

# SEASN

## A COMPENDIUM of Selected Best Practices on Sustainable Development Goals



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# **A COMPENDIUM of Selected Best Practices on Sustainable Development Goals**



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# FOREWORD



The historic 2015 agreement among world leaders at the United Nations on a universal 2030 Agenda for Sustainable Development committed 196 countries to pursue a set of 17 Sustainable Development Goals (SDGs) leading to a better future for all. The shift from commitment to action can only be achieved if sustainable development moves from the periphery to the core of decision-making in both public and private domains.

From reaching social and economic equality to combating climate change, the SDGs cannot be achieved without determined and sustained efforts from all the sectors of our societies. More than ever, continuous innovation and integrated approaches are needed. The South East Asia Sustainability Network (SEASN) as an alliance of higher education institutions and other related sustainability organizations, agencies, NGOs and industries in the region can therefore play a critical role in exchanging of ideas, findings, information, and good practices in teaching, research, community engagement and institutional arrangement with a focus on the SDGs.

Few years into the implementation of the 2030 Agenda, many SEASN members and their stakeholders have taken successful actions to achieve sustainable development goals (SDGs). This compendium therefore screens some of the SEASN members' inspiring success stories that are showing results and impacts in practice. This compendium can function as a useful reference and illustrate that promoting innovative practices is vital for achieving the sustainable development goals and leaving no one behind.

I trust that this compendium will serve as a useful and inspiring document for the members of academia, sustainability practitioners, policy makers, private sector, and the general public with passion for sustainability to usher in a more responsible and sustainable approach that advances the 2030 Agenda in Southeast Asia. I would like to express my gratitude and heartiest appreciation to the contributors, authors and editors for their hard work and dedication in materializing this compendium. It is hoped that this initiative would help bring about a greater change towards a sustainable future.

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**Vice-Chancellor**  
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# PREFACE

The creation of this compendium is derived and inspired by the concept of Sustainable Development Goals (SDGs) which is implemented in the visions of Universiti Sains Malaysia (USM); “Transforming Higher Education for A Sustainable Tomorrow” and the South East Asia Sustainability Network (SEASN); a network “committed to address regional and global sustainability challenges.”

Celebrating the 50th anniversary of USM and the 10th year since the establishment of the Centre for Global Sustainability Studies (CGSS), it is with the greatest aspiration that the agenda of sustainability would be broadened to produce people with better consciousness when it comes to different pillars of sustainable development.

To collaborate in the exchange of ideas especially those related to sustainability, South East Asia Sustainability Network (SEASN) was established to serve as a platform to support higher education institutions, NGOs, other sustainability organisations, agencies and industries in Southeast Asia. The focus of SEASN is set on Water, Energy, Health, Agriculture, Biodiversity; Climate Change & Disaster Risk Management, Consumption & Production and Population & Poverty. SEASN is also a medium to interchange findings, information, and good practices in teaching, research, community engagement, and institutional arrangement based on the focus.

The compilation of information in this booklet is meant to serve a finer understanding of the good practices that could be enacted by the institutions globally in order to achieve the Sustainable Development Goals (SDGs). With the efforts and support from the sustainability teams and the administration, respectively, the practices in this document are certainly possible to be executed in different other settings.

Therefore, SEASN has collected these good practices from various member institutions, which should be the exemplars to others and drive the organisations to take the similar approach of developing sustainable living style which later would be followed by the communities.

This compendium is hoped to be used as a quick reference to the viable practices for a sustainable living and achieving the SDGs.

# Increasing the Awareness of Reduction Single Use Plastic by Practical Waste Separation of Green Faculty to Green University

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## Abstract

The concept of waste reduction had been used for many years in various countries but not all can be effective from the implementation. One of the reasons is the difficulty in habit changing or not accepting to change. The single use plastic will not be removed from daily life as long as the consumer does not understand or has awareness of not to consume it. Although many chemists try to find out some products made from the recycling of the single use plastic, in reality, the single use plastic after consumption is mixed with other types of waste and is not easy to separate especially when mixing with organic or kitchen waste. The implementation of the separation of the whole municipal solid waste will increase the awareness of single use plastic because after the completion of separation, only the left overs in the bin for the collector is only single used plastic. This would increase the awareness of not to consume single use plastic.

Keywords: Single Use Plastic, Awareness, Practical Waste Separation  
Focus Area: SDG 12 - Responsible Consumption and Production

## Introduction

The municipal solid waste has been produced and reached 1.13 kg per household, per day in 2017 from the statistic of waste in Thailand by the Pollution Control Department (Figure 1).



Figure 1 Waste situation in Thailand



The deployment of waste management has been assigned to the local administrative organization together with the private sector encouraged to invest and utilize waste as raw material or fuel for waste to energy incinerator. From 77 provinces, 49 provinces managed to have the refuse-derived fuel processing plants. In 6 provinces, there are waste incinerators operated by private companies.

In detail of each province, the waste separation still be the problem. Even in the municipal solid waste incinerator that has to confront with mixed type of waste and has to burn all of that. The mixing of organic waste also reduces the heating value whereas the general and seasonal rainfall is also the problem for the waste to energy. Some type of hazardous waste for example the dry batteries are also mixed with municipal solid waste.

Songkhla as one of the big provinces in Thailand, located at the Hadyai Campus of Prince of Songkla University, has one municipal solid waste incinerator. The aforementioned problem particularly waste separation is a must to do in the province. The faculty of Environmental Management has therefore established the green team with the objective to start up the green measures in the faculty to response the big picture of responsible consumption and production which is one of the sustainable development goals. The concept of green team is to start and send the practice to the university in order to expand to community or province.

The green team has started from the restaurant in the faculty. The discussion between the owner of the restaurant and the dean of the faculty has started. The plastic cup has been replaced by paper cup. The use of plastic tubes has been banned. The Measures has been communicated to the customers to bring their own cups for all beverages in order to get the price reduction. The coffee break in the meeting of the faculty must not use the single use plastic. This ban of the single use plastic has started since 1st January 2019. On 1st of February 2019, the measures of no plastic bags in the faculty has been launched. On 1st March of 2019, the separation of used dry batteries has been launched as well. This is in order to be the university centre for collecting, sending and paying to the proper company that can solidify it and keep in secure landfill.

The key to success is due to the small starting unit and it is easy to handle but the measure will reflect the administrative team of the university to comply and implement the same measures. The step by step reflection will lead to the acceleration of the progress. The green team has also set up the monitoring teams and indicators. With the 50 staff of the faculty, everybody will monitor each other by reporting to the center of monitoring staff.

SDG number 12, responsible consumption and production is very qualitative and is difficult to be measured. For banning of single use plastic, the green team set 100% no single use plastic in the form of replacing beverage containers. For banning of plastic bags, the green team expects 100% of no plastic bags entering the gate of the faculty. Lastly, for collecting used dry batteries, the faculty expects to get 5,000 kg per year that can be sent to the solidification company for keeping in secure landfill.

## Results and Impacts

From the 3 measures with the poster of No Plastic Bag, No Single Use Plastic, and Used Dried Batteries Centre as in figure below.



**Figure 2** Poster of No Plastic Bag, No Single Use Plastic, and Used Dried Batteries Centre

As the start of no plastic bag measures, it was very early to conclude but the green team received good experience. The no plastic bag measures easy and we found only few cases of waling pass the main gate with plastic bag and they are not staff of the faculty but people from outside.

For the no single use plastic, the restaurant tried to use the old plastic cup to change to the paper cup. There were many customers of the restaurant complained for not having tubes for the beverages. On the other hand, around 50% of the customers understand and comply with the measures very well.

For the collection of the used dry batteries, it is around 15 kg in the container provided by the faculty.

Although the green team has started the idea but the participation from stakeholders is very good. The green team has reviewed the previous research and found that the ease of complying to a measure is very important to their success. Therefore, the green team designed to have the innovation to become the solution to the university and community respectively by using recycling machines, composting machines and hazardous collecting machines which is connected via the IOT system. The result would be displayed via the mobile phones of consumers to increase the awareness as in Figure 3.





Figure 3 Smart Compost / Recycle / MSW / HSW bin

### Conclusion

It is not easy regarding the problem of municipal waste management but from research and experience, it can be concluded that the change brings a habit of customers that must confront with complain but after that the familiarity with the system will remove it against the mind. In terms of systematic thinking, all types of waste must be managed i.e. organic waste, MSW, HSW.

# Towards Achieving the SDGs: The Case of SEAMEO RECSAM's SEAMEO Basic Education Standards Common Core Regional Learning Standards in Mathematics and Science (SEA-BES CCRLS)

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## Abstract

The SEAMEO Basic Education Standards (SEA-BES) is a regional curriculum project aimed at developing learning standards known as Common Core Regional Learning Standards (CCRLS) in Mathematics and Science. It serves the goal of improving the quality of education in the SEAMEO Member Countries through comparison and identification of gaps in terms of curriculum content as well as basis for assessing student learning outcomes. Learning outcomes encompass cognitive and non-cognitive outcomes, such as attitudes, skills and competencies essential for participation on the 21st century. The standards were developed by the science and mathematics education experts and professors from institutions of higher learning from SEAMEO and beyond, specialists from SEAMEO sister-centres and national science and mathematics centres, lecturers from teacher training institutes, and primary and secondary school teachers from Penang state in a number of regional and national level workshops. This case study reports the purposes of the project, aims, framework and content of science and mathematics standards encompassing three key stages. Results showed that contents of CCRLS Science were directly related to Sustainable Development Goals. Likewise, current and perceived future impacts of the project were discussed.

**Keywords:** Learning standards, Curriculum development, Science education, Mathematics education, Sustainable development goals

**Focus Area:** SGD 4

## Introduction

ASEAN region necessitates an education policy that would lend support to reforms in science and technology and mathematics education curriculum in basic education particularly the primary and secondary education levels toward achieving scientific and technological literacy, lifelong learning and the 21st century skills that eventually contributes to realising sustainable development goals. SEAMEO education priority areas include development and enhancement of 21st century skills comprising of character education, entrepreneurship education, information



and communications technology, language and literacy, numeracy, and scientific and technological literacy in all learners. Thus, SEAMEO RECSAM, with its mandate to promote science and mathematics education in the Southeast Asian region, led one of the 12 initiatives under the Golden SEAMEO and reflected in the SEAMEO Strategic Plan 2011-2020, known as SEAMEO Basic Education Standards.

Under the new SEAMEO Education Agenda (2015-2035), SEA-BES project is re-aligned into Priority Area #7 Adopting a 21st Century Curriculum which states "to pursue a radical reform through systematic analysis of knowledge, skills, and values needed to effectively respond to changing global contexts, particularly to the ever-increasing complexity of the Southeast Asian economic, socio-cultural and political environment, developing teacher imbued with ASEAN ideals in building ASEAN Community within 20 years."

### **Purposes of Common Core Regional Learning Standards under the SEA-BES project**

The SEA-BES CCRLS project initiative would support SEAMEO Member countries in the following respects:

- a) to be used as an analytical tool to support future development of regional integrated curriculum necessary for ASEAN integration emphasizing on 21st century skills;
- b) to strengthen ASEAN collaboration on curriculum standards and learning assessment across different educational systems to effectively respond to the changing global context and complexity of ASEAN;
- c) to promote in every member country the establishment of best practices to overcome differences in curriculum;
- d) to produce systematic discussion process for the establishment of the regional integrated curriculum and assessment;
- e) to be used as a platform for curriculum development and professional development for all stakeholders and for developing teachers imbued with ASEAN ideals in building ASEAN community; and
- f) to serve as a platform for assessment such as the Southeast Asia Primary Learning Metrics (SEA-PLM).

### **SEAMEO Basic Education Standards Common Core Regional Learning Standards**

The SEAMEO Basic Education Standards Common Core Regional Learning Standards (SEA-BES CCRLS) is a regional curriculum project which present common, shared and agreed upon standards for what every learner should know, be able to do and value in mathematics and science. Basically, the aim of the SEA-BES CCRLS in Mathematics and Science is "to provide world-class learning standards in Science and Mathematics, including 21st century skills that can be used as benchmarks in SEAMEO Member Countries to ensure all students have access to fundamental knowledge, skills and values in order to be socially responsible, globally competitive and sustainable."

The SEA-BES Phase 1- Development of the Common Core Regional Learning Standards started in November 2014 and finally published in 2017. The SEA-BES CCRLS in Mathematics and Science publications were shared to all the 11 Ministries of Education of SEAMEO, SEAMEO sister-centres, national science and mathematics centres, higher education institutions, teacher education institutions, secondary and primary schools within and beyond the Southeast Asian region.

From 2017 to the present, SEA-BES Phase 2 is currently undertaking the project “Development of STEM Planning and Design Learning Framework” in collaboration with the Faculty of Education, Monash University, Australia. The outputs of the project are the STEM Planning and Design Learning Model for Teachers and Students with accompanying STEM lesson sequences and will be shared to all SEAMEO Member Countries. Moreover, the SEA-BES is also pursuing an “Online Survey on Year 9 and 10 Students Beliefs and Attitudes towards Science and Science Education” in collaboration with the School of Education, University Technology Sydney, Australia. Findings from the research will become inputs in revising the CCRLS in Mathematics and Science publication.

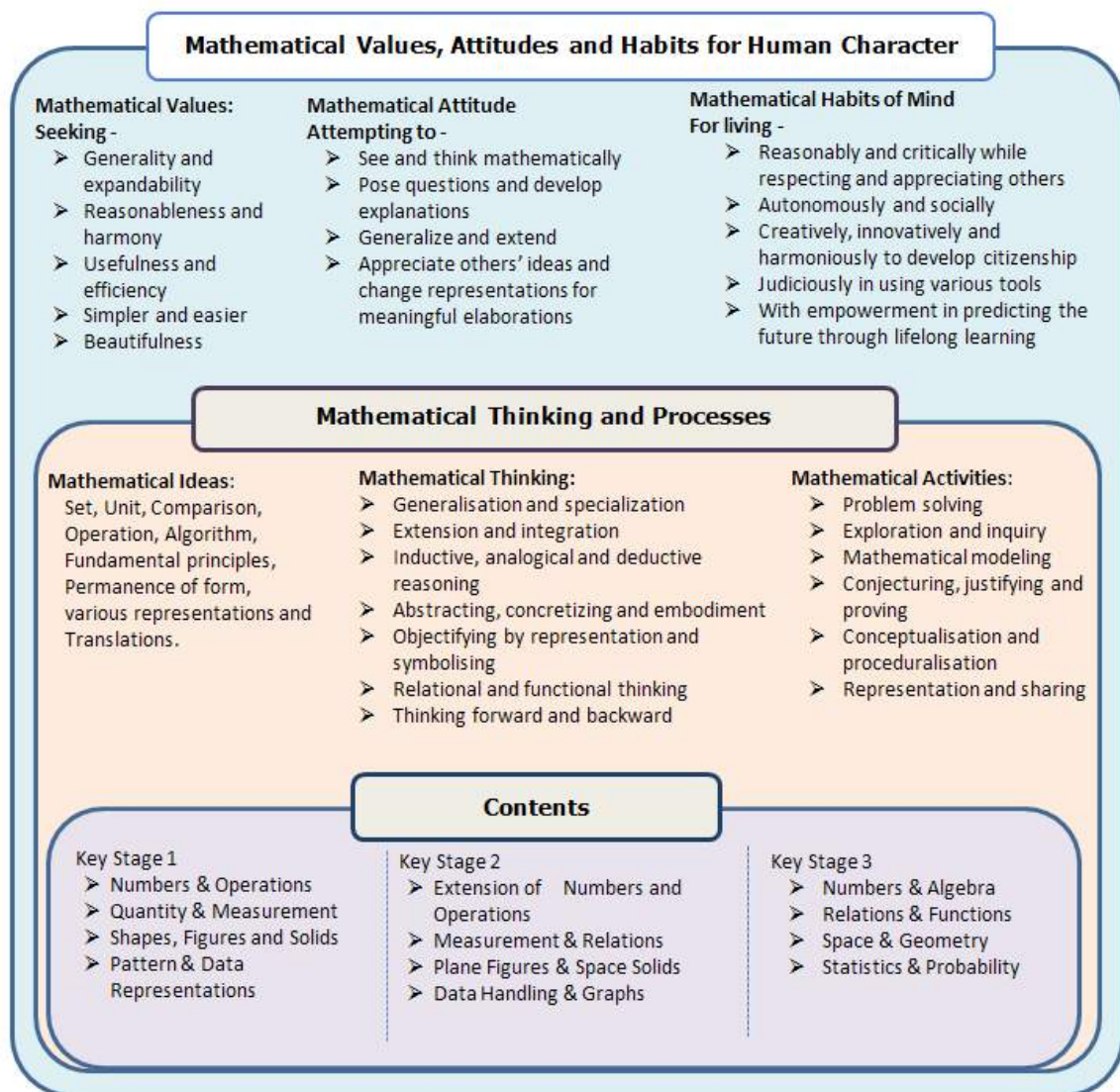
### **Aims and Frameworks for CCRLS in Mathematics and Science**

The aims of Mathematics in CCRLS for developing basic human characters, creative human capital, and well qualified citizens in Southeast Asia for a harmonious society through mathematics are to: (a) develop mathematical values, attitudes and habits of mind for human character; (b) develop mathematical thinking and enable to produce appropriate process; and (c) acquire proficiency in mathematics content and apply mathematics in appropriate situations.

Correspondingly, the aims of Science in CCRLS are to: (a) develop scientific literacy whereby scientific knowledge acquired through the processes of science with technology as an enabler is applied in daily lives and used to acquire new knowledge; (b) instil the ability to carry out scientific inquiry to understand the world around us; (c) demonstrate the understanding of the nature of science in the process of carrying out scientific investigation; (d) develop scientific skills through hands-on and minds-on experiences; (e) develop understanding of the interrelationship of science with society, environment, technology, engineering and mathematics; (f) demonstrate ethical behaviour, scientific attitudes and values when undertaking scientific thinking and processes; and (g) demonstrate the ability to use the acquired scientific thinking and processes in making informed decisions, and debating scientific and social-cultural issues.

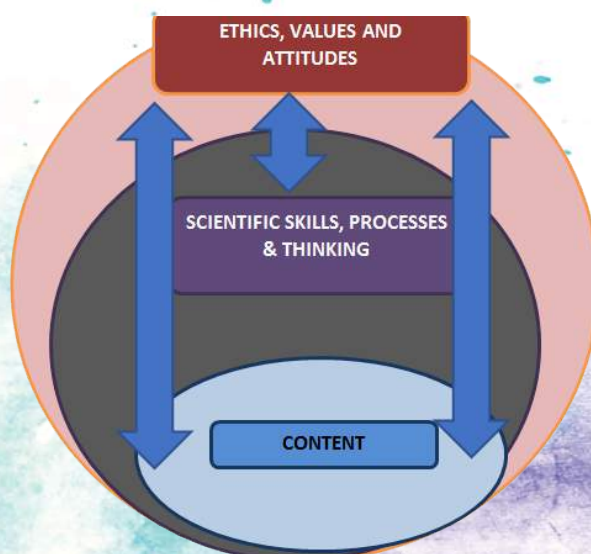
The framework for CCRLS in Mathematics is shown in Figure 1 is developed under the three components and the discussion of humanistic and philosophical nature of mathematics. The framework also provides the concrete ideas of Mathematics on the above aims.





**Figure 1 CCRLS Framework for Mathematics**

The framework of CCLRS in Science as shown in Figure 2 covers the major aspects of Science, as well as the social and technological implications of Science while Table 1 shows the components of the framework.



**Figure 2 CCRLS in Science Framework**

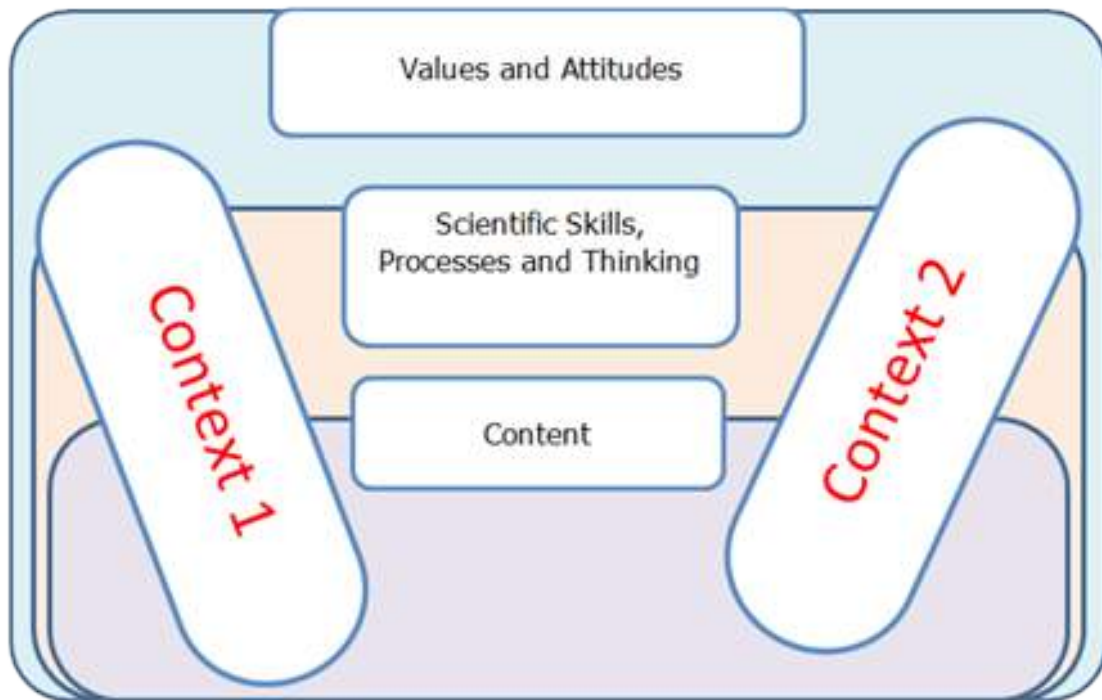
**Table 1**  
Components of CCRLS Science Framework

Content	Scientific Skills, Processes and Thinking	Values and Attitudes
<ul style="list-style-type: none"> <li>• Scientific Inquiry</li> <li>• Life and the Living World</li> <li>• Material World</li> <li>• Energy and Change</li> <li>• Earth and Space</li> <li>• Science, Engineering, and Technology for Sustainable Society</li> </ul>	<p><b>Science Skills and Process</b></p> <ul style="list-style-type: none"> <li>• Questioning</li> <li>• Observing</li> <li>• Classifying</li> <li>• Measuring</li> <li>• Hypothesizing</li> <li>• Predicting</li> <li>• Inferring</li> <li>• Explaining</li> <li>• Communicating</li> <li>• Evaluating</li> <li>• Identifying and controlling variables</li> <li>• Formulating and testing hypothesis</li> <li>• Defining operationally</li> <li>• Interpreting data</li> <li>• Planning and carrying investigations</li> </ul> <p><b>Thinking</b></p> <ul style="list-style-type: none"> <li>• Critical and Creative Thinking</li> <li>• Reasoning</li> <li>• Problem Solving</li> <li>• Decision Making</li> <li>• Applying and Creating</li> <li>• Generating Solutions</li> <li>• Safe use of Equipment</li> <li>• ICT skills</li> <li>• Collaboration skills</li> </ul>	<ul style="list-style-type: none"> <li>• Caring for the living and non-living environment</li> <li>• Social awareness</li> <li>• Sustainability</li> <li>• Responsibility</li> <li>• Truth</li> <li>• Interdependence</li> <li>• Integrity</li> <li>• Perseverance</li> <li>• Self-discipline</li> <li>• Self-esteem</li> <li>• Empathy</li> <li>• Appreciation</li> <li>• Trust</li> <li>• Critical reflection</li> <li>• Inventiveness</li> <li>• Tolerance</li> <li>• Uncertainty</li> <li>• Belief and interest</li> <li>• Curiosity</li> <li>• Honesty</li> <li>• Objectivity</li> <li>• Open-mindedness</li> <li>• Respect for evidence</li> </ul>



### Context to Link the Three Components

The three components shown in Figure 2 are embedded in every key stage (i.e. Key Stage 1 – Grades 1 to Grade 3; Key Stage 2 – Grades 4 to Grade 6; and Key Stage 3 – Grades 7 to Grade 9) as standards for the content of teaching. “Values and attitudes”, component and “Scientific skills, processes and thinking” component cannot exist without “Content” component. The first two components can be taught through teaching with the content. For teaching those three components at the same time, context is introduced as shown in Figure 3.



