It is important for stakeholders and institutions to understand that the actions outlined not only mitigate environmental impacts, but also meet the economic bottom line with cost savings through increased energy, water, or operational efficiency. With students and faculty increasingly making informed, environmentally-conscious choices in their higher education needs, we believe that going green will be a competitive advantage for institutions in the education industry.

Useful Links

Bursa Malaysia regulations on sustainability disclosures
http://www.bursamalaysia.com/misc/system/assets/5949/regulation_rules_main_market_bm_mainchapter9.pdf

BSEEP Building Energy Efficiency Technical Guideline for Passive Design
http://www.mgbc.org.my/news/bseep-building-energy-efficiency-technical-guideline-for-passive-design/

Green Building Index
www.greenbuildingindex.org

Iskandar Regional Development Authority
www.irda.com.my

Low Carbon Cities Framework and Assessment
http://esci-ksp.org/wp/wp-content/uploads/2012/04/Low-Carbon-Cities-Framework-and-Assessment-System.pdf

Low Carbon Society Blueprint
http://2050.nies.go.jp/cop/cop18/SPM_LCS%20Blueprint_Iskandar%20Malaysia.pdf

Ministry of Energy, Green Technology and Water
www.kettha.gov.my

The Green Purchasing: The New Growth Frontier
http://www.igpn.org/DL/Green_Purchasing_The_New_Growth_Frontier.pdf

Sustainable Procurement Resource Center
http://www.sustainable-procurement.org/resources/tools-and-guidance/

The 2015 Budget Speech
http://www.thestar.com.my/News/Nation/2014/10/10/Budget-2015-full-speech-text/

Bibliography

BBC, 2011. *Low Energy Lighting Guide for TV Production,* s.l.: BBC, ARUP.

Bersin, J., 2013. *Forbes.* [Online]
Available at:
http://www.forbes.com/sites/joshbersin/2013/12/19/ten-predictions-for-talent-leadership-and-hr-technology-in-2014/
[Accessed 28 August 2014].

Brambley, M., 2005. *Advanced Sensors and Controls for Building Applications: Market Assessment and Potential R&D Pathways.* s.l.:prepared for the U.S. Department of Energy by Pacific Northwest National Laboratory.

Building Energy Efficiency Technical Guideline for Passive Design, 2013. *Building Energy Efficiency Technical Guideline for Passive Design.* Kuala Lumpur: Building Sector Energy Efficiency Project.

Carbon Trust, 2007. *Energy Efficiency – Best Practice Programme (EEBPP) – Technology Overview – Lighting – Bright Ideas for ,* s.l.: Carbon Trust.

Carbon Trust, 2012. *Food and drink processing,* s.l.: Carbon Trust.

Carbon Trust, 2012. *Learning to improve energy efficiency: Schools,* s.l.: Carbon Trust.

Carbon Trust, 2012. *Training colleges and universities to be energy efficient,* s.l.: Carbon Trust.

CarbonTrust, 2002. *Good Practice Guide 319: Managing energy in warehouses.,* s.l.: HMSO.

CIBSE, 2006. *Environmental Design Guide,* s.l.: CIBSE.

Columbia University, 2011. *Powerhouse Chiller Plant Expansion.* [Online]
Available at: http://facilities.columbia.edu/node/1328/1330
[Accessed 15 06 2014].

COSPP, 2013. *Cambridge CHP district heat plan wins funding.* [Online]
Available at: http://www.cospp.com/articles/2013/01/Cambridge-CHP-district-heat-plan-wins-funding.html
[Accessed 15 06 2014].

D'Souza, C., 2014. *Food waste disposers can mitigate climate change and reduce costs.* [Online]
Available at: http://wastewise.be/2014/05/food-waste-disposers-can-mitigate-climate-change-and-reduce-waste-management-costs/
[Accessed 7 July 2014].

Department of Education and Early Childhood Development, 2012. *Resources for School Energy Managers-Hot water in Schools,* s.l.: Department of Education and Early Childhood Development,

Australia.

Department of Standards Malaysia, 2007. *MS 1525:2007*. [Online]
Available at:
http://www.utm.my/energymanagement/files/2014/07/MS-1525-2007.pdf
[Accessed 1 September 2014].

Edna Ishayik, 2013. *In Schools, a Water-Saving Program Begins With a Flush*. [Online]
Available at: http://cityroom.blogs.nytimes.com/2013/03/12/in-schools-a-water-saving-program-begins-with-a-flush/?_php=true&_type=blogs&_r=0
[Accessed 27 August 2014].

EIA, 2007. *Commercial Building Energy Consumption Survey* , s.l.: EIA.

