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UI Green
Metric

World University Ranking

PROCEEDINGS OF
INTERNATIONAL WORKSHOP
ON UI GREENMETRIC 2016

Fostering Sustainable Culture
in Global Universities

Preface

PROCEEDINGS OF INTERNATIONAL WORKSHOP ON UI GREENMETRIC 2016

This proceedings contains the results of the International Workshop on UI GreenMetric 2016, International Workshop on UI GreenMetric 2016, organized by the Universitas Indonesia. This is the 2nd International Workshop on UI GreenMetric 2016. The first one was conducted in November 2013.

This workshop is an academic forum for Rectors, Vice Rectors, and Director of Sustainability and Facilities, of UI GreenMetric participant. They have shown a lot of development to achieve best positions in each category at the UI GreenMetric Ranking of World University.

In this workshop they share their efforts in improving sustainable environment in their campuses. This forum aimed at providing an opportunity for the top leaders of participating universities to explain their university's excellence in sustainability and Green Campus efforts. We also hope that this event will provide an opportunity for cooperation in sustainability management in campuses. We also hope that this event will also be a media in which we can hear and accommodate some comments from participants to improve our tools to evaluate university performance. There are 16 countries.

Editors:

Riri Fitri Sari
Nyoman Suwartha

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Preface

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Riri Fitri Sari
Nyoman Suwartha

Jakarta, 21st April 2016

Best Wishes

Prof. Dr. Ir. Muhammad Anis, M. Mst
Rector of Universitas Indonesia

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Rector's Welcome



Prof. Dr. Ir. Muhammad Anis. M. Met

Rector of Universitas Indonesia(Steering Committee of the Workshop Organizing Committee)

Dear Rectors, Vice President, University Leaders, Campus Sustainability Officers and all of the participants. Welcome to the International Workshop on UI GreenMetric 2016. This is the 2nd workshop on UI GreenMetric after a successful event in 2013.

We are honored to welcome all distinguished Rectors, Vice Rectors, Director of Facilities and Sustainability from more than 15 countries in this event.

We are proud to receive many positive feedbacks from many university leaders worldwide, which shows that after 6 years from its initiation UI GreenMetric has become a knowledge hub. Our workshop has also become an experience sharing event in which we can learn from each other in implementing sustainable campus infrastructure.

I am pleased to see the strength of the participation here, in which we receive many prompt and direct responses from our colleagues overseas which share the same goals and priorities. This is a proof that the issue of sustainability has gained the attention of academics worldwide.

We hope that Universitas Indonesia's initiative to draw attention to the sustainability issues through ranking will bring about direct changes in society.

We look forward to the presentations and discussions on the issue of campus greening. I wish you all a constructive and productive time during the conference and hope your stay is enjoyable.

Jakarta, 21st April 2016

Best Wishes

Prof. Dr. Ir. Muhammad Anis. M. Met
Rector of Universitas Indonesia

Remarks from the Minister of Science Technology and Higher Education of the Republic of Indonesia



Dear Rectors, Vice President, University Leaders, Campus Sustainability Officers.

Welcome to Indonesia. First of all I would like to thank all the participating universities of the UI GreenMetric Ranking of World Universities for your inspirational effort to provide the best campus environment in their universities.

I would like to congratulate the University of Indonesia for their 7th year effort to initiate to stimulate a lot of improvement and innovation in many universities worldwide through the UI GreenMetric Ranking of World University.

Concern on the sustainability is the main theme of our time, in which Sustainable Development Goals have become the commitment of global leaders. Universities should develop the future leaders with a lot of campus life experience in order for them to have competence in terms of knowledge, psychomotor skills, and attitude for fostering sustainable culture. In order to achieve the goal of a sustainable earth we should provide an environmentally concern learning process. University is a small city and will provide a small portrait of a country. Students will lead the future lifestyle of the country and the world.

Indonesia government is committed to improve the quality of its Higher Education system and to implement the green and sustainable movement throughout our campuses. We are proud that the Universitas Indonesia's GreenMetric has become of well accepted measurement tools in the world. We hope that the contribution of Universities in initiating conversation between university leaders throughout the world will all improve the competitiveness of Indonesia in general.

In conclusion, I would like to thank all the speakers and participants of this International Workshop for their dedication and commitment that makes this workshop a successful event. I wish you all the best to make this event a great opportunity to share experience and to learn from other university leaders. I am sure all of you is the ambassador of sustainable world.

Thank you

Mohammad Nasir.

**Minister of Science Technology and Higher Education
of the Republic of Indonesia**

A Glimpse of UI GreenMetric Ranking & Dreams of Future University Infrastructure



Prof. Dr. Ir. Riri Fitri Sari MM MSc
Chairperson of UI GreenMetric (Chairperson of the Workshop Organizing Committee)

We warmly welcome you to the Second International Workshop on UI GreenMetric 2016. This marks the end of the 6th year since we started our university ranking. This event is hosted by the Universitas Indonesia and held at The Margo Hotel, Depok - Indonesia, and includes UI campus tour visit to the greenery of the rain forest in the outskirt of Jakarta. The aim of this conference is to provide an opportunity for UI GreenMetric participants to explain their university's excellence in UI GreenMetric and also to provide an opportunity for cooperation in sustainability management in campuses. In this International Workshop, participating universities leaders will share their achievement in leading sustainability and conservation programs in their campuses. We are very proud to receive many warm and encouraging responses from many university Rectors/Presidents/Vice Chancellors from many countries.

We are happy to know that our dream and imagination that UI GreenMetric will be one of the hub that connects many universities in the world becomes a reality. We thank the Rectors and high rank officers from more than 14 countries who are willing to share their experience and efforts in improving sustainable environment in their campuses. The conference program is comprised of keynote talks, plenary talks, and invited talks. We hope that this event will be the discussion ground among many universities towards the next step of achievement in implementing green and sustainable academic and research infrastructure in their universities. This proceeding includes the written contributions from the speaker and poster session presenters of IWGM 2016 which consists of 17 articles. It covers the 6 indicators used in UI Greenmetric, i.e Setting and Infrastructure, Energy and Climate Change, Waste management, Water management, Transportation and Education.

We would like to thank International Ranking Expert Group (IREG), under President Jan Sadlak for their support, although due to the time restriction no representative from IREG could come to this workshop. We thank the Minister of Research Technology & Higher Education of Republic of Indonesia, Prof. M. Nasir for his willingness to be a keynote speaker which will show the support of Indonesian government to the UI GreenMetric as one of the university ranking in the world. We would like to thank Dr. Roseann Runte, CM, BA, MA, PhD - President of the Carleton University - Canada, Mr. Mark Poland - Director of Buildings and Estates UCC - Ireland, Dr. Musaad Almosaind, Princess Nourah University - Saudi Arabia, Prof. Joni Hermana - Rector of Institut Teknologi Sepuluh November - Indonesia, Dr. Khalil Jamshidi - President of the University of Zanjan - Iran, Prof. Dr. Adi Zakaria Afiff, S.E., M.B.A - Vice Rector for Finance, Logistic, and Facilities Universitas

Indonesia – Indonesia, Prof. Dr. Jesus Cano Sierra – Rector's delegate for the sustainability and environmental quality, Universidad Castilla La Mancha – Spain, Prof. Dato' Seri Dr. Mohamed Mustafa B Ishak – Vice Chancellor of Universiti Utara Malaysia – Malaysia, Mr. Dominik Schmitz – Senior Scientist and Expert at BOKU'S Center for Global Change and Sustainability Universitat fur Bodenkultur Wien – Austria, Professors Komisarenko Nataliia-Delegate of the Rector of Uman National University of Horticulture (Uman State Agrarian University) – Ukraine, Prof. Luiz Roberto Guimaraes Guilherme – Delegate of Rector of Federal University of Lavras – Brazil, Asst. Prof. Dr. Chanan Phonprapai – Assistant to the Rector for Administration of Thammasat University - Thailand, Ms. Sakiko Okayama – Chiba University Environmental ISO Secretariat – Japan, Assoc. Prof. Boonchai Stitmannathum, Ph.D – Vice President for Physical Resources Management Chulalongkorn University – Thailand, Prof Dr Fathur Rokhman Mhum - Rector of Universitas Negeri Semarang – Indonesia, Prof. Dr. Federico Fernandez – Delegate of the Rector of Universidad de Castilla la Mancha in Sustainability Issues – Spain, Prof. JC Leong - Dean of the Office of International Affairs – National Pingtung University of Science and Technology – Taiwan, Professor Majed Abu Zraig – Director of International Relations Office and Professor of Water and Environmental Engineering Department of Civil Engineering, Jordan University of Science and Technology– Jordan, and Prof. Dr. Werry Darta Taifur, S.E, M.A - Former Rector Universitas Andalas – Indonesia for their contribution to this workshop and the proceedings. We also thank all participants for this workshop for their active participation in the workshop.

Enjoy your visit to Jakarta and our Depok campus.

We wish you a fruitful Workshop and a courage to making beautiful dream of the next generation of sustainable campuses throughout the world becomes true.

Prof. Dr. Ir. Riri Fitri Sari
Chairperson of UI GreenMetric Ranking

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UI GreenMetric World University Ranking: Background of the Ranking

1. Origins of the ranking

The UI GreenMetric World University Ranking is an initiative of Universitas Indonesia which is being launched in 2010. Prof. Gumilar Rusliwa Soemantri Stated that it is a part of strategy of raising its international standing. The University hosted an International Conference on World University Rankings on 16 April 2009. It invited a number of experts on world university rankings such as Isidro Aguillo (Webometrics), Angela Yung-Chi Hou (HEEACT), and Alex Usher (Educational Policy Canada). It was clear from the discussions that current criteria being used to rank universities were not giving credit to those that were making efforts to reduce their carbon footprint and thus help combat global climate change.

2. Aim of the Ranking

The aim of this ranking is to provide the result of online survey regarding the current condition and policies related to Green Campus and Sustainability in the Universities all over the world. It is expected that by drawing the attention of university leaders and stake holders, more attention will be given to combating global climate change, energy and water conservation, waste recycling, and green transportation. We hope that the ranking will be useful to university leaders in their efforts to put in place eco-friendly policies and manage behavioral change among the academic community at their respective institutions.

3. Creating the ranking

Universities that wish to participate are asked to provide numeric data on a number of criteria that can give a picture of their commitment to the greening of their campus and putting in place environmentally friendly policies that support sustainability. The criteria include such baseline information as the size of the university, both spatially and in terms of population, the campus location and the amount of green space; and also information on energy use, transport, water use and recycling and waste treatment. In addition, it will ask about efforts being made by the institution towards establishing green policies and management.

4. Methodology used to create the rankings

4.1 The philosophy behind the rankings

We based our instrument on a broad philosophy that encompasses the three Es: Environment, Economics and Equity.

4.2 The criteria

We selected criteria that are generally thought to be of importance by universities concerned with sustainability. These include the collection of a basic profile of the size of the university and its zoning profile, whether urban, suburban, rural. Beyond this we want to see the degree of green space. The next category of information concerns electricity consumption because of its link to our carbon footprint. Then we want to know about transport, water usage, waste management and so on. Beyond these indicators, we want to get a picture about how the university is responding to or dealing with the issue of sustainability through policies, actions, and communication. In the first version of the methodology, used in 2010, 23 indicators were used within the five categories to calculate the ranking scores. In 2011, 34 indicators were used. Then in 2012 we leave the indicator of "smoke free and drug free campus environment" and used 33 indicators to evaluate the

green campus. In 2012, we also categorize the indicators into 6 category including education criteria. One change being considered is the formation of a new category for sustainability education and research.

4.3 Scoring

Scoring for each item will be numeric so that our data can be processed statistically. Scores will be simple counts of things, or responses on a scale of some sort.

4.4 The weighting of criteria

Each of the criteria will be categorized in a general class of information and when we process the results, the raw scores will be weighted to give a final calculation. The weighting Criteria can be found in figure 1.

4.5 Refining and improving the research instrument

While we have put every effort into the design and implementation of the questionnaire, we realize that this third year round is bound to have shortcomings. Therefore, we will be reviewing the criteria and the weightings continuously to reflect input from participants and state of the art developments in the field. We welcome your comments and input.

4.6 Data collection

Data will be collected through online system between June-October 2016 from the universities we have contacted and who are willing to provide information.

4.7 Initial results

The preliminary result of the metrics is usually released in December.

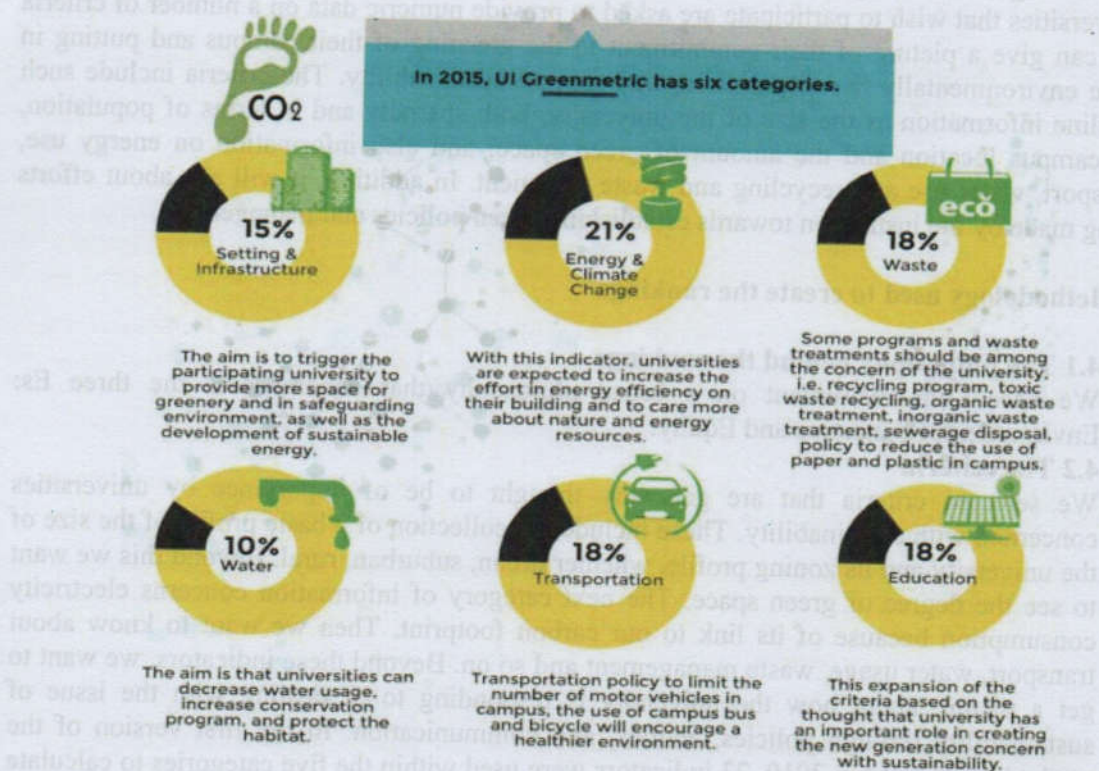


Figure 1. Indicators and Weightings of UI GreenMetric World University Ranking 2015

**PLENARY SPEECH :
“Sustainability in Global Universities”**



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World University Ranking

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**Fostering Sustainable Culture
in Global Universities**

Universitas Indonesia, Depok, Indonesia April 21st 2016

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Carleton University's Integrated Vision for Sustainability in Research, Teaching, Campus Plan and Operations

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Abstract. Universities have the privilege of combining research and teaching on sustainability while undertaking serious efforts in operationalizing sustainability on campus in planning, construction, retro-fitting aging edifices, and making sustainability a theme of campus life. Universities also have the challenges of ever-insufficient funding and of bridging the silos that exist due to sprawling campuses, the tendency for disciplines to be centered on specific and exclusive approaches to issues, and the difficulty of communicating at once to a highly specialized community and the general public. Carleton University has dedicated considerable efforts to integrating campus sustainability efforts with teaching and research and is today privileged to announce its Global Water Institute.