**Figure 3** Interlinking of the three components with the context

## **The Common Core Regional Learning Standards and Sustainable Development Goals**

OECD (2005) defined the 21st century skills as “competency for successful life and well-functioning society”. United Nations sets the sustainable development goals (UN, 2015) under the necessity of the development of every society as well as sustainability of social welfare. On this context, Mathematics and Science are the necessary subjects in education for success in various fields as well as human welfare. Mathematics and Science are the tools for overcoming the challenges of diversities in Southeast Asia through developing the competency for competitiveness and in creating a harmonious society as envisioned in the Common Core Regional Learning Standards. Likewise, it is important to highlight that CCRLS is directly related to the 17 SDGs and targets especially SDG#4 “to ensure inclusive and quality education for all and promote lifelong learning” and other SDGs.

The United Nations 2030 Agenda for Sustainable Development Goals is a plan of action for people, planet and prosperity. These agenda include the 17 SDGs: (1) no poverty – end poverty in all its forms everywhere, (2) zero hunger – end hunger, achieve food security and improved nutrition and promote sustainable agriculture, (3) good health and well-being – ensure healthy lives and promote well-being for all at all ages, (4) quality education – ensures inclusive and equitable quality education and promote lifelong learning opportunities for all, (5) gender equality – achieve gender equality and empower all women and girls, (6) clean water and sanitation – ensure availability and sustainable management of water and sanitation for all, (7) affordable and clean energy – ensure access to affordable, reliable, sustainable and modern energy for all, (8) decent work and economic growth – promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all, (9) industry, innovation and infrastructure – build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation, (10) reduced inequalities – reduced inequality within and among communities, (11) sustainable cities and communities- make cities and human settlements inclusive, safe, resilient and sustainable, (12) responsible consumption and production – ensure sustainable consumption and production patterns, (13) climate action – take urgent action to combat climate change and its impacts, (14) life below water – conserve and sustainably use the oceans, seas, and marine resources for sustainable development, (15) life on land – protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss, (16) peace, justice and strong institutions – promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels, and (17) partnerships for the goals- strengthen the means of implementation and revitalize the global partnerships for sustainable development.



## **Results and Impacts**

### ***Sustainable Development Goals Mapped in the CCRLS Science***

The CCRLS provide the content and context for teaching and exploration which encompasses metacognition, critical reasoning and communication for the attainment of the scientific, technological and mathematical literacy. Moreover, the CCRLS relates to SDGs as it encompasses the three dimensions of sustainable development, namely; the economic, social and environmental perspectives as they are embedded in the content and as context of teaching Science and Mathematics.

SDG #4 has set targets by 2030, namely; to ensure that all youth and a substantial proportion of adults, both men and women, achieve literacy and numeracy; ensure that all learners acquire the knowledge and skills needed to promote sustainable development, including, among others, through education for sustainable development and sustainable lifestyles, human rights, gender equality, promotion of a culture of peace and non-violence, global citizenship and appreciation of cultural diversity and of culture's contribution to sustainable development; build and upgrade education facilities that are child, disability and gender sensitive and provide safe, non-violent, inclusive and effective learning environments for all. The contents of CCRLS Science were found to directly relate to a few SDGs as shown in Table 2.

**Table 2**

Mapped Contents of CCRLS Science and SDG Covered

Scientific Inquiry	Topics	SDG Covered
	Science Process Skills	#4- quality education #9- innovation
	Managing Laboratory Apparatus and Specimens	#4- quality education
	Observing safety in the Laboratory	#4- quality education
	Scientific Attitudes, Ethics and Noble Values	#4- quality education
	Scientific Investigations	#4- quality education #9- innovation
	The World of STEM	#4- quality education; #8- decent work and economic growth #9-innovation; #12-sustainable consumption and production; #15- promote sustainable use of terrestrial; eco-systems, manage forests and halt biodiversity loss
Life and the Living World	Living and Non-living Things	#15- promote sustainable use of terrestrial ecosystems, manage forests and halt biodiversity loss
	Personal Health and Healthy Lifestyle, Human Organ Systems	#2 – zero hunger; #3 good health and well-being; #12- ensure sustainable consumption and production
	Animals, Plants and Microorganisms	#12-sustainable consumption and production; #15- promote sustainable use of terrestrial ecosystems, manage forests and halt biodiversity loss
	Ecosystem, Biodiversity and Environment	#11-sustainable cities and communities- make cities and human settlements inclusive, safe, resilient and sustainable #12-sustainable consumption and production; #15- promote sustainable use of terrestrial ecosystems, manage forests and halt biodiversity loss;
	Cells and Biotechnology	#4-quality education; #9-innovation



The Material World	<b>Topics</b>	<b>SDG Covered</b>
	Properties, Composition and Classification of Matter	#4-quality education; #12-sustainable consumption and production
	Water as Matter	#6-ensure availability and management of water and sanitation; #14-sustainable use of oceans, seas and marine resources
	Acids, Bases and Salts	#9–innovation; #12-sustainable consumption and production
Energy and Change	Chemical Reactions	#9-innovation; #12-sustainable consumption and production
	Sound, Light and Waves	#9-innovation
	Electricity and Magnetism	#7-access to affordable, sustainable and modern energy for all; #9-innovation; #12-sustainable consumption and production
	Force and Motion, Pressure	#7-access to affordable, sustainable and modern energy for all; #9-innovation; #12-sustainable consumption and production
	Energy, Work, and Power	#7-access to affordable, sustainable and modern energy for all; #9-innovation; #12-sustainable consumption and production
	Heat	#7-access to affordable, sustainable and modern energy for all; #9-innovation; #12-sustainable consumption and production
	Nuclear Physics	#7-access to affordable and sustainable and modern energy for all; #9-innovation; #12-sustainable consumption and production

Earth and Space	<b>Topics</b>	<b>SDG Covered</b>
	Solid Earth, Soil, Water and Natural Resources	#6-ensure availability and management of water and sanitation; #9-innovation #12-sustainable consumption and production; #14-sustainable use of oceans, seas and marine resources; #15- promote sustainable use of terrestrial ecosystems, manage forests and halt biodiversity loss
	Atmosphere, Weather, and Climate	#4-quality education; #9-innovation; #13 climate action – take urgent action to combat climate change and its impacts;
	Earthquakes, Volcanoes and Disaster Risk Management	#4-quality education; #9-innovation; #13 climate action – take urgent action to combat climate change and its impacts;
	Earth, Solar System and the Universe	#4-quality education; #9-innovation; #13 climate action – take urgent action to combat climate change and its impacts;
	Space Technology	#4-quality education; #9-innovation
Science, Engineering and Technology for Sustainable Society	Environment and Conservation of Natural Resources	#4-quality education; #9-innovation; #12-sustainable consumption and production; #15- promote sustainable use of terrestrial ecosystems, manage forests and halt biodiversity loss
	Ecosystem and Environmental Management	#4-quality education; #9-innovation; #11-sustainable cities and communities; #12-sustainable consumption and production; #15- promote sustainable use of terrestrial ecosystems, manage forests and halt biodiversity loss
	Human Health and Management	#2 – zero hunger; #3- good health and well-being; #4-quality education #9-innovation; #12-sustainable consumption and production
	Scientific, Technological and Engineering Break-through	#4-quality education; #8- decent work and economic growth #9-innovation; #12-sustainable consumption and production; #15- promote sustainable use of terrestrial; ecosystems, manage forests and halt biodiversity loss



## **Impacts**

The SEA-BES CCRLS project is used as benchmarks in curriculum development among SEAMEO Member Countries to ensure all students have access to fundamental knowledge, skills and values, including 21st century skills in science and mathematics in order to be socially responsible, globally competitive and sustainable. The CCRLS Science is utilised in the development of an integrated, interdisciplinary and multidisciplinary STEM Planning and Design Learning Framework with accompanying STEM lesson sequences. Major problems and issues such as energy, climate change impacts, diseases, natural disasters, violence, pollution, environmental degradation and natural resource depletion become the centrepiece of these STEM lessons to realise SDGs and targets. Likewise, research studies are undertaken where findings and good STEM and SDG practices could be integrated in the revision of the CCRLS. Moreover, the concept of global thinking, global perspectives and global citizenship will be integrated in future curriculum development projects to ensure that the new Agenda for Sustainable Development is realized and the lives of all humanity will be improved and our world will be transformed for the better towards a more resilient and sustainable planet Earth.

## **Conclusion**

The SEA-BES Common Core Regional Learning Standards in Science and Mathematics serve as a tool to strengthen regional collaboration on curriculum standards and learning assessment, curriculum and professional development and a mechanism to enhance competitiveness in the era of globalisation, nurturing ASEAN values and spirit and in building a harmonious, progressive, peaceful, resilient and sustainable ASEAN community as guided by the United Nations 17 Sustainable Development Goals and 169 targets.

## **Acknowledgement**

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# Eco-University Policy and Implementation of Mahidol University, Thailand

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## Abstract

Mahidol University (MU) has been living a long history for over 129 years, which is recognized as a large higher education institution comprising of academicians and professionals in every field, both in arts and sciences. Salaya campus is the main campus of MU, where it is located in Nakorn Pathom province, west of Bangkok, Thailand. MU has driven the eco-university policy for sustainable development on campus and in the surrounding community by creating a balance of economic, social and environmental dimensions that will lead to efficient use of resources, social equality and improved quality of life of staff, students and the surrounding community. The university aims to reduce greenhouse gases by at least no less than 25% within the year 2021 in comparison with gas emissions of the base year 2016. This plan complies with Thailand policies in accordance with its ratification of Paris Agreement in reducing greenhouse gases by no less than 20-25%. To achieve this goal, the university has adopted three strategies including 1) Promotion of an increase in resource efficiency; 2) Promotion of low carbon technology and innovation to reduce greenhouse gases; and 3) Promotion of community engagement.

**Keywords:** Eco-University, Green campus, Greenhouse gas, Resource efficiency, Community engagement.

**Focus Area:** SDG 12 and 13

## Introduction of Mahidol University [1]

Mahidol University (MU) has its origins in the establishment of Siriraj Hospital in 1888 by His Majesty King Chulalongkorn (Rama V), and the hospital's medical school is the oldest institution of higher learning in Thailand, granting its first medical degree in 1893. Later becoming the University of Medical Sciences in 1943, Mahidol University was renamed with great honor in 1969 by H.M. King Bhumibol Adulyadej, after his Royal Father, H.R.H Prince Mahidol of Songkla.

MU has since developed into one of the most prestigious universities in Thailand, internationally known and recognized for the high caliber of research and teaching by its faculty, and its outstanding achievements in teaching, research, international academic collaboration and professional services. This diversified institution now offers top quality programs in numerous social and cultural disciplines, including the most doctoral programs of any institution in Thailand, yet has maintained its traditional excellence in medicine and the sciences.

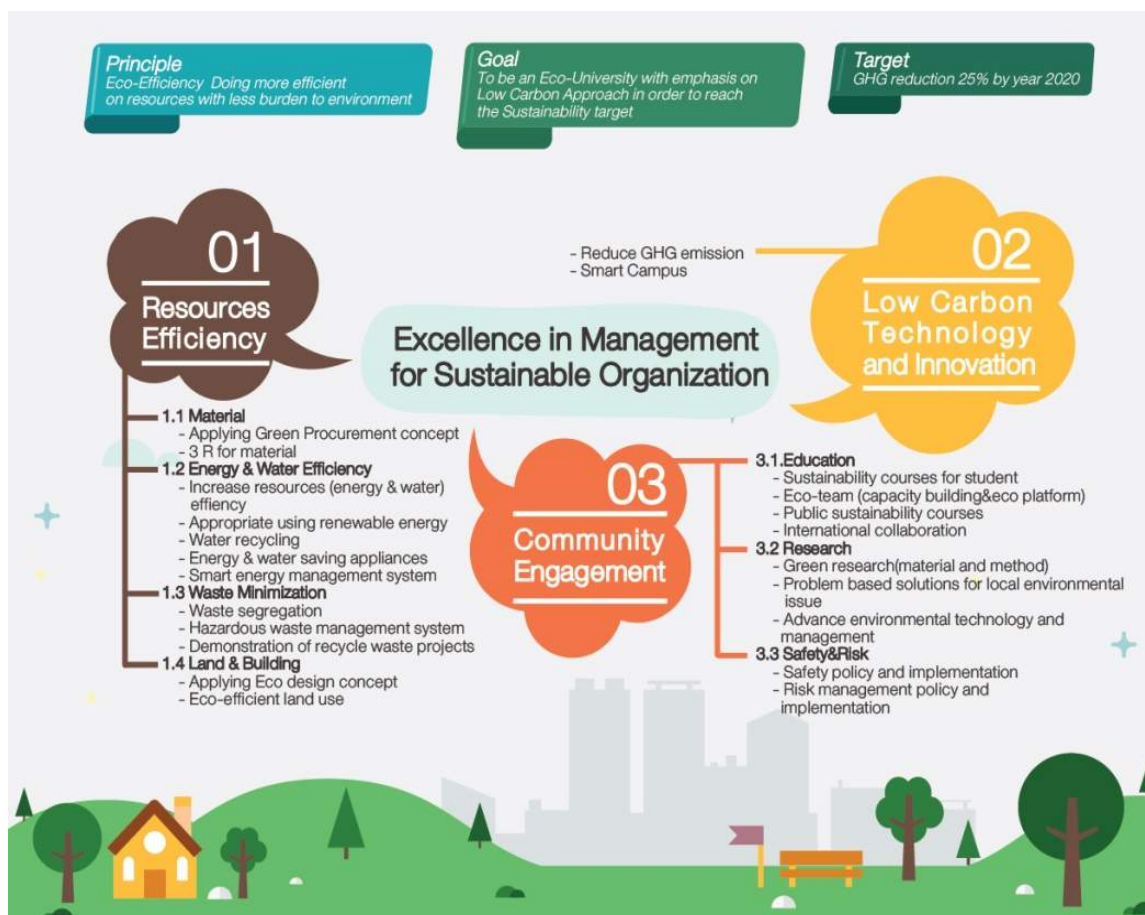
MU has three campuses in the Bangkok metropolitan area: the large suburban campus at Salaya in nearby Nakhon Pathom province, where is the main campus of MU, and two inner city campuses in Bangkok Noi and Phayathai in the Bangkok area, in addition to a downtown high-rise office site for the College of Management. There are also provincial campuses in Kanchanaburi (west of Thailand), Nakhon Sawan (north of Thailand) and Amnaj Charoen (north-eastern of Thailand) provinces.

MU is organized into 17 faculties (responsible for both research and teaching), 7 institutes (mainly focusing on research), 6 colleges (mainly focusing on teaching) and 9 centers (mainly providing academic services). MU has approximately 24,000 students, of whom some 15,500 are undergraduate students and some 8,300 are postgraduate students. It also has a total of 3,000 academic staff responsible for teaching and research, as well as some 6,500 academic assistants, 5,900 administrative staff, and 8,700 other employees (including hospital employees).

### **MU Eco-University Policy**

In year 2015, MU had launched the “Eco-University” policy, which drives university for sustainable development on campus and in the surrounding community by creating a balance of economic, social and environmental dimensions. This will lead to efficient use of resources, social equality and improved quality of life of staff, students and the surrounding community. The university aims to reduce greenhouse gases by at least no less than 25% within the year 2021 in comparison with gas emissions of the base year 2016. This plan complies with Thailand policies in accordance with its ratification of Paris Agreement in reducing greenhouse gases by no less than 20-25%. To achieve this goal, the university has adopted three strategies including 1) Promotion of an increase in resource efficiency (which is focused on SDG11); 2) Promotion of low carbon technology and innovation to reduce greenhouse gases (which is focused on SDG12); and 3) Promotion of community engagement. The eco-university strategy was summarized and illustrated in Figure 1.





**Figure 1** The summarization of eco-university strategy

### Eco-University Indicator and Monitoring

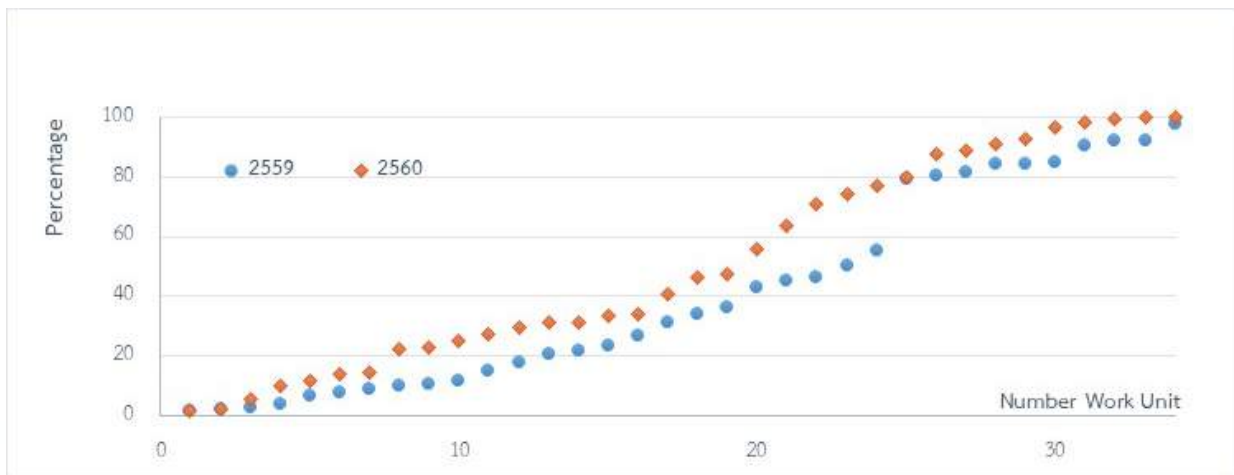
MU has emphasized sustainable corporate management which is a strategy in the university operation through work agreement to set operational goals between the university and faculties. With respect to this agreement, the faculties shall report their performances at the end of the agreement period, and one of the report topics shall be the performance results following six eco-university indicators including raw materials, energy use, water use, wastes, buildings and greenhouse gases [2]. The criteria of each eco-university indicators are shown in Table 1.

**Table 1**  
Eco-university indicators and criterias

Indicators	Criteria
1. Material	Over 50% of purchased green product procurement
2. Energy	No increase of energy consumption
3. Water	No increase of tap water consumption
4. Waste	Segregation of waste must be required
5. Building	There is over 50% of green building elements.
6. Greenhouse	100% of carbon footprint for organization assessment in all work units has been completed

### Material

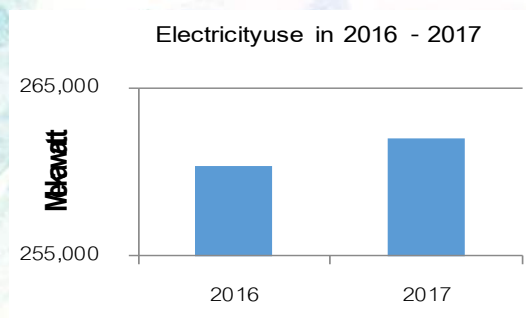
The university has paid attention to the environment and sustainable development, therefore it organized a seminar project of “green product procurement” in accordance with United Nations’ sustainable development goals No. 12: Sustainable Production and Consumption. The seminar was intended to introduce criteria, rules and regulations of green product procurement to the university’s work units (including faculties, college, institute, and center). Regarding the performances of the university work units in year 2017, 15 more work units were qualified according to raw material criteria, and each faculty had a tendency to use more environmental friendly products than in year 2016. The percentage of green product procurement comparing between year 2016 and year 2017 is shown in figure 2.



**Figure 2** The percentage of green product procurements comparing between year 2016 and year 2017

### Energy

In year 2017, the total electricity consumption of MU was 261,989.04 MW, most of which was used by the work units providing medical services. The comparison of total electricity consumption between year 2016 and year 2017 is illustrated in Figure 3. It was indicated that 21 work units, or 11 more work units this year, were able to reduce use of electricity; compared with those in the previous year, accounting for 2,224.68 MW of decreasing power. In addition, MU has been operating energy saving projects, for instance, producing electricity from solar renewable energy and solar cells, production of biodiesel from used cooking oil. The university also organized activities to promote energy conservation and energy saving such as MU Light Out and MU Energy Award.

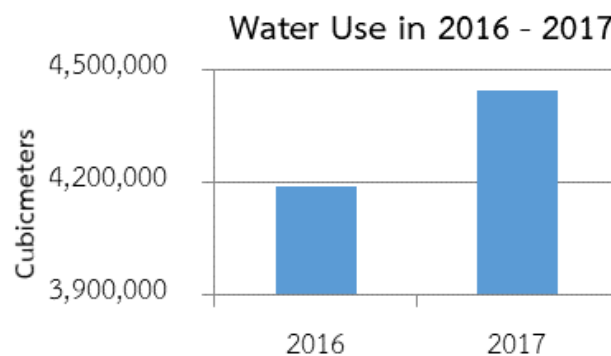


**Figure 3** Electricity consumption in year 2016 and 2017



## **Water**

The total water consumption of MU in year 2017 was 4,447,043.57 cubic meters. There were 9 more faculties or a total of 21 work units reducing water consumption, which was a total decrease of 85,972.11 cubic meters, compared with that of the previous year (see in figure 4). The recycle of treated wastewater project was implemented in order to reach more numbers of water reduction. It has been working most effectively, causing 71.2% of treated water to be reused on the campus, which can save 111 m<sup>3</sup> of tap water per month (2,300 baht per month), and reduces greenhouse gas emissions by 3 kg CO<sub>2</sub> eq/ month. In addition to its high capacity with only 150,000-baht investment and a 5-year payback period, the project became a good model for other workplaces of Mahidol University.



**Figure 4** Water consumption in year 2016 and 2017

## **Waste**

MU has been running a campaign on separation of garbage by providing waste sorting bins in all the work units; however, the collection of waste sorting data is still challenging. In the year 2017, it was indicated that the waste database improved and there was an increase in waste sorting by 12.47% compared with that in the previous year. This might have resulted from cooperation of all work units in data collection. In addition, the university developed the recycling waste bank project whose operational database was systemized. It was revealed in year 2017 that the purchase of recycling wastes through the project rose to a total of 1,207 tons.

## **Building**

MU has pushed forward the environmental friendly features of the work unit buildings to meet green building criterias in order to minimize their impact on the environment and reduce negative effects on staff health. In comparison with the previous year assessment, in year 2017, a total of 20 workplace buildings or 6 more of them were qualified to meet 50% of criteria for eco-friendly building features.

## **Greenhouse Gas**

The university has organized the MU Carbon Footprint Program in which the collected data of resource use have been calculated to find the quantity of greenhouse gases emitted by the organization [3]. The program has been well cooperated by all work units in providing required information. According to the previous year performance, a total of 16 work units emitted 9,264 tons CO<sub>2</sub>eq, and a total of 33,111 tons CO<sub>2</sub>eq was emitted from activities taking place on the campus in year 2017. As a result of these facts, the university set up some projects to reduce greenhouse gas emissions including 1) waste recycling, 2) reduction of plastic bags, 3) carbon capture and storage in biomass, 4) reduction of energy, and 5) changing appliances into power saving/energy conservation. After the implementation of the projects, the emission of greenhouse gases decreased by 3,654 tons CO<sub>2</sub>eq or 12% of the total greenhouse gas emissions in the same year.

## **Conclusion**

MU is determined to be a world-class university. In order to reach the excellence in management for sustainable organization, eco-university policy is one of the focused policy. The 3 strategies with 6 core indicators of eco-university has been implemented, which can drive environmental friendly and sustainable development activities following the 17 sustainable development goals [4].

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# Profiling A Campus Sustainable Transportation System

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## Abstract

As a university that strives to become a reputable international learning hub, UPM is committed to develop and provide services based on the principles of sustainable development. This is to ensure that UPM is relevant as a driving factor to increase the quality and sustainability of life. Looking at the future, as the campus population and activities grow, a comprehensive study on the transportation system in UPM to promote a more sustainable transportation system on campus is vital. Currently, the transportation system in UPM Serdang campus is still in a conventional way where the concentration of motorised vehicles is high. The increasing trend of using motorised vehicles as the main mode of

transportation on campus has increased the congestion during peak hours. As a university that aims to be a green campus, UPM needs a more comprehensive and sustainable transportation plan to improve mobility in its main campus. This includes shifting the need for a motorised vehicle to a greener choice such as walking or using a bicycle and buses, and also implementing a more sustainable transport policy. The number of vehicles travelling across campus, and consequently, their impact on the environment can be related back to several determining factors which include (1) the capacity of the existing road infrastructure; (2) the quality of transportation services and facilities provisions on campus (3) the geographical setting of campus living and motorized vehicle use; and, (4) the low participation in sustainable transportation programs such as bus services. A proper transportation planning study is required to provide better accessibility and improve mobility within the campus area.