EY, 2013. *Take 5: Budget 2014 Malaysia,* Kuala Lumpur: Ernst & Young Advisory Services.

GeSI, 2008. *Smart 2020*. [Online]
Available at:
http://www.smart2020.org/_assets/files/02_Smart2020Report.pdf
[Accessed 7 August 2014].

Greentech Malaysia, 2013. *Government Green Procurement in Malaysia*. [Online]

Available at:
http://www.greentechmalaysia.my/content.asp?cmscategoryid=397&zoneid=2#.VARHbPmSwYo
[Accessed 1 September 2014].

GSV EDU, 2012. *Education Sector Fact Book*, s.l.: GSV EDU.

Harvard University, 2013. *Sustainability Report*, s.l.: Harvard University.

Heriot-Watt University Malaysia, n.d. *Heriot-Watt at Putrajaya: Malaysia's first purpose-built green campus.* [Online]
Available at: http://www.hibikii.com/knowledge/heriot-watt-putrajaya-malaysias-first-purpose-built-green-campus/
[Accessed 27 August 2014].

Hitachi, 2014. *Escalators (VX Series).* [Online]
Available at:
http://www.hitachi.com/environment/showcase/solution/industrial/escalator.html
[Accessed 20 August 2014].

Illinois Smart Energy Design Assistance Center, 2009. *Energy Evaluation and Recommendations* , s.l.: Illinois Smart Energy Design Assistance Center.

Iskandar Regional Development Authority, 2011. *Invest education Iskandar Malaysia: Asia's Education Destination of Choice.* 1st ed.

s.l.:Iskandar Regional Development Authority.

Iskandar Regional Development Authority, 2014. *5th High Level Seminar on Environmentally Sustainable Cities.* [Online]
Available at: http://www.hls-esc.org/documents/5hlsesc/Iskandar.pdf
[Accessed 8 July 2014].

Low, M. L. & Kasmuri, A., 2014. *IM Biz Watch.* [Online]
Available at: http://www.iskandarmalaysia.com.my/sites/default/files/IM%20BizWatch%20July%202014.pdf
[Accessed 22 August 2014].

Monash University Malaysia, 2014. *Quest to Solve Water Scarcity.* [Online]
Available at: http://www.monash.edu.my/news/researchers-say/quest-to-solve-water-scarce
[Accessed 15 August 2014].

National University of Singapore, 2014. *National University of Singapore Office of Environmental Sustainability.* [Online]
Available at: www.nus.edu.sg
[Accessed 18 July 2014].

Nisen, M., 2013. *Business Insider.* [Online]
Available at: http://www.businessinsider.com/how-nike-solved-its-

sweatshop-problem-2013-5?IR=T&
[Accessed 28 August 2014].

Oxford University, 2012. *Energy Toolkit*, s.l.: Oxford University.

PEMANDU, 2010. *Economic Transformation Programme: A Roadmap for Malaysia*, Putrajaya: PEMANDU.

Princeton University, 2014. *Energy Management Projects.* [Online]
Available at:
http://www.princeton.edu/facilities/info/energy/energy_management/upgrades/index.xml#comp00004edde0b70000004fdb4139
[Accessed 15 06 2014].

Rochester Institute of Technology, n.d. *Waste Cooking Oil to Fuel Program.* [Online]
Available at:
http://www.rit.edu/affiliate/nysp2i/sites/rit.edu.affiliate.nysp2i/files/biodiesel_workshop_presentation_2012-10-05.pdf
[Accessed 21 July 2014].

Stanford Graduate School of Business, 2014. *Environmental Leadership.* [Online]
Available at: http://www.gsb.stanford.edu/stanford-gsb-experience/life-stanford-gsb/campus/environmental-leadership
[Accessed 27 August 2014].

Sustainable Energy Authority of Ireland, 2014. *Building Energy*

Management Systems (BEMS). [Online]
Available at:
http://www.seai.ie/Your_Business/Technology/Buildings/Building_Energy_Management_Systems_BEMS_.html

Sustainable Stock Exchange Initiative, 2013. *Bursa Malaysia (Malaysian Exchange).* [Online]
Available at: http://www.sseinitiative.org/fact-sheet/bursa/
[Accessed 26 August 2014].

The New Indian Express, 2014. *260 Biogas Plants in Schools.* [Online]
Available at:
http://www.newindianexpress.com/cities/thiruvananthapuram/260-Biogas-Plants-in-Schools/2014/01/02/article1978199.ece
[Accessed 27 August 2014].

The University of Nottingham Malaysian Campus, 2014. *Earth Hour Carnival at Nottingham University.* [Online]
Available at:
http://www.nottingham.edu.my/NewsEvents/News/2014/Earth-Hour-Carnival-at-Nottingham-University.aspx
[Accessed 27 Augiust 2014].