Keywords: Carleton, water, sustainable, environment

1. Introduction

When you live in the North, surrounded by ice or when you live on islands, surrounded by the sea, it is hard to imagine that water is not actually abundant on our planet. Indeed 97% of the world's water is salty or otherwise undrinkable. 2% is locked in ice caps and glaciers. That leaves only 1% for all of humanity's needs. We tend not to think of water unless there is a drought or flooding. Some land masses are slowly sinking due to rising sea levels and the exploitation of underground aquifers. Some populations are forced to consume non-potable water, contaminated by toxic materials or other contaminants.

One billion people in the world lack water. 3.5 million people around the world die every year from water-related diseases. Children account for 84% of water-related deaths. Indeed, every 15 seconds a child dies from a water-related disease.

Knowing this, we must act and as universities we have the privilege of researching the causes of problems and seeking solutions. We have the responsibility to educate the next generation and the public to ensure that once the problem is solved, it does not continue. Finally, we have the obligation to take every step possible to alleviate the problem through our actions and example. Our campuses are, in effect, living laboratories and work to solve a problem such as the preservation of our most precious resource cuts across all functions of the institution, integrating academics and administrators in a single purpose.

2. Water Institute at Carleton University

At Carleton University, we realized that the problem of water is global. A natural resource, water knows no boundaries. The same is true of pollutants. We were facing a challenge that was too large for a single institution. Indeed, we realized that there are fine researchers and groups around the world working on different aspects of water. At the same time, we understood that this is not only a scientific issue, but one for engineers, social scientists and humanities scholars alike. Respect for this valuable resource must become part of our culture. This cannot occur if we only educate our own students. We must reach out to the population in general. Thus, we determined to create a Global Water Institute with a network of scholars stretching around the world. We decided to make this Institute firmly based in interdisciplinary research and we decided to hold an international conference every two years to which the top scholars in the world would be invited. The results will be made public and widely available in the hopes that they will influence behaviour as well as the development of good policy

governing the use and distribution, treatment and collection, safeguarding of reserves, and the health of our world population.

To accomplish these goals we needed to seek funding and identify and hire top scholars. We needed to create an International Advisory Board which includes scholars, informed citizens, activists and those who understand the issue and are prepared to volunteer their time and expertise to assist us in achieving our vision. We are delighted to announce that the goals have been substantially met and that the Institute will be officially announced very soon.

The Institute fits nicely with our programs in Environmental Science, Environmental Studies, Sustainable Energy, Environmental Engineering, Sustainable Architecture, and Sustainable Energy Policy. New buildings and renovations of older buildings are all "green" and demonstrate visibly our commitment to the environment and sustainability. These symbols are underpinned by a strategic sustainability plan which emanates directly from the University's Strategic Plan, linking all sectors and departments in a common vision.

Work includes efforts to support energy efficiency, to reduce waste and promote recycling, to eliminate vehicles producing greenhouse gases (meaning electric vehicles and convenient charging stations), to work with the local municipality to increase mass transportation, and a plan promoted by our students who voted to purchase bus and train passes for all students.

3. Carleton University Sustainability Programs

Every year we offer prizes for the best suggestions on ways to reduce our carbon footprint. They are funded by our Green Revolving Fund and, this year alone, 19 projects were funded. They range from the offering of free bicycles for use on campus and the automatic shut-down of computers to lights and competitions to reduce water usage in student residences. The university has done much serious work refitting buildings to reduce energy use. The first phase of this project reduced energy costs by \$120,000 per annum and moved the project to 4 Green Globes from 2. The second phases of the project included two buildings, a reduction of 22% in utility use, an annual cost savings of \$151,000 and a reduction in CO2 emissions by 288 metric tons per annum. This is the equivalent of removing 130 cars from the road every year!

We have reduced our waste by 61% since 2009 while we grew in numbers of students and buildings at the same time. One project included students who collected 5,000 kg of clothing, bedding and household items which were donated to the Diabetes Clothesline Project.

Since we submitted our application to this program, we have increased waste collection and recycling, added bike racks and storage sheds, expanded car sharing options on campus, and introduced a bike share program. We have continued to reduce energy use and improved monitoring systems. We have engaged the community through Earth Day activities, walking tours, a sustainability guide and newsletter, and numerous activities announced through social media.

4. Conclusion

I would like to thank you for your work in promoting Green campuses. UI GreenMetric is a leading way to share information, to encourage friendly competition, to inspire us all to strive to achieve even greater excellence in reducing our carbon footprint. In turn, I would like to invite you to provide me the names and coordinates of people who would like to be part of our Global Water Institute and Network. Together we can save lives, improve the quality of life and ensure the sustainability of our people and nations.

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Development of Sustainability in University College Cork

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¹Building and Estates, University College Cork, Cork, Ireland

²Vice President Teaching & Learning, University College Cork, Ireland

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Abstract. This paper sets out how University College Cork has over recent years developed as a campus with a strong focus on environmental sustainability. The need for change in social, political and economic agenda to include environmental sustainability is essential if we are to protect the interest of future generations. The arguments in relation to climate change are proven and universities must act as leaders in institutionalising sustainability in all its areas of activity.

1. Introduction

Founded in 1845, University College Cork (UCC) is one of Ireland's premier universities. It boasts a vibrant, modern city centre campus encompassing a range of modern historic buildings located on an attractive landscaped site of over 70ha. The University is home to some 20,000 full-time students and employs c.2800 people. The University is highly committed to sustainability and the green agenda. It was the world's first Green-Campus university awarded by the Foundation for Environmental Education (FEE 2014) based in Copenhagen, Denmark and is currently ranked 4th globally in the global UI Green Metric World University Rankings.

The University is acutely aware of the global context in which its strategy is grounded. In September 2015, the United Nations General Assembly passed a resolution which formally adopted 17 Sustainable Development Goals as summarised in graphical form in Figure 1 below. As a global university, University College Cork is fully cognisant of the contribution it can make to the realisation of these goals.



Figure 1 - UN Sustainable Development Goals (SDGs)

UCC had special observer status (the first Irish third level institute to do so) at the UN Climate Summit in Paris (COP21) which reached an ambitious and historic deal to limit global temperature increase to below 2 degrees above pre industrial levels. Our researchers contributed actively in Paris and locally in the national media in and around the time of the Summit to communicate simply and clearly with the public in fully understanding the importance and significance of all that emerged over that period. Back on campus research scientists and students took part in the COP21 Global sit down to raise awareness of the climate research and remind makers of the serious decisions that were required.

The focus on sustainability at UCC is embedded in the Universities Strategic Plan (2013-2017) which includes in one of its key Goals to "further enhance UCC's reputation as Ireland's Green University" [1]. In practice the objective is deeper than stated in the Plan and goes to the heart of everything the University does. We strongly believe a true Green Campus involves bringing together the teaching, research and operations activity to work seamlessly together to advance the green agenda. This requires a loosening of the traditional structures that often govern university activity with students,

academics and support staff all working on cross cutting areas of interest. It is this lively sharing of ideas, projects and interests that delivers real change. Our guiding motto is that the Green Campus is 'Student led, research informed and practice focused'.

In order to embed these ideas, UCC established a Green Forum which is co-chaired by Professor John O' Halloran, Academic and Vice President for Teaching and Learning, and the Director of Buildings and Estates, Mark Poland, who has responsibility for many of the operational areas of sustainability in UCC. The Forum is open to all at UCC and includes students, academics, support staff and suppliers/contractors who work on our campus. All ideas are embraced, debated and distilled for further action. Discussions range across curriculum development, student projects, society activities, operations on campus etc. A key initiative in recent months has been the development of a new Sustainability Strategy which pulls together in one document all aspects of the sustainability agenda identifying strategic aims, objectives and performance indicators for each strand. We will set out some high level aspects of each of the strands in this strategy.

2. Sustainability Policy

Like many strategy documents we have developed an overarching policy which states that "University College Cork is firmly committed to the principles of sustainability. Recognising that our activities impact upon the environment through our education, research and ancillary operations, our infrastructural development and our influence on the wider community of which we are a part; we are cognisant of our environmental responsibilities in local, national and global terms"[2]. We set out our commitment to continuous improvement in our environmental performance and commitment to address our full range of activities and across all of our strands.

3. Sustainability Citizenship

The University is cognisant that each of us, individually, is an integral part of the wider environment and accordingly should act as good citizens of the Earth. This University commits to support and promote such sustainability citizenship amongst its student and staff population. In particular we believe we have a responsibility to engage, inform and influence the incoming students of the positive role they can play as responsible global citizens. UCC was the first University in the world to be awarded a Green Campus Flag by the Foundation for Environmental Education based in Copenhagen. Green-Schools (known internationally as Eco-schools) is an international education programme run by the Foundation for Environmental Education (FEE) and active in over 23,000 schools across 43 different countries. It is operated in Ireland by An Taisce, the National Trust for Ireland. It promotes environmental sustainability and action through a seven step programme, awarding a Green-Flag to successful applicants. The steps begin with the establishment of a committee representative of all major stakeholders. This committee must then undertake an environmental review and develop and action plan which is implemented, monitored and evaluated continuously. The programme must be linked to the curriculum/learning on campus and the committee must inform and involve the wider community. Central to the Green-Flag ethos is the involvement of all stakeholders and the embedding of environmental sustainability and awareness throughout all aspects of the institution. Currently, in UCC there are over 120 student clubs and societies representing a range of interests. The Students Union who represents student interests at all levels of University Governance have embraced the Green agenda and its Deputy President is responsible for promoting this agenda in his sabbatical role. Many of the student societies are involved and the Environmental Society (Envirosoc) has taken a lead role in mobilising the student population. With many students having come from Green-Schools, and aware of the positive impacts that come with the adoption of a Green-Flag ethos, they decided that it should be possible to adapt the programme to suit a university model. In continuing Green-Schools to third level it would ensure students continued to learn and contribute as valuable working citizens in an environmentally healthy and equitable society. In 2010 UCC was the first University in the world to be awarded a Green Campus Flag which was renewed in 2013 and again in 2016.

The Students Union and the many societies engage in wide ranging activities throughout the College year. In the last year a climate change conference was organised, awareness days took place and a lively mix of fun activities ensured that the student body remained engaged. There is an

understanding and acceptance that student interest and enthusiasm can vary from year to year as the student body changes. In order to help ensure continuing student engagement a number of internships/placements ("UCC Works") were advertised from 2014 to 2016 in collaboration with the UCC Careers office to encourage and reward students who commit to putting in a certain number of hours and show leadership in sustainability. This proved very successful in the 2014/2015 academic year with seven students participating (out of 12 advertised positions), and 5 students coming on board in 2015/2016. Each student is given an aspect of sustainability to work on during the year. One student sought each student society to make green pledges and another organised a carbon calculation and offsetting project around a climate change conference. Completion of a successful internship is included in the students University degree transcript and allows the student to demonstrate to prospective employers their commitment to sustainability as an undergraduate. The new University wide module (see later) and PhD modules developed recently are also available to all students.

4. Recycling and Waste

The University is committed to reduce the volume of waste generated and to increase the proportion of the waste which is recycled. Resource management practices based on reduce, reuse and recycle principles. The University strives to reduce the acquisition of new materials, re-using existing materials and increase recycling to the best possible standards. A detailed analysis of all our waste streams has been completed [3, 4] to assess the levels of waste produced across all campus activities. The range varied from food, packaging, chemical etc. Plans to capture for recycling a much of this waste as possible have been developed in conjunction with our suppliers and contractors. A series of recycling centres has developed which are located strategically across campus to allow students and staff to recycle paper, plastics, cardboard, batteries, electrical goods etc. Biodegradable waste is segregated at source in our restaurants and our landscape waste is composted on site and reused in the garden management. Our recycling waste rates have increased to 80% and we are targeting further increases. Significant volumes of waste have been diverted from landfill and significant financial saving have been achieved. We are currently piloting a "bin less" to reduce waste handling and allow staff to undertake their own segregation at office level.

5. Energy, Water, Climate Change

UCC has been in the energy reduction space for quite some time with the establishment of an energy committee in the 1980's in response to the 'oil crisis' in Ireland at that time. During the intervening period the key energy indicator (kwhr/m²) has been tracked with a continuous downward trajectory achieved Figure 2. A three pronged approach is used to achieve these results. Firstly, the technical improvements in the energy performance of plant and equipment through energy retrofits and increasing use of renewables. Secondly a concerted effort to encourage better energy awareness by users through information provision/reminders and use of polluter pays principle. Thirdly we work hard to ensure that all new developments are constructed to the highest sustainability principles. These are no short term measures but require an ongoing focused and sustained programme of work. We are guided in this by our ISO 50001 Energy Management System which provided a structured approach to identifying our significant energy users and allows us to plan and verify each energy reduction initiative. We have been supported in these efforts over the years by Sustainability Energy Ireland, the Irish government's energy policy agency who have provided technical assistance and grant support for various schemes over the last 10 years. We are currently exploring the use of Energy Performance Contracting to allow us to target saving from our existing outdated district heating system. This 'pay as you save' approach with private sector finance offers accelerated investment potential but is difficult from a contractual and public sector procurement perspective. The Irish Government has set us ambitious savings targets of 33% by 2020 in line with international agreed targets. As you can see from Figure 3 we are currently ahead of our "glide path" and we will seek to exceed the identified target.

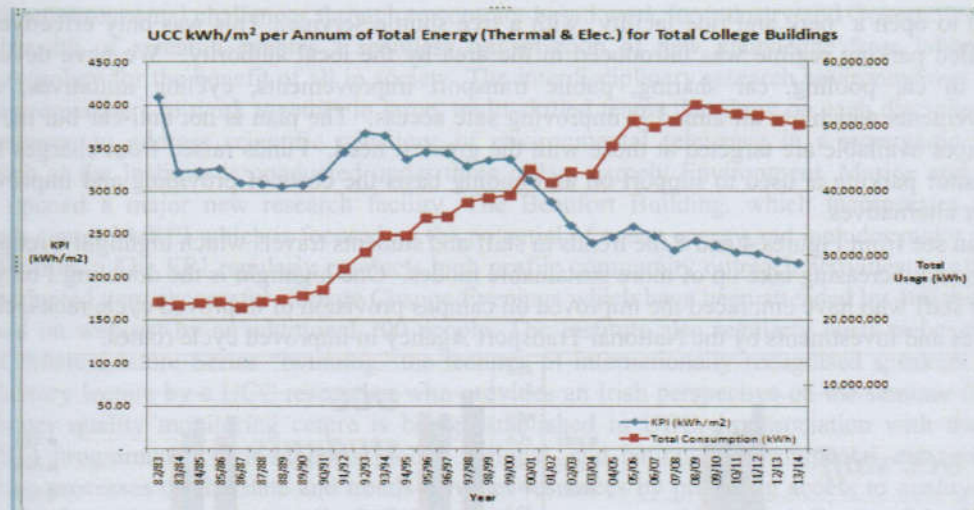


Figure 2 - Long Term Energy Performance Trend

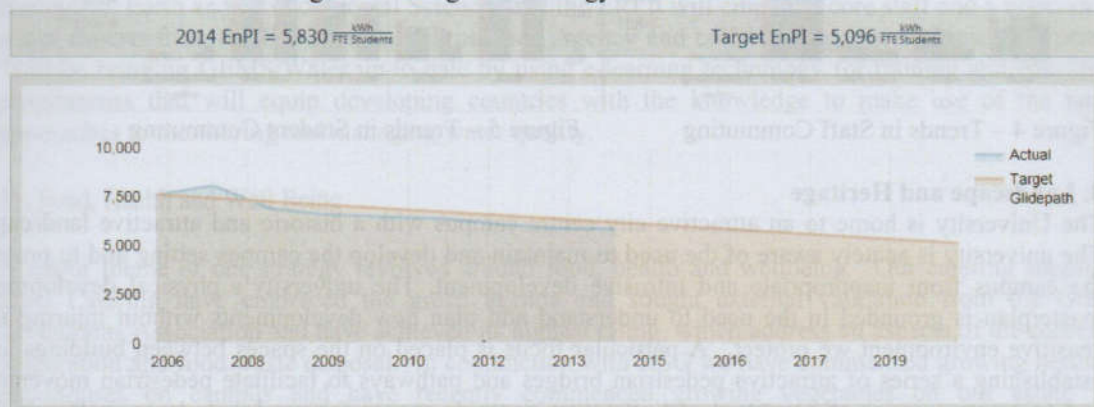


Figure 3 - 23.4% Towards 2020 Target of 33% Reduction Compared with Baseline Year 2006-8

6. Procurement and Contracts

UCC by its nature procures a large amount of goods and services, and the environmental implications of such expenditure can be significant. This is a great opportunity for the University to reduce the environmental impact of its purchasing decisions by implementing a systematic green procurement process. Furthermore, owing to the scale of the procurement, such a system (along with similar action by other public procurers) can affect real change in the marketplace resulting in great availability and more competitive pricing of environmental preferable products. A green procurement policy is in place with a focus on total life cycle product cost, reduction in packaging and preference for environmentally friendly eco labels. In the procurement process for design teams for capital development a heavy weighting is applied for expertise in designing sustainable buildings.