**Keywords:** Campus sustainable transportation system, green campus

**Focus Area:** Related to SDG 3, SDG 9 and SDG 11 (Sustainable Transportation Campus)

SDG 3: Good health and well-being

Goal 3: Ensure healthy lives and promote well-being for all at all ages

Target: By 2020, halve the number of global deaths and injuries from road traffic accidents 3.7

SDG 9: Industry, innovation and infrastructure

Goal 9: Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation

Target: Develop quality, reliable, sustainable and resilient infrastructure, including regional and trans border infrastructure, to support economic development and human well-being, with a focus on affordable and equitable access for all

SDG 11: Sustainable cities and communities

Goal 11: Make cities and human settlements inclusive, safe, resilient and sustainable

Target:

i. By 2030, provide access to safe, affordable, accessible and sustainable transport systems for all, improving road safety, notably by expanding public transport, with special attention to the needs of those in vulnerable situations, women, children, persons with disabilities and older persons

ii. By 2030, enhance inclusive and sustainable urbanization and capacity for participatory, integrated and sustainable human settlement planning and management in all countries

iii. By 2030, reduce the adverse per capita environmental impact of cities, including by paying special attention to air quality and municipal and other waste management

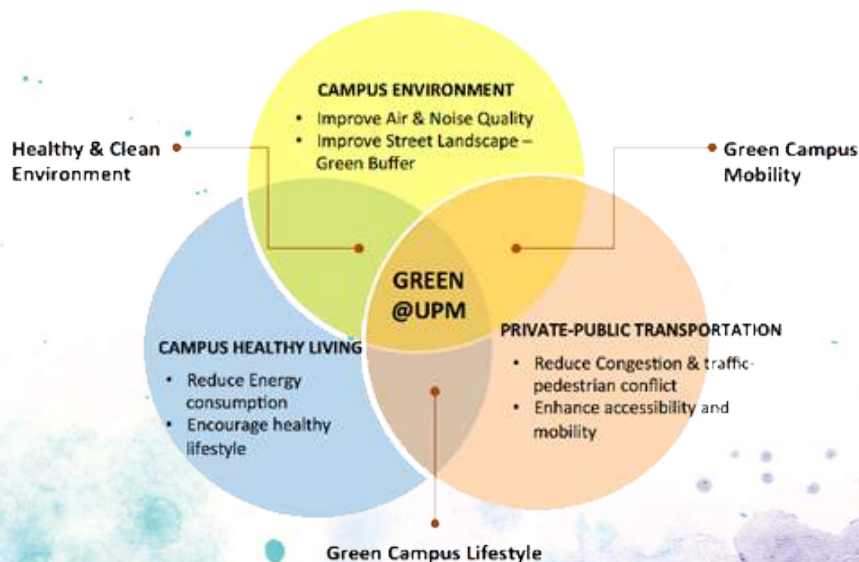
iv. By 2030, provide universal access to safe, inclusive and accessible, green and public spaces, in particular for women and children, older persons and persons with disabilities

Source: United Nations (2017)



## Introduction

Campus environment as a dense hub of activities; from learning to teaching, living to managing, has highlighted the important of campus community engagement; individually and collectively roles in the main agenda of university's green systematic transformation fundamental. At the forefront of campus sustainability movement, UPM is fully committed to alleviate and mitigate adverse environmental impacts caused by the transportation activities. Profiling the sustainable transportation system of campus is a vital approach in ensuring the dynamic sustainability process in university is achievable. UPM is committed to provide reliable and efficient transportation services that developed based on the principles of sustainable development and responsible in raising the quality of life and ensure continuity of universal life (Fig. 1). Sustainable Development Goals (SDGs) is interpreted as the fundamental approach that explains the importance of conserving ecological balance by reducing the depletion of natural resources through a sustainable transportation system approach. Comprehensively, SDGs adaptation into university transportation system, maneuver as the fundamental approach to addresses, involves and promotes, on the minimization of negative environmental, economic, societal, and health effects. It nourishes the transition of sustainable lifestyle of the campus society through the activities of teaching, research, outreach and partnership. The Green@UPM strategic plan to meet SDGs is outlined to reflect on university contributions in achieving the sustainable campus environment. UPM's transportation action plans are aligned with the fundamentals and guidelines of sustainability and this, in connection with the SDGs are comprehensively planned to build campus- wide green campus culture to address the issues arising from the imperative for university mobility and accessibility.



**Figure 1** Green@UPM

The sustainable transportation system in campus provides a valuable starting point for good resource management and environmental contributions to physical activity levels in the population, especially in surrounding university's campus. In such situations, carbon footprint is a poor representative of the environmental conditions of the green campus life. Along with UPM's long planning timeframes, centralized organizations, and dense populations, thus UPM campus is such an ideal place to examine the possible application of carbon mitigation strategies. A connected campus community could be created through a sustainable transportation system approach. Sustainable transportation provides a variety of benefits, such as saving money, conserving energy, adopting a healthier and active lifestyle, and reducing carbon emissions. Among the viable options of the sustainable transportation system are walking, cycling and taking a bus.

A comprehensive sustainable transportation master plan as a planning tool would become a guide for the campus development within the next several years in a more sustainable practice. Through a sustainable transportation plan, problems relates to transportation system, mobility and accessibility among UPM communities could be tackled, thus providing a better and encouraging environment to practice sustainable lifestyles in aspect of mode choice of our daily transportation. For example, the pedestrian access and connections elements are emphasised in the campus transportation plan and become even more important as the majority of students does not own vehicles except permitted by the Security Division, thus walking is their main mode of mobility from residential colleges to classes or other campus activities. In the bigger picture, planning through the transportation view, we can shape the society to practice more sustainable lifestyles.

To determine how to improve that connectivity, the design team examined the university's comprehensive geographic information system (GIS) maps to identify major concentrations of class activity and pedestrian routes, which illustrated where sidewalk and bikeway networks should be completed and enhanced to improve connections. In addition, the team established design guidelines for creating safer night time walking routes, complete with pedestrian-level lighting.

Undeniably, the facilities designated for promoting pedestrian and public mode of transportation have been provided in the university such as the shuttle bus services, pedestrian walkways and cycling lanes. However, the utilisation of these facilities is yet well accepted by the campus community. The current origin and destination points of transportation system within the campus is designed to be more benefitting for motorized vehicles, whilst causing walking and cycling becoming less popular choices among the students. The provision of the facilities for walking and cycling such as shaded walkways, bicycle paths, secure bicycle parking and signage, are not efficiently provided, nor the existing roads carry positive characteristics for better traffic and transportation flow. Therefore, it can be argued that a proper UPM Transportation Master Plan is needed for improving the transportation system and service quality in UPM. The empirical data gained from this research project is relevant and essential for determining the future planning of university's green transportation system.



Sustainable Transportation is referred as an advance environmentally sustainable policy and investment that reduces carbon and other harmful emissions from transportation sources (Part III Sustainable Transportation System, 2010). In other words, sustainable transportation in campus is an effort of campus transportation in improving the campus environment by lessening environmental degradation incurred from unnecessary vehicles usage by the campus community and keeping the campus free from exhaust fumes, congestion and energy waste (Sustain Cornell, 2019).

The current condition of the transportation system in UPM Serdang Campus was evaluated through various approaches, such as statistical analysis, road mapping analysis and Level of Service (LOS) analysis for traffic and pedestrian volume. These were carried out to identify the issues and challenges surrounding the transportation system on campus, which would help us to identify ways to solve these issues. This research aims to improve the quality of life for UPM community by proposing improvements that can be done to the existing transportation plan in a timely and efficient manner. The output from this research would provide better insight for assisting the decision making process of the UPM management regarding the sustainability of the transportation system in UPM.

### **Bottom-up Approach in Sustainable Transportation Blueprint Process**

UPM Sustainable Transportation Blueprint 2019–2024 was carried out with the intention to comprehensively study the current issues and therefore come out with several programs and initiatives regarding the transportation system within UPM in order to promote the sustainable transportation system within the campus. UPM has undertaken a detailed analysis of the current state of transportation service and facilities in four different approaches to identify:

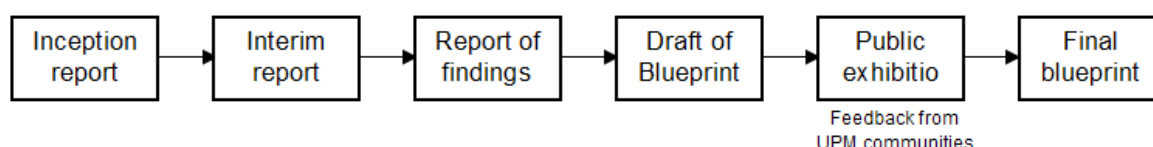
- 1) Traffic-pedestrian volume and road capacity study
- 2) Parking provision and capacity study
- 3) The level of service green bus services
- 4) Environmental impact of transportation study

<p>Traffic-pedestrian volume and road capacity study</p> <p>i. Traffic volume study</p> <p>ii. Road capacity study and level of service</p> <p>iii. Pedestrian volume study</p>	<p>Parking provision and capacity study</p> <p>i. Parking space inventory survey</p> <p>ii. Parking space utilization survey</p> <p>iii. Parking availability study</p>	<p>The level of service green bus services study</p> <p>i. Existing bus profile</p> <p>ii. Bus stops facilities evaluation</p> <p>iii. Level of students' satisfaction and level of bus service</p>	<p>Environmental impact of transportation study</p> <p>i. Noise pollution study</p> <p>ii. Air quality study</p> <p>iii. Roadside plants' air pollution tolerance index</p> <p>iv. Green buffer study</p> <p>v. Carbon emission</p>
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*Source: Environmental and Transportation Planning Lab (2019)*

The procedure of public exhibition and participation approach-relate to inclusiveness and participation practiced throughout the project reach out toward UPM communities did follow the SDG insight to involve all layers of communities. Inclusiveness in this context refers to public access to information and ability to participate in giving feedback thus influence the decision making. As in our case, we disseminate the information through our official website, emails, Facebook page and physical advertisement such as banner and poster, to ensure most of the UPM communities are well informed about the sustainable transportation planning project. In a nutshell, all persons are able to enjoy the equal rights and opportunities to access and give feedback regarding this project's output.

Stages of UPM Sustainable Transportation Blueprint:



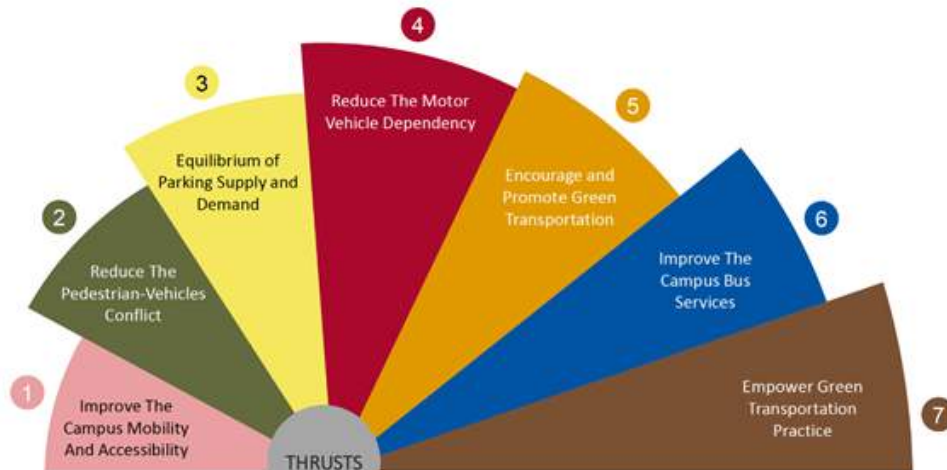
### The Way Forward of Campus Connectivity and Mobility

The output of UPM Sustainable Transportation Blueprint meant to improve the transportation services and facilities towards the UPM community and at the same time lessen the impact of transportation towards environment. UPM Sustainable Transportation System Blueprint is the university's roadmap for greener and sustainable campus mobility and accessibility. The strategies and action plans are formulated to promote better transportation system in campus to achieve these objectives:





The seven thrusts (Figure 2) of UPM Sustainable Transportation Blueprint (Environmental and Transportation Planning Lab, 2019) namely:



**Figure 2** Seven Thrust in UPM Sustainable Transportation Blueprint

#### 1) Improve the campus mobility and accessibility (SDG 11)

The objective of this thrust is to provide and enhance the use of alternative modes of transportation through improved transportation choices. Among the actions recommended to achieve the good level of mobility and accessibility in sustainable campus transportation are by redesigning shuttle bus routes and network, redesign and extend pedestrian walkway connectivity, extend bicycle lane coverage and connectivity, improve driving lane conditions and circulation, create a safe shared multi-modal streets, have accessible bus stop locations and facilities, continuous paved and covered pedestrian walkway, complete cyclist facilities and install automatic traffic counts at main entrances. The focus is to enhance the pedestrian and cyclist friendliness throughout the campus by providing safe pathway for users and thus improve aesthetic and environmental qualities of the campus. The inclusion safety features for pedestrians can encourage more trips to be made on foot.

#### 2) Reduce the pedestrian-vehicles conflict

Two main action plans under this thrust is to design an improvement of prioritize area and for pedestrian and cyclist needs. Among the strategies are by creating signature streetscape of pedestrian and bicycle lanes, restoring grandeur of pedestrian path along the main entrance lane, redesign aesthetic left-side bicycle lane, extend covered walkway in core academic zone, improve safety design of pedestrian and bicycle lane, campus pedestrian signage, provision of pedestrian bridge and underpass pedestrian crossing and emphasize safe and comfortable campus pedestrian and cycling environment. The focus of designing a high quality of streetscape design with great visual amenities is to emphasize the sense of belonging and create a comfortable environment to the pedestrian and cyclist. Hence, it will create a good walking and cycling experience to users.

### 3) Equilibrium of parking supply and demand

The objective of this thrust is to improve the overall parking management in campus especially at the core academic zone and residential colleges. Parking management is one of the crucial indicators in transportation sector in order to reduce congestion. The design and implementation of parking management system can help the university in achieving sustainable transportation title. The strategies intend to imply shared parking facilities and improve parking facility design and operation as improper parking management would bring difficulty and complex to the users.

### 4) Reduce the motor vehicle dependency

There are three main action plans outlined under this thrust which are UPM car free morning program, uplift carpooling activities among UPM community and optimizing the security network within the campus. Listed under these action plans are the UPM car free morning on campus, installing car free morning signage to alert users, introducing campus ambassadors for carpooling programs, UPMride mobile application, rideshare service for women, strengthen the implementation of sticker among students and staff, and introduce the matric code identification system. Strengthening the law to reduce the motor vehicle dependency would help in shaping the behavior of students, staff, authorities, and the most important thing is contributing within a part of the sustainable transportation development on the campus.

### 5) Encourage and promote green transportation

The objective of this thrust is to encourage the community to appreciate the green facility, encourage them to use it and as well as protect the environment through improvement of green facilities and regulation. Under the green initiatives strategies are carpooling program (ride and reward), green parking, and green funding for better enforcement of vehicle regulation.

### 6) Improve the campus bus services

There are two main initiatives focused under this thrust, which are to exchange the use of express bus to the shuttle bus and improve the overall Putra bus services. The objective is to provide a fundamental mobility service to the students in order to access the classes and campus activities' venue which are usually in the core academic area. Among the strategies are authorized bus-only routes on the campus to reduce conflict with other motorized vehicle, improve of bus stop amenities and facilities, and greater innovation for current UPM bus application.

### 7) Empower green transportation

This thrust focused on the policy and regulation that should UPM take seriously to achieve the sustainable transportation system. Among the policy introduce are Zero Emission Vehicles, Low Carbon Campus, Pedestrian and Cyclist Oriented Campus, Greater Ratio of Non-Motorized Transportation, and UPM Car Free Morning. These policies have insight to develop strong partnership with stakeholders to leverage funding for green transportation goals. Collaborative partnership with stakeholders on zero emission vehicles via sharing on relevant research and data would be done to ensure integration and consistency to achieve the goal.



At the end, we provide milestones of implementation steps for UPM management to give a consideration on. The implementation of UPM Sustainable Transportation Blueprint is envisage as an important contribution to sustainable transportation in campus, contribute to responsible use of resources and address the adverse impact of climate change in campus context.

### **Conclusion**

The implementation of the four sub project of transportation planning facilities within UPM campus seeks to sensitize the universal community, generate awareness and modify habits that produced changes and improve the social and environmental impacts that the problems of current transportation system generates for the UPM campus community. Integration of spaces, providing safe and equal access for all to physical and social infrastructure, focusing on sustainable and integrated pedestrian and cyclist oriented development by implementing policies, strategies and actions as the fundamental drivers of change are among the key indicators in ensuring the sustainable transportation system could take place in UPM within the timeframe along with the guides from the Sustainable Development Goals' strategies and target for better human settlement and placemaking.

### **Acknowledgement**

This Universiti Putra Malaysia Sustainable Transportation System Blueprint presents the strategies and action plan under seven (7) strategies framework from the project team of the Sustainable Transportation System in Universiti Putra Malaysia Serdang Campus. This project may not been possible without the support of financial assistance from Putra Grant 2018: UPM Current Issues (9300437) and support from the RMC UPM.

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# Implementation of the 2030 Agenda for Sustainable Development in Universiti Putra Malaysia

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## **Abstract**

As Universiti Putra Malaysia (UPM) now ranked the 1st in Malaysia in UI Green metric Index, continuous effort are in place to address the challenges of SDG. The primarily central locations, size and number of staff and students and activities in UPM are significant contributors of greenhouse gas emissions. Thus, this paper will discuss the initiative and strategy taken by Universiti Putra Malaysia in planning and developing the sustainable campus. Specific initiatives implemented by UPM in promoting, inculcating and expanding the sustainability effort within our campus community and also to the public are also be shared. All these innovations are meant to raise awareness, collaboration and communicate university aspiration towards achieving SDG. Some enhancement was done in our strategy to balance between the national tertiary educational aspiration and UN SDG. As alternative for the UI Green metric Index namely the sustainability index of My-Hijau is now available in Malaysia, there must be an initiative to synchronize all these effort into a more inclusive index in terms of national sustainability which is to date there is still no satisfactory index that can meet all of these criteria. UPM commitment towards implementing the SDG is very much assured.

**Keywords:** University, Sustainability, Assessment, Index, Initiatives

**Focus Area:** SDG 11 Sustainable Cities and Communities; SDG 12 Responsible Consumption and Production; SDG 14 Life Below Water; SDG 15 Life on Land



## Introduction

Declining environmental, economic and social conditions of the world require a response from the academic community. Indeed, addressing problems related to our ability to continue to occupy the planet in such a manner as to not deplete our natural resources; harm our air, water, and soil; and undermine the social, cultural and economic sustainability of our communities is the biggest challenge to universities nowadays. Higher education institutions play an important role in implementing the United Nations SDGs agenda with a huge responsibility to move beyond its current sphere of academic influence and assume responsibility for becoming a platform for individual, community and social change. Considering how we shape the lives of students and contribute research to industry and government, institutions of higher learning possess the unique ability to promote sustainability and create more sustainable communities in the future. Institutions of higher learning are a key stakeholder in 1) built environment with buildings in many major cities around Malaysia and 2) the lives of students and 3) sustainability research. Thus, universities have the opportunity to not just improve sustainability of their facilities, but to also demonstrate to their students and staff how the built environment can be structured to benefit both the environment and the occupants.

Universiti Putra Malaysia (UPM) is counted as the top sustainable institution in Malaysia according to the UI GreenMetric World University Ranking 2018. This is despite UPM primarily central locations, size and number of staff and students and activities that are significant contributor of greenhouse gas emissions. The ranking could be attributed to the facts that UPM have had a UPM green policy since 2011 while the UI GreenMetric which was developed by Universitas Indonesia for measuring a spectrum of six indicators ranging from i) setting and infrastructure, ii) energy and climate change, iii) waste management, iv) water management, v) transportation management and vi) education and research was launched in 2010. The UPM Green Policy stipulates to reduce the production of all types of residues from campus activities through the 4R (reduce, reuse, repair, recycle) measures, reduce the use of private motor vehicles by improving disabled-friendly public transport on campus and between it and the public transport hub in its vicinity, provide safer lanes for cyclists and pedestrians and adopt the concept of sustainable development in the management and development planning of the campus.

As many different definitions and interpretations of the sustainability concept exist, it is not surprising that the strategies of universities that are beginning to strive for sustainability show some differences. Increasing numbers of universities in Malaysia and ASEAN region have already become engaged in the process of integrating sustainable development in their activities and are looking for ways to improve their sustainability outcomes despite the numerous scope and definitions of sustainability on the literature.

An early definition of sustainability was presented in The Brundtland Report where sustainability is defined as “development... meeting the needs of the present without compromising the ability of future generations to meet their own needs” and further noted a concern “about the accelerating deterioration of the human environment and natural resources, and the consequences of that deterioration for economic and social development...” (UN General Assembly Report of the World Commission on Environment and Development, 1987).

Our sustainability goals clearly stated the intention of UPM to be a leader in sustainability among higher learning institution in Malaysia and becoming a model in inculcating green activities in teaching ecosystem, learning, research and professional services. These, together with The Brundtland Report definition are guiding principles for UPM in seeking recognition via the UI GreenMetric World University Ranking. Thus, numerous thrust, initiative and activities are being synchronized to meet both specifications concurrently.

### **Initiatives for Sustainability @ UPM**

Despite the vast land and green landscape on UPM property coupled with a long history of agriculture education, it was observed that staying on top in terms of sustainability had its fair share of struggle. The 2018 UI GreenMetric World University Ranking showed very little difference between UPM and other Malaysian universities. Thus, with the green policy as a guide, a number of innovations and best practices have been put in place since 2011 to sustain UPM as a green campus. The initiatives which were selected based on a number of criteria such as the university system, including curricula, research, physical operations, industrial and community outreach and engagement and assessment and reporting are as follows:

1. SDG 14 Life Below Water and SDG 15 Life on Land. The preservation of biological diversity in natural and man-made environment in UPM was made via the setting up of the Urban Wildlife Sanctuary inside the campus and was linked with tract or green belt along the university's perimeter. Among others, this habitat provides a refuge for water birds, small mammals as well as for the jungle fowl.

2. SDG 11 Sustainable Cities and Communities. A program for advocating reduction in the release of greenhouse gases, which contribute to climate change, through the efficient use of energy to prevent wastage and the use of alternative energy to lower dependence on nonrenewable energy is already in place. These are a continuous campaign that has now been embedded into our respective unit KPI (Key Performance Indicators). Among the targets are to reduce the adverse per capita environmental impact of our campus by focusing on air quality.

3. SDG 15 Life on Land. A consistent effort of reforestation and tree planting on yearly basis has been implemented since 1991 where some 350,000 forest trees from 128 species have been planted in Serdang main campus as well as Bintulu campus, covering 47 hectares. This is on top of a mega planting of more than 10,000 landscape plants on campus;



4. SDG 12 Responsible Consumption and Production. The establishment of the UPM Wastebank on campus is a continuation of various recycling and conservation programmes and now has been embedded into teaching and research activities. The target is to reduce waste generation through prevention, reduction, recycling and reuse.

5. SDG 11 Sustainable Cities and Communities. UPM recently launched our green campus transportation blueprint as a follow up from the establishment of on-campus bike lanes to reduce vehicle traffic. This blueprint would guide UPM in traffic issues especially upon completion of new LRT line which has a station in our campus.

6. SDG 12 Responsible Consumption and Production. The collaboration between UPM and Majlis Perbandaran Subang Jaya (MPSJ) has led to the setting up of the Serdang Biomass Town. Among the features of this venture is a centre for recycling of used cooking oil into biodiesel oil for vehicles and machinery on campus in partnership with the neighbouring residential community of Seri Serdang and a vermicomposting facility next to the Seri Serdang wet market. The target is to achieve an environmentally sound management of wastes throughout their life cycle by reducing their release to air, water and soil in order to minimize their adverse impacts on human health and the environment.

7. Practice and propagation of green policies and implementation of EMS MS ISO 14001. Each entity in UPM has committed to implementing the policies objectives on their own compound within both campuses. This is being monitored by the Sustainability Committee (Policy) and Working Committee for Sustainability (working level).