Tufts University, 2014. *Bulb Exchange,* s.l.: s.n.

UNEP, 2009. *Buildings and Climate Change,* s.l.: UNEP SBCI.

University College of Technology Sarawak, 2014. *Green Building Index (GBI).* [Online]
Available at: http://www.ucts.edu.my/green-building-index.html
[Accessed 27 August 2014].

University of Twente, Unilever, 2013. *Sustainable Warehousing,* s.l.: University of Twente, Unilever.

US Department of Energy, 2014. *LED Lighting.* [Online]
Available at: http://energy.gov/energysaver/articles/led-lighting
[Accessed 13 July 2014].

US EPA, 2009. *A Guide to Energy-Efficient Heating and Cooling.* [Online]
Available at:
http://www.energystar.gov/ia/partners/publications/pubdocs/HeatingCoolingGuide%20FINAL_9-4-09.pdf?7abc-7028
[Accessed 13 July 2014].

UTM , 2014. *UTM Campus Sustainability.* [Online]
Available at: http://www.utm.my/sustainable/

WBCSD, 2008. *Energy Efficiency in Buildings: Business Realities and Opportunities,* s.l.: World Business Council for Sustainable Development.

World Bank, 2014. *GDP (current US$) | Data | Table - The World Bank*. [Online]

Available at: http://data.worldbank.org/indicator/NY.GDP.MKTP.CD
[Accessed 10 06 2014].

World Bank, 2014. *Public spending on education, total (% of GDP).* [Online]
Available at:
http://data.worldbank.org/indicator/SE.XPD.TOTL.GD.ZS
[Accessed 15 06 2014].

World Trade Organization, 2014. *Education Services.* [Online]
Available at:
http://www.wto.org/english/tratop_e/serv_e/education_e/education_e.htm
[Accessed 15 06 2014].

WRAP, 2011. *Food Waste in Schools.* [Online]
Available at:
http://www.wrap.org.uk/sites/files/wrap/Food%20waste%20in%20schools%20full%20report%20.pdf
[Accessed 27 August 2014].

WTO, 2014. *Education Services.* [Online]
Available at:
http://www.wto.org/english/tratop_e/serv_e/education_e/education_e.htm
[Accessed 15 06 2014].

EY | Assurance | Tax | Transactions | Advisory

About EY
EY is a global leader in assurance, tax, transaction and advisory services. The insights and quality services we deliver help build trust and confidence in the capital markets and in economies the world over. We develop outstanding leaders who team to deliver on our promises to all of our stakeholders. In so doing, we play a critical role in building a better working world for our people, for our clients and for our communities.

EY refers to the global organization, and may refer to one or more, of the member firms of Ernst & Young Global Limited, each of which is a separate legal entity. Ernst & Young Global Limited, a UK company limited by guarantee, does not provide services to clients. For more information about our organization, please visit ey.com.

About EY's Climate Change and Sustainability Services
Governments and organizations around the world are increasingly focusing on the environmental, social and economic impacts of climate change and the drive for sustainability.

Your business may face new regulatory requirements and rising stakeholder concerns. There may be opportunities for cost reduction and revenue generation. Embedding a sustainable approach into core business activities could be a complex transformation to create long-term shareholder value.

The industry and countries in which you operate as well as your extended business relationships introduce specific challenges, responsibilities and opportunities.

Our global, multidisciplinary team combines our experience in assurance, tax, transactions and advisory services with climate change and sustainability knowledge and experience in your industry. You'll receive tailored service supported by global methodologies to address issues relating to your specific needs. Wherever you are in the world, EY can provide the right professionals to support you in reaching your sustainability goals.

www.ey.com

About IRDA
The Iskandar Regional Development Authority (IRDA) is a Malaysian Federal Government statutory body tasked with the objective of regulating and driving various stakeholders in both public and private sector towards realizing the vision of developing Iskandar Malaysia into a strong and sustainable metropolis of international standing

The Division provides strategic advice on environmental planning, development and management, carries out research and works in partnership with external agencies to promote a green growth economy for Iskandar Malaysia. In addition, the Division builds capacity, collaborates to integrate Climate Change programmes, statutory requirements related to the environment and supports green growth aligned to national commitments.

For further details, please contact the Head of Environment Division, IRDA.

EY
Building a better working world

ISKANDAR REGIONAL DEVELOPMENT AUTHORITY

ISKANDAR
REGIONAL
DEVELOPMENT
AUTHORITY

Iskandar Regional Development Authority (IRDA)
#G-01, Block 8
Danga Bay, Jalan Skudai
80200 Johor Bahru
Tel: +607 233 3000
Fax: +607 233 3001