7. Commuting

UCC operates a commuter planning strategy which aims to increase access to the University while reducing our reliance on the single occupant car journey. A Commuter Plan and strategy supported by our Commuter Plan Manager oversees this ongoing initiative. UCC is at the edge of the City core and is reasonably well served by public transport. Roughly half of our student body are living at home and the other half live away from home and avail of a combination of purpose built and shared rented houses around the university. UCC cannot provide car parking for all those who would like to drive to the campus. The local road network would grind to a halt if UCC build significant additional parking. The focus on the commuter plan is to provide a range of alternative access opportunities to staff, students and visitors to access the University safely and efficiently. We were the first University in

Ireland to open a 'park and ride facility' with a free shuttle service. This was only effective once a controlled parking regime was introduced in the area by the local authority. We have developed a series of car pooling, car sharing, public transport improvements, cycling initiatives, walking improvements which are all aimed at improving safe access. The plan is not anti-car but the limited car spaces available are targeted at those with the greatest need. Funds raised from charges for staff and visitor parking is used to support on an ongoing basis the costs of providing and improving the greener alternatives.

You can see from Figures 4 and 5 the trends in staff and students travels which highlight a reduction in car use and increasing take up of more sustainable modes. One highlight is the doubling of bicycle use among staff who have embraced the improved on campus provision of improved cycle racks, changing facilities and investments by the National Transport Agency in improved cycle routes.

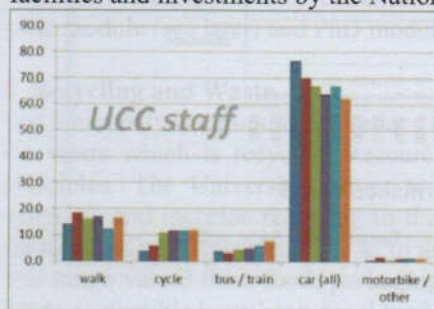


Figure 4 – Trends in Staff Commuting

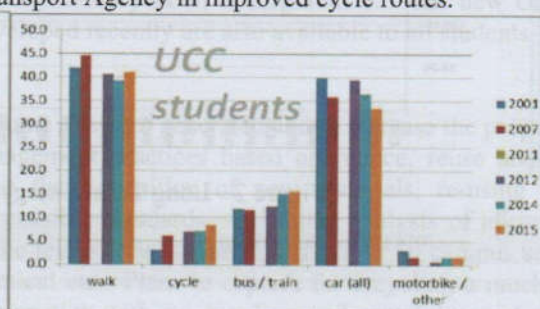


Figure 5 – Trends in Student Commuting

8. Landscape and Heritage

The University is home to an attractive city centre campus with a historic and attractive landscape. The university is acutely aware of the need to maintain and develop the campus setting and to protect the campus from inappropriate and intrusive development. The university's physical development masterplan is grounded in the need to understand and plan new developments without injuring the sensitive environment we protect. A particular focus is placed on the spaces between buildings and establishing a series of attractive pedestrian bridges and pathways to facilitate pedestrian movement and to create a series of courtyard and attractive riverside spaces for use by students, staff and the population of Cork City. UCC has also focused strongly on the enhancement of our site biodiversity with events like the "Bioblitz", a fun competition with other Universities to identify and record over 24 hours a list of plant, animals and other species on campus. A Biodiversity Survey has identified important habitats for protection and areas of the campus are earmarked for wild flower meadows and a less intrusive maintenance regime. UCC has also just launched a new Green Trail which is a guided audio tour which allow visitors to explore aspects of the University's historic landscape and our green story in a self-directed user friendly way.

9. Teaching and Learning

UCC has a range of undergraduate and postgraduate courses in the areas of sustainability. We would like to embed sustainability modules across all our courses in time. This year we launched a university wide module open to all students with a series of diverse topics from urban planning, ethics, marketing and food production. The module involved on line conversations following each module to encourage participation and debate. The module has proven to be very popular among students and indeed other learners in the community who had not previously accessed UCC's courses. It is expected that a full on line module will be launched in 2017.

10. Research

UCC is one of Ireland's leading research intensive Universities. The Environmental Research Institute is focused on providing knowledge-based options to address major societal challenges and in developing and strengthening Ireland's leadership in eco-innovation and innovation in policy and governance. The Institute fosters a broad approach to environmental research that ranges from "blue skies" research aimed at new knowledge creation, to applied research designed to generate solutions to

specific environmental challenges through to contract-based work for industry and Government bodies. This breadth of research enables a seamless transmission of new knowledge from laboratory to industry/policy for the benefit of all in society. The interdisciplinary research environment at the ERI enables researchers to work together in large, multi-skilled teams that draw on each discipline's core competences to address scientific questions of environmental relevance in a synergistic manner. Research at the Institute is conducted under three pillars namely Environment, Marine and Energy. UCC opened a major new research facility, The Beaufort Building, which incorporates a major research center MaREI which is focused on the potential of ocean energy and includes major new test bed facilities. The ERI regularly conducts high profile community outreach activities on climate. It has conducted very successful Climate Change Evenings which have been attended by 400 people and watched on webcast by an additional 200 people. The Institute also regularly hosts webcasts of the EPA Climate Lecture Series "twinning" the lectures of internationally recognised speakers with an introductory lecture by a UCC researcher who provides an Irish perspective on the seminar theme. A new water quality monitoring centre is being established in UCC, in association with the UNEP GEMS14 programme which supports global, regional, and national environmental assessment and reporting processes on the state and trends of water resources by providing access to quality-assured data and information on water quality in freshwater ecosystems worldwide". A Centre of the School of Biological, Earth and Environmental Sciences and the ERI it will employ a core staff and a network of water experts from the Environmental Protection Agency and collaborating Universities. The centre "will be bringing GEMS/Water up-to-date by using e-learning technology for training and education programmes that will equip developing countries with the knowledge to make use of the latest approaches to monitoring and managing water quality.

11. Food, Health and Well Being

A major theme of our strategy revolved around food, health and wellbeing. Our catering suppliers KSG Catering have embraced the green agenda and sought external validation from the Green Restaurants Association and have achieved its highest rating, which address all aspects of the sourcing, preparation and food waste disposal. In conjunction with KSG we have commenced growing herbs in glasshouses on campus and have recently commenced growing vegetables on our estate for consumption in our restaurants. The student body also run a community garden on campus with a number of polytunnels for education and practice in organic methods of cultivation. The University is also a Healthy Promoting University and provides significant supports to our students as they go through the transition from second level students to students that are world ready and work ready.

12. Conclusion

UCC is heavily committed to developing as a truly green university. This is a long term project which ebbs and flows but which is on an upwards trajectory. It takes hard work and commitments from all strands of the University community working together and building year on year on successes and failures alike. It requires leadership from the academic community and a willingness from the student body and the support services. It should contribute developing a next generation of globally aware students and leaders committed to sustainable living.

References

- [1] University College Cork, Strategic Plan 2013 – 2017
- [2] University College Cork Sustainability Strategy (Draft)
- [3] Waste Management in UCC – A Review of General Waste Management Facilities and Services, D'Arcy 2014
- [4] Waste Management in UCC –Specialised Waste Management Report & Guidelines, D'Arcy 2014

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- [4] Waste Management in UCC –Specialised Waste Management Report & Guidelines, D'Arcy 2014

Sustainability at PNU Campus

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Abstract. PNU is considered one of the biggest universities in the world and has the largest utilities plants over the Middle East. From this point we direct our attention to having an efficient operation to save the campus assets and operational cost. The PNU Campus is mainly a specialized university campus for women. It is The biggest university in the world to be dedicated for women only (60,000 students) that encompasses specialties ranging from liberal arts, science, medical faculties. The campus is designed to have the most flexibility for ease of future adaptation. The project architecture character is design with a modernized Islamic vocabulary. The project design utilizes the most up to date and state of the art technology for both educational spaces and facilities and for the systems used in the project. The campus was designed according to the highest standards and taking into consideration sustainability and LEED requirements. The campus has an Automated People Mover System (APM) serving most of PNU Campus.

Keywords: University campus for women, eco-campus, environment, Automated People Mover System (APM)

1. Introduction

PNU is considered one of the biggest universities in the world and has the largest utilities plants over the Middle East. We direct our attention to having an efficient operation to save the campus assets and operational cost. The PNU Campus is mainly a specialized university campus for women and it is the biggest university in the world to be dedicated for women only (60,000 students) that encompasses specialties ranging from liberal arts, science, medical faculties. The campus is designed in 2010 to have the most flexibility for ease of future adaptation. The project architecture character is design with a modernized Islamic vocabulary. The campus was designed according to the highest standards and taking into consideration sustainability and LEED requirements. The campus has an Automated People Mover System (APM) serving most of PNU Campus.

2. Implementation of Sustainable Campus at PNU

For PNU to be a green university all functions need to be operating from the same Green Agenda, all feeding into each other creating a synergy of sustainable activity running through PNU. In PNU sustainability policy we consider Systematic Integration of Sustainability Principles, Master Planning, Design and Construction, Operations and Maintenance, Climate Change Mitigation and Renewable Energy, Transportation, Recycling and Waste Management, Environmentally Preferable Purchasing.

3. PNU Strategic Goals in Sustainability

The PNU 10-year strategic plan has seven goals that emphasize sustainability in all aspects of university operations. These goals can be achieved through the following strategic objectives:

- Supporting projects for investing PNU resources and utilities.

- Achieving sustainability through efficiency and effectiveness in operating PNU utilities and managing its resources.

PNU is playing a responsible role to implement sustainable best practices through various projects that the department manages from design to construction and after construction. Every day these practices are being utilized during operation and maintenance of the campus. These practices save energy, improve occupant comfort and environment, reduces carbon footprint that resulted into a better Sustainable environment and a Greener campus.

Sustainable Operation - Energy Management Program (EMC)

Energy management is the use of engineering and economic principles to control the cost of energy to provide needed services in buildings and industries. Approximately 14 percent of the costs of a building with an expected 40-year life span are in the building's design and construction; the remaining 86 percent of costs is in operations and maintenance. Technology alone does not ensure an energy efficiently operated building. Management and the operators can have the most significant impact on building energy use and cost.

- Develop the preliminary Energy Strategy
- Get buy in from Top Management
- Organize administrative and management structure
- Conduct Energy Cost and Use tracking
- Conduct an energy audit
- Identify, analyze, and prioritize opportunities
- Implement energy projects, processes, and training
- Monitoring, targeting, and reporting

Sustainable Operation - Integrating sustainability and energy conservation

Formulating and integrating sustainability and energy conservation in all aspects of operations in support of the efforts of the university. Management and maintenance of the Facilities' department will lead these efforts and the entire independent unit will work to identify initiatives in its business plan.

Sustainable Operation – PNU Sustainable Key Performance Indicators

The environmental KPI includes the environmental aspects to evaluate the performance regarding actions taken in order to save natural resources and reduce the consumption

Sustainable Operation - PNU's Sustainability Instructions to PNU users

- Areas of concern:
 - Environmental awareness
 - Energy management
 - Water management
 - Waste management
 - Housekeeping management
 - Operation Automation/Optimization

Resource efficiency

To help us benchmark progress, we capture and report on our consumption, waste generation across our campuses. We are also implementing a system to monitor energy and water consumption across our buildings in real time. Water is a precious resource and essential in maintaining our natural landscapes, which are an important part of our campuses. Our water conservation initiatives include: smart irrigation technologies, water-sensitive urban design to manage storm water, minimum water-efficiency standards for new buildings and refurbishments, rainwater harvesting systems

PNU Water Management System

Our Statement is **"When it comes to water, every drop must counts"**

Water Management System - Water Action Plan

PNU is developing a Water Action Plan to build on our water conservation achievements to date and guide the University's water management activities in the future. The Plan will outline actions, strategies and targets to realize our vision of establishing a campus-wide closed loop water system at PNU.

Water Management System - Water Conservation

The conserving water is one of our key water management strategies. We've reduced our water use significantly through initiatives like PNU's Water Conservation Program, and through water conservation policies for all buildings on campus.

PNU Water Management Program

It becomes clear that great efforts have been exercised by the PNU to face the crisis of water which aims to support the role of the sustainable management for water consumption, through preparing plans and policy, using modern irrigation techniques will help in solving the crisis. Besides, there should be more strict procedures to reduce the consumption of water and promoting the strategy of using water. The use of advanced and appropriate methods for the assessment of Water resources will develop common interest issues and creating a common attitude among the PNU Society.

A sense of responsibility among PNU Staff and Students is highlighted to activate and increase the role of the sustainable water resources in PNU Campus.

Water Management System -Water Conservation Techniques used in PNU

- Using water-conservative low consuming type appliances and sensor-operated automatic faucets to reduce water consumption
- Using Maximo program as a computerized maintenance management software to record any water losses and follow up the corrective actions
- The Sewage treatment Plant to treat the sewage water and use it for irrigation
- The Reverse osmosis Plant to desalinate the deep wells water and use it for irrigation
- The Automatic Irrigation operation depends on the weather station to determine the optimum time for the irrigation
- Using the Drip Irrigation Method
- Timers are used to control irrigation schedule
- Irrigation is taking place at early hours of the day to avoid evaporation due to high temperature and low humidity occurring during the day
- Training is performed frequently by the contractors to enhance awareness of water conservation and apply water conservation measures
- The Billing system reports monthly water consumption of each villa and apartment, then tenants are informed for any overspending noticed
- Brochures were distributed to all tenants and users to conserve water during daily use

Water Management System - Sewage Treatment Plant (STP)

- It is one of the unique sewage treatment plant in the region, with a current capacity range from 2,500 m³ – 3,000 m³ with maximum capacity of 10,050 m³ per day
- This treated water is used for the irrigation system that requires water amount of around 8,000m³ per day

Water Management System - RO Plant

- This plant treats the deep wells water using the reverse osmosis technique to desalinate the water and use it to make up the irrigation water

- This Plant produce almost 5,000 m³ as daily production from both deep wells that are available at PNU

Water Management System - Potable Water Consumption

Water Management System - The Environmental KPI

Environmental KPI includes water management and conservation to evaluate contractors' performance regarding actions taken in order to save water and reduce consumption

Green Campus Results - Benefits of Water Management in PNU

By successfully applying the previously elaborated best practices of Water Management along with the support and commitment of all involved parties, significant savings could be expected in annual operational expenses in PNU.

Green Campus Results - Savings in 2016

- **Electrical saving Percentage:**
January 2016 = 4 %
February 2016 = 13 %
- **Potable water Savings Amounts:**
January 2016 = 52,440 m³ = 34%
February 2016 = 38,292 m³ = 20%

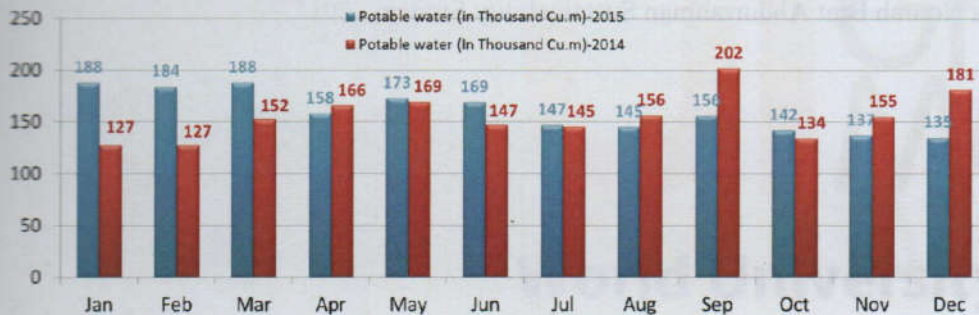


Figure 1. Potable Water at PNU

Note: Occupancy has been increased in several locations as well as the number of students

Green Campus Results - Lessons Learned

- ☐ Metering has provided a tool for usage analysis
- ☐ Metering has provided a tool for cost analysis
- ☐ Demonstrating savings and paybacks has been made easier with data

4. Conclusions

In our Campus Sustainability Plan we realize that it need top down commitment, bottom up support and enthusiasm, lead green team and set goals & priorities, development of Green policy, benchmark all operations on campus, behavior and cultural change awareness and practices, sustainability in core curriculum and academic affairs, and we need to track, improve, and move on.