8. A special grant for current issues is being offered by the Research Management Centre in which one of the grantee was a project related to Transport Masterplan for Serdang Campus. As UPM was established 1931, numbers of infrastructures and facilities in the campus need to be transformed to meet current demand in the campus. Thus, the university has offered financial support in terms of grant for this purpose.

9. Instituting sustainability elements into administrative domain by means of star rating for administration and management. After two years of implementation in UPM, the sustainability items are now establishing a subsection with expanding criteria been included from year to year. One important aspect here is the setting up of targets and indicators by means of measuring the distance to a target to assess the current status or trend. The star rating also proposes indicators for each criteria as an important tool to ensure that the achievement could be assessed and to identify whether it has achieved the target.

10. The New Year address by our Vice Chancellor would serve as a medium for deepening the engagement of universities with the sustainability agenda by setting up direction for years to come with action plan to improve our environmental performance in terms of campus management.

## **Challenges in Sustainability @ UPM**

Over the last decade numerous sustainable campus initiatives have been organized with multiple partners whether inside or outside the campus. Yet, the output of these activities is much less impactful with few success stories. Inevitably, management, research, education, communication and operation of any university with a genuine interest in sustainable development will have to change. Thus, UPM endeavors to raise awareness on sustainable development by addressing these formidable challenges:

a) Effectively institutionalizing sustainability thinking; the majority of campus representatives are well versed in the concept of sustainable development, but less familiar with the concept of a sustainable university. Therefore, the test of success of a sustainable university has to be how a university contributes to building human, natural and also social capital. It is important to highlight another aspect of sustainability which meets the various expectations written in the SDG.

b) Sustainability is widely perceived to be the domain of environmental cluster lecturers and while many academics are aware that sustainability has some role to play in their teaching, some of them view that role in quite limiting ways.

c) Related to the above, another challenge would be to move beyond the realm of environmental cluster to a more central position in university administration. An effort for this would be to engage boards of directors in supporting the campus sustainability agenda. While academia have a reasonably common conceptualization of sustainable development and what constitutes a “sustainable university”, the level of sustainability knowledge among the stakeholders within the university and their understanding on the role of university in creating a sustainable future are unknown. This would also mean allocating a budget model for any sustainability initiatives.

d) On the one hand, participation in UI Green Metric Index or any sustainability ranking, establishment of a green mandate, taking part in sustainable forums, while on the other hand the application of sustainable development for concrete focus sector is weak, if not insufficient, would attest to the discontinuity of transmission between declarations and actions.

e) We believe sustainability in higher education should not be dominated by practical ‘greening the campus’ programs and initiatives only. Sustainable university should seek institutional transformation in strategic and systematic ways. A national networking of sustainability consisting of academicians as well as students is the way forward.

f) One of the challenges is to develop an efficient, flexible system of in-house sustainability benchmarks due to varying degree of job scope and specialization among campus community. We have proposed ‘Anugerah Penarafan Bintang Pengurusan Pentadbiran’ with a sub component of sustainability’ as a flexible and robust benchmarking that is needed to sustain interest of users in UPM.



## **Results and Impacts**

The most prominent impact from sustainability initiatives namely energy saving measure was saving in electricity bills. We noted the most significant constraints to moving toward sustainability are financial predicaments, lack of understanding and awareness of sustainability issues amongst the university population and a resistance to change.

In relation to sustainability index, the latest index known as MyHijau University Index (MHUI) is now been proposed by Malaysian Green Technology Corporation which consist of Building Consumption Input System (BCiS) in support of universities seeking to adopt their sustainability rating scheme for new and existing buildings. MyHijau is part of Low Carbon City Framework (LCCF) which is quite similar to MyCrest established by our Public Works Department. The BCiS is an online input database system for the purpose of data collection and monitoring the energy and water consumption of buildings and would help universities in ensuring efficient usage of energy. This development shows that more agencies are contributing towards sustainability in Malaysia. However, we believe closer engagements with stakeholders are needed to ensure no duplicating of efforts while we are heading towards the same direction of UN SDG.

## **Conclusion**

UPM success in being ranked first in the country for nine consecutive years under UI GreenMetric is the result of team effort with dedicated person in charge in every entity tasked with these initiatives. UPM recognizes that higher education institutions can do more to help in the transition to a low-carbon future by adopting sustainability initiatives which would help reduce operating costs and facilitate healthier and more productive working environment. Evident shows that there continues to be no one-size-fits-all approach for universities to become more sustainable. Since sustainable solutions require inter-disciplinarily, continuous engagement between universities, government and industries are needed to avoid duplicating works and to pool resource of research in this multi-disciplinary topic and diverse people for the betterment of Malaysia and the world.

# Nurturing Virtue Ethics For Value Driven Sustainable Development Initiatives

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### **Abstract**

Sustainability and Serenity Hub, Universiti Sains Islam Malaysia (USIM) was established in January 2019. Its primary role is to coordinate all sustainable development initiatives led by academicians, administrators and students of the university. A roundtable discussion organized in March 2019 gathered researchers, green activists and volunteers from the university. The outcome was the mapping of current existing activities with the Sustainable Development Goal (SDG) and the well-being of the community from the principles of Syariah. SDG 4 and SDG11 were found to be the main cluster of current initiatives concentrating mainly on the education for Indigenous People, Special Needs community, sustainable kampung concept, happy city and Green Campus programs such as edible garden, therapeutic garden, mini fruit orchard for the planting tree campaign. This paper discusses some of the core initiatives being encouraged through the nurturing of intrinsic values of wisdom and justice. These values are based on Attasian concept of virtue ethics that drives the inner force of voluntarism. The value-driven approach for promoting sustainable development and community wellbeing gives an inner drive and sustainable motivation. The psychological conscious awareness of the good values of SDG in line with virtue ethics concept need to be awakened to encourage psychomotor self-regulation and individual good practices that will lead to emergent collective societal shared common values, responsibilities and conducts.

**Keywords:** community well being, virtue ethics, sustainable communities, voluntarism, value-driven sustainable development.

**Focus Area:** SDG 11 Sustainable Cities and Communities



## Introduction

Sustainable development initiatives have been an agenda put forth in USIM 2016-2015 Strategic Planning where USIM Green and Sustainable Campus is one of the strategic thrusts. This indicates the management commitment for the 2030 Agenda for Sustainable Development. Diverse efforts from the three main components which are academicians, administrators and students grew but mostly operating in silos. General policy on green and sustainable campus has not been drafted as the roadmap for all initiatives in USIM. Thus, reporting on sustainable development agenda is difficult due to the distributed and fragmented nature of the current approaches. Besides that, even though, there exist regulation on promoting the Reuse, Reduce and Recycle (3R) campaign, it was not well accepted in terms of practice which requires a change of habits. In sustainable development initiatives, creating an impactful awareness in people is the important element that can lead to actions driven internally rather than just through enforcement of regulations.

Sustainability and Serenity Hub was formed in January 2019 to resolve such matters. Its main functions are to become the centralized reporting unit for the SDG outcome, coordinating and monitoring the initiatives and eventually to draft the Blueprint of USIM Green and Sustainable Campus. This is in line with the mapping of the SDGs to the Eleventh Malaysia Plan strategic thrusts in the Mid Term Review of 11th Malaysia Plan 2016-2020 (Malaysia, 2018).



**Figure 1** The Mapping of the SDGs to the Eleventh Malaysia Plan strategic thrusts (Malaysia, 2018)

In March 2019, a Sustainable Development Initiatives Roundtable Discussion was organized to gather all the stakeholders to share their efforts, programs, initiatives and discussed issues, challenges and possible future directions towards USIM Green and Sustainable Campus agenda. One of the key discussion is the underlying foundation for USIM Green and Sustainable Campus being itself an Islamic University. Thus, a community well-being framework is based on principles of Syariah (Maqasid Syariah) that emphasized on the attainment of good, welfare, advantage, benefits and warding off evil, injury, loss of the creatures (Khan & Ghifari, 1985). The community well-being is classified by the level of necessity which encompasses of preservation of belief, life, lineage, intellectual and property (Khalid et al., 2015). The framework was mapped to the SDGs as shown in Figure 2 (Abdul Rahman, 2019).



**Figure 2** Mapping of Maqasid Syariah to SDGs

One of the successful initiatives was the Edible Garden and Mini Fruit Orchard projects initiated by the Facility Development and Management Department, USIM. Edible Garden is a garden that uses 'edible plants' concept known as a vegetable garden or fruit, red chilli, citrus, lady fingers, tomatoes, flower cabbage includes turmeric as shown in Figure 3. The success factor was attributed not only to the management commitment and support but mainly the voluntarism spirit of the administrative staffs stems from a deep passion and high sense of responsibility. They willingly spend their time after office hours or come earlier in the morning. The best practice shared in this article becomes the inspiration of the value-driven sustainable development encouraged by virtue ethics that gives the deep meaning to a person's outlook of life that influences the way a person does things.





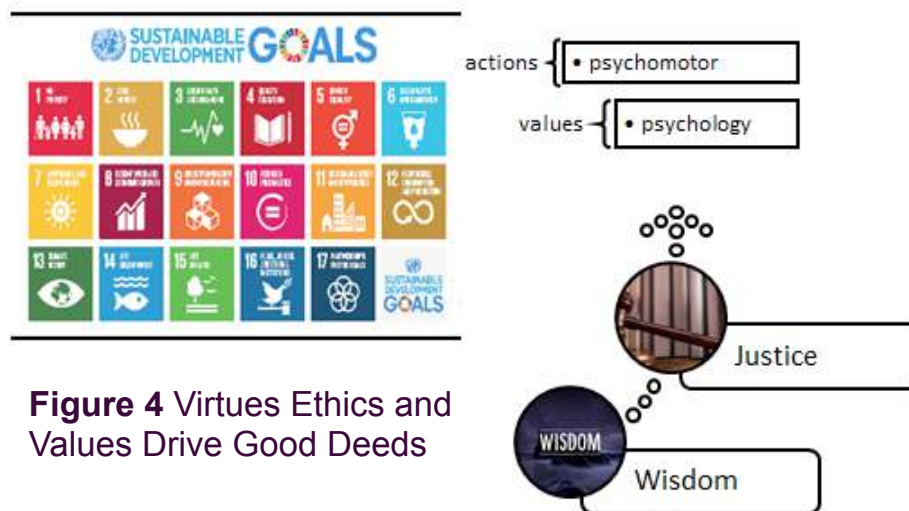
**Figure 3** USIM Edible Garden, Agrofarm and Mini Fruit Orchard

In the Aristotle theory of ethics, the concept of virtue ethics emphasizes character traits that emphasize on four cardinal virtues: wisdom, justice, courage and temperance. Al-Attas (2015) deliberated in his book *On Justice and The Nature of Man* that the true foundation of ethics is wisdom and justice where courage and temperance are subsumed under it. Some maintain justice inherent in nature itself while others believe it stems from God's will. According to Al-Attas (2015),

*"Wisdom is the knowledge given by God that enables the recipient to know the right place or to render correct judgment as to the right place of a thing or an object of knowledge. Justice is the condition whereby things or objects of knowledge are in their right places"*

Value of a rational being is wisdom either theoretically or in practicality (Kania, 2017). Based on this premise, value-driven sustainable development is the inner drive that harnessed wisdom and justice. The SDG could be achieved through an educational approach that builds the virtue ethics that promote the good life, happiness, flourishing and life lived well. The value-driven motivation will produce actions related to being sustainable that will appreciate the benefits of the conduct to oneself. For example, the 3R campaign probably lacks good success due to the understanding that it will only benefit others thus will not go into the trouble of collecting recycle materials. So the focus of the campaign will not only highlight the benefit to the environment but what spiritual values or moral indicators that we are practising with a simple act such as switching the lights off, reducing the amount of water and food wastage or even planting trees that give a deeper meaning and inner commitment to those acts. As a Muslim for example, it is part of the belief that wastage is prohibited and a small act such as those that is considered as good deeds, makes you a good person which

will be rewarded accordingly later in the Hereafter. Strengthening this belief has resulted in an interesting outcome in terms of sustaining good behaviour and should be encouraged even more as depicted in Figure 4. Collectively, emergent behaviour of the community will give an impact through shared a vision model based on the value of giving and saving the planet to the person and the community that give the spill over effects to the environment. The commitment is much more permanent through the self regulating principles.



**Figure 4** Virtues Ethics and Values Drive Good Deeds

On the other hand, eco-challenge events were organized that involves USIM students in the form of Green Explorace. Participants will move in a team from one checkpoint to another where green activities such as gardening, planting, seedling, plogging which is a combination of jogging with picking up litter will be carried out. Response from participants was very encouraging. They have the chance to learn about gardening, walk around the campus and appreciate the environment and it is a stress reliever doing the gardening. The sense of commitment to the trees that were planted, seeing them grow gives a sense of fulfilment that they have done something beneficial and useful to the environment. Every second through the oxygen was emitted.

This good sense is also obvious when the Students Council Representative requested to collaborate on the next event called Lestari Run. The run involves around 1000 students during the orientation week of Tamhidi Centre for the new enrolment of pre-university programs. Similar activities will be carried out with wider space around campus, more trees including that involving landscaping.

At Save Our Rainforest Race (SORR) on 30th March 2019 organized by Pertubuhan Pelindung Khazanah Alam Malaysia (PEKA), 120 students voluntarily participated in four buses that travelled to Melaka to join the challenge. This is a promising beginning and a good indicator that the youth can be motivated and inspired by nurturing the good values and creating a sense of responsibility to protect nature. They will be leaders of the future generations inculcating with green and sustainable development awareness.



Besides the effort, one of the challenges is the maintenance of the gardens especially during the semester break when students are not around the campus. Thus, we are setting a smart edible garden concept by the installation of IOT based control system to assist in managing the plant especially daily watering. A humidity sensor will be used to collect the data of the soil that can be monitored with smartphone apps through a cloud server. The integration with technology will help us to efficiently manage the garden through the Internet and can benefit the data analytics from sensors function as double loop feedback for the benefit of the growth of the plant. A model of this smart IoT based edible garden integrates with rain harvesting is currently in the process of setting up at Mizan Park, USIM, the living lab for sustainable development initiatives related to SDG11. We also collaborate with a company that produces electric scooter and electric food truck to promote a clean vehicle concept based on green technology to the campus as shown on the photos below.



## Conclusion

It has been about 6 months since the hub was initiated. Year 2019 is the year we plan to focus on creating awareness with campaigns such as OASIS project to reduce plastic bottles, initial work on Green Campus, strengthening community engagement programs that have long been a tradition among students and staff, food bank programs such as Free Food, Foodbank Siswa, Souq Hurrah program and free market with the local NGOs. These campaigns highlighted the benefits of this act in terms of spiritual aspect as well as social and environmental aspects such as the amount of oxygen we can contribute to the environment, every tree we plant which is a living thing will give the spiritual satisfaction of the human soul and make us good people not only to humans but also to the planet. Everything we do motivated by nurturing our virtue ethics

leads to value-driven sustainable development. It makes everybody happy including the Creator whom will be very pleased. Educating on the values of the SDGs is much more fulfilling rather than just regulations without moral and ethically conscious minds which exert the actions with full sense of responsibility.

### **Acknowledgement**

We would like to thank the committee members of the Sustainable Development Initiative in USIM Dialogue 2019, Landscape Unit, Facility Development and Management Department, USIM and Agrosiswa Students Club for their cooperation and commitment to share this vision of a greener environment and working together to save the planet.

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# Universiti Teknikal Malaysia Melaka (UTeM) Practices Towards Sustainable Energy Management

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## Abstract

**Purpose** – The paper is intended to highlight the energy management system at the university in providing a sustainable and efficient energy practices.

**Design/methodology/approach** – The sustainable energy management system (SEMS) consists an energy policy, energy management committee and energy cost centers, which provide awareness activities, technical training and implementation of the energy policy.

**Findings** – A sustainable approach enables the university to reduce its energy consumption, save money on utilities and lower the carbon emission to the environment.

**Research limitations/implications** – SEMS requires top management support and commitment, which is important in the implementation of energy policy.

**Practical implications** – The sustainable energy management system can be replicated at other universities with regulated setup supported by the top management.

**Social implications** – The attitude among the university staff and students towards energy conservation and energy efficiency could be changed with continuous awareness activities.

**Originality/value** – SEMS does not only highlight the technical side of the system but also how human behavior adapts to changes with persistent reminders of energy policy.

**Keywords:** Sustainable Energy Management, Energy Efficiency, Energy Policy, Energy Conservation

**Focus Area:** SDG 12 - Responsible Consumption and Production

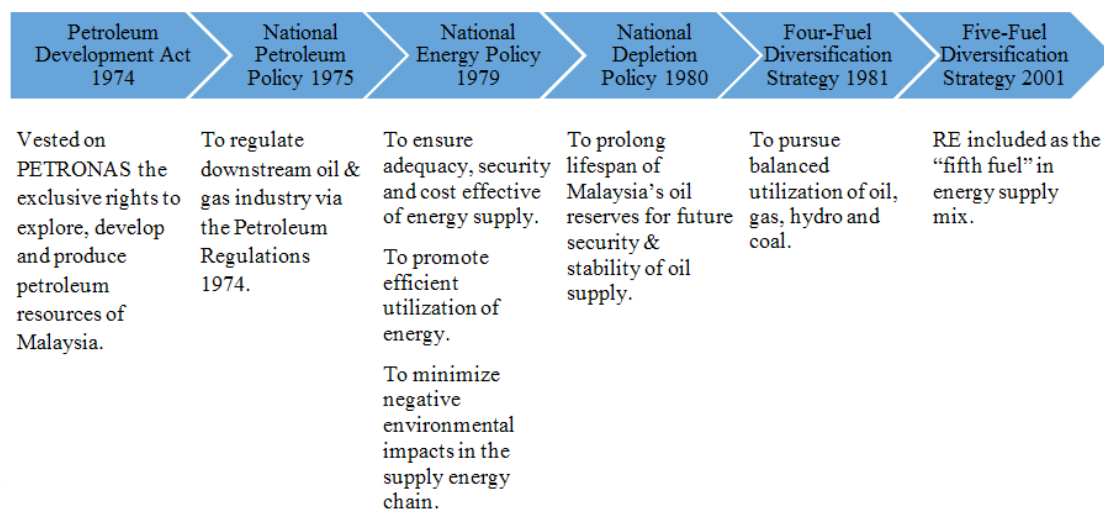
## Introduction

It is best to review the activities and policies undertaken by the government to ensure sustainable energy management practices are taking place nationally, then to focus on the background of the implementation of energy policy at Universiti Teknikal Malaysia Melaka (UTeM) and how the university has managed to utilize this national energy management scheme.

### a. Malaysia Energy Scenario

Since the first industrial revolution, mankind is used to energy related activities. Energy, in terms of electricity and fuel, could be used for transportation, domestic and industrial use. Currently, main sources of energy are from non-renewable resources; coal, oil and natural gas [WER]. These resources are depleting and getting scarce. Furthermore, the use of these hydrocarbon resources is harming the environment with the emission of green-house gasses. Thus, the energy-related policy is needed to ensure the availability, affordability and security of the resources while protecting the environment.

Malaysia first embarked on the energy-related policy when Petroleum Development Act 1974 was established. In 1979, National Energy Policy 1979 (NEP) was developed in order to regulate downstream oil & gas, and petrochemical industries in Malaysia. NEP has three objectives: to secure the supply of energy at effective cost, to promote the efficient utilization of energy, and to protect the environment by minimizing the negative impacts of energy production, transportation, conversion, utilization and consumption. A complete picture of derivation of the energy policy until 2001 is as shown in Figure 1.



**Figure 1** Development of energy policy in Malaysia

In 2009, National Green Technology Policy was launched with the aim to utilize green technology as a driver to accelerate the national economy and promote sustainable development. During the 2009 United Nation Climate Change Conference in Copenhagen, Malaysia committed to reduce its carbon emission intensity of its Gross Domestic Products (GDP) by 40% by 2020, compared to its 2005 levels [DOE]. Under Paris Agreement (PA), this is committing to reduce Greenhouse Gas (GHG) emissions by 45% by 2030 in relation to our 2005 GDP.



National Energy Action Plan (NEEAP) 2016 – 2025 was introduced to promote efficient use of energy, strengthen institutional framework and establish sustainable funding mechanisms towards implementation of energy efficiency initiatives, as well to promote private sector investment in energy efficiency initiatives. This commitment, together with objectives of each policy and act is achievable if each energy user in Malaysia is aware and contributes towards conservation and energy-efficient activities/program, governed by a systematic system known as Sustainable Energy Management (SEM).

Under the Eleventh Malaysia Plan initiative (2016-2020), Sustainable Energy Development Authority (SEDA) has embarked on several Energy Efficiency projects. One of them is on Energy Audit Conditional Grant for commercial building. Another is a voluntary program, Sustainable Low Carbon Building Assessment (Under the Low Carbon Building Facilitation Program). Both programs are introduced to create awareness and initiative by building owners to acknowledge how much energy their buildings use and whether the buildings are energy efficient. The programs are also aimed to make sure that the building owners commit and invest on energy efficiency projects.

#### b. UTeM Energy Scenario

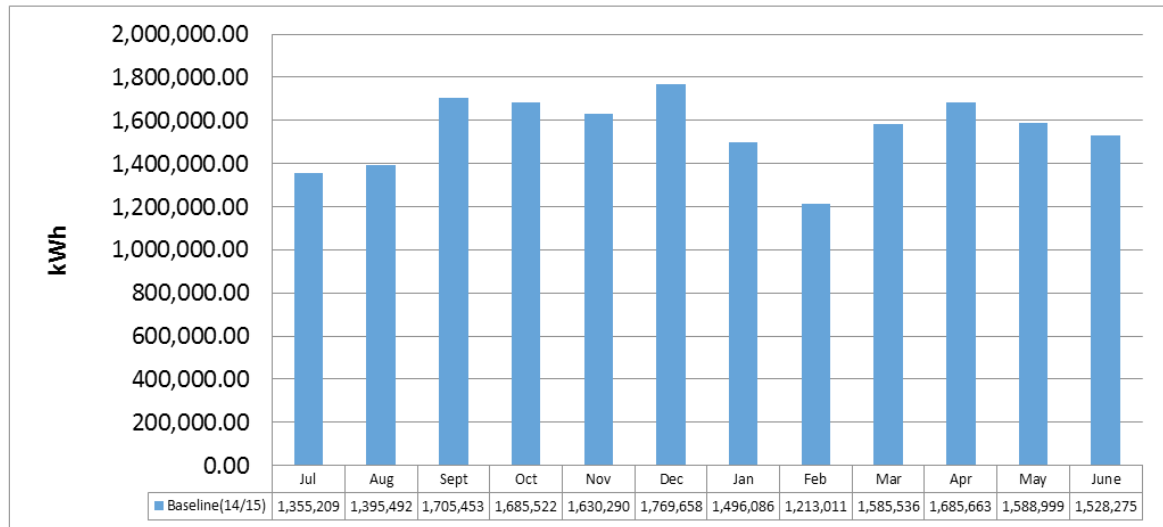
In UTeM, the implementation of SEM has started since July 2015. The main reasons of this implementation are due to university's financial sustainability in the future, and the Efficient Management of Electrical Energy Regulations 2008 (EMEER 2008). The university is affected under this regulation due to the electrical consumption that exceeded 3,000,000 kWh for six consecutive months. UTeM has adopted these requirements in its university curriculum to provide awareness among students and staff in at least four categories of United Nation's Sustainable Development Goals, as shown in Figure 2 [UNDP]; namely quality education, affordable and clean energy, responsible consumption and production and climate change.



**Figure 2** Sustainable Development Goals by United Nation [UNDP]

In general, the electrical energy cost of UTeM was in the increase pattern, started from its establishment in 2000 to June 2015. In addition to limited financial support from the Malaysian government, the university has committed to manage its energy consumption in order to ensure that energy is efficiently used, and the saving, best practices and innovation can be continuously sustained. It is achieved through implementation of SEM. It is expected that implementation of structured SEM will then contributes to the reduction of energy cost.

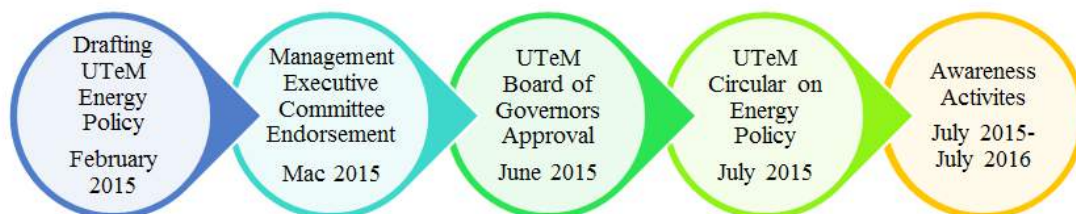
Figure 3 shows the electrical energy consumption of main campus before the implementation of SEM from July 2014 to June 2015. During this period, the total electrical energy consumption was 18,639,195.96 kWh with average of 1,553,266.33 kWh per month. This consumption led to building energy index (BEI) of 221.71 kWh/m<sup>2</sup>·year. This BEI is slightly lower than the average commercial building at 250 kWh/m<sup>2</sup>·year [Roy et al., 2005].



**Figure 3** Electrical energy consumption for main campus from July 2014 to June 2015 (before implementation of SEM)

## Methodology

The first of step of SEM at UTeM is the establishment of the temporary energy committee to draft UTeM Energy Policy for the approval of Management Executive Committee and University Board of Governors. The energy policy was drafted in February, approved in June and implemented in July 2015. Figure 4 shows the initial activities undertaken between February 2015 until June 2016. One of the important aspects of this policy is the appointment of full time Energy Manager at UTeM to fulfill the requirement of EMEER 2008.

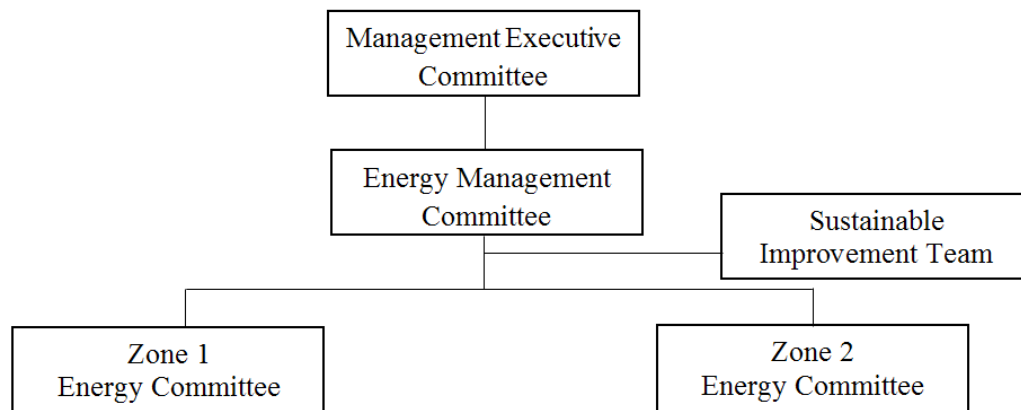


**Figure 4** The First Year Process of SEM

The second step is the establishment of energy committee of various levels to oversee and monitor the implementation of the university energy policy, as shown in Figure 5. The main committee, UTeM Energy Management Committee, is required to plan activities to ensure university staff and students are aware of the importance of using energy efficiently and the actions to be taken to fulfill the needs. The main committee, with the advice of Energy Manager, will report to Management Executive Committee at least twice a year, mainly on the EMEER report, which needs to be submitted to the Energy Commission every six months.



The sub-committee at each department is required to record monthly details of equipment and energy related activities. Sustainable Improvement Team (SIT) will suggest plans to be employed for the process and equipment to be upgraded to increase the efficiency of the system.



**Figure 5** Energy Management Committee

The third step is to prepare a roadmap for SEM at UTeM. In order to have a sustainable system, SEM needs to be endorsed by a certified body. UTeM adopted Energy Management Gold Standard (EMGS) set by ASEAN Energy Management Scheme (AEMAS), Figure 6.



**Figure 6** AEMAS Energy Management Gold Standard [EMGS]



The fourth step is to do internal audit before the adoption of SEM in order for it to be compared after its implementation. Achievements on Energy Policy, Energy Team, Motivation, Marketing and Investment are evaluated for the university and each department. The initial Energy Management Matrix (EMM) for the university is as shown in Figure 7.

Level	Energy Policy	Energy Team	Motivation	Information System	Marketing	Investment
4	Energy policy, action plan and regular review, have commitment of top management as part of an environmental strategy	Energy management has been fully integrated into management structure. Clear delegation of responsibility for energy consumption.	Formal and informal channels of communication regularly exploited by energy manager and energy staff at all levels.	Comprehensive system sets targets, monitors consumption, identified faults, quantifies savings and provides budget tracking	Marketing the value of energy efficiency and the performance of energy management both within and outside the organization	Positive discrimination in favor of "green" schemes with detailed investment appraisal of all new build and refurbishment opportunities
3	Formal energy policy, but no active commitment from top management	Energy manager accountable to energy committee representing all users, chaired by a member of the managing board	Energy committee used as main channel together with direct contact with major users	M&T reports for individual premises based on sub-metering, but savings not reported effectively to users	Programme of staff awareness and regular publicity campaigns	Same payback criteria employed as for all other investment
2	Unadopted energy policy set by energy manager or senior department manager	Energy manager in post, reporting to ad-hoc committee, but line management and authority are unclear	Contact with major users through ad-hoc committee chaired by senior department manager	Monitoring and targeting reports based on supply meter data, Energy unit has ad-hoc involvement in budget setting	Some ad-hoc staff awareness training	Investment using short term payback criteria only
1	An unwritten set of guidelines	Energy management is the part-time responsibility of someone with only limited authority or influence	Informal contacts between engineer and a few users	Cost reporting based on invoice data. Engineer complies reports for internal use within technical department	Informal contacts used to promote energy efficiency	Only low cost measures taken
0	No explicit policy	No energy management or any formal delegation of responsibility for energy consumption	No contact with users	No information system. No accounting for energy consumption	No promotion of energy efficiency	No investment in increasing energy efficiency in premises

**Figure 7** UTeM Energy Management Matrix before SEM [EMGS 2 STAR Report]

## Results and Discussions

Several new developments have occurred after the energy consumption baseline was set for July 2014 to Jun 2015. First, the electricity bill of one of the buildings in campus, which initially billed separately, was added to the main bill since January 2016. Second, a new hostel complex was included in the current main electricity bill since September 2017. Third, due to the development of the new hostel, a new sewage pumping system was built. The amount of power usage for this pumping system increased tremendously. However, the billing for the sewage system was done separately.



It is suggested that a new adjusted baseline is required in order to compare the annual energy consumption. Therefore, the new baseline is to include extra building bill but disregard the bills for sewage system and the new hostel. The new baseline is as shown in Figure 8.

#### **a. Energy Consumption: kWh, Emission and BEI Reduction**

Based on the adjusted annual baseline consumption in Figures 8 and 9, annual reduction of energy consumption is tabulated in Table 1. A total 8,189,272 kWh was saved, which accounted close to RM 3 million of utility cost reduced based on tariff of RM0.365 per kWh.

In terms of carbon emission, the baseline year produced 13,116 metric tons of Carbon Dioxide Equivalent (CDE). Year 1, 2 and 3 produces 11,845, 10,719 and 10,992 metric tons CDE respectively. This accounted for total emission reduction of 5,792 metric tons CDE from reduction of 1,271 (Year 1) 2,397 (Year 2) and 2,124 (Year 3).

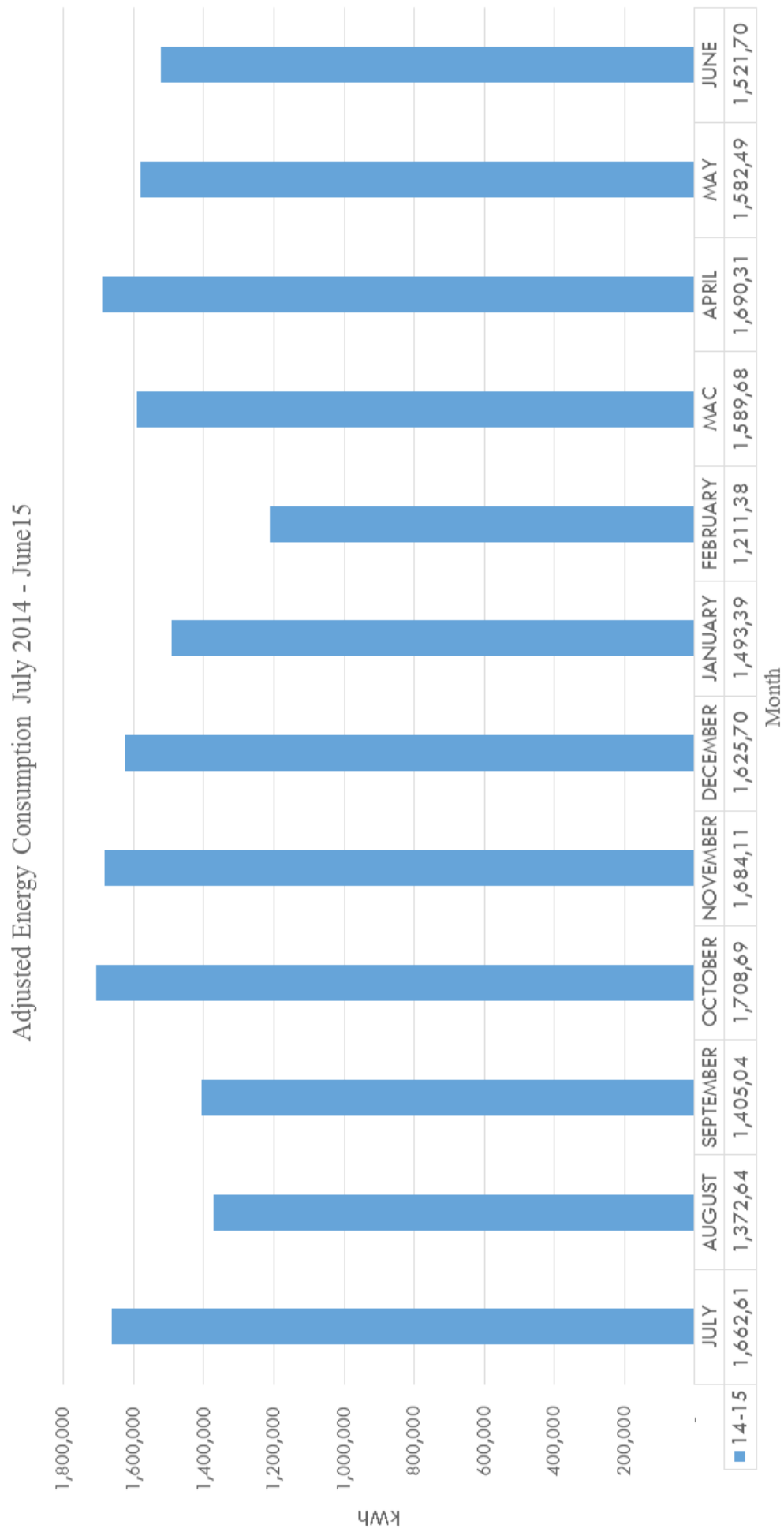
Reduction of energy consumption resulted in the reduction of BEI for Year 1, 2, 3. A total of 40 points reduction can be considered based on the best annual consumption to date, that is Year 2. A slight increase in Year 3 could be the effect of extra usage of facilities for students staying inside the new campus accommodation.

**Table 1**

Total Annual Saving, Emission and BEI Reduction

Year	kWh	Annual Saving	Emission Reduction	BEI
Baseline	18,547,798	-	-	221.71
Year 1	16,750,885	1,796,913	1,271	199.93
Year 2	15,157,945	3,389,853	2,397	180.92
Year 3	15,545,292	3,002,506	2,124	185.54
<b>Total Reduction</b>		<b>8,189,272 kWh</b>	<b>5,792 Metric Tonne CO2</b>	<b>40.79</b>
		<b>RM 2,989,084.28</b>		

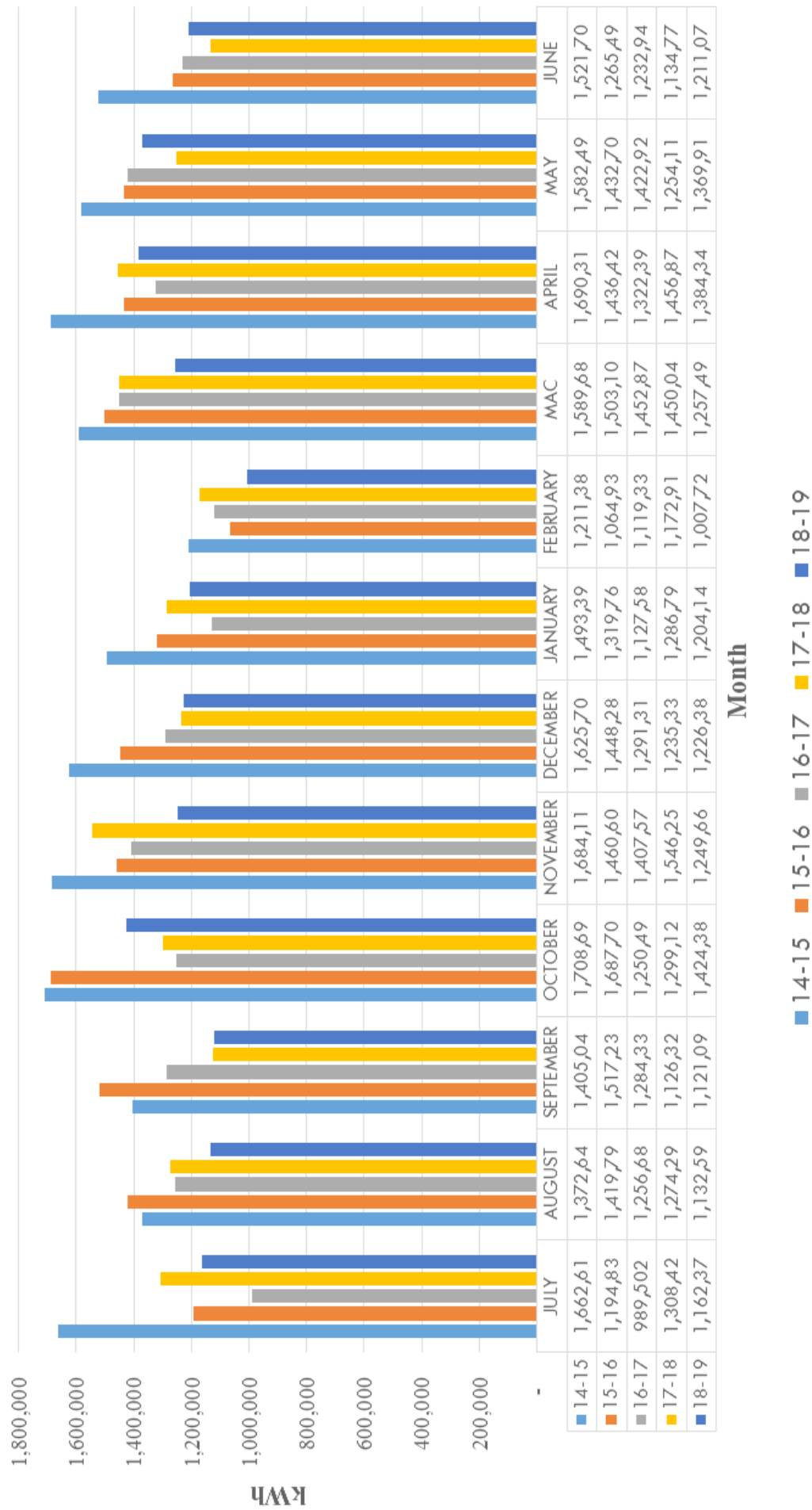
Year 4 data shows more promises of further reduction of energy consumption. The total energy consumption for the 10 months was only at 12,170,198 kWh. Consumption in May and June can be expected to be around 2.8 million kWh, which could bring the total for Year 4 at 14.8 million kWh. Saving for Year 4 is expected to be around 3.7 million kWh, which amount to another RM 1.3 million saving on utility cost, reduction of 2,600 metric tons CDE and about 45 points reduction of BEI to 177.



**Figure 8 Adjusted Baseline**



## ENERGY CONSUMPTION AFTER SEM



**Figure 9** Annual Energy Consumption

## b. Energy Management Matrix

The EMM has increased significantly compared to the initial EMM before the implementation of SEM. The points for each category of EMM ranging from mid-2 to mid-3, which bring the average around 3.

Level	Energy Policy	Energy Team	Motivation	Information System	Marketing	Investment
4	Energy policy, action plan and regular review, have commitment of top management as part of an environmental strategy	Energy management has been fully integrated into management structure. Clear delegation of responsibility for energy consumption.	Formal and informal channels of communication regularly exploited by energy manager and energy staff at all levels.	Comprehensive system sets targets, monitors consumption, identified faults, quantifies savings and provides budget tracking	Marketing the value of energy efficiency and the performance of energy management both within and outside the organization	Positive discrimination in favor of "green" schemes with detailed investment appraisal of all new build and refurbishment opportunities
3	Formal energy policy, but no active commitment from top management	Energy manager accountable to energy committee representing all users, chaired by a member of the managing board	Energy committee used as main channel together with direct contact with major users	M&T reports for individual premises based on sub-metering, but savings not reported effectively to users	Programme of staff awareness and regular publicity campaigns	Same payback criteria employed as for all other investment
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**Figure 10 UTeM Energy Management Matrix after SEM**  
[EMGS 2 STAR Report]

## c. Training & Awareness Program

The Energy Management Committee has planned several technical courses for staff, students and general public, namely Energy Audit Training Course, Energy Manager Training Course and Fundamentals of Energy Management. Energy Awareness talks are part of the annual activities given to each department at the university. Each new semester, these awareness talks are also given to students who live in the campus' accommodation. A specially arranged talk for top management of the university is also organized. The university has managed to train 27 Certified Energy Managers (CEM) and 7 Registered Electrical Energy Managers (REEM).

## d. Award

UTeM's SEM has been recognized by AEMAS to have 1 STAR in 2016. In late 2018, UTeM had applied 2 STAR recognition and currently, UTeM is in the process of closing 12 Opportunity for Improvement (OFI) in the coming months. The target is to reach the 3 STAR Gold Standard in two years' time.



The university has applied and secured two buildings, namely Chancellery and Library, for Audit Grant from SEDA. Both buildings have the potential to increase their energy efficiency based on the findings by Hafiz et al. (2018a, 2018b). Based on their potentials, the Library and Faculty of Information and Communication Technology buildings are voluntarily applied for the SEDA's Sustainable Low Carbon Building Assessment. Both buildings are recognized for their energy efficient scheme. Compared against their baseline year data (2014-2015), the Library was awarded Two Diamond while Faculty of Information and Communication Technology fared much better being awarded Four Diamond for its energy consumption reduction.

UTeM also won at the Melaka State Green Award. The energy reduction initiative contributed for the 2016 Green Practice Award under Higher Institution category.

### **Conclusion & Future Works**

UTeM's SEM is slightly different from other institutions' approach. While most institutions' SEM approach is top-down instruction, UTeM's is based on bottom-up approach with the support of the top management. Currently, the SEM is organized by the Centre for Sustainability and Environment (CSE) at the university.

SEM requires continuous activities on energy conservation and energy efficiency. History shows that without proper planning and action plans, previous achievements would count for nothing as slacking behavior and attitude would contribute to waste of energy. Year 1 data, which involved no-cost and low-cost efforts, shows that by changing human behavior and mindset, reduction of energy consumption can be achieved. UTeM's SEM has contributed to energy saving, cutting the utility cost, reduction of emission of green-house gasses, and thus saving the environment.

Future works include the implementation of internet-of-things (IoT) in data reading and collection at each department sub-meter level. Currently, the sub-meters are analog and needs to be read manually. However, the meters are read on working days and not on exact day at end of the month. The use of IoT system is to ensure that each department knows its portion of the university's electricity bill and plan accordingly on ways to reduce its energy consumption.

Hopefully this SEM approach can be replicated at other institutions of higher learning, which consume a large amount of energy, so that the utility bills can be reduced. By reducing the electricity consumption, Malaysia could save the environment and decrease the effect of foreign exchange rate due to the usage of coal in electricity generation.

### **Acknowledgement**

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# The School of Humanities, Universiti Sains Malaysia Water Saving Project: A Water Saving Best Management Practice for Universities

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## **Abstract**

Water is a serious current problem that occurs world-wide that cannot be solved by the governments alone. Engagement of all stakeholders is vital in addressing water problems. Universities are like small towns with dense populations and are large water consumers. The role of universities has also evolved from solely academic to a more holistic one encompassing social, economic and environmental responsibilities to help achieve Sustainable Development Goals (SDGs). Universiti Sains Malaysia (USM), one of Penang State's largest water consumers, needs to control and reduce its water usage. Water consumption is high in USM because only the USM administration pays for the water and not the staff, students or visitors. They have poor awareness and apathy on water which has resulted in a lot of water wastage leading to huge water bills. The School of Humanities (SOH) in USM is taking the lead to reduce water consumption via its demonstration project on water saving with the support from all stakeholders in the campus. The main objective of the project is to control and reduce water usage. The methodology includes addressing the hardware (water fittings) and software (humans) parts. Addressing the hardware includes installing a rainfall harvesting system as an alternative water source, changing conventional/outdated water fittings that use a lot of water are to water-friendly fittings, and plugging all the leaks in the water system. The harvested rainwater is used for general washing, toilet flushing, gardening and car washing. Addressing the software includes creating water awareness and providing water education, changing human behaviour in water use practices and sensitizing staff, students and visitors on water use. Results of the project showed that water use can be reduced by half resulting in significant water saving. This also contributed to USM's aim of being a sustainability-led university. The project also enhanced water awareness and increased commitment of staff, students and visitors on water conservation. Overall, the project showed that the water consumption amount in USM can be controlled to a level that can benchmark USM as a "Water Responsible" and Sustainability-led university.

**Keywords:** Water Conservation, Water Saving Devices, Rainfall Harvesting, Water Awareness, Universiti Sains Malaysia

## Introduction

The Global Water Institute warned the world in 2013 that 700 million people worldwide could be displaced by intense water scarcity by 2030 (Hameeteman, 2013). It was subsequently reported that around 4 billion people, representing nearly two-thirds of the world population, experience severe water scarcity during at least one month of the year (Mekonnen and Hoekstra, 2016). Groundwater sources are also experiencing severe stress as more than a third of the world's largest groundwater sources are already in distress (Richey et. al., 2016). The United Nations then reported in 2018 that over 2 billion people live in countries experiencing high water stress (<http://www.unwater.org/water-facts/scarcity/> Accessed 29 May 2019). The most alarming scenario is the fact that global climate change is expected to exacerbate global water problems, which by 2030, water scarcity in many arid and semi-arid countries will displace up to 700 million people (UNESCO, 2009). Water scarcity affects every facet of life and is considered one of the most critical issues confronting humanity in the 21st century. Amongst the countries facing water problems, Malaysia suffers from periodic dry spells, chronic water pollution, degradation and destruction of water catchments, seasonal floods and many other unresolved water issues. This is despite the fact that Malaysia is a country endowed with abundant rainfall. Mismanagement and wastage, along with public apathy have exacerbated water problems, moving the country from one of relative abundance to one that is affected by water scarcity in terms of space and time (Chan, 2012a). The most alarming fact is that most Malaysians feel that water management is the sole responsibility of either the government or the water service provider (private sector), without realizing that water consumers can have a huge impact on water resources. Water consumers, especially the large ones such as businesses, factories, hotels, universities and schools consume a huge amount of water and can exert enormous pressures on the water supply system. It is therefore necessary to engage all stakeholders involved in water resources supply and demand to ensure that water resources can be sustained. Water service providers need to ensure effective water supply, and at the same time, water consumers need to save water and use it wisely. In most developed countries, water supply and water demand require the engagement of all stakeholders where everyone is involved. Furthermore, when water resources are dwindling due to climate change and other causes, water service providers and water consumers need a change of mindset from consumptive wastage to wise use of water (Bhattacharyya et. al., 2015).

A university has dense population (often in the tenths of thousands), dense built-up properties (often hundreds of buildings) and dense infrastructures (roads, gardens, piping networks, water fittings). A large university therefore consumes a lot of water ([https://www.colorado.edu/center/sites/default/files/attached-files/campus\\_water\\_use.pdf](https://www.colorado.edu/center/sites/default/files/attached-files/campus_water_use.pdf) Accessed 31 May 2019). In the 21st century, a university's role has also evolved from solely academic to being more socially responsible that benefits local communities. Universities have also taken on the role of becoming more environmentally-friendly and sustainable (International Sustainable Campus Network, 2014). For example, Georgetown University (USA)'s Regents Hall science building received LEED Gold Certification for its green design and operations from the U.S. Green Building Council. The building is built on a large green space with a green space rooftop, both of which reduce runoff.