The following is our Proposed Campus Sustainability Plan Recommendations

- Finalize the Energy Management System with the contractors, and have a fully operational system by 2016.

- Perform Audits as suggested in the approved master plan, and comply with the recommended procedures
- Implement Energy/Water Conservation Strategies
- Keep track of consumption and savings through a metering and reporting system per building on monthly basis
- Evaluate Performance and update objectives accordingly
- Adopt continuous improvement concept
- Record Energy/Water Management violations on MAXIMO
- Enhance involvement of Employees, Students, and Occupants
- Enhance communication and collaboration between concerned parties

We are finding ways to operate more sustainably through a range of practical strategies. We have prioritized energy and water consumption, waste management, recycling and transport as key areas for improvement, such as reduce energy and water usage, educate our staff and students on energy and water management, document and publish all information to achieve improvements, uphold legal requirements regarding energy use, continuously improve our performance and systems, effectively utilise energy efficient products.

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**Session I:
“Setting & Infrastructure”**



World University Ranking

PROCEEDINGS OF
INTERNATIONAL WORKSHOP
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Fostering Sustainable Culture
in Global Universities

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The Future Challenge for the Implementation of Eco-Campus Programme at ITS Surabaya

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Abstract. As one of the largest university in East Java, Institut Teknologi Sepuluh Nopember (ITS) has a mission to produce graduates who have the main competency in science and technology with environmentally friendly vision in the future. One of our approach to implement this policy is *Eco and Smart Campus* programme, that is aimed at shifting the mind-set of ITS academic community to be more concern and responsible to their environment. There were 5 main activities that have been implemented, and these were associated with the development of technology, facilities and infrastructure, and also changing the attitude of academic community in dealing with environmental issues. Some of the main activities include the research development of the ITS electric bus, the establishment of safety riding and cycling routes within internal campus, the construction of communal wastewater treatment plants, and the social engineering programme to increase our environmental awareness. Lesson learnt from our experience creates future challenges for the eco and smart campus implementation as it will be more complex. The growth of student bodies and its campus, will obviously increase the water and electricity consumptions, and it will be followed by the increase amount of solid wastes, wastewater, and air pollution. This condition could become a potential problem if the eco-campus programme is not implemented continually. The changes in mind-set and attitudes of the ITS community become a major challenge for the implementation of eco and smart campus, in addition to the challenges of continual maintenance of its facilities and infrastructures that are supported by the development of environmentally friendly policies and rules. The aforementioned factors need to be considered by ITS in order to maintain the momentum to achieve the world class university status in the future.

Keywords: challenges, eco-campus, environment, attitude, mind-set.

5. Introduction

Several environmental issues, such as; the climate change, the water, air and soil pollution, water crisis, energy and natural resources issues, and also the reduction of green areas are the global issues that have become a real problem for our societies including for the university community nowadays. Concerning of these global issues, ITS commits to play an active role in the development of science and technology with environmentally-friendly lifestyle approach. For that reason, the academic community of ITS must involve in creating a campus with a good culture condition in associated to the environment.

ITS is a science and technological university that was established in 1960, and is located at Sukolilo Sub-district, Surabaya. The campus covers the area of ± 186 Hectares, which includes approximately 40% building area, and therefore become one of the largest campus in East Java. There are twenty-eight departments at ITS with very diverse activities, both for the academic and non-academic activities. As a one of the major university in East Java, ITS has approximately 20,000 students in total, with nearly 1,000 lecturers and 700 of non-academic staffs. Since 2011, ITS has established the new vision-mission that is to be an international research-based university and to promote environmental science and technology. Therefore, the implementation of Eco-Campus become one of the main programme for ITS.

As described by the Environmental Protection Agencies [1], eco-campus is defined as a campus that consider and have good culture in associated with the environment in systematic and continuous

activities. The reflection of the involvement of the entire academic community is by paying attention to the health aspect and the sustainability of environment. Therefore ITS started to focus its activities to have more attention on the environment.

In 2010, ITS identified that the university should pay about IDR 3.6 billion/years for the consumption of clean water and consumed about 8.7 million kWh of electricity per year. This electricity consumption generates of Greenhouse Gases (GHG) emissions by 3.65 million kg of CO₂/year [2]. Moreover, ITS also produced a large amount of solid waste, which is about 6,025 m³/years, excluding the solid waste from biomass, such as; grass, leaves and so forth [3]. As described previously, the academic community of ITS is approximately around 20,000 people. If half of that population bring their cars or motorcycles, the number of motor vehicles in ITS can reach 10,000 units/day. Consequently, it will produce significant GHG emissions to the atmosphere. In fact, this condition is a real problem that have been confronted by ITS. In addition to the consumption of electricity and water, the waste production, and the number of motor vehicles in campus, other issues that need to be handled by ITS properly, are the reforestation of campus environment, improving traffic arrangements on campus, and also the establishment of green building codes.

Based on these above circumstances, ITS have been implementing Eco-Campus that aimed to enhance the campus life with a good environmental culture by involving the entire academic community. Eco-Campus is not a single event but it is real continuous actions that aimed at changing the mind-set of the ITS academic community gradually to achieve the main goal to be more concern about their environment.

There are five major programmes in the Eco-Campus, namely: 1) the Efficiency of Water Consumption and Enhance the Quality of Water, 2) Energy Efficiency Improvement Programme, 3) Integrated Waste Management Programme, 4) Sustainable Transportation Programme, and 5) Green Campus Programme. These activities are supported by the programme of social engineering, with the main purpose is to create awareness and active participations from all relevant stakeholders, as well as to ensure the consistency of the implementation of the programme and also the related regulations about Eco-Campus that have been made by ITS management. Since 2011, ITS has been implementing Eco-Campus with various activities including the improvement of infrastructures, the application of environmentally-friendly technologies and the tree planting for decreasing air pollution.

6. Implementation of Eco-Campus at ITS

ITS had already started and implemented several environmentally-friendly activities before 2011. There were several activities that had been carried out, including the introduction course of environmental science for all new students at ITS in their earlier stage; the introduction of e-learning by Shared-ITS, which is one of its objective is paperless works; the implementation of a web-based for selecting the student's courses every semester through ITS Integra, which is also aimed at conserving paper usage; and the availability of internet-based communications systems and intranet for the entire academic also for paperless works purpose.

Several studies concerning the ITS environment also have been conducted. For instance: the study on Efficient Use of Air Conditioner (AC) at ITS with the Approach of Life Cycle Assessment (LCA) and Life Cycle Cost (LCC); Design Cycles Routes in ITS Campus; Development of Energy Saving Car as a Tool for Transportation System in ITS Campus; Alternative Treatments of Laboratory Waste and Domestic Waste at ITS; Evaluation of Drainage System at ITS; Alternative Management of Water; Mapping the Adequacy of Vegetation for Reducing the CO₂ Concentration at ITS; Mapping the CO₂ Distribution Concentration Contributed by Motor Vehicles at ITS Campus; and the study of CO₂ Emissions based on the Carbon Footprints from Secondary Academic and Non-Academic Activities at ITS Surabaya.

Furthermore, in order to support the implementation of eco-campus at ITS, several research groups from several departments that focus on environment studies have been established as well. These research group, among others, are the Centre for Sustainability (CFS) at the Department of Industrial Engineering; Research Group of Solid and Hazardous Waste, Water Pollution Control, Water and Wastewater Purification in the Department of Environmental Engineering; and Research Group of Energy in various departments at ITS.

Since 2011, several activities have been implemented, such as evaluation and revitalization of ITS Master Plan by considering Eco-Campus policy. In line with the ITS commitment, the development of ITS Master Plan will be evaluated and revitalized based on eco-campus concepts, such as green building design standards, design of green infrastructures, and improvement of the drainage systems. These designs will be developed through several studies involving various fields from departments at ITS. The successful achievement of Eco-Campus programme is not only indicated by its physical achievement, but also shown from the span of changes in attitude and mind-set of all elements of ITS academic community in having more environmentally-friendly lifestyle. It is necessary to have a fundamental change in the attitude and mind-set of the entire academic community of ITS through socio engineering programme. The development of the attitude and mind-set with high environmental awareness will encourage the implementation of eco-campus programme to be more systematic and sustainable. In the long term, this will be in turn become inherited to ITS alumni that will eventually have a big impact in the development of environmental culture in Indonesia. However, socio engineering programme is not only aimed at changing the attitude and mind-set of the academic community in ITS, but also intended to introduce the concepts, ideas, and opportunities for the increase on participation level of all stakeholders in the Eco-Campus programme. Some forms of activities in the socio engineering programme include socialization and campaign of eco-campus; design learning materials for students of S1-S2-S3 regarding the environment, eco-campus, and sustainability; implementation of seminars about environment and sustainability; campaigns on waste separation; competition of ideas and innovation in saving water, electricity, and paper in all departments at the ITS; and many competitions such as eco-quote race that intends to increase the participation of all elements of the academic community in the implementation of eco-campus.

A programme called "Safe, Comfortable, Healthy and Humane Internal Movement System" is other implementation of Eco-Campus. This programme consists of the establishment of the cycles-routes, which is integrated with other modes of transportation; the construction of convenient and integrated pedestrian; the installation of informative signs with great aesthetic pleasure; the management of bike shares or bike along the campus; the improvement of roads infrastructures; and riding safety campaign for the ITS community as well. To provide comfortably and healthy a movement system, there are also an emission tests for motor vehicles at ITS on a regular basis. With this kind of programme, it is expected that all vehicles within the ITS campus areas can met the carbon emissions of the ambient air quality standard. Currently, ITS has had alternative cycle-routes and bicycle parking as well in some departments to support the internal movement system programme. Another development through a variety of research in the transport sector and spatial planning will be integrated with this programme. A mass-transportation system that employing electric buses has been introduced and will be developed further in the future. Currently, ITS has already had one electric bus for mass-transport that is operated within and around the campus. Those aforementioned activities, the integrated research in associated with transportation system and the construction of better transportation facilities and infrastructures, both are carried out in order to support the achievement of environmental friendly transportation system at ITS.

Concerning the water consumption at ITS, the increase on water usage efficiency will be conducted by several activities, among others, are by minimising the water leakage through the rehabilitation and revitalization of the water supply pipe network; by applying metering of water supply in each department, as well as by planning the development of facilities and infrastructure that support water savings. The water reuse programme for domestic wastewater and also laboratory wastewater

management will be developed in order to improve water quality at the ITS environment. The development pertaining the water quality that has been undertaken is the construction of wastewater treatment at ITS that includes the construction of wastewater treatment in the Department of Environmental Engineering and the implementation of waste water recycling, for instance for plants watering purpose, and water treatment in the "Manarum Ilmi" mosque.

In term of waste management system, ITS has built and operated composting centre to manage the general waste that is generated from all activities at ITS. Moreover, the preparation of an integrated waste management system for ITS and the implementation of several policies related to waste management system in campus, both have been undertaken in order to support the implementation of good practice waste management system at ITS. Furthermore, community services that involve the community around and outside the campus area in harnessing the recyclable materials from their waste have been introduced as well. The compost that is produced from composting centre has been used for urban farming in ITS. Since 2013, ITS has an organic vegetable garden, which is called SaYOR ITS. This urban farming is carried out with no chemical pesticides and has been already harvested excellent vegetables. ITS vegetables products are highly in demand for sale and now is available at the minimart of ITS.

The other important programme is improving the efficiency of electricity consumption. Electrical energy savings in the ITS will be carried out by a network reconfiguration and electricity metering in every department, automation of energy use in the classroom, and general illumination settings. ITS has already had internal policies regarding the electricity consumption. It is included the policy about the minimum temperature control of air conditioning systems, which should not be lower than 25°C and the policy of gradual replacement of electrical appliances with energy-efficient appliances. Various studies involving several disciplines have also been carried out regarding to the use of renewable energy. One of the research that have been implemented for renewable energy is a solid waste power plant (PLTSa) using gasification processes. This power plant obtains the energy from burning the non-organic waste and can reach the capacity of up to 3 kilowatt (kW), which can illuminate all the streets at ITS Student Dormitory, which have 11 light poles, and each pole needs 125 watts for 2 hours. Research about the renewable energy is one of the top research priority at ITS recently, therefore it is believed that the attempt to improve the efficiency of electricity consumption at ITS can be achieved.

7. The Challenge for the Eco-Campus Implementation

The biggest challenges for the implementation of Eco-Campus in many universities are the sustainability of the programme. As describe previously, that all the academic community should take a role and have responsibility for the implementation of this programme. The main objective of this programme is to change the mind-sets and attitudes of the whole academic community to be more aware to the environment. To change the mind-set and attitude of the whole academic community need a long time. It needs to encourage people to be more concern about the environment, and to organise more discussions about the environment in campus. Based on the development assumption of ITS in the future, the population of academic community in 2025 will reach 25.350. With this huge population, the demand for electricity and water will increase significantly. Furthermore, the amount of solid waste and wastewater from any activities in campus will also go increase considerably. The GHG emission from the growth number of motor vehicles inside the campus will increase massively as well. If the attempt to achieve the environmentally-friendly lifestyle through eco-campus cannot be implemented properly and continuously, those aforementioned potential pollution will potentially cause problem for ITS in the future.

The other future challenges in Eco-Campus implementation is the maintenance of environmental-friendly infrastructure. ITS has already had composting unit, wastewater treatment plant, even power plant using solid waste (PLTSa). This infrastructure needs a proper and sustainable management, both for its operation and maintenances. The maintenances of these facilities and infrastructures are

required in order to ensure that they can be operated well. The planning of institution unit at ITS that has the responsibility to manage and operate the facilities is required in order to ensure that the entire systems can be running well.

The availability of the related institution rules and regulation is also among the main factors that influence the sustainability of the implementation of Eco-Campus. The academic community of ITS need to implement the Eco-Campus on their daily activities by complying the rules that have been established by the institution management.

As one of the science and technological university in Indonesia, ITS also focuses in the development of the environmentally-friendly research and technology. Various researches involving numerous researchers from different disciplines to develop environment-based infrastructure are very potential to be conducted by ITS. The electric cars, electric buses, and also renewable energy from solid waste are among the ITS researches that show the potential of this institution regarding the development of the environmentally-friendly research and technology. Through these kind of research, ITS potentially can involve in international level concerning the environmental issues.

8. Conclusions

Eco-campus is an important part in the management of activities within a university. ITS has proven that with science and technology approach some creativity can be developed to create environmentally friendly technologies. ITS has five main activities or programmes in Eco-Campus that lead to the vision and mission as a campus with the international reputation. These five programmes namely Efficiency of Consumed Water and Enhance the Quality of Water, Energy Efficiency Improvement Programme, the Integrated Waste Management Programme, Sustainable Transportation Programme, and Green Campus Programme. ITS has implemented throughout the programmes and found that the main challenge for its implementation is how to ensure the sustainability of the programmes. The change of the mindset and attitude is the main targets in the future as well as the challenge of creating a variety of environmentally friendly technologies.

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2012 to measure and rank universities around the world show that many universities have taken sustainability as a serious key concept into account. The purpose of this paper is to report the efforts of the University of Zanjan and its contribution to sustainability and share its experience with other higher education institutions. The paper reports the sustainability indicators in terms of the setting and infrastructure, education, research and other activities as follows.