The building has sustainability features via its integrated water management system with a 20,000-gallon (75,708 litres) rainwater harvesting cistern built under the building. The rainwater harvested is used for irrigation and flushing. The combination of water reclamation and water efficiency strategies allows the building to reduce water consumption by 87 percent (<https://sustainability.georgetown.edu/water/conservation> Accessed 31 May 2019). Elsewhere, as part of its sustainability plan, the University of Chicago aims to reduce the campus' consumption of potable water via implementing a variety of water conservation strategies such as smart irrigation systems, using harvested rainfall, running water saving campaigns and others. In 2015, the university installed a system of automated controls and a 120,000-gallon (454,249 litres) stormwater storage vault for harvesting, retaining and discharging stormwater and water reuse. This system allows harvested water to be discharged when a storm is forecasted or freeing storage space to capture rainwater. When the storm is over, the tank retains the harvested rainwater for use in the campus ([https://sustainability.uchicago.edu/campus\\_initiatives/water\\_conservation/](https://sustainability.uchicago.edu/campus_initiatives/water_conservation/) Accessed 11 June 2019). Vanderbilt University has big plans to power its campus entirely through renewable energy as it commits to carbon neutrality by 2050 (<https://www.vanderbilt.edu/sustainability/our-goal/> Accessed 11 June 2019). The university also has implemented many water-saving features in all new facilities since 2007, including retrofitting over 500 bathroom water-saving fixtures producing annual savings of 10 million gallons (37.85 million litres) of water and saving US\$67,000 in the university's main campus. Since 2013, the university has made all non-residential urinals water-free and installed low flow and no touch faucets (sensor-operated). This reduces water use by controlling water flow and has health effects as it prohibits the spread of germs from touching the faucet handle. Low flow toilets have also been implemented, changing traditional toilet flushes of 3.5 to 5.5 gallons (13.2 to 20.8 litres) of water to Low flow toilets of 1.2 to 1.6 gallons (4.5 to 6.06 litres) per flush. Changing single flush toilets to dual-flush toilets has reduced water use as less water is used to flush liquid waste (0.8 gallons [3.03 litres] per flush) and for solid waste (1.3 to 1.6 gallons [4.92 to 6.60 litres] per flush). Non-potable groundwater is also collected from the utility tunnels and pumped to the cooling towers at the cogeneration power plant and used for irrigation on Vanderbilt's athletic fields. This alone reduces Vanderbilt's water bill by 50 million gallons (189.27 million litres) a year.

In a nutshell, universities certainly have a big role to play in terms of water management. In an era of environmental consciousness and sustainability, university staff and students are expected to be more sensitized towards environmental issues such as water conservation, water management and water education, like how they are sensitized about social/community and economic/financial issues towards achieving Sustainable Development Goals (SDGs). Academics and students have a unique opportunity to educate water users and empower them to conserve both in schools, and throughout the community. Whether one is a staff member or a student, there are many areas for promoting water conservation. For example, lecturers as teachers, the main point of contact for our younger generation, play a vital role in the sustainability of universities, especially in terms of clean water sustainability. Examples from many universities via many innovative water conservation projects, lecturers and researchers can make water conservation as part of the course syllabus that they teach and engage the youngsters early.

Lecturers can also promote water conservation in schools and universities by promptly reporting leaks or other forms of water waste to maintenance staff. Most importantly, maintenance staff who deal with water facilities such as plumbers and hydraulic engineers who are directly involved with water facility infrastructures, can play a crucial role in maximizing plumbing efficiency and minimizing plumbing problems. Besides fixing water leaks, these maintenance staff can periodically audit plumbing fixtures by thoroughly inspecting all such fixtures in the campus. Students make up the majority of the campus population and by virtue of their sheer large numbers, they are able to make a significant impact on water conservation in the campus. Students who are sensitized towards water conservation will make a significant contribution towards wise use of water. They also provide thousands of eyes in spotting water leakage, water wastage and water thefts. They can also serve as “water rangers” for water conservation both within the campus and with their families and the immediate outside university communities.

### **Universiti Sains Malaysia - A Water Sustainable University?**

Universiti Sains Malaysia (USM) has prided itself as a sustainability-led university and should lead by example (Dzulkifli Abdul Razak, 2010). Notwithstanding other aspects of sustainability that USM has achieved, the university's average water consumption is very high by any standards. In 2010, the USM main campus's water bill averaged MYR200,000 (MYR1= US\$0.327 as of 4 October 2012) per month or equivalent to about 200,000 m<sup>3</sup> of water consumed. This adds up to about MYR2.4 million per year or (at the average water tariff of MYR1/m<sup>3</sup> (1m<sup>3</sup>= 1000 liters), the amount of water used is about 2,400,000,000 liters in 2010. If we divide this by 20,000 people (main campus staff and students), the per capita water consumption is about 120,000 liters/capita/year or 329 liters/capita/day (lpd). In comparison, the United Nation's international recommended standard is 165 lpd, Penangites average is 286 lpd and Malaysia's national average is 220 lpd. It is important to note that the average industry benchmark for educational institutions is 144 lpd (Chan, 2013). This puts USM's usage of 329 lpd at 2.28 times above the industry's benchmark. With such enormous water usage, USM is a long way from becoming a sustainability-led university, at least in terms of water sustainability! This study identified that the main sources of water wastage in USM were as follows: (i) Timer Operated Urinals (these urinals flush every five minutes throughout the year, even during the three months between June to August when students are on vacation); (ii) Traditional Single Flush Cisterns (every flush uses 9 liters of water compared to 3 to 5 liters for water friendly cisterns); (iii) Manual Taps (often left leaking); Manual Showers (often left leaking); Leaking Taps/Pipes (not repaired on time); (iv) There is no Alternative Water Source such as Rainwater or Well/Groundwater (USM depends 100 % on publicly supplied piped water from the Penang Water Authority); (v) There is Human Apathy/Irresponsibility in terms of water uses in USM. This is because the staff, students and visitors do not pay for the water they use inside the campus. Only the university management pays for it. Hence, they do not pay attention to their water use. Hence, despite the fact that USM prides itself as a sustainability-led university (Koshy and Kamarulazizi Ibrahim, Undated), it is not really “water-friendly” and is far from achieving water sustainability. So, it is time for change. USM needs to install water savings fittings, replace water-wasting fittings with water-saving ones,



and educate its staff and students on the importance of water savings. This project is a first step towards that direction (Chan, 2012b; Chan, 2014).

Notwithstanding the USM case, almost all other institutions of higher learning in Malaysia are huge water consumers. The main reason is that only the administration pays for the water but not the staff, students or visitors. Hence, there is a lot of wastage resulting in huge water bills. Hence, it is imperative that such institutions embark on water demand management to reduce their water footprints via using green technology and changing consumers' behavior (Chan, 2012c). In USM, the School of Humanities (SOH) is taking the lead to reduce water consumption via a Best Management Practice (BMP) Demonstration Project on water demand management. The main objective of the project is to reduce water demands via finding alternative water source such as a rainfall harvesting system, change water behavior via changing water fittings and changing human behavior in water use. The methodology involves installing a rainfall harvesting system whereby the rainwater harvested is used for toilet flushing and gardening, changing conventional "water-wasting" fittings to "Water-Friendly" fittings, and changing the mindset of all staff, students and operators in the school from that of "Free Water" to "Paid Water" (Chan, 2011).

This SOH's BMP is a first of its kind in the whole country. The project has great potentials as the water savings, both in terms of water saved and monetary savings are enormous. When it is successful, similar projects can be replicated in all Schools, Centers, Canteens, Hostels, Buildings in all 3 campuses in the university as well as in all other universities. The main objectives of the project are: (i) To install a rainfall harvesting system (an alternative water source) for all SOH's buildings; (ii) To change all conventional "water-wasting" fittings to new "Water-Friendly" fittings; (iii) To change the mindset of all staff, students and operators in SOH from that "Free Water" (Paid by USM) to "Water Paid by SOH" (Water Use KPI of SOH); (iv) To increase awareness and educate all SOH's Staff, Students and Visitors on Water Savings in all buildings in SOH towards the sustainability of water in the school; and (v) To reduce Water Consumption to a level that can be benchmarked as a "Water Responsible" School in an APEX-Sustainability-led University.

### **Methodology**

The methodology involves both changing the "hardware" (physical installations of water structures such as faucets, showers, flush cisterns, urinals, pipes and other water fittings) as well as changing the "software" (human behavior in terms of water awareness and water use). Traditional water fittings that waste a lot of water such as timer-based urinals, 9-litre flushing system and manual taps were changed to push urinals, dial-flush system and automatic taps respectively. The water pressure was also manipulated by installing water balance regulators to control water flow to a satisfactory level adequate for most usage that did not compromise on comfort. The first physical installation was to install a water meter for the SOH (Figure 1). This is important to keep track of the amount of water usage and the amount of rainfall harvested. Other physical installations involved the installation of several rainfall harvesting systems complete with gutters on rooftops in the four buildings of the school that are connected

via drainpipes into 4 water tanks of between 5,000 liters to 10,000 liters capacities. The tanks are also connected to the piped water supply whereby during the dry season when there is not enough rainwater collected, piped water would automatically be channeled to the toilets and garden taps for uninterrupted use. The rainwater harvested is only used for toilet flushing and gardening. Another method is the use of education to increase water awareness and change the mindset of all staff, students and operators in the school from that of “Free Water” to “Paid Water”. In this respect, periodic road shows and talks were held, and water saving pamphlets, postcards and calendars were distributed to staff, students and visitors. In order to monitor the amount of water used, water meters were installed in all four buildings. Readings were taken before and after the project started. Quantitative and qualitative surveys were also conducted to test the staff, students and visitors’ awareness on water issues.



**Figure 1** The first step – Installing a water meter for the School of Humanities, Universiti Sains Malaysia

### **Rainfall Harvesting System**

The School of Humanities’ Rainfall Harvesting System consists of a rooftop gutter system that drains rainwater down several pipes to several water tanks between 5,000 liters to 10,000 liters capacity (Figure 2). The water tanks are then linked by water pipes to the toilets (for flushing) and garden taps (for washing and gardening). Results indicated that a large amount of rainwater can be harvested every month. This is because there is abundant rainfall every month, averaging between 200 to 500 mm per month (Chan, 1990). Hence, the lesson learnt is that Malaysia has high rainfall all year round and has great potentials for rainfall harvesting. Unfortunately, Malaysians are not capitalizing on the country’s rich potentials on rainwater at the moment (Chan, 2002). Installing a Rainfall Harvesting System in apartments is fairly easy as most rooftops have built-in gutters and drain-pipes trapping rain. Chan (2012) showed that large buildings such as condominiums have large roof areas that can harvest more rainwater than the buildings could use. To use more of the harvested rainwater, it needs to be diverted to the gardens for watering plants, and to areas whereby washing activities such as car washing, toilet washing and flushing and general floor washing take place. In the School of Humanities project, the four tanks would fill up quickly to the brim after each heavy rainstorm event. Hence, the school is currently not fully utilizing all its harvested rainwater. The school’s cleaners and gardeners also



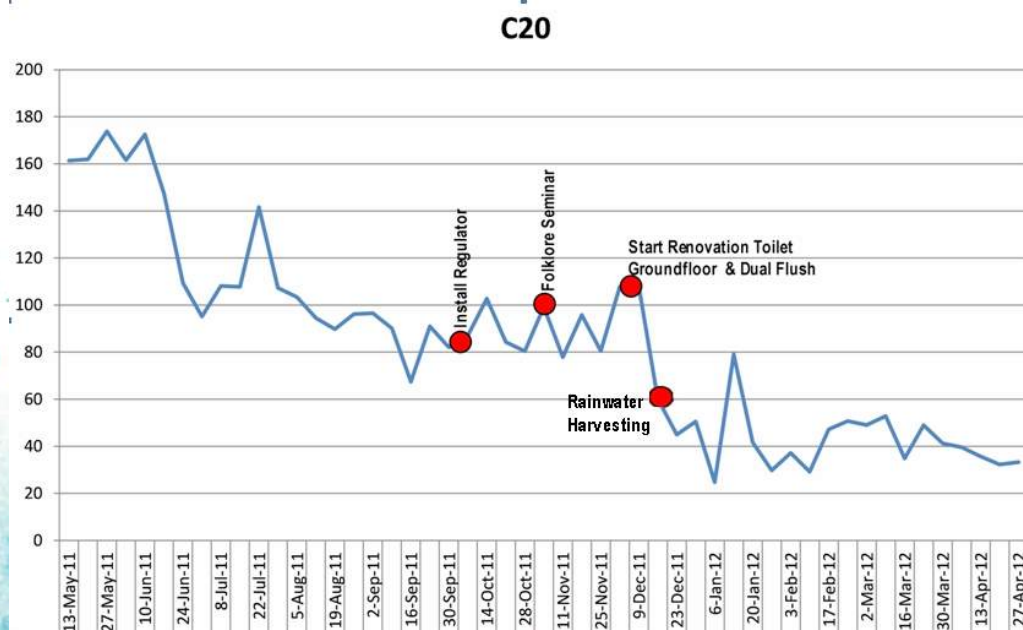
**Figure 2** The Rainfall Harvesting System installed at the School of Humanities, Universiti Sains Malaysia



prefer to use the piped water from the Penang Water Authority as it has better water pressures to enable them to finish their work faster. The school also has a small garden in front of building C24 and C20 where there are not that many plants to water (for gardening), in and around these two buildings. Hence, it was proposed to build a car-washing bays utilizing rainwater next to building C20. It was also suggested that rainwater to be channeled to other buildings next to the school, viz. the Centre for Global Sustainability Studies (CGSS) and the Institute of Postgraduate Studies (IPS).

### Installation of Water Saving Fittings

The number of water saving fittings installed in the school totaled to 74 units. The types of Water Saving fittings include: 25 Dual flush cisterns; 31 Automatic Push taps; and 18 Push Urinals. The areas installed with such fittings are the toilets on all the four buildings in C20, C24, C11 and C12. Figure 3 shows water consumption data for the school. Before the installation of the rainfall harvesting system on 23rd Dec 2011 and water saving fittings installation on 30th Sept 2011 (regulators) and 9th Dec 2011 (Dual flush), it is clear that the average water consumption in the school was very high, between 150 m<sup>3</sup> to 160 m<sup>3</sup> per week. After both systems were installed, the water consumption showed a significant decrease. This was shown in June 2011 onwards with water consumption figures averaging between about 70 m<sup>3</sup> to 80 m<sup>3</sup> per week. This is a significant decrease of more than 50 %. Figure 1 illustrates the trend of this significant decrease in water consumption. In terms of monetary savings, this may not be much as the water tariff is MYR1.00 per cubic meter. This is equivalent to a monetary savings of only MYR80 to MYR 90 per week for the two buildings of C20 and C24. The other two much smaller buildings of C11 and C12 did not show any significant decrease in water savings as these two buildings housed only about 30 to 40 academic staff each.



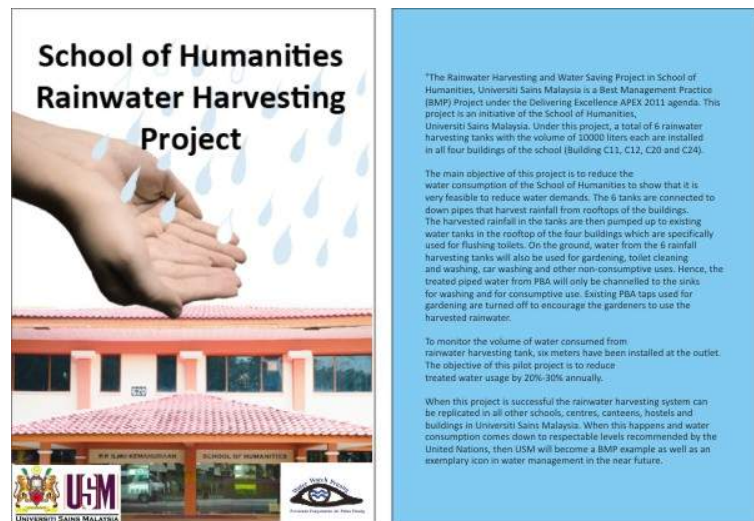
**Figure 3** Average water consumption in the School of Humanities (Building C20) indicating that after both Rainfall Harvesting system and Water Saving Devices were installed, the water consumption showed a significant decrease

## Water awareness and education

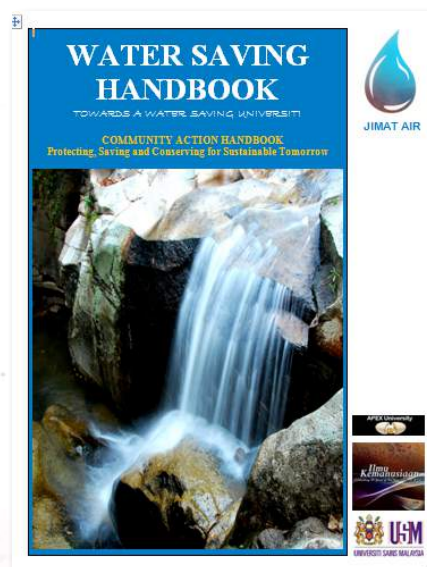
In terms of changing human behavior on water usage, several water awareness and educational materials were made and distributed to the staff, students and visitors. These included a water saving handbook (Figure 4), a rainfall harvesting manual (Figure 5), a water saving calendar (Figure 6), and water saving post-cards. These materials were distributed to staff, students and visitors. Water Watch Penang, an NGO, collaborated with SOH and carried out the campaign ([www.waterwatchpenang.org](http://www.waterwatchpenang.org) Accessed 12 June 2019).



**Figure 6**  
Ways to Save Water



**Figure 5** Rainfall Harvesting Handbook



**Figure 4**  
Water Saving Handbook



Monthly talks on water awareness and water savings as well as training sessions on building water management and practices were also held for staff and students. These sessions were well attended and became a regular activity in the school whereby staff and students had the opportunity to interact and work on a common issue. It also built good collaborations amongst staff and students (Figure 7).



**Figure 7** One of the monthly talks on water awareness and water savings cum training session on building water management and practices held in the School of Humanities for staff and students

### **Significant Water Savings**

The SOH rainfall harvesting and water savings project produced significant water savings, both in terms of volume of water saved as well as monetary savings in terms of reduction of water bill. Meter readings had been carried out since April 2010. Only buildings C11 and C12 were initially connected to rainwater while buildings C20 and C24 were connected much later in July 2012. Rainwater can only be supplied to toilets and this project needed extra funding for extra piping system. The meter readings for buildings C11 and C12 were monitored. Rainwater was used for all the toilets in C11 and C12 beginning week 31 December 2011 to 6 Jan 2012. It dropped during the first week of usage to 1.634 cubic meters. Strangely, on the second week the usage jumped to 3.253 cubic meters. Further monitoring is needed to study the long-term usage. It should also be noted that all usages for C20 and C24 recorded heavy usage on the same week. Figure 8 shows the harvested rainwater in building C20 (main building) being used for gardening. Even without using rainwater, the water saving fittings were shown to be highly effective in saving about 50 % of normal water use. It can therefore be concluded that there are tremendous potentials for water demand management and rainfall harvesting in universities in Malaysia. Logically, this project should be replicated in all institutions of higher learning, businesses, hotels, schools and government offices.





**Figure 8** The harvested rainwater in the School of Humanities' Building C20 is used for gardening

### **Conclusion**

In conclusion, there is no doubt that the School of Humanities USM Water Saving Project has shown remarkable success in terms of water demand reduction and water saved as the water consumption was reduced by about 50%. When the rainwater harvested is used in buildings C20 and C24, it is expected to generate even greater amounts of water saved. The rainwater harvesting system, though initially problematic, showed great promise as more water was harvested which then could be used. Water saving devices/fittings also showed tremendous potentials. Controlling the water pressure by installation of water balance regulators was very successful, although some members of the staff were initially unhappy about the reduced flow rate caused by lower water pressures. Overall, water savings were significant, and the toilet fittings were also aesthetically beautiful. For the staff, students and visitors who were exposed to the water saving campaign, they became more aware of the importance of water and were enlightened on the many advantages of Water Demand Management, Rainwater Harvesting, and Water Saving Devices available in the market. Other benefits of the project include closer cooperation amongst colleagues, staff and students, and staff and visitors. Significantly, this project can be easily replicated in other universities and institutions of higher learning across the country as the methodology is simple and effective. This project has shown that water demand management is "workable". The success story of this project needs to be publicized and this BMP should be properly documented and replicated not only in universities but in all large buildings throughout the country. This project also proves that smart partnerships



between the government, private sector, NGO and local communities are indeed workable. Universities are like small townships and as such have great potentials to save water, given the large amounts of water they use. This project has not only generated water savings but also changed the mindset of water consumers, which is more difficult to do. Participants in this project showed greater awareness on water and environmental issues after being exposed to the project, proving that the project had a profound effect on them. However, some of the problems encountered include the inaccuracy of old building plans (many pipes and their connections could not be identified), underground leaking and the lack of vendors in rainfall harvesting systems. The university's rigid tendering procedures for water works was also a hindrance that caused the project much delay. At present, the rainwater harvesting system is only functioning in buildings C11 and C12. Unless new budget be given to construct extra piping to the tanks (Building C24 and Building C20), this project will not be 100% successful. Nevertheless, this rainwater harvesting project can be considered a pioneer project in Malaysia and as an institution of learning, we are duty bound to welcome visits, give talks and attend conferences to publicize this sustainable project in line with USM's status as a sustainability-led university. An off-shoot of this project is that of a university-wide water saving project funded by water savings acquired from a reduction of water tariffs in three hostels given by the water service provider. It is envisaged that this project will run for seven years and by the end of that period, hopefully all buildings in USM main campus will be fitted with rainfall harvesting systems and water saving fittings, and their staff and students highly sensitized towards water conservation.

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# University Of Malaya Living Lab Programme and UM Eco-Campus Blueprint as University Best Practices in Promoting Sustainable Development Goals Agenda

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### **Abstract**

Interest is mounting in the co-design and co-production of knowledge and solutions for advancing global sustainability. Universities are playing an increasingly significant role in championing and advancing sustainability as local and global priorities via cross-cutting collaborations. This paper discusses the potential of living labs concept on campus as enablers to provide an innovative and prototypical framework for the adoption of campus sustainability and sustainable development agenda. The University of Malaya Living Labs Grant Programme (UMLL GP) was launched in 2015 to support the aspirations of University of Malaya to be among the leading Eco-Campus while promoting participation of the entire campus, a rarely visible trait in other research grants. Living Lab combine two main components, namely translational action research and sustainable campus transformation plan. Living Lab in university context fosters applied research and education by using the campus to test real-time sustainability solutions, offering opportunities to all university stakeholders to turn theory into practice, and enabling students to achieve greater engagement with their study material and a more well-rounded educational experience. This paper discusses the roles of UM Living Labs projects as enablers, institutional support system, and exploring key strengths and challenges on its implementation on campus.

**Keywords:** living lab, eco-campus, campus sustainability, SDGs, co-creation

**Focus Area:** SDG 17 - Partnership for The Goals



## Introduction

Universities as an Institute of Higher Learning (IHL) have to be the key exemplar to the society in showcasing best practices and models of practical sustainability agenda. The roles and contributions of universities can be divided into four main areas: education, research, operations, and sustainability leadership.

Some of the key roles for universities are as follows, but not limited to:

- Providing knowledge and solutions that underpin the implementation of SDGs: Universities drive technological and societal progress through research, discovery, knowledge creation, and adoption;
- Creating current and future SDG implementers: universities have access to large populations of young and curious people with passionate, creative and have a desire for a better world. Universities must garner efforts in equipping current and future leaders, decision-makers, innovators, educators, entrepreneurs and citizens with the knowledge, skills and motivation that will help them contribute to achieving the SDGs;
- Embodying the principles of the SDGs through organisational governance, operations and culture: through their staff, students, campuses, neighbourhoods and supply chains, universities exemplify a significant social, economic and environmental footprint;
- Providing cross-sectoral leadership in implementation: Universities have the capacity and responsibility to guide and spearhead the local, national and international response to the SDGs through leadership and partnership.

Hence, this paper will discuss some of the best practices that the University of Malaya as one of the distinguished higher education institutions in Malaysia have put forth in order to successfully implement Sustainable Development Goals agenda within campus community.

One of it is the launch of UM Eco Campus Blueprint document in 2015 as a main referral source of action plans and activities on research and development and simultaneously initiate the offering of University of Malaya Living Lab Grant Programme (UM LLGP) to researchers.

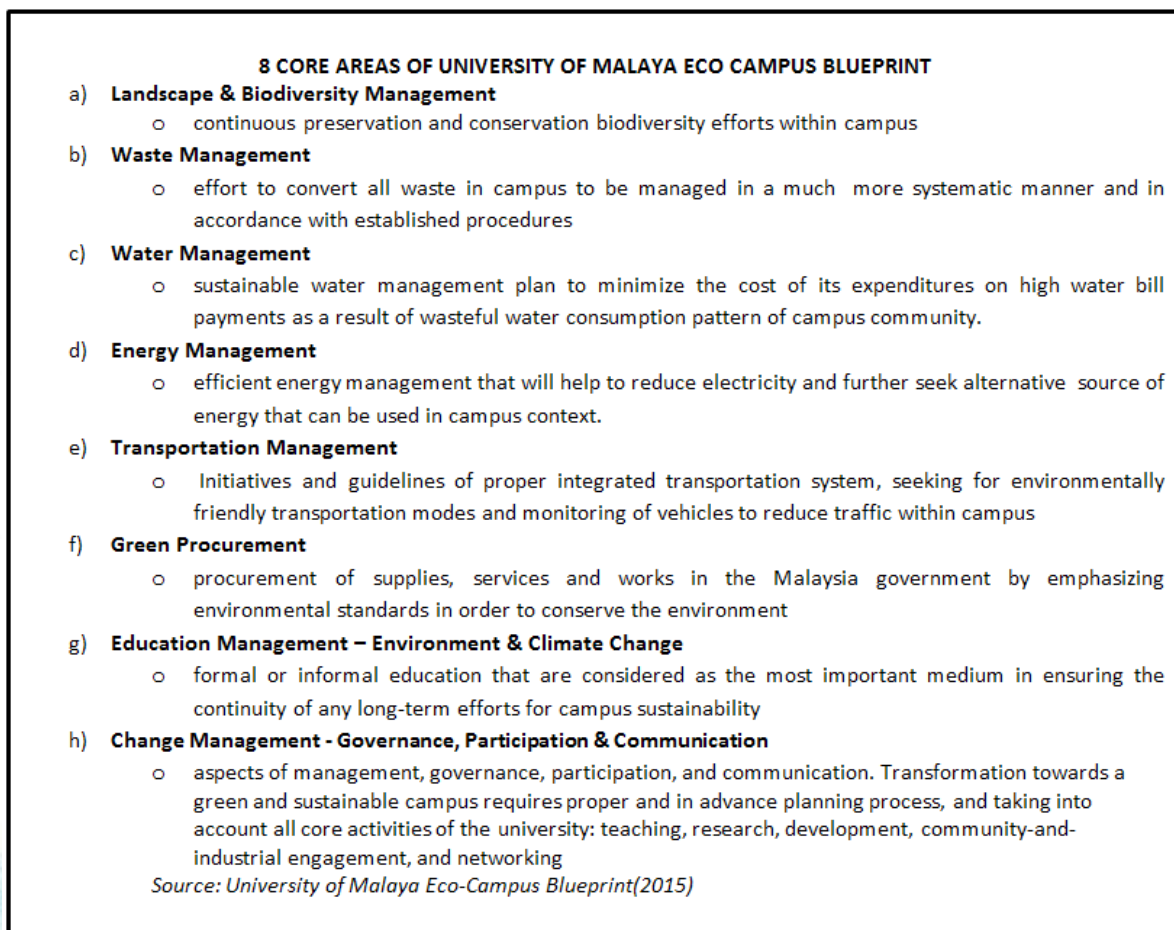
The concept of living labs in sustainability research can be interpreted as a human-centric combination of research-and-development approach whereby innovations are planned, co- created, implemented, evaluated and accessible in an open, collaborative, cross-contextual real-world settings. This approach does not only involve its beneficiaries in the development processes, but also aims to facilitate the interaction among other relevant stakeholders, such as academia and research organisations, industries, professionals, local communities, and public partners.

This grant aims to convert university campuses into a living laboratory through strategically aiming at the production of quality translational research on the ground while working collectively to transform UM as an eco-campus with the

integration of Agenda of Sustainable Development 2030 (SDGs). This grant also serves as a viable platform for researchers to actively assist the Department of Development and Estate Maintenance (JPPHB) to gradually improve the sustainability campus initiative operation and performance which eventually contributes to better and efficient management of water, waste, and energy without neglecting green biodiversity within campus vicinity.

UM LLGP also serves as a platform that fosters beneficiaries such as non-academic staffs and external stakeholders to learn the output of living lab research and improve their understanding particularly on environmental sustainability initiatives. This is in-line with the university's aspiration to be a world class research university which is not only strong in theoretical research, but also excellent in translating and applying it into the real world.

In order to strategically align the need of SDGs according to the university needs and action plan, University of Malaya Eco Campus Blueprint (UMECB) was introduced to serve as a guideline; a main referral document in any kind of development planning in the university. The UMECB focuses on 8 core areas shown in Figure 1.



**Figure 1 8 Core Areas of UM Eco-Campus Blueprint**

Unlike typical and conventional research grants which usually take about 24-36 month to be completed, the duration of UMLLGP grants only allowed researchers to run the programme within 12-month timeline. Therefore, rigorous monitoring has to be carried out as directed by the Deputy Vice-Chancellor



(Research & Innovation) in order to ensure all projects are progressing to meet their promised KPIs until the completion of their research. The research outputs and data gathering from UMLLGP would not only help in terms of campus sustainability related rankings such as UI GreenMetric World University Rankings (UIGM), Low Carbon Cities Framework (LCCF), Green Campus Audit, Times Higher Education (THE) World University Impact Rankings - SDGs, International Sustainable Campus Network (ISCN) and National Department of Solid Waste Management (JPSPN) but also serves as an important measure to the university in terms of calculating the annual total of carbon reduction, income savings and new innovation with regard to the sustainability initiatives that the university has achieved.

Evaluation is necessary to analyse strengths and weaknesses of each project, and thus will continuously help to improve new research agenda, adjusting research infrastructure and projects. Therefore, UMLL researchers are obligated to attend 2 monitoring sessions throughout their research period which usually be held every 6-months of project duration. Within a one-year timeframe, each project is required to submit 3 progress reports and 1 final report as part of the commitment upon their successful grant application.

## **Results And Impacts**

### **UM LLGP Contribution Towards Sustainable Development Goals**

Since the inception of UM Living Lab Grant Programme (UM LLGP) in 2015, a total of 45 projects have been implemented via this strategic initiative with a total accumulation of research grants of RM3,984,935 supporting 8 Core Areas of UM Eco-Campus Blueprint (UMECEB) which is aligned with SDGs; underpinning three pillars of sustainable development (environment, social and economy), UM LLGP is now in its fourth cycle, where solutions are applied on a larger scale throughout the campus. It has already shown more than 6,590,000 kg CO<sub>2</sub> GreenHouse Gases (GHG) emission reduction on which the amount of direct and indirect monetary gains from these collective initiatives surmount more than RM 1,196,102 as of a one-year progress.

The following Table 1 listed all the UM living lab programmes mapped out according to their respective core areas and SDGs. From the given table, the most significant SDG is SDG11 - Sustainable Cities and Communities followed by 7 out of 8 core areas focused on SDG17 -Partnership for the Goals and SDG13 - Climate Action. This paper will discuss more on SDG 17- Partnership for the Goals due to our belief that it is the most essential key element to ensure that the sustainable efforts implemented by the university can be further expanded and replicated to other parts of society. SDG 17 generally refers to the need of cross sectoral and multi-pronged approach collaboration with local authorities or other interested stakeholders, or it can also be an international collaboration in-pursuit to contribute to other SDGs. This indicates that 'Living Lab' heavily ties with the concept of co-creation to strengthen and streamline cooperation by using SDGs as a shared framework and pathways in defining collaborative way-forward.

In the case of UMLLGP programme, the SDG 17 is more focused on creating new innovation, transferring technical and technological knowledge that the researchers have and providing an acceptable solution pertaining to real sustainability issues that include social, economy and environmental problems that arise within the campus boundaries. It is also tailored in a way that is directed towards capacity building, human capital development and to empower students and staff as the main stakeholders and perhaps to bring alternative source of income to the university. Ultimately the main contribution towards SDG 17 is to bring potential collaboration from interested stakeholders such as local authorities, neighbourhood communities and business entities to work together and to be able to replicate the living lab model into their respective areas. Hence, Table 1 indicates a list of programmes which contribute greatly on SDG 17.



**Table 1** List of Living Lab Programme Initiatives in University of Malaya and Contribution towards Sustainable Development Goals (SDGs)

Core Areas	List of Living Lab Programme Initiatives in University of Malaya	Contribution Towards Sustainable Development Goals (SDGs)
<b>Landscape &amp; Biodiversity Management</b>	<ul style="list-style-type: none"> <li>• The RIMBA Project</li> <li>• The Design and Investigation of A Novel Ecological Air Cleaning and Cooling System Using the Concept of A Living Green Wall</li> <li>• A Virtual Reality Application on Plants in University of Malaya</li> <li>• Essence of Green Roofs/Walls: UM Campus as an Experimental and Computational Living Lab towards Enhancing the Outdoor Thermal Comfort Conditions</li> <li>• Eco-Slope: Slope Eco-Engineering Techniques towards Sustainable and Green Landscape</li> <li>• Healthy Soil for a Healthy Environment; Reducing dependency on Chemical Fertilizers Consumption in UM using Organic Materials</li> <li>• Carbon Storage Mapping Initiatives through Real Time GPS Tracking and IOT Monitoring</li> </ul>	<p><b>SDG 3</b>-Good Health &amp; Wellbeing  <b>SDG 11</b>- Sustainable Cities &amp; Communities  <b>SDG 13</b>-Climate Action  <b>SDG 15</b>-Life on Land  <b>SDG 17</b>-Partnership for the Goals</p>
<b>Waste Management</b>	<ul style="list-style-type: none"> <li>• Zero Waste Campaign (ZWC)</li> <li>• Construction Waste Recycling Center for Sustainable Drainage Construction</li> <li>• UM Zero Food Waste Campaign</li> <li>• Agro-hero: Promoting Green Practices to Communities for Sustainable Agriculture</li> <li>• Safe Disposal of Unused Medications - Working towards a Green Pharmacy in the University of Malaya Medical Centre</li> <li>• Smart Waste Management System using Internet-of-Things (IOT)</li> <li>• Managing Kitchen Waste using Black Soldier Fly (BSF)</li> <li>• Recycled Plastic Aggregate as Replacement for Conventional Aggregates in Concrete</li> </ul>	<p><b>SDG 11</b>- Sustainable Cities &amp; Communities  <b>SDG 12</b>-Responsible Consumption &amp; Production  <b>SDG 13</b>-Climate Action  <b>SDG 15</b>-Life on Land  <b>SDG 17</b>-Partnership for the Goals</p>

<b>Water Management</b>	<ul style="list-style-type: none"> <li>• Water Warriors</li> <li>• Water Monitoring via Internet-of-Things (IOT)</li> </ul>	<b>SDG 6- Clean Water &amp; Sanitation</b> <b>SDG 11- Sustainable Cities &amp; Communities</b> <b>SDG 12-Responsible Consumption &amp; Production</b> <b>SDG 13-Climate Action</b> <b>SDG 17-Partnership for the Goals</b>
<b>Energy Management</b>	<ul style="list-style-type: none"> <li>• Optimizing Energy Cost with Evolution Computing Based Building Energy Management System</li> <li>• Smart Management of Electrical Appliances and Energy Saving using Internet of Things</li> <li>• Smart Modular Electrical Energy Monitoring and Management System</li> <li>• Carbon Abatement Module for UM Eco-campus: Addressing Urban Heat Island and Climate Change Impact</li> <li>• Energy Conservation Culture in University of Malaya Campus</li> <li>• Smart-E (Smart Energy Monitoring &amp; Optimization for Pre-existing Campus Buildings)</li> <li>• Zero Carbon Building Assessment for UM Chancellory Building and Other UM Office Buildings</li> </ul>	<b>SDG 7-Affordable and Clean Energy</b> <b>SDG 9- Industry, Innovation &amp; Infrastructure</b> <b>SDG 11- Sustainable Cities &amp; Communities</b> <b>SDG 13-Climate Action</b> <b>SDG 17-Partnership for the Goals</b>
<b>Transportation Management</b>	<ul style="list-style-type: none"> <li>• Sustainable Transport System in University of Malaya Campus: Study on Improve the Feeder Bus Service and Promote Non-motorized Transport Mode in Campus</li> <li>• Real-time and Automated Traffic Data Inventory and Monitoring System (TDIM)</li> <li>• Working towards A Sustainable Means of Campus Transportation</li> <li>• Evaluating Walkability Index of Campus Communities to Promote Sustainable Transportation in UM</li> <li>• Walking as a Green Transportation Mode in UM Campus</li> </ul>	<b>SDG 11- Sustainable Cities &amp; Communities</b> <b>SDG 13-Climate Action</b> <b>SDG 17-Partnership for the Goals</b>
<b>Green Procurement</b>	<ul style="list-style-type: none"> <li>• Integrating Green into The University Malaya's Procurement Process: A Move</li> </ul>	<b>SDG 12- Responsible Consumption &amp; Production</b>
<b>Health and Wellbeing</b>	<ul style="list-style-type: none"> <li>• Forward Homes for Active Ageing</li> <li>• The UM Cancer Farm: A Lifestyle Lab</li> </ul>	<b>SDG 3-Good Health &amp; Wellbeing</b> <b>SDG 11- Sustainable Cities &amp; Communities</b> <b>SDG 17-Partnership for the Goals</b>



<b>Education &amp; Change Management</b>	<ul style="list-style-type: none"> <li>Transforming the Role of Surau APIUM for Campus Sustainability Through Tmarah Green Project</li> <li>University of Malaya Ecological and Hydrological Data Warehouse Prototype System</li> <li>Decentralization of Laboratory Exercise via Remote Application: A-State-of-the-Art Approach towards Efficient Educational Facilities Resource and Energy Management in Academic Institutions</li> <li>Embedding Shades of Green in UM's Reporting Practices</li> </ul>	<b>SDG 4</b> –Quality Education <b>SDG 6</b> - Clean Water & Sanitation <b>SDG 7</b> -Affordable and Clean Energy <b>SDG 11</b> - Sustainable Cities & Communities <b>SDG 12</b> -Responsible Consumption & Production <b>SDG 17</b> -Partnership for the Goals
<b>Management - Governance, Participation &amp; Communication</b>	<ul style="list-style-type: none"> <li>Enhancing the Visibility of UM Regional Center of Expertise (RCE) Central Semenanjung through Partnership with Bukit Fraser's Community and Authority</li> <li>The Faculty Sustainability Report Card: Documenting Faculty Sustainability Initiatives towards UM Eco-Campus</li> </ul>	<b>SDG 7</b> -Affordable and Clean Energy <b>SDG 12</b> -Responsible Consumption & Production <b>SDG 13</b> -Climate Action

## **Selected Case Study: Three Pioneer UM Living Lab Programmes**

### **Case Study 1: University of Malaya Zero Waste Campaign (UM ZWC)**

UM Zero Waste Campaign (UM ZWC) was introduced in 2011 to start a long-term campaign to achieve an integrated and sustainable waste management model and ultimately a zero-waste campus. From 2015 to 2018, UM ZWC is fully funded by Sustainability Science Research Cluster of UM (Susci) as one of the living labs of UM as well as by JPPHB under the RMK-11 budget. Starting from late 2018, UM ZWC with other Living Labs are now strategically positioned under the banner of UM Eco-Campus Secretariat. UM ZWC operating projects including in-house composting centre, food waste segregation scheme, research composting emission and waste characterization, anaerobic digestion (AD), used clothes collection program, wood waste separate collection, e-waste collection and drop-off recycling collection were initiated under the campaign. Since the inception of the project in 2011 until December 2016, a total of 474.54 ton of solid waste has been diverted from disposal in landfill with composting, AD, recycling, re-use and energy recovery. A roadmap of UM ZWC was drawn up in 2013, with a goal to achieve 60% landfill diversion by year 2040. In the next 5-10 years, UM ZWC will play a vital role to formalize the recycling collection in UM and further increase the organic waste recycling with green waste shredding and composting. To date, UM ZWC has saved UM a total surmounted more than RM200,000 from total waste disposal fees, and also contributed income generations up to RM22,000 via sales of in-house organic composts. In a nutshell, UM ZWC has successfully diverted a total of more than 800 tonne of solid wastes from landfill in 2018 alone with a total carbon reduction of 4,608,000 kg CO<sub>2</sub> -eq. UM ZWC has trained and conducted variety modes of training to visitors more than 10,000 individuals since its inception. Among the latest contribution of UM ZWC includes (1) spearheading the initiation of banning single-use plastics in campus policies, (2) 3Rs and food waste separation campaign at campus-wide level, (3) launch of UM Intelligent Recycling Centre which encourage campus community to practice recycling with redeemable merit point system, and (4) intensive promotion on the use of UM ZWC organic compost as part of initiatives in promoting Circular Economy and Waste-to-Wealth model, and (5) capacity building and training on integrated solid waste management to both local and international participants.

### **Case Study 2: Water Warriors (WW)**

Water Warriors Living Lab, a bottom-up sustainable campus action research initiative in applying the integrated 'Heartware - Hardware – Software' approach for the management of water bodies at the University of Malaya since the year 2013. This framework advances the proposition that a heartware approach is needed to enhance sustainability efforts, in addition to the more universal and strategic hardware and software approaches. The paper describes the Water Warriors' experience in applying the heartware approach has been a strengthening factor in resolving water conservation issues in the university, and discusses important lessons learned to date. Water Warriors (WW) is a Living Lab initiative currently being run by a group of volunteers and action researchers from the University of Malaya, Kuala Lumpur, Malaysia. We apply the integrated "Heartware - Hardware - Software" approach to help enhance campus sustainability transition in the management of water bodies at the University of Malaya campus - particularly



Tasek Varsiti, the main lake located at the heart of the campus. WW started as a bottom-up movement in 2013 through the intellectual support from the Japan-Malaysia research programme on ‘Risk-Based Asian Oriented Integrated Watershed Management’ (ACP-IWM), a bilateral research consortium between Malaysian and Japanese researchers. Since then, it has organically grown into a campus sustainability Living Lab under the then Sustainability Science Research Cluster (up to 2018) as one of the custodians of UM Eco-Campus Core Area: Water Management. Among significant contributions of Water Warriors: (1) water quality data monitoring, (2) revival of Tasek Varsiti as the heart of UM, (3) launch of Responsible Lakers communal clean-up programme, (4) Citizen Scientist Programme to encourage and educate youths to play an active part in promoting science as a tool towards sustainable community culture, (5) water conservation via Rain Water Harvesting System with Department of Development and Estate Maintenance (JPPHB), (6) promoting efficient water consumption among staff and students of UM, and (7) introducing innovative water efficient appliance known as ‘Mr Thimble’ which reduces water flows installed at all suraus (prayer rooms) in the campus.

### **Case Study 3: The RIMBA Project**

The Rimba Project (RIMBA), a Living Lab initiative for campus greening and biodiversity conservation at the University of Malaya (UM), Kuala Lumpur. The RIMBA Project was established in early 2014 with these objectives: to aid the University in developing greening policies consistent with best practices in conservation; to raise awareness of urban biodiversity; and to complement the role of UM’s Rimba Ilmu Botanic Garden in nature education and outreach. Since its inception, The RIMBA Project has employed a range of methods to accomplish these objectives: working closely with student volunteers to document biodiversity in and around the campus; conducting ongoing tree-tagging and tree-mapping initiatives; setting up a conservation nursery to build capacity for Rimba Ilmu; building volunteer capacity. As a result, The RIMBA Project has successfully put urban biodiversity conservation on the University’s sustainability agenda; diversified and enhanced the services provided by Rimba Ilmu; engaged and maintained a consistent volunteer base. Among critical contributions of RIMBA project: (1) Biodiversity surveys and Campus Greening: tree tagging, Geographic Information System (GIS) analysis, and conservation of tree stands for reforestation, (2) conservation nursery, (3) Capacity building of volunteers and RIMBA Ilmu. RIMBA Project has also contributed income generations to UM surmounted to RM32,000 in total via guided walk, book and merchandise sales.

### **Conclusion**

All in all, UM Living Labs initiatives are crucial in translating the aspirations highlighted in UM Eco-Campus Blueprint in solving campus sustainability issues while elevating environmental, social and economic performance. These collective initiatives which have shown remarkable contributions and positive impacts built upon smart partnership and co-creation cutting across stakeholders serves an important milestone for University of Malaya in many years to come. It is our utmost hope that more higher education institutions will join the campus sustainability ‘bandwagon’ for the sake of a securing a more promising, cleaner and safer future.

Higher education institutions play a critical role as a central educational and transformative agent to produce future sustainability leaders, champions and communities which goes beyond its day-to-day core business.

### **Acknowledgement**

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# From Policy to Action towards Sustainable Campus: A Case Study of Chulalongkorn University

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## **Abstract**

Chulalongkorn University (CU), the oldest university of Thailand, is located in the central of Bangkok, the capital city. After the 100th anniversary of the establishment, sustainability is still a main mission of the strategic plan during 2017-2020 announced by the president of the university. Actually, the concept of sustainability has been intervened into routine operations, teaching and research affairs for many years before the Sustainable University Policy was officially announced in 2017. The policy is designed to comply with three pillars of sustainability, i.e., environment, economy and society, which five key issues are focused on: 1) Infrastructure and physical feature; 2) Quality of life; 3) Resources and environmental management; 4) Teaching and research; 5) Good governance and engagement. The master plan and action plan were initiated by the CU Committee for Campus Sustainability; subsequently, all activities have been collaborated by all parties including executive, faculty member, student and staff. Sustainable goals and initiatives are set up for many challenges such as green campus, health and equality promoting on campus, ultimate resource use and zero waste, and smart transportation. Some main programmes with achievements are present hereinafter.

**Keywords:** sustainable campus, waste management, health and safety, smart transportation

**Focus Area:** SDG 3, 6, 9, 11, 12

## **Introduction**

Chulalongkorn University (CU), founded in 1917, is the first university in Thailand. The university was named after King Chulalongkorn (Rama V) who officially announced to improve higher education of the country to produce personnel with ability to serve both public and private sectors. CU is located in the central of Bangkok and covers an area of over 1,800,000 square meters in which about 50% is allocated for academic purpose (Fig. 1). Recently, more than 37,000 students (about 70% undergraduates and 30% graduates) are studying in this

comprehensive university which provides almost 450 programmes including about 90 international programmes. Moreover, about 2,800 faculty members and 5,000 support staff are working in the campus. Located in the prime business district of Bangkok, CU has to design the long-term land use planning, particularly for education, revenue, environment and society. It is actually a top challenge for changing traditional practice and pushing forward. However, the university must be a knowledge centre and paragon for the sustainable development of the country. Both social initiatives and technical innovations should be implemented within the university for community learning which may lead to better quality of life and resilient society. CU has invested continuously for many infrastructures and facilities which are expected to be the learning space for faculty member, student, staff as well as community surrounding the campus. More information is provided at the main website of the university (<https://www.chula.ac.th>) and Green Chula website (<http://www.green.chula.ac.th>).



**Figure 1** Map of Chulalongkorn University showing land plan for academic activities, social and commercial zones.

### **Sustainability**

Sustainability is one of the main strategic goals of the university plan during 2017-2020. However, many activities and projects have already been proceeded under the concept of sustainability for many years before the Sustainable University Policy was officially announced by the CU president in 2017. This is the first time when the university policy is designed clearly to comply with three pillars of sustainability, i.e., environment, economy and society. Subsequently, five key issues are focused on: 1) Infrastructure and physical feature; 2) Quality of life; 3) Resources and environmental management; 4) Teaching and research; 5) Good governance and engagement.

These issues must be intervened into the routine operations, teaching, research, industrial linkage and social engagement. Recently, the CU Committee for Campus Sustainability were appointed and arranged the regular meeting to design the master plan and action plan of sustainability. All activities under the CU sustainability program are collaborated by all parties including executives, faculty members, students and staffs. Many challenges including: green campus; health and equality promoting on campus; ultimate resource use and zero waste; smart transportation. Some main sustainability programmes with their achievements are reported below.