2. Higher Education in Iran and the status of the University of Zanjan

Higher education in Iran is provided through a large network of over 2500 public, private and state affiliated universities, which includes:

- State-run universities and institutions for non-medical higher education (supervised by the Ministry of Science, Research and Technology) and for medical higher education (supervised by the Ministry of Health and Medical Education);
- Public higher education institutions of distance learning (Payame Noor University); institutions for educating and training teachers; and institutions for practical and technical learning (Elmi Karpordi Institutions); and
- Private higher education institutions related to Islamic Azad University; and independent private higher education institutions.

The 2015 statistics shows that 4.7 million students study in both public and private higher education institutions in Iran. There are over 70000 academic staff in these institutions [3].

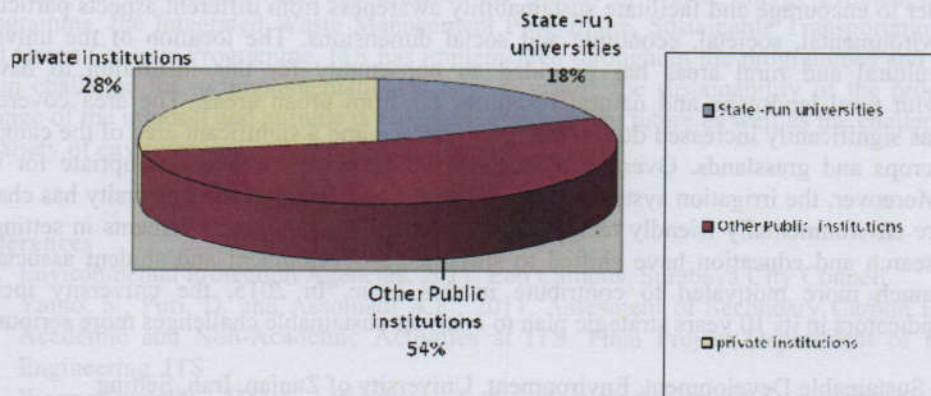


Figure 1. Percentage of Iranian students in terms of different higher education institutions

State-run universities with 700000 students include 130 non-medical universities and 63 medical universities. These state-run universities are considered as the highest ranked Iranian universities and the students at different educational levels (bachelor, master and PhD) need to be accepted through competitive exams. The University of Zanjan, as a state-run university, is ranked 19th among both Iranian public and private non-medical universities. It has almost 10000 students with 1000 academic and administrative staff.

3. Location, Setting and Infrastructure of the University of Zanjan

3.1. Location

The University of Zanjan is a comprehensive public university in Iran. It was established as an agricultural higher education institute in a public granted land in a semiarid rural area 6 km away from the city in 1975, but it was developed in four main faculties related to agriculture, engineering, humanities and science in its main campus, comprising 37 educational departments and a research institute with 3 research departments. The university has two campuses. The main campus is located in an area of 421 hectares, in the south west of the Zanjan City, the center of the Zanjan Province, at the north west of Iran (with a distance of 330 km away from the capital city of Tehran. The second campus is located in an area of 30 ha in the Abhar City, another populated city of the Zanjan Province.

3.2. Setting and Infrastructure

The total ground floor area of buildings is estimated to be 180000 out of 4500000 m² total university area in two campuses. This means only 4 percent of the university area is covered by buildings. Moreover, the average land per students is calculated as 450 m². The university has significantly increased its woodland area since its establishment, which was originally covered by rangelands and croplands. In 2015, 15 percent of the university was covered by woodlands and 72.2 percent by agricultural lands (rangelands and croplands) and other planted landscape vegetation. These areas are used for research, education, landscape management and production. The first week of March every year, the Iranian celebrates natural resources management and environment week and one of the days is called "Tree Planting Day". The university also calls its students and staff to participate in this event for plantation. Water can be absorbed in almost 90 percent of the university area, including agricultural lands, woodlands and other planted landscape vegetation.

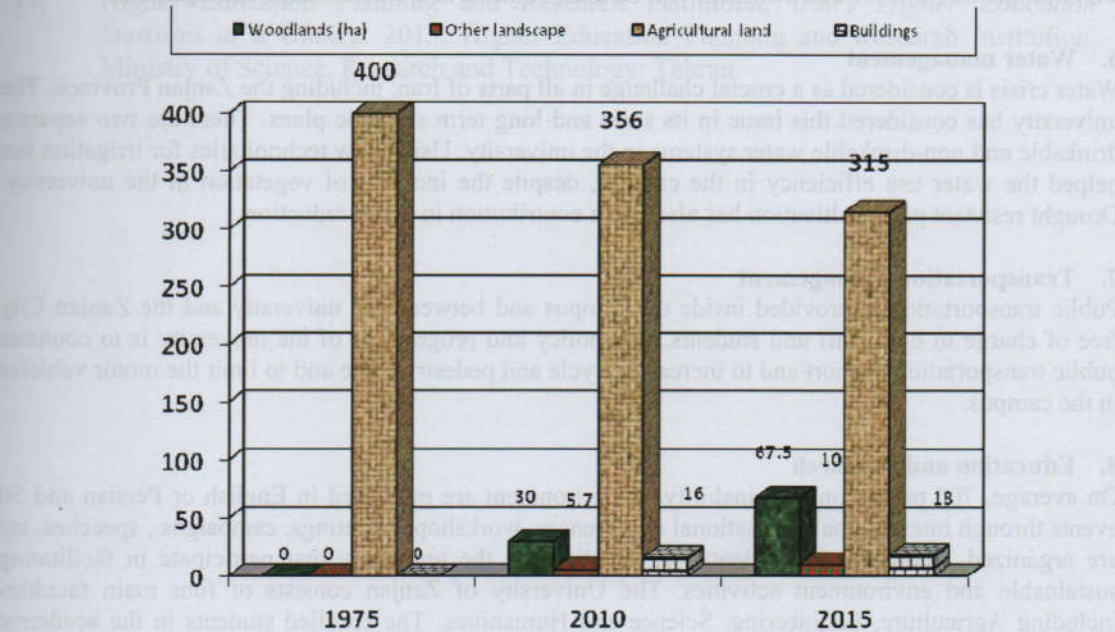


Figure 2. Woodland area increase in the University of Zanjan

All the woodland areas have been planted by drought resistant trees proper for semiarid areas. Moreover, the irrigation for trees has changed to the dripped irrigation method and other modern irrigation techniques have been utilised in croplands. This has improved the irrigation efficiency and conserved water resources. These conservation activities and other sustainability efforts have demanded an investment of almost 25 percent of the total university budget.

4. Energy and Climate change

During the last decade, energy efficient appliances have partially been replacing conventional appliances. Electricity and heating systems have partially been changed through utilisation some more eco-friendly technologies, for example using double glazing windows, smart electricity and heating in some buildings, and using solar energy. Most buildings have natural ventilation and full-day natural lighting. Energy management and climate change policies have been ratified in the long term strategic programme of the university, particularly using solar power and biogas technologies, smart use of electricity and heating systems, greenhouse gas emission reduction, green building design through using natural ventilation and lighting, etc. The university has not calculated the campus yearly carbon emission yet, but it has been considered as a mandate for the future.

5. Waste management

Vegetation waste is either used by for livestock consumption in the university farm or composted through natural composting or using vermicompost. Inorganic waste such as plastic and papers are collected separately for recycling. The university has a contract with an environmental NGO to give these wastes to that organization for recycling. Inside and outside of the all building bins with recycle signs have been installed. Toxic wastes are also handled by labs and farm through collecting, containing and giving to relevant registered organizations for their disposal. Sewage disposal is partially managed by using technologies in order that its water is reused and its sludge is treated through reusing and composting for farms. The university strategic plan and policies has put sustainable waste management into its agenda through programmes such as using biogas technologies for sewage management, continuing recycling and composting, and toxic waste management. The water produced from sewage treatment will be used in farms and for landscape management.

6. Water management

Water crisis is considered as a crucial challenge in all parts of Iran, including the Zanjan Province. The university has considered this issue in its short and long term strategic plans. There are two separate drinkable and non-drinkable water systems in the university. Using new technologies for irrigation has helped the water use efficiency in the campus, despite the increase of vegetation in the university. Drought resistant plant cultivation has also had a contribution in water reduction.

7. Transportation Management

Public transportation is provided inside the campus and between the university and the Zanjan City free of charge to both staff and students. The policy and programme of the university is to continue public transportation support and to increase bicycle and pedestrian use and to limit the motor vehicles in the campus.

8. Education and Research

On average, 700 papers on sustainability or environment are published in English or Persian and 50 events through international and national conferences, workshops, meetings, campaigns, speeches, etc are organized. There are 33 students' organizations in the university that participate in facilitating sustainable and environment activities. The University of Zanjan consists of four main faculties including Agriculture, Engineering, Science and Humanities. The enrolled students in the academic year of 2015- 2016 have been 10000 in 284 undergraduate and postgraduate programmes studying in 35 educational departments, which consist of:

- Bachelor degree (BA/BSc): 7793 students in 67 programmes
- Master (MA/MSc): 1666 students in 115 programmes
- PHD Candidates: 336 students in 102 programmes

In addition to part time academic members, there are 470 full time and permanent faculties/ academic members with PhD degrees (Assistant professors, Associate Professors and Professors). Almost 450 administrative staff also work in the university.

Approximately one third of educational programmes provide courses and research regarding sustainability and environmental concerns. One third of research projects and budget have directly or indirectly been allocated to sustainable development.

9. Equity in education

Most Iranian students do not pay any tuition fee for their education, but if they should, they get loans for their education. Almost 55 percent of the students are female. The university facilitates low cost and subsidised accommodation for all students inside the campus through student halls, located in separate areas for male and female students. These student halls have all the facilities required for student life, including IT services, reading rooms, gyms,

restaurants, subsidised meals, mosques, and so on. Single foreign students with scholarship can use free-catered accommodation. The university also facilitates accommodation for other married and single foreign students without scholarship, through university private accommodation.

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Towards Sustainable University through Setting and Infrastructure Development at the Universitas Indonesia

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Abstract. Universitas Indonesia (UI) is the nation's oldest and greenest campus. UI is generally considered as the most prestigious university in Indonesia, the best campus in Indonesia according to the 2015/2016 QS World Universities Ranking^[1] (1st ranked in Indonesia, 79th in Asia and 358th in the world) and be the only university in Indonesia ranked in the THEs ranking 2015/2016^[2] (#601-800 world university ranking). The university has continuously improving green program and awareness of the entire academic community for a greener living. Geographically, UI campus position located in two areas; Salemba (Jakarta) and Depok (West Java). As the main campus, Depok campus (covered 320 ha) endorsed around 70% of the area with astonishing greenery as a city forest and an ideal landscape for academic nuance of beautiful and tradition tranquil. This paper focused on the setting and infrastructure development in Depok Campus based on the Master Plan and its implementation since 2013. It describes the achievement as well as some future works and challenges facing by the university particularly in setting the landscape and managing the infrastructure inside the campus. The Depok Campus is set carefully as maintained tropical greenery, half of which is set aside exclusively as an ecological laboratory and conservation area. Some developments and improvements have been made during the last three years. Integrated Laboratory and Research Center (ILRC) building equipped with solar catchment had been built. An Occupational Health, Safety and Environment (K3L) unit has been established since 2014. There are some infrastructures development such as LEED building certification at the Student Activity Center (Pusgiwa), solar panel and green roof installment at the Faculty Club Building and Art and Culture building, rain water harvesting storage and water fountain development at the Faculty of Public Health, domestic water treatment at the Faculty of Health Sciences, and solar air-conditioning system at the Faculty of Engineering. Continuing these sustain development in tracks brings Universitas Indonesia as the one of the ideal campus in the world and having the third rank in UI GreenMetric 2015 for "setting and infrastructure" category. Even though some target and prestige have been achieved, several home works and challenges need to be accomplished in the near future to ensure and maintain the setting and infrastructure development in Universitas Indonesia towards sustainable campus in the ever competing environments around the globe.

Keywords: Green campus; Setting and infrastructure; Sustainable university; Universitas Indonesia

9. Introduction

Global development in recent years brings indications that the future of the world are on the down edge of the environment. Global warming is a reflection of the unsynchronized development of science and technology with the human awareness of the environment on moral and ethical level. In

order to anticipate this, Universitas Indonesia (UI) has an obsession to create an environment-based campus or known as the 'green campus'. As an educational institution with a world-class university perspective, UI has resources to be the significant other in the surrounding environment. The ecosystem in UI is lush and green as real concern to the environment inside the campus. This environment is well developed based on supports of many scholars in environment studies and academic board of Universitas Indonesia.

Based on the allocation of Campus Area Plan, there are four ecosystem components in University of Indonesia, lies in Depok. They are: Physical building and green landscape buffer of 170 ha, Water ecosystem of 30 ha, City forest area of 100 ha, and Supporting facilities and infrastructure, including environment buffer of 12 ha.

As the needs for continuously improving environmental and sustainability in UI campus, since 2011, a number of Rector Decree related to environmental issue and sustainability have been established such as mitigation and adaptation policies to climate change, policy for transportation inside campus, the use of bicycle and pedestrian paths, water and energy conservation, and waste management policies.

10. University Setting and Infrastructure

10.1. Landscape

Campus setting plays significant role for academic atmosphere. Good setting nurtures the spirit of learning and intensifies connection of academic community to the society surrounding it. It is undeniable that infrastructure plays significant role in supporting various activities for an institution to function. Setting and Infrastructure contains original 20 items which include hard and soft infrastructure with location characteristics described as urban or rural. Overall areas and sizes of academic community, built versus open spaces, green space ratio, vehicles, and environmentally related programs, are within this category

City Forest. City forest managed by Universitas Indonesia, has tropical rainforest characteristics with three types of advanced ecosystem, they are: (1) Tree ecosystem from eastern part of Indonesia; (2) Tree ecosystem from western part of Indonesia; and (3) JABODETABEK original vegetation complex combined with Jati Mas Forest growing green Rector Building and Faculty of Computer Science and Faculty of Social and Political Science Building.

UI has a 1.1 hectares area for deer breeding. Up to 2013 there was about 28 Timorensis-deer inhabit in the breeding area before they are all gone due to guard rail of the breeding area was destructed by thieves. Area for reforestation is allocated for about 100 hectare. Beside reforestation, Sub-Directorate of Campus Environment Development (PLK) UI also promotes an Enrichment Planting program aimed to enriching and adding trees type variety. Enrichment planting program is expected to reach the target 50% of the 680 species of trees planted by 2017. There are about 27,350 of trees were planted by 2013. Several events related to environmental sustainability regularly conducted, such as workshop on planting Belimbing tree (star-fruit tree) in vacant land inside UI areas that organized by student association involving local community around UI, reforestation program by PLK in corporation with some CSR of private companies.

To realize Rector Decree in the field of green and sustainability policy, then in the year 2013 UI implementing Green Campus program. The program aims for creating campus as a centre of activity and empowerment of stakeholders and strategic partners in the conservation of the environment prevent pollution and damage as well as the creation of clean and green campus. The program covers several activities supporting sustainable campus policy in Universitas Indonesia, such as: water conservation and utilization; renewable energy and utilization; land utilization; and minimizing waste generation.

Artificial lakes. Aside of of beautiful and comfortable City Forest area, there is also a lake inside Universitas Indonesia Campus in Depok for water absorption area. There are 6 lakes inside the Campus in Depok, abbreviated as KAMPUS represent 6 species of tree in Indonesia, they are:

1. Kenanga lake (28,000 m²), located between Rectorat building and UI Mosque, built in 1992.

2. Aghatis lake (20,000 m²), located between Faculty of Mathematics and Natural Science and Jakarta State Polytechnic, built in 1995.
3. Mahoni lake (45,000 m²), located in North and South campus, bordered with main street of South Boulevard (East of Faculty of Humanities and Faculty of Psychology, west of Faculty of Economics), built in 1996.
4. Puspa lake (20,000 m²), located between Lake Ulin and Lake Mahoni, built in 1995.
5. Ulin lake (72,000 m²), located between Lake Puspa and Lake Salam, built in 1998.
6. Salam lake (42,000 m²), located in line with the flow from north to south as series of Lake Ulin and Lake Puspa, built in 1998.

10.2. Green Building and Facilities

To show our commitment in green campus, new buildings were developed adopting green and sustainable building concept. The structures and the processes were environmentally responsible, and high efficiency in using energy, water, and materials.

New Library. The library at the Depok campus was launched on May 13, 2011. Built on a 33,000 meter square area, this library is considered as the largest library in Southeast Asia. Designed according to a sustainable building concept, the library powers itself with solar energy. It is smoke-free, green-roof, and economical in terms of electricity, water and paper usage. The library has the capacity to accommodate about 20,000 visitors per day and have collection of 1,500,000 books.



Figure 1. The new Central Library building

The new library has a philosophy *Crystal of Knowledge*. A philosophy want this library became the central gathering of knowledge and science. The new library is located on the shores of Lake Kenanga with a total area of 33,000 m². The new library building design concept of green, in accordance with the ideals UI wants to be a green campus. One application of the concept of the green is to use a cooling system water cooled chiller.

Not only in green area and transportation, Universitas Indonesia has relocated nine massive African Baobab trees aging over 100 years (one said to be 240 years old) to the Depok campus to prove the university commitment in going green.

Integrated Laboratory and Research Center (ILRC). The ILRC building was built with a great destination for a clean and organized all researches in UI. One of the examples is the development of the UI-Olympus Bioimaging Center, as the first bioimaging laboratory established in Indonesia. The

ILRC building was designed in a half-circle shape, specifically aimed to receive the sun light equally distributed to each rooms of the building.

Cultural & Art Center. The Cultural & Art Center building is one of the UI efforts as an education institution which considered the soft skill competency of the students. The 11,600 m² building is located beside the UI Mosque and Kenanga lake. The building design concept is *magic box*, which is expected as a unique building that motivate and encourage the student's talent in arts world.

Faculty Club (FC). The FC building was built up in ± 10 Ha area as an integrated space for sports (national Olympic standard pool, tennis court, golf driving, gymnasium, meeting rooms, restaurant, etc. In this building also installed solar panels.

Solar Air-conditioning System. In order to mitigate environmental pollution and reduce the greenhouse gas emissions of a building inside the university, a research collaboration in 2014 has resulted in a 239 kW solar air-conditioning system using a single-double effect combined absorption chiller. It was installed in a building at the Faculty of Engineering, Universitas Indonesia [3].

Student Activity Center. Student activity center (Pusgiwa) building is provided for the UI student activities. Here lies the secretariat of the various student organizations that exist in the UI. In addition, there are also many facilities that can be used by UI students. Facilities include a hall that can accommodate about 300-400 people. In 2015, the building was registered to be a Leadership in Energy and Environmental Design (LEED)-certified buildings.

Dormitory. UI has two university dormitories, located in Depok and Salemba, Jakarta. The 25,534 square meters Depok dormitory, surrounded by lakes and greenery, accommodates 400 male students and 445 female students. While the historical Salemba (Jakarta) dormitory "Wisma Rini" covers an area of 11,134 square meters and accommodates 110 male students and 115 female students.

Campus Bus. Campus buses are available for student transportation at the Depok campus. In 2005, UI had a total of 20 campus "yellow buses". They serve regular routes inside the campus area from Monday to Friday from 7:00 am to 9:00 pm and Saturday from 7:00 am to 2:00 pm.

Campus Bike. As proof of its commitment in implementing "go-green", UI has provided a free-of-charge campus bicycle facility for its students. More than 300 bikes were offered in several bike shelters inside the campus. The students need to show their UI student card to the rental officer. The bike must be used on bike lanes and it must be returned to where it was rented or another bike station. Campus bikes can be rented until 5:00 PM.

11. Results of UI GreenMetric 2015

Setting and infrastructure is one of the UI GreenMetric category that contributes 15% of the overall score. Based on the UI GreenMetric 2015 ranking result (Table 1), for setting and infrastructure category UI collects higher point from three main criteria; first, the ratio of open space area towards total area; secondly, area on campus covered in forested vegetation; and third, area on campus covered in planted vegetation.

Table 1. Universitas Indonesia' scores for setting and infrastructure based on UI GreenMetric 2015 result

Indicators	2014 Score	2015 Score	Maximum Score
The ratio of open space area towards total area	267.4	278	300
The ratio of open space area towards campus population	75	23	300
Area on campus covered in forested vegetation	180	182	200
Area on campus covered in planted vegetation	100	200	200
The ratio of area on campus covered in non-retentive surfaces towards total area	270	242	300
The ratio of sustainability budget towards total university budget	140	108	200
	1,032	1,033	1,500

With a total score of 1,033 for setting and infrastructure category (overall score for all 6 categories was 6,157), UI stays at rank 33 [4]. Compared with the data in 2014, there is decrease in scores for the ratio of open space area/campus population, the ratio of area on campus covered in non-retentive surfaces/total area, and the ratio of sustainability budget/total university budget. However, for the other indicators showing an increasing scores. In contrast, if we compare to the first rank university of UI GreenMetric 2015 that is University of Nottingham (UK) which has score for setting and infrastructure about 724 (of the total score 7,267), obviously UI has a relative better campus setting and provided supporting infrastructures. While for the highest score in setting and infrastructure category is gained by University Putra Malaysia (1,095). Figure 2 shows the comparison between these three universities.

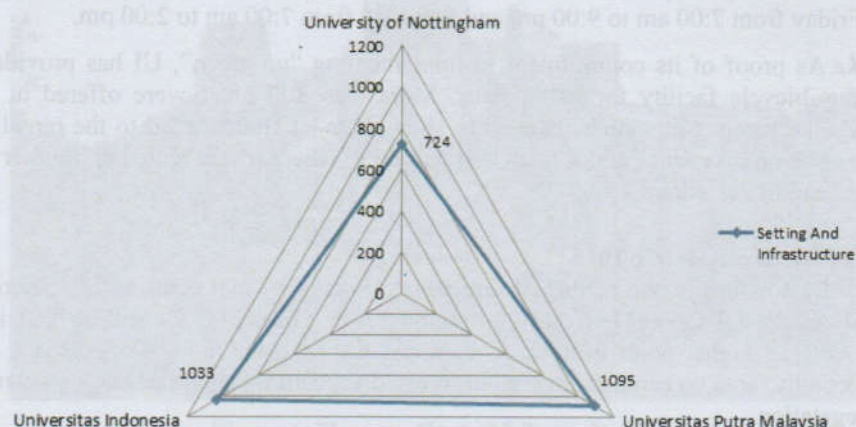


Figure 2. Comparison between the 1st ranked university, Universitas Indonesia, and the highest score for setting and infrastructure category (based on UI GreenMetric 2015 result)

As mentioned above, setting and infrastructure contributes 15% of overall score. Hence, the score in this category is not a direct factor determining the final ranking result, because there are still 5 more other important categories in UI GreenMetric that also should be considered and be improved gradually.

12. Future Works and Challenges

The implementation of the Depok Campus Master Plan drives the entire campus community actively involved in the development programs. Many faculties propose extension plans. Yet only some

proposals had partially funded. There are some new facilities that were built, such as a complete Central Library, a part of new wing of Faculty of Humanities, a complete laboratory of the Faculty of Engineering, a part of new Faculty of Computer Science, a part of new Faculty of Nursing, a partial Faculty Club, a part of Integrated Laboratory, and a part of Art and Cultural Centre. The new Library was successfully completed after a competition and because of the innovative scheme, the Rector ordered that all new building should be selected through competition process. The problem faced by any construction of new building should follow a strict rule of a state owned building which is annually funded and as the time consuming during the process of bidding and design development, the building has always finished in a rush manner. In this instance the quality of finishing is usually low.

The University has recorded a list of figure in Setting and Infrastructure which show a respective number of spaces occupied. The number includes, among others, 2,384,325 m² of land area (about 80 hectares of lake is excluded); 131,934 m² of ground floor (5.53% building coverage); annual usage of 19,272,115kwh of electricity; and 25% of university budget dedicated to environmental effort. The number of cars circulated in the campus are about 200 daily which is increasing alarmingly as up to the present, prior to the construction of parking building, the cars park inside the campus land and the condition is not favorable for environment. A further policy for limiting motor vehicle including motorcycle is needed with fair sanction. The bike way has been successfully utilized yet it needs continuous effort for maintenance which becomes increasingly costly. Many faculties had successfully prohibited cigarette smokers, and it provides good practices lesson for others to follow.

A community campus proper behavior program needs to be planned and implemented with fair enforcement act to avoid a misuse of the social responsibility action from the university. It is the task of the education institution to also provide an education program to construct a more civilized behavior for the public. University budget for research and sustainability operation are also a significant issue in the near future. In this way a sustainable future can be achieve and Universitas Indonesia can retain the leading role in shaping a liveable and sound sustainable environment.

13. Concluding Remarks

In line with the UI Strategic Plan 2012-2017 and the Rector Decree, the UI achievements in particular setting and infrastructure sector will continuously be enhanced to the optimum value. UI will continue its policy of environmental and campus sustainability to become more modern, multi-cultural and high achieving university. Certainly, great support and commitment from all member faculties, staff and students are required to realizing green campus areas as an eco-friendly based education infrastructure in the form of eco-science-park.

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**SESSION 2:
“Energy & Climate Change Policy”**



**UI Green
Metric**

World University Ranking

**PROCEEDINGS OF
INTERNATIONAL WORKSHOP
ON UI GREENMETRIC 2016**

**The University of Alcalá's efficient energy policies. Where are we? Where
are we headed?**
**Fostering Sustainable Culture
in Global Universities**

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Abstract. The UAH is firmly committed to sustainability and environmental protection. Its Governing Body approved an Environmental Policy Statement, which enshrined the University's commitment to promoting the sustainable use of resources and to developing exacting environmental management as a quality indicator. This environmental policy is being developed through an Environmental Quality Program, whose actions involve the entire University community and which has converted the UAH into one of the most sustainable university according to the international GreenMetric index.

Some concrete actions related to energy efficiency in university facilities are presented in this paper. These actions form part of a global strategy for energy efficiency improvement, which affects buildings, facilities and roads. This designed strategy has been implemented with public contracts through a competitive dialogue procedure and a public-private partnership. All the initiatives we have carried out in the last 13 years, along with those to be carried out in the next 10, represent a significant contribution towards building a more sustainable society locally and globally. It is difficult to contribute to any solution if we are not aware that we form part of the problem. That's why the UAH thought of measuring the impact of its activities on GHG emissions by calculating its carbon footprint. These results should only drive us on to work even harder to improve efficiency and sustainability and to act as an example for our students, who are the generation that will have to build a more socially, economically and environmentally sustainable future.

Keywords: Energy efficiency - Climate change - Carbon footprint - Competitive dialogue.

1. The UAH today: facts and figures

Considered one of Europe's oldest, the University of Alcalá (UAH) can trace its origins to the "studium generale", or medieval university, created in 1293. In 1499, Cardinal Cisneros gave the institution a new lease of life with the foundation of a "Colegio Mayor", or "Greater College". The UAH was declared World Heritage in 1998.

The UAH'S current portfolio of degree programmes boasts a broad offer in fields of knowledge ranging from the Humanities to Engineering, from Social Sciences to Experimental and Biomedical Sciences. The University's student body numbers 30,000 students—13,000 of them postgraduates or lifelong learners—across its three distinct campuses: the historic city-centre campus with buildings from the sixteenth and seventeenth centuries; the external science and technology campus; and the Guadalajara campus [1].

The UAH is aware of the environmental impact of its activities and, particularly, of its energy consumption. That is why it has been working for years to minimize the former and optimize the latter with the aid of energy-saving measures which gathered speed after its 2003 Environmental Policy Statement.

In the last few years a succession of different external studies and audits have been carried out by experts in order to grasp more fully the University's energy needs and to set ambitious goals for cutting down consumption and replacing current energy sources with cleaner and more sustainable ones.

Thanks to these policies, we are the top university in Spain and one of the leading universities internationally for environmentally sustainable practices, according to the GreenMetric World University Ranking [2], which assesses the sustainability policies of universities worldwide.

This paper provides a short overview of the University of Alcalá's chief actions in matters of sustainability and energy efficiency to date, and introduces those that are planned for the near future.

2. Where are we?

The International Energy Agency has stated [3] that the world is heading for a future of unsustainable energy if urgent measures fail to be implemented to optimise available resources. Sustainable development means "development that meets present needs without jeopardising the capacity of future generations to meet their needs," and is recognised as such in the UN's Brundtland Report of 1987 [4]. In a university sustainable development requires sustainable convergence between finances, the university community and proper environmental management.

Over ten years ago, in 2002, the Conference of Spanish University Presidents (CSUP) created the Environmental Quality and Sustainable Development work group [5]. Today, sustainability is a sector-wide policy in the Spanish university [6]. CSUP-Sustainability is the forum for discussing strategies and presenting best practice in eight fields of activity, from sustainability and health to energy efficiency or education for sustainability. Since January 2014, the Chair of CSUP-Sustainability is Professor Galván, President of the University of Alcalá.

In addition to educating, advancing knowledge and so forth, the University of Alcalá's social commitment entails becoming a benchmark for the achievement of a model of sustainability not only in the Spanish university, but across all social, technological and economic sectors. Among its many functions, one must be to foster habits of environmental respect and to decrease the environmental impact of human activities.

With this goal in mind, in 2003 the University of Alcalá issued its **Environmental Policy Statement** with a view to making environmental issues part and parcel of its planning, execution and assessments. This environmental policy has defined several lines of strategy:

- Prevent, reduce and eliminate negative environmental impacts that may result from the university's activities.
- Rationalize consumption and promote increasing efficiency in the use of material and energy resources.
- Promote waste prevention and appraisal (recycling, recovery and re-use).
- Inform, train and make the university community aware by promoting active participation in environmental management and in enhancing the quality of the university environment.
- Monitor continuously the environmental repercussion of university activity and assess achievement of the established aims and goals.
- Maintain channels of dialogue and cooperation with public and private bodies engaged in environmental issues.
- Tailor its environmental policy to the new requirements proposed by university associations at home and abroad, always with a view to continuous improvement.
- Promote in its sphere of influence a policy of Environmental Excellence in Development by acting as a catalyst and assessor of such a policy in collaboration with other public and private bodies.

As a consequence of this institutional commitment, the University of Alcalá has implemented an **Environmental Quality Programme** with the aim of identifying and controlling factors affecting the environment in order to effect continuous improvement in the University's environmental management. Under this programme action is taken in various fields: energy saving and efficiency, economising on water, waste management, sustainable mobility, environmental enhancement, and so forth.

The University of Alcalá teaches through its management. Management is both a lever of change permitting more sustainable and responsible organisation and a linchpin of social commitment.

Since 2005 the University has managed to stabilise consumption, and from 2006 onwards has registered a downturn, due chiefly to energy saving and efficiency initiatives.

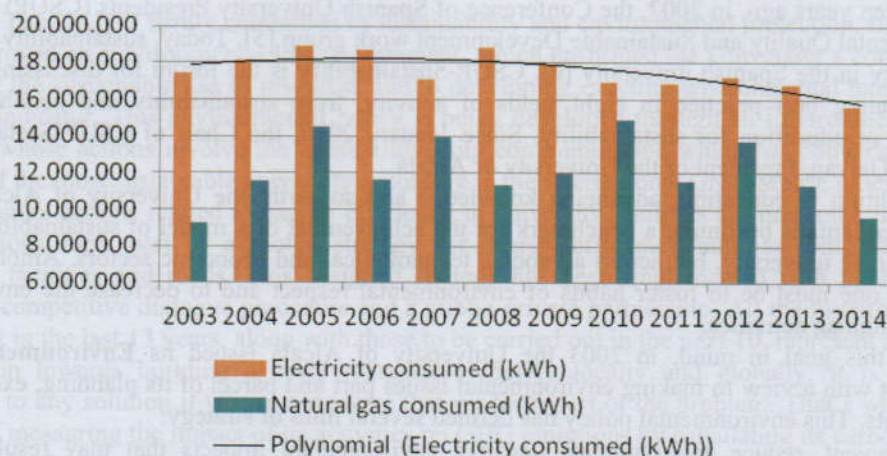


Figure 1. Evolution of electricity and natural gas consumption
Source: Own data

The following is a synthesis of the actions taken regarding energy saving and efficiency.