### **Chula Zero Waste**

Chula Zero Waste programme aims to change the attitude and behaviour of the CU community in regard to waste reduction. All activities are based on the 3Rs concept (Reduce, Reuse and Recycle). This campaign is also wished to protect all persons from waste-related health risks, to improve the campus environment and to encourage the use of reusable or refillable items. During the operation, CU has collaborated with researchers, communities and private companies to extend this zero waste campaign to the public. Some innovative products have been developed to serve the community. Campaign, economic tools as well as innovative products have been used during the program (see Fig. 2). During couple years of implementation, about 2.5 million plastic bags, 2 million single-use plastic containers (bottle and cup), and 85 tonnes of garbage have been reduced. Bioplastic-coated cup (Bio PBS), called zero-waste cup, was initiated by research Centre of Excellence on Petrochemical and Materials Technology (PETROMAT) in collaboration with PTT Global Chemical Public Company Limited; the zero-waste cup has replaced the plastic cup used in the university cafeterias and canteens, before being thrown away to the composting facility. More information is available at the website of Chula Zero Waste (<http://www.chulazerowaste.chula.ac.th>).

### **Centre for Safety, Health and Environment**

Centre for Safety, Health and Environment of Chulalongkorn University (SHECU) was established in 2016 according to the safety policy of university. Safety is the first and foremost awareness when conducting research, studying and working on the campus. As an educational institution, CU aims to raise this awareness to all parties. The main goals are to enhance safety of student, faculty and staff, to establish safety standard for all laboratories throughout the university and to motivate a mindset for safety in all student, faculty and staff. More than 850 laboratories are recently under operation; about 70% of them have begun to follow the enhancement of Safety Practice of Research Laboratory in Thailand (ESPreL) after the official announcement of safety policy. Some labs were rapidly improved and complied with the safety standard (see Fig.3). Zero accident is the main strategic target.





**Figure 2** Chula Zero Waste Program providing various campaigns, zero waste cup (an innovative product) and composting facility for waste management throughout the campus.





**Figure 3** Enhancement of Safety Practice of Research Laboratory in Thailand (ESPreL) developed by CU research group is used to improve laboratories in the campus. Training and knowledge-sharing activities are also provided by the Centre for Safety, Health and Environment of Chulalongkorn University (SHECU).

Campaigns and capacity building programs have been regularly provided to all university members. The ESPReL was initiated and developed by CU research group under commission of the National Research Council of Thailand (NRCT) and it is now implemented in nationwide universities. Therefore, SHECU is now becoming a training and knowledge-sharing centre of the country. More information is available at the websites of Green Chula and SHECU (<http://www.green.chula.ac.th>; <https://www.shecu.chula.ac.th>).

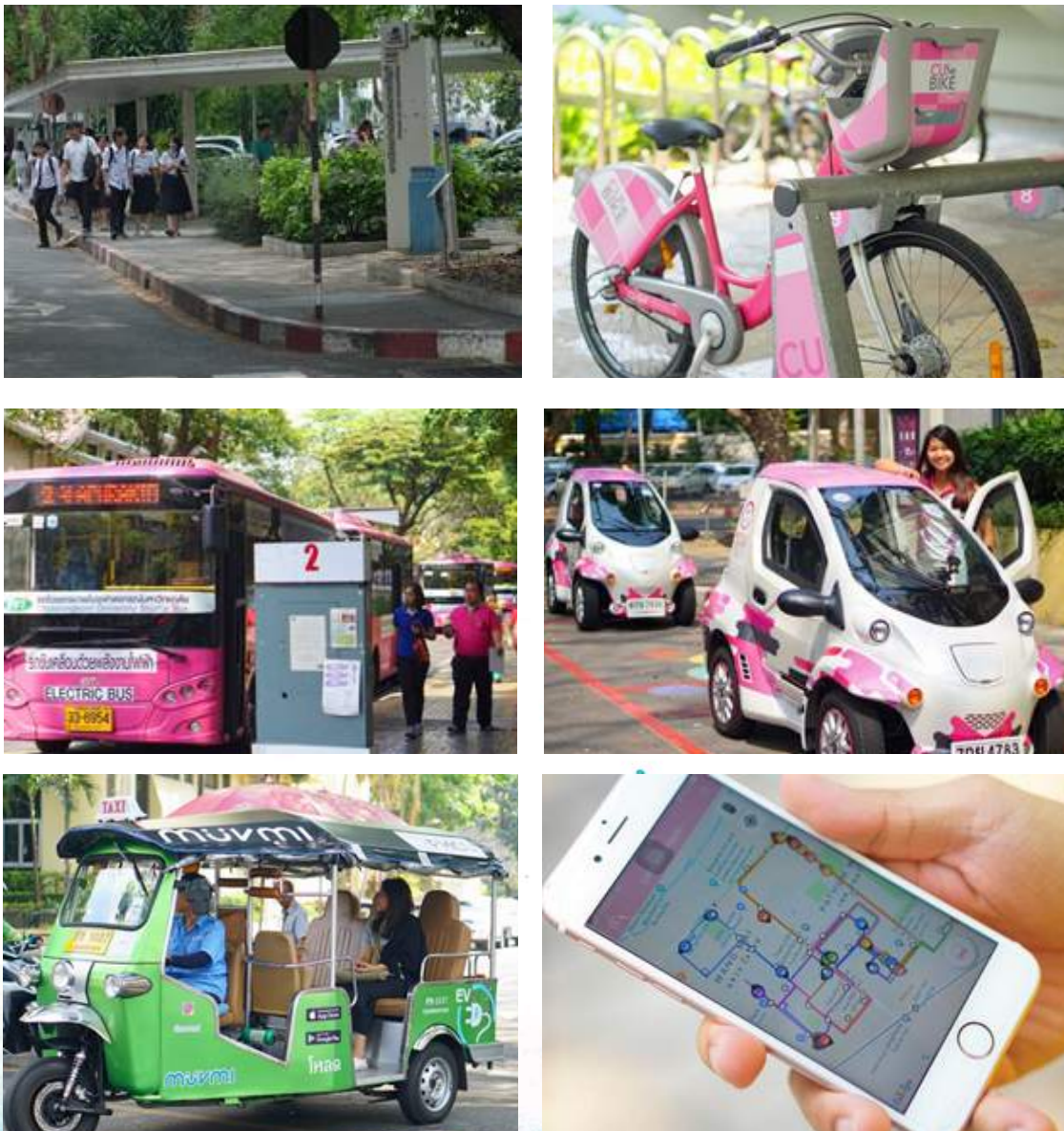
### **Smart Transportation**

Alternative smart transportations (see Fig. 4) have been initiated and expanded around the campus for the following reasons: to make campus transportation more convenient for student, faculty, staff and the public, to decrease CO<sub>2</sub> emission, to promote exercise via cycling and walking, and to reduce vehicle traffic. Cycling and walking campaign is encouraged; some facilities such as bike lane, cover way and sky walk have been constructed to support the campaign. Moreover, CU sharing bike programme, providing 120 bicycles with 8 service stations are recently in service around and nearby the campus. Fully electric vehicles including CU Shuttle Bus, CU TOYOTA Ha:mo and Muv Mi (Fig. 4) are served as smart and green transportation for all CU members and public. Over 300,000 passengers are regularly taking these services every month. Mobile applications have been initiated and engaged to facilitate all passengers (Fig. 4). Some applications have been developed for commercial use by former CU students. More information is provided at the Green Chula website (<http://www.green.chula.ac.th>).



### **Food Sanitation Policy**

University cafeterias and canteens (Fig. 5) serve thousands of customers daily, providing tasty, healthy, low cost food. To maintain the hygiene and ensure consumers are protected, the food sanitation policy is implemented to protect consumers from food poisoning and other food illnesses. It is also a regulation among Thai universities in food sanitation. Moreover, food wastes generated from cafeterias and canteens are utilised as substrates for bioenergy producing. Used cooking oil, more than 3,5000 kg/year is collected and sent to biodiesel production which has been supported by Bangchak Corporation Public Company Limited. Food garbage (about 40-80 kg/ day) is fed into biogas facilities (Fig. 5) which based at the campus. These facilities are also designed for research and teaching instruments (<http://www.green.chula.ac.th>).



**Figure 4** CU Smart Transportation Projects are operating within the campus and connecting to the surrounding business centres and communities; for instance, cover way, CU sharing bike, various fully electric vehicles (i.e., CU Shuttle Bus, CU TOYOTA Ha:mo and Muv Mi). Mobile applications are available for booking and checking.





**Figure 5** Food sanitation is provided at a main student canteen in which biogas facility is set beside

### ***CU Centennial Parks***

CU Centennial Parks (Fig. 6) was officially opened to the public on 26 March 2017. This park was initiated to commemorate CU's centennial anniversary. The targets are to create green landscapes for educational purposes where the university community and public can exchange knowledge and relax, to provide a venue for individuals and groups to take advantage, to contribute to the "Green Axis" project by extending the green area on the western side of the campus, to create gardens of local vegetation following organic, or natural practices, according to an urban jungle concept and to create a prototype for urban water storage (<http://www.green.chula.ac.th>). Park@Siam (Fig. 6), a small park located in the heart of Siam Square, the most famous shopping centre in Bangkok, was constructed by CU to increase green area of the city providing to the public.

In addition, CU is working on more projects and activities which are related to promotion of health and equality in campus. All of which follows the CU sustainability roadmap for pushing Thai community towards sustainable development goals.



**Figure 6** CU parks including 100 Years CU Park and Park@Siam

## **Conclusion**

The year 2019 marks the 102nd anniversary of the establishment of Chulalongkorn University. Given the incredible changes over this time period, Chulalongkorn University has prepared its students and developed knowledge to keep pace with the rapidly changing world. While we affirm our commitment to academic standards and high-quality research to progress into the second century, sustainability is one of the primary core missions in which the understanding and practice of sustainability are disseminated through various activities and operations. This mission provides the basis for the development of Chulalongkorn University's management strategies. Research funds have been administered for academic activities through various research clusters and academic programs. In addition, the university has applied the Philosophy of the Sufficiency Economy developed by King Bhumibol Adulyadej of Thailand and the Sustainable Development Goals (SDGs) set by the United Nations to drive the institute to have the best practice of sustainability.

In conclusion, the university realises that successful improvement of sustainability performance necessarily relies on systematic data collection. Therefore, recent management approach has been focussing on upgrading data collection and analysis processes in many areas of university operations including the amount of resources consumed on campus (e.g. energy, water, chemicals) as well as the volume of emissions to the environment (e.g. waste, greenhouse gas). With more accurate data, the university can gauge its sustainability performance and properly select future targets and initiatives.

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## Reporting for Sustainability - The New Reporting Regime

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The value of non-financial reporting is not much disputed within business. More than three-quarters of CEOs agree that sustainability contributes to their companies' long-term success. Indeed, as sustainability goes mainstream, companies are more likely to be giving more consideration to their sustainability reporting efforts. PwC's recent study Sustainability reporting and disclosure – What does the future look like? confirms this.

The sustainable development movement is gaining momentum with global commitments to UN SDGs and the COP 21 Paris Climate Change Agreement. Since 2006, companies who measure their sustainability performance have notably increased in number.

Greater transparency about how sustainability matters affect an organisation's strateg(ies), operations and long-term prospects are the attributes that the stakeholders are looking into now. Companies need to respond.

Unfortunately, there is a confusing mix of reporting formats, disparate coverage of sustainability information and a multitude of methods being employed to communicate the information. Not to mention the ever-increasing amount of information that is not linked to companies' basic strategy. It is hardly surprising, then, that current sustainability reporting may not match certain stakeholders' needs. Improving, as well as actually doing, sustainability reporting is vital.

Of course, investors are conscious that identifying environmental, social or financial risks to a business are part of utmost importance. Forward-thinking companies acknowledge that their relations with other stakeholders are important. But now, a new relationship is emerging between society, the environment and business. As a direct result, all management levels require more thinking about sustainability, especially at company board level. It is crucial for top management to integrate sustainability into the company's vision and strategy. Most vital of all, is to see sustainability as a value-creator, not a cost.

Since the 1970s, a gradually increasing portion of business value has become attached to not just environmental stewardship, but also to other less tangible aspects, such as relationships and trust. People, capacity-building and intellectual capital have also become more critical for long-term business success.

As we project the managers to integrate sustainability into our practices and processes, engage stakeholders and demonstrate corporate social responsibility, we help reduc(ing) the risk to reputation and finances. Else than that, we also demonstrate sound management practice These are the aspects that investors, customers and potential employees increasingly look for.

But how to prepare an integrated report? Basically, the steps involve:

- Getting ready for integrated reporting by collecting Environment, Social and Governance (ESG) information
- Achieving management buy-in
- Developing integrated thinking and articulating strategy.

#### Getting ready for integrated reporting

Preparing a sustainability report is already a good start, as it develops the habit of collecting and disclosing material social, environmental and economic information.

How adequately are you engaging the stakeholders? A solid sustainability report (conveys) the material issues from the perspective of wide-ranging stakeholders. This is essential for accountability, reputation, risk identification and accountability. In sustainability reporting, these stakeholder engagement and materiality processes are functional as the bases for your company's report. However, senior management must also involve themselves and take a much wider view of a range of issues.

#### **Achieving Buy-in**

To get the senior management buy-in, think of and talk about sustainability as value creation. Do financial statements provide a full picture of value? Chief sustainability officer, other board members or high-level managers could help in securing broader senior management support.

Board buy-in is also necessary - for credibility, certainly. Additionally, integrated reports are forward-looking. A governance body must also be identified to be responsible for the report content.

As for the report itself, there is no need to use the full framework immediately. Begin, perhaps, with integrated reporting elements at the front of the sustainability report or annual review. Some non-material information could go online.

#### **Developing Integrated Thinking**

Determine material issues for integrated reporting by engaging senior management and stakeholders.

Agreeing on the business model with the senior team may be difficult. Setting capitals - financial, manufacturing, intellectual, human, societal and natural - and thinking beyond capital flows are important here.

Above all, tell your value creation story. This should cover all six capitals and connect with your business model. Then, communicate your strategy so that it links with your value creation story.



Connectivity of information is critical to sending a strong, credible message:

- within your integrated report
- across other reports and communications.

Developing integrated thinking is hard to tackle at first. It helps to identify gaps in thinking. The unending task of fixing these gaps demands understanding of why they occur. They could emerge because business value is only measured in dollars, still a fixed belief in many organisations.

Nevertheless, research shows younger people nowadays like to work for socially responsible, ethical organisations that practise sustainability. So, it is worth the effort to clearly articulate the business case that lies behind company initiatives and demonstrate how the company creates value via non-financial means.

Working in silos is no longer an option. Organisations need to develop both formal and informal communication channels and networks, as well as look for different leadership styles to help shift the culture and increase diversity.

Companies where most leaders display few or no values and lack of authenticity will not thrive in the sustainability era. Think before you write - fixing gaps in integrated thinking is the first move towards successful integrated reporting.

### **The European Example**

Let us take as an example of the European Union (EU), where member states have agreed to support reforms requiring big listed companies to report how they impact on environment and society. This is a strong signal that voluntary corporate social responsibility (CSR) is the past and mandatory CSR is the future. It is undoubtedly a step forward, though it remains to be seen if meaningful changes will be the result, because of the wording used and some obvious loopholes.

Thousands of large EU companies are now accountable, not only to their shareholders, but also to their stakeholders. They will be legally obliged to report on their business activities and the non-financial impacts of these business activities. This covers policies on corruption, diversity and social issues. Along with these, it encompasses risks posed to human rights and environment, not just directly, but through supply chains, too.

Disappointingly, member states such as the United Kingdom (pre-Brexit), Germany and Poland opposed the requirements, so they will not apply to most big companies – it is estimated that less than 15% of the EU's large companies will be obliged to report. In addition, companies can choose the reporting indicators and standards they use. As a consequence, making comparisons between companies will not be worthwhile.

Moreover, reports will not be verified, only audited, and any company that fails to comply will not face sanctions. In short, companies have great flexibility in how far they comply and reform. While some companies like Sweden's Ikea and Anglo-Dutch Unilever favour reform, others lobby against, and worry about bureaucracy and costs involved with a mandatory approach. It is still under debate whether CSR works better when it is voluntary.

Whether the reporting process is seen as an advantage or disadvantage, whether adverse impacts or potential costs are the focus, business leaders will still have to make meaningful data available and valuable for everyone.

### **Pressure from the People**

Pressure - from employees, investors and civil society groups - to be more transparent and accountable is sure to increase. So, savvy business leaders will certainly recognise, as many have already, that these reforms can be a useful tool that can be used as an advantage. By complying with the new requirements, they will have an enhanced understanding of the risks they face and will act to reduce these risks. This will not only benefit their reputation, but also their long-term survival business and profitability. Increased transparency will result if the companies played their role in driving the market onwards.

It is doubtful if a voluntary approach to corporate, social and environmental reporting brings about a more just, sustainable society. Many argue, in fact, that such reporting has to be mandatory and meaningful if we were to take it seriously and evade 'greenwash', whether it is a superficial or insincere display of concern for the environment shown by an organisation or the practice of promoting environmentally friendly programmes to deflect attention from an organisation's environmentally unfriendly or less savoury activities.

Of course, pinpointing risks is only a step in preventing possible harms. But we must first acknowledge risks, or else we risk not addressing them at all.

### **From Print to Web**

Corporate sustainability reports have been steadily moving online, too. The Internet offers an ideal platform, dialogue tools and new accountability levels. Most companies still need paper reports. Nevertheless, a growing number of firms have found online reports are easier to use.

While most companies' web-based sustainability reports currently lean towards repeating the printed versions, firms considering exclusively web-based publication are continue to grow in number. It is their preferred way to use their websites to spark and stimulate more accountability to stakeholders.

Organisations cite much the same reasons for web-based sustainability reporting as for print-based:

- improve a company's ability to manage its business and decision processes
- enhance stakeholder engagement
- create better relationships
- raise business value by optimising potential

These objectives are made to be easier and cheaper ways to strive for with web-based reporting, and the stakeholder range is wider and more diverse.



Several advantages accrue from online sustainability reporting. You can reach immeasurably larger and more diverse stakeholder groups, while being able to track which information they do or do not use. You can update as often as required, increase both the nature and quantity of the available information, and cater to different languages and interests. You let the visitors choose which parts they want to read, while encouraging them to give feedback and participate more. Last but not least, you avoid the paper-based reports, considering the costs of printing and distribution.

On the downside, Internet access is not guaranteed to everyone, and visitors risk information overload when they access the site. Privacy concerns may clash with visitor tracking. Also, information-gathering and verification may pose technical challenges, when regular updating is expected.

We have also seen how the information gathered on the Web can raise, rather than lower, the demand for paper-based reports. As an alternative, readers might just print out their own copies.

Ultimately, though many organisations take full advantage of the Internet's transaction speed, they perhaps do not yet fully appreciate the care and dedication required in this latest approach to engaging stakeholders.

Whatever the case, clearly the future of corporate disclosure, as the Global Reporting Initiative (GRI) has foreseen, will be "digital, responsive and interactive."

### **Enablement by Design**

Helping visitors to locate and comprehend corporate sustainability information is greatly facilitated by web design, easiness of navigation and tools used. Two principal aspects that have a marked influence on the success in communicating sustainability issues on company websites are linking and feedback tools.

The key Internet advantage over more traditional media is being able to link web pages. Yet, in spite of the mushrooming of available corporate sustainability data, companies have shown little proof in which they can help visitors effectively access it.

Unfortunately, business organisations still have a long way to go in relating business performance directly to sustainability information. Even when a visitor finds on a company or corporate website about extensive social and environmental information, this information rarely links logically to product information, let alone the core business. A prime example is that numerous corporations do not electronically or actually connect annual financial reports to their sustainability or environmental reports. This does not encourage investors to consider Planet (environment) or People (social) data.

External linking also appears to be a challenge for many organisations. Obviously, companies wish visitors to stay on their website, but this should not preclude, for instance, linking to third-party websites - especially those with contrast views. This all helps towards a balanced understanding. It also shows that a company is

open to questions and dialogue. Helpful and informative websites make users return.

Naturally, a company's internal structure dictates how far its website can demonstrate an integrated approach. One example is how the overall company conveys sustainability issues throughout its component parts.

Another example is how the web department understands triple bottom line information or People, Planet, Profit, and how it relates that understanding to internal systems for publishing company website material.

IKEA, Disney, and Tiffany & Co are examples of well-known companies using effective web-based sustainability reporting. Telekom Austria, Larsen and Toubro, and Westpac Australia may be less well-known. BT is web-only; BP's website has DataDesk - a customising tool that presents visitors' selected topics in a single document; Nike uses online video to look inside its factories.

### **Feedback Tools**

The Internet offers possibilities beyond text information and static graphics. However, before adding features to your company site, consider if:

- they add real value for visitors
- the chosen format is appropriate.

Companies can conduct stakeholder engagement via methods such as forums and panels, but online tools bring capacity for two-way dialogue. E-mail, web forums and chat rooms have introduced potential for much greater stakeholder engagement across company processes - not only for collecting feedback on reports, but also in helping to identify concerns and understand the stakeholders' opinions.

### **Potential in Engagement**

Web-based tools obviously enable companies to conduct dialogue and to reach new audiences in novel ways. Companies should look at this potential as a key priority.

For now, though, companies rarely use online engagement to its full benefit. Certainly, its anonymity might reduce the value of feedback gathered, hence, other traditional means of engaging stakeholders should run in parallel. We should dialogue on face-to-face, as much as we log on. Only then we can claim to have a fully rounded view of others' perspectives.

Sustainability reporting is migrating online, surfacing familiar issues such as standardisation.

Thus, the influential Global Reporting Initiative (GRI) launched the Digital Reporting Alliance at their 2016 Global Conference in the Netherlands. It aims to help businesses leverage digital platforms in order to raise the standard of their sustainability reporting, as well as addressing the issues of lack of both structured data and demand for digital reporting itself.



The result will be a platform for simpler digital sustainability report filing and a common system of digital reporting. Currently under-utilised, this should eventually facilitate the innovation and sharing of best practices, as well as easier analysis and integration of sustainability information.

Already, thousands of global companies use GRI sustainability reporting guidelines as the basis for their sustainability reports. However, the reporting standards are changing, and could evolve rapidly before 2019.

### **Forward Focus**

We can see the move towards modular GRI Sustainability Reporting Standards against this backdrop, as guidelines evolve, is enhancing the global standards' credibility and leading to greater take-up rate.

The new modular structure will ensure standards:

- remain up-to-date
- align with international instruments
- absorb additional sustainability topics more easily
- keep pace with new developments.

Finally, establishing formal standards will allow GRI to be referred even more in policy initiatives around the globe, supporting greater uptake of credible sustainability reporting.

The main changes that companies anticipate are that a fresh set of modular GRI Standards will be formed with content from both the Implementation Manual and the G4 Guidelines.

The majority of the changes, significantly, focus on format and presentation – it is not just G5, and it has no additional new content. The key G4 concepts carry through, including, the stress on reporting only material topics, Reporting Principles and use of “disclosures on management approach.”

The new modular structure is possibly the most evident difference:

- Three standards universally applicable to organisations will be based on:-
  - the G4 Reporting Principles
  - “in accordance” options
  - General Standards Disclosures
  - Disclosure on Management Approach.
- 33 “topic-specific” standards that cover a single sustainability topic will be based on G4 aspects.

The idea is that, when you prepare a sustainability report in line with GRI Standards, you use the three universal standards and choose the relevant topic-specific standards based on the materiality analysis.

The changes incorporate lessons learned from real-life company reporting practice. GRI checks how organisations report as compared to the guidelines and maintains an online platform to gather direct stakeholder feedback.

Also, from G4's release in 2013, GRI has been developing a thorough Frequently Asked Questions (FAQs) for the guidelines. This clarifies repeatedly misinterpreted G4 elements or elements inconsistently applied, based on direct feedback from reporters.

Furthermore, organisations which prepare a report in accordance with GRI Standards can:

- use additional disclosures from other frameworks or standards to report on their material topics
- include this information in their report.

GRI Standards do not specifically focus on investors, but instead include all stakeholders, whose views and concerns we must consider in order to fully understand sustainability issues that should concern corporations.

All in all, then, it looks as if sustainability reporting has a very sustainable future.

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# NOTES





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