1. Initiatives to raise awareness among the university community of energy saving, led chiefly by our EcoCampus office.
2. The introduction of environmental criteria in the university's invitations to tender (Green contracting) and, particularly, when adjudicating contracts, the encouragement and positive assessment of tenders made by companies with an energy efficient management system certified by some official body.
3. Energy audits have been performed of all our buildings and efficient rehabilitation work (on building enclosures, for example) undertaken, while installations such as boilers have been replaced with others running on natural gas.
4. In addition, initiatives have been implemented in lighting systems (the sectoring of lighting in all buildings, the exploitation of natural light, the reduction of lighting in lifts, lighting management systems, presence detectors in zones used occasionally, and so on) and in information systems (reduction of ghost energy consumption).
5. Radiators have been fitted with thermostatic valves and solar shield panels have been installed, as well as air curtains over main or frequently transited entrances—all with a view to making an appreciable cut in our consumption and raising awareness among the university community.

Moreover, important efforts have been made to increase our renewable energy pool by means of thermal solar technology for ACS heating, the use of plant waste as biomass, the use of alternative energies for pumping, and so forth.

The UAH also has an energy generating installation (Trigeneration) [9] in its Engineering School, while its Chemistry Building boasts the most important geothermal installation in any public building in the Madrid Region, and the largest of its kind in any European university.

All of that has allowed the University's energy consumption per user first to fall and then to be maintained, thus contributing through its actions to meeting the objectives of the Spanish Government's Action Plan for Energy Saving and Efficiency (2011-2020).

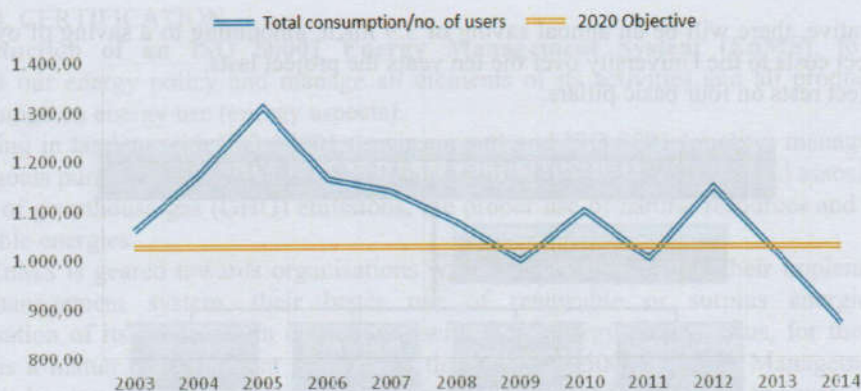


Figure 2. Energy consumption per user (2003-2014) and goals for 2020

Source: Own data

The UAH also boasts Spain's first solar powered vehicle recharge point in its "Rey Juan Carlos" Botanical Garden. Two other recharge points have been opened recently at other sites.

The Botanical Garden is itself a further example of sustainability, a 260,000 m² green space with over 120,000 plant species which amounts to a first-class teaching and experimental resource for students and the general public alike.

Naturally, a university like the UAH cannot overlook teaching and research. In both areas, sustainability and efficiency are a top priority.

Our degree in Environmental Sciences is considered one of the best in Spain [8]. Our master's programmes in Advanced Architectural and Urban Projects (which offers specialties in "Architecture and Environment" and "Urban Intervention"), Natural Protected Spaces and Restoring Ecosystems are among Spain's highest rated, according to the newspaper *El Mundo*'s ranking of the Top 250 Master's Degrees [8].

What is more, the UAH is home to well-established research groups in the fields of renewable energies, green chemistry, climatic impact, water treatment, biodiversity and environmental technology and prevention; also to pioneering research projects on waste water purification, bio-fuel production, solar studies, climatic evolution and so on, some in collaboration with prestigious external bodies such as NASA, the European Space Agency and the Centre for New Water Technologies. The "Consolider Tragua" project about reusing purified urban waste waters was distinguished with the International Water Association's Prize for Excellence in Sustainable Water Management.

3. Where are we headed?

Our experience over 10 years of initiatives between 2003 and 2013 recommended that our efficient energy policies be stepped up in accordance with four basic lines of action:

- Bring to completion our policies for energy sustainability through renewable energies.
- Go further in matters of saving and management on the principle that the most sustainable energy is the energy that is not consumed.
- Integrate technology and innovation into the strategic management of sustainable energy.
- Set up a model of management and ongoing improvement to facilitate the monitoring and certification of our efficiency policies.

To this end, in the course of 2014 a cooperation contract was signed by the public sector (the University) and the private sector in order to execute a global, integrated project for the interior lighting of the UAH's buildings and installations and its external campus's road network. The idea was to improve energy efficiency in terms of lighting, to reduce energy consumption and/or to create energy generating systems for sale or self-consumption, thereby helping to cut the UAH's energy bill.

This has borne fruit in a twelve-year contract worth 7 million Euros of private funding to be financed essentially through savings achieved in energy consumption. When all initiatives are 100

percent operative, there will be an annual saving of 3.9 mKh, amounting to a saving of over 200,000 Euros in direct costs to the University over the ten years the project lasts.

The project rests on four basic pillars.



Figure 3. UAH strategy regarding energy efficiency

Source: Own data

PILLAR 1. IMPROVEMENTS AND RENOVATION WORK

A series of initiatives is envisaged on three fronts:

- The replacement and/or renewal of both indoor and outdoor lighting installations on the External Campus. This has meant replacing over 65,000 light fittings, something we have achieved this very year.
- The installation of building automation control and management devices (detectors, pushbuttons, sensors, light regulators, and so on) to enhance performance and efficiency while ensuring permanent user comfort.
- Facility improvements and renovation work.

PILLAR 2. CENTRALISED ENERGY MANAGEMENT

Initiatives are under way to:

- Implement centralised energy management: quality control, uses, licences, certifications and regulations.
- Develop a centralised remote Management Platform for all our facilities' building automation devices and lighting.
- Implement a full guarantee maintenance system with the aim of achieving operational perfection in all elements of new installations and of maintaining over time performance at initial levels.

PILLAR 3. RENEWABLE ENERGIES.

The University of Alcalá has a significant tradition of commitment to renewable energies: geothermal energy, trigeneration or solar panels are only some examples. Despite the scarcity of funds for investment and the absence of a stable regulatory framework, the University of Alcalá remains steadfast in its commitment to renewable energies on two fronts:

- Completing direct use of renewable energies with the installation of a 30 kWp photovoltaic solar plant; installing a mini-wind farm or a biomass boiler. In addition, a free-cooling system is to be installed in our computing services. Also, photovoltaic LED light fittings running entirely on solar power are being installed. We also aim to promote the use of electric vehicles by increasing the number of top-up points (two new ones have been opened recently) and requiring our suppliers to use this type of vehicle.
- Promoting consumption compensation in both electricity and gas. Since 2010 all our electrical energy comes from renewable sources, and is certified as doing so. As for gas, since this year, all emissions due to our consumption will be compensated by the supplier.

PILLAR 4. CERTIFICATION.

Introduction of an ISO 50001 Energy Management System (EnMS), to develop and implement our energy policy and manage all elements of its activities and all products or services which impinge on energy use (energy aspects).

Working in tandem with ISO 14001 (environment) and ISO 9001 (quality) management models, the main goals pursued by the EnMS are ongoing improvement in energy use and associated costs, the reduction of greenhouse gas (GHG) emissions, the proper use of natural resources and the promotion of renewable energies.

The EnMS is geared towards organisations wishing to show publicly their implementation of an energy management system, their better use of renewable or surplus energies, and their systematisation of its processes in consonance with their energy policy. Thus, for the University of Alcalá it is a matter of paramount importance that this ISO 50001 Energy Management System be implemented as it will be its energy and environmental blueprint for the years to come.

4. *By way of conclusion: the UAH's contribution to climate change*

All the initiatives we have carried out in the last 13 years, along with those to be carried out in the next 10, represent a significant contribution towards building a more sustainable society locally and globally.

In terms of sustainability, the UAH initiates actions and measures which aim at preventing, reducing and eliminating any negative environmental impact deriving from our university activities. But it wants to go one step further. As a public institution devoted to education, it wants to have a transforming effect on policy and contribute, albeit modestly, to solving global problems, among them, of course, global warming.

It is difficult to contribute to any solution if we are not aware that we form part of the problem. That's why in 2011 the UAH thought of measuring the impact of its activities on GHG emissions by calculating its carbon footprint [10].

In order to estimate its emissions, the University followed the guidelines of ISO 14064-1:2006 and of the World Resources Institute's GHG Protocol and took into account these sources of emissions:

- Scope 1. Direct GHG emissions: Associated with combustion of natural gas in boilers. Deriving from use of refrigerant gases. Associated with combustion of vehicle fuel.
- Scope 2. Indirect GHG emissions: Associated with electricity consumption. Associated with use of direct thermal energy.
- Scope 3. Other indirect GHG emissions. Due to travel in buses paid for by the UAH. Associated with air travel of UAH teaching staff. Caused by rail travel by UAH teaching staff. Or by fuel consumption of maintenance vehicles belonging to UAH subcontractors.

In 2011, 65.68% of the UAH's GHG emissions were indirect Scope 2 emissions due to the purchase of electrical and thermal energy (5,288.36 TCO₂ tonnes); 33.95% were direct Scope 1 emissions (2,733.22 TCO₂ tonnes); and the remaining 0.37% were Scope 3 emissions.

Emissions deriving from electricity consumption are without question the most significant (55.8% of TCO₂ tonnes), followed by gas consumption (18.7%). That is why efficient energy policies are so important since they reduce quite considerably the direct and indirect emissions caused by our activity. It is thanks to those policies that in 2010 the University of Alcalá was already in a position to consider itself a low carbon organisation, meeting even then the objectives fixed for reduction by 2040.

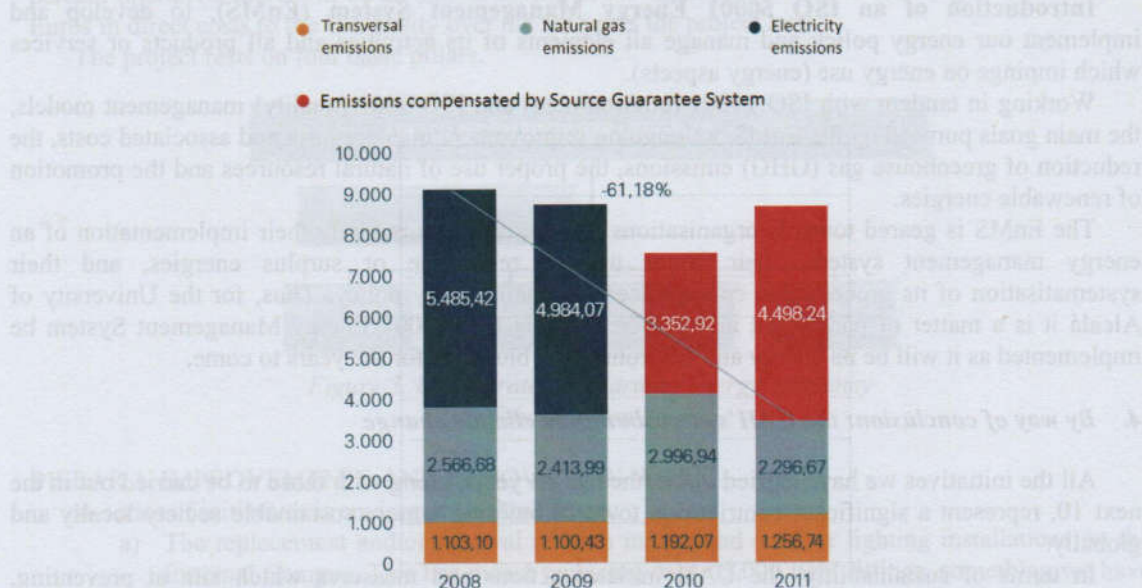


Figure 4. University of Alcalá Emissions TCO₂.

Source: Carbon footprint, UAH 2011. Gas Natural-Fenosa - UAH

But these results should only drive us on to work even harder to improve efficiency and sustainability and to act as an example for our students, who are the generation that will have to build a more socially, economically and environmentally sustainable future.

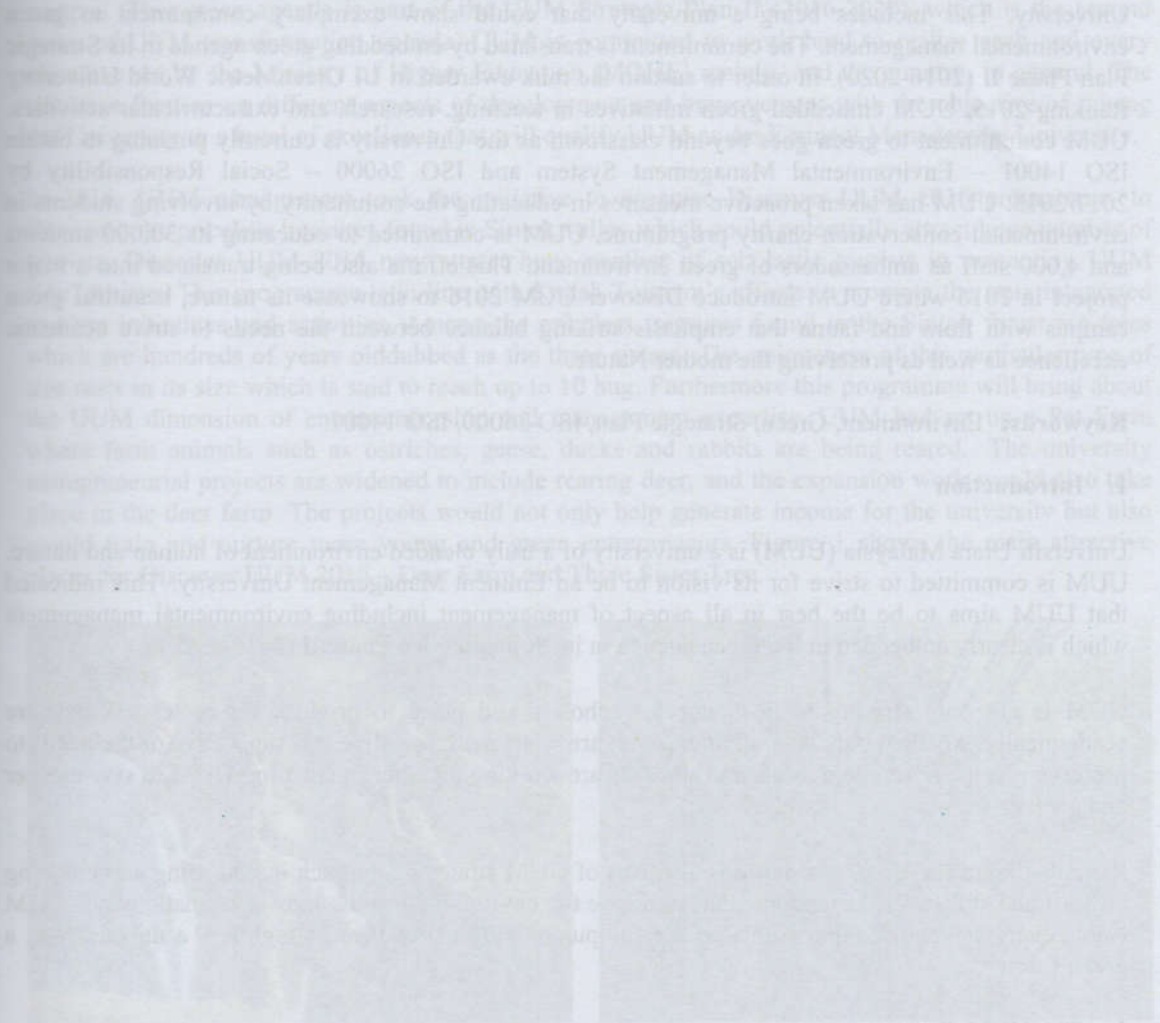
International distinctions such as being rated third most sustainable university in the world by the non-profit, San Francisco-based organisation, Coolmyplanet, or our consistently high position—always among the top 40—in the University of Indonesia's GreenMetrics ranking are incentives which encourage us to carry on in the same direction.

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1. The UUM Campus

Universiti Utara Malaysia (UUM) established on 16 February 1984, is the sixth Malaysian public university. It is the only university in Malaysia that was established as a public university. The UUM campus is located in the town of Alor Setar, in the state of Kedah, on the northern tip of the Malay Peninsula. The campus is situated on a hillside, overlooking the Alor Setar River. The campus is a large, modern university with a focus on green spaces and sustainable development. The campus is surrounded by a mix of natural vegetation and some developed areas. The overall impression is of a large, modern university campus with a focus on green spaces.

The University in a Green Forest – Towards Eco-Friendly Campus

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Abstract. Universiti Utara Malaysia (UUM) is committed to strive to be an Eminent Management University. This includes being a university that could show exemplary commitment to green environmental management. The commitment is translated by embedding green agenda in its Strategic Plan Phase II (2016-2020). In order to sustain the rank awarded in UI GreenMetric World University Ranking 2015, UUM embedded green initiatives in teaching, research, and extracurricular activities. UUM commitment to green goes beyond classroom as the University is currently pursuing to obtain ISO 14001 – Environmental Management System and ISO 26000 – Social Responsibility by 2017/2018. UUM has taken proactive measures in educating the community by involving students in environmental conservation charity programme. UUM is committed to educating its 30,000 students and 4,000 staff as ambassadors of green environment. This efforts also being translated into a major project in 2016 where UUM introduce Discover UUM 2016 to showcase its nature, beautiful green campus with flora and fauna that emphasis striking balance between the needs to strive academic excellence as well as preserving the mother Nature.

Keywords: Environment, Green, Strategic Plan, ISO 26000, ISO 14001.

1. Introduction

Universiti Utara Malaysia (UUM) is a university of a truly blended environment of human and nature. UUM is committed to strive for its vision to be an Eminent Management University. This indicated that UUM aims to be the best in all aspect of management including environmental management which is clearly embedded in the green agenda in its Strategic Plan Phase II (2016-2020).

UUM is not only striving to be house for scholars and place to produce future leaders that are academically excellent but also individuals that are concerned, sensitive and supportive of the needs to preserve green environment. Staff and students are working together in ensuring UUM to stay cleaner and greener.

Participating in the UI GreenMetric is also part of UUM strategic approach in educating and ensuring all staff and students to care, appreciate and love the environment in the most systematic ways. UUM wants every stakeholder that comes to the campus to truly experience its tagline – a university in a green forest.

2. The UUM Campus

Universiti Utara Malaysia (UUM) established on 16 February 1984, is the sixth Malaysian public university. It is the only university set to focus solely on management education. The UUM campus was built on an area of 1,061 hectares in Sintok (in the district of Kubang Pasu), situated about 48 kilometres from North Alor Setar and 10 kilometres from East of Changlun, a small town along the North-South Highway, near the Malaysia-Thai border. UUM has evolved to an open campus where outsiders and tourists are allowed to visit and utilise the various facilities within it. An area encompassing 107 hectares of forest has been developed into various facilities to attract tourists to the northern region and to satisfy the recreational needs of the members of the campus community. Among these facilities are picnic areas, a nine-hole golf course, a go-kart circuit, a shooting and archery range, an equestrian site, and many others that are fast gaining popularity among tourists and the members of the campus community alike.

UUM plays a major role in national and international education platform specifically in the management field. The UUM Transformation Plan which is essentially a roadmap for the future pursuits and endeavours of UUM, is divided into two phases. Phase one, from 2011 till 2015, is focused on unequivocally placing UUM on the local academic map in a systematic and planned manner. During this period, greater emphasis was given in ensuring the successful achievement of the objectives of the First Phase while, at the same time, being mindful of the imperatives of the Second Phase of the Transformation Plan, which started from 2016 till 2020. In 2015, UUM unveiled an interesting new tagline- "The University in a Green Forest". This new tagline aptly described the serene and beautiful ambiance of the unique and mesmerizing flora and fauna surrounding UUM campus. This green agenda is part of the UUM Strategic Plan II (2016-2020), which is the second wave of UUM transformation agenda. UUM is committed to work hard to realise each and every objective set by the Ministry of Higher Education (MOHE) mainly, and the country, in general. The initiative focuses on different aspects of development and improvement with the objective of raising the University to a level of excellence that will qualify UUM as An Eminent Management University.

In 2016, UUM management took the initiative to organise Discover UUM 2016 programme, to showcase the priceless treasures found in Sintok valley which could potentially attract huge number of tourists. Discover UUM 2016 may attract huge number of scholastic tourists in promoting UUM EduTourism. This programme is in line with Kedah Tourism's efforts to promote the state integrated tourism initiatives and activities. Among the priceless treasures found in the Sintok forest are trees which are hundreds of years old dubbed as the three sisters. The uniqueness of this particular type of tree rests in its size which is said to reach up to 10 hug. Furthermore this programme will bring about the UUM dimension of entrepreneurship and management expertise. UUM had set up a Pet Farm where farm animals such as ostriches, geese, ducks and rabbits are being reared. The university entrepreneurial projects are widened to include rearing deer, and the expansion work would also take place in the deer farm. The projects would not only help generate income for the university but also would train and nurture more young and green entrepreneurs. Figure 1 shows the main attractive places for Discover UUM 2016 – Deer Farm and Three Sister Tree.



Figure 1: Discover UUM – Deer Farm and Three Sisters Tree

In order to promote green initiatives, a sustainability web site known as "Rimba Hijau" was developed. The website can be accessed through <http://rimbahijau.uum.edu.my/>. Through "rimba hijau", UUM stakeholders are updated with information on various green projects and activities. The website also aims to promote sustainability of UUM green campus.

3. Green Initiatives

UUM is ranked second for the first time as the greenest university in Malaysia according to UI GreenMetric World University Ranking 2015. This award has boosted the level of awareness on sustainability practice on campus. In order to sustain, UUM is taking green initiatives, to be integrated into UUM teaching, research, and extracurricular activities. The concept of sustainability was integrated into teaching, research and operation of the University. UUM commitment to green goes beyond classroom as the University is currently pursuing to get ISO 14001 – Environmental Management System and ISO 26000 – Social Responsibility by 2017. UUM is committed to educate its 30,000 students and made them the ambassadors to green environment when they become part of the workforce after graduation. This has resulted not only in the sustainable development of the campus, but has also raised awareness of sustainability among UUM community members.

3.1 Green Community Engagement

Efforts are being made to cultivate human resources by fostering a series of sustainability programme among the student bodies. There are several series of voluntary student activities to enhance campus sustainability. These include “S.O.S-Save Our Shores Series”, “3R- Reuse, Reduce, Recycle”, “UUM Green Run” “**Greener, Cleaner & Campus Initiative (GCCCI)**” and etc. held by different university departments and groups.

Among the initiatives is Mangrove Clean Up through S.O.S-Save Our Shores Series. UUM has taken proactive measures in educating the community by involving students in the environmental conservation charity programme. The main activity of the programme is clearing the areas around the Kilim jetty and mangrove forests along Kilim River including Langgun Island, Kuala Ibus and Merdeka Coastal areas, in Sungai Petani. More than 600 mangrove seedlings were planted along the coast of Kuala Ibus. Moreover, education sessions to local community concerning the importance of environmental conservation were held. This programme has successfully educated and enhanced the spirit of volunteerism among students, local community, developers and local government in conserving the environment.

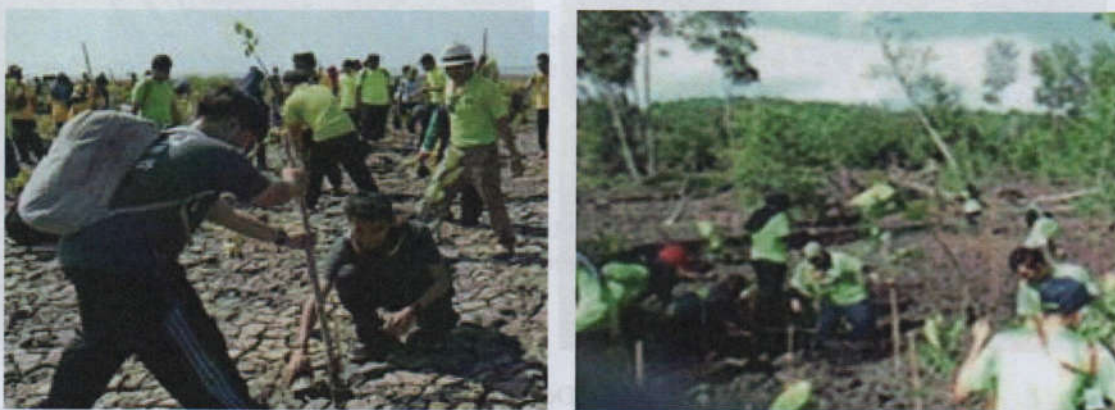


Figure 2: Community Engagement Activities – Mangrove Clean Up

UUM is also committed in the 3R programme (Reuse, Reduce, Recycle), run by the Students Consumer Movement. It is an activity of collecting recyclable items while exploring UUM campus. The programme has been successful in instilling awareness among students on the importance to keep the campus green and clean. Besides, the 3R programme also involves UUM students and other school students in Kedah area. The program aims to raise awareness in each student on the importance of safeguarding the environment and instil love for the environment.

3.2 Green Research

UUM is actively involved in green research and publication. Among the research is the development of a model for Sustainable Agriculture in Rural Area: A Case of Agropolitan Project in an Abandoned Area. The model provides a framework of action to stakeholders in the agriculture sector to adopt the concept of systematic sustainable agriculture. It focuses on organic rice based on the "System of Rice Intensification" technique. This research has resulted in a variety of research projects, publications, consultancy, cooperation with domestic and foreign agencies, and innovation within and outside the country such as collaborative research from 3 local agencies - KEDA, Koperasi Agro Belantik, POLIMA), and 2 international bodies (Bogor Agricultural Institute, and NagrakOrganik SRI Centre, Indonesia).

UUM researchers are also encompassing their research in developing a Total Economic Evaluation (TEV) and Management Effectiveness model for Marine Area Protection (MAPs) in Malaysia. Currently, there are THREE TEV models developed, -Pulau Payar (Kedah), Pulau Redang (Terengganu) and Pulau Tioman (Pahang). The model developed aims to measure the effectiveness of the management of marine parks in Malaysia. This measure is to assist the management of the Department of Marine Park Malaysia (DMPM) to view, monitor and improve the department internal and external service quality. This research has resulted in publication, cooperation with the Department of Marine Park Malaysia (HQ and State), Public Universities (in the field of marine science and oceanography) and several other government agencies and presentation of a paper at a seminar organised by the DMPM.

UUM has successfully organised a Symposium on Technology Management, Operation and Logistic (SIPTIK) in every semester since 2012 until now. This symposium aims to expose on green management among UUM students. It has successfully gathered hundreds of academicians, industry players and environmental activists to discuss the future and roadmap of environmental friendly tourism for UUM. The symposium objectives was to create awareness and showcase potential that is wide open not only in the area of technology management, operations management, logistics transportation but also in the application of green initiatives in various industries.

3.3 Green Energy Saving

As "University in a Green Forest", UUM aspires and draws on every single possibility to save energy and has even made it a culture among UUM community to reduce energy consumption. UUM has taken several measures over the time in using energy efficient appliances. To illustrate, retrofitting from fluorescent tubes (T8) to (T5) and LED tubes, replacement of (SON) street light to LED fittings, retrofitting from (SON) compound light to Induction lamp fittings, replacement of Metal Halide High Bay fittings to Induction lamp fittings, and replacement of flood light system from metal halide fittings to LED/Induction lamp fittings. UUM has also made considerable lighting management system at the lecture theatres, building passageways/corridors, and public toilets. In addition, Building Automation System for air-conditioning operation system in administration, academic buildings and lecture theatres has helped to reduce remarkable energy consumption. Furthermore, utilization of natural ventilation and application of High volume low speed fan (HVLS) and utilization of natural lighting have made this effort even more practical.

Besides, application of Solar panels to mini golf lighting system is also an effort in using renewable energy resources. UUM has also conducted energy conservation programme. For instance, implement rescheduling of air-conditioning system operation by reducing total operation by half an hour. UUM also conducted campaigns such as Earth Hour Programme and to switch off the lights, fan and split unit air-conditioner when not necessary.

The Go Green effort does not end there, but continued to spread in buildings where UUM emphasizes on green building elements. 30% of the building space utilises natural ventilation, 20% of building space utilises full day lighting and less than 35% for circulation in building efficiency.

Finally yet importantly, UUM has introduced the greenhouse gas emission reduction policy. In order to put this policy into action UUM has forbidden open burning, made air-conditioning mechanical, and replaced halon and CO2 gas in firefighting system with environmental friendly gases such as clean agent and FM200.

4. Summary/ Concluding Remarks

UUM is fully committed to contribute towards the green agenda. The green programme introduced has successfully raised awareness and commitment among staff and students on the importance of preserving the environment. Besides, the programme has also successfully stimulated UUM's desire to remain as a campus of 'A University in a Forest – Truly Eco-Friendly Campus'. It also responded to the government and the world's intention to produce graduates who are sensitive to the importance of safeguarding the environment. This initiatives implemented by UUM top management does not only stops among among UUM citizens but the word of mouth has spread to all especially Changlun folks and Kedahan people. The Ministry of Higher Education has also regarded our green agenda as something that is unique which strikes the balance between the needs of academic excellence as well as preserving our mother nature. In the long run, the concept of education tourism or edu-tourism has garnered significant number of tourist to visit UUM campus. To date almost 150,000 visitors from 50 countries visited UUM when we started promoting visit UUM since 2015.

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The Development of Sustainability at BOKU University of Natural Resources and Life Sciences, Vienna Austria

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Abstract. At BOKU University of Natural Resources and Life Sciences in Vienna sustainability issues have gained increasing importance in research and education especially in the last decade through e.g. founding BOKU's Centre of Global Change and Sustainability (gW/N) in 2010. In 2013/2014 gW/N implemented a comprehensive sustainability strategy at the university with the aim to develop and manage a broadly accepted and ambitious sustainability agenda for the next years. The paper will introduce how sustainability is institutionalized at BOKU and how the sustainability strategy process was implemented. Finally BOKU's CO₂ compensation system and the CO₂ mitigation strategy will be introduced.

Keywords: Sustainability activities at BOKU, developing a sustainability strategy, CO₂ compensation system and climate mitigation projects

1. Introduction

At BOKU sustainability issues have constantly gained increasing importance in research and education. Its outside and self-perception is that of a sustainable university. It was the first Austrian university to be certified according to the European eco-management and audit system (EMAS), one of the two first universities in Austria that published a sustainability report, it takes a leading role within the Alliance of Sustainable Universities in Austria, and it is usually under the top-ranked universities of the GreenMetric World Universities Ranking. Sustainability geared further momentum by BOKU's Centre of Global Change and Sustainability (gW/N) since 2010 and by implementing a comprehensive sustainability strategy in 2013/2014 with the aim to map out a broadly accepted and ambitious sustainability agenda for the next years.

2. Institutional set up for sustainability activities at BOKU

2.1. The Centre for global Change and Sustainability gW/N

The centre was founded with an initial staff of eight and the aim to promote sustainability at the university in the areas of teaching and research as well as in everyday campus operations i.e. green campus. By end of 2015 28 persons were employed.

As a key function it takes an active role in the stimulation, coordination and performance of BOKU research (locating relevant calls for proposals, coordinating between BOKU institutes, drafting proposals and taking part in the implementation of projects). For gW/Ns research the sustainability impact is the main focus. Ideas for new sustainability projects are being brought to the team by the university directorate, senate, institutes, students or by public stakeholders. For projects being (co-) developed, either through a joint research project or through gW/N's budget, the project team is seeking for alliances/organizations within the university to then institutionalize the project results or the new initiative. Hence the goal of gW/N is not necessarily to grow as institution, but to implement many sustainability activities at different institutions at the university. Examples for a successful development and transfer of gW/N projects are the BOKU Ethics Platform, now anchored at the university senate, or the Green Meeting Certification which is now being offered by BOKU's event management centre.

The gW/N also promotes and coordinates relevant teaching. While it offers more than 10 courses per semester itself, staff members constantly give lectures in other courses. In 2010 gW/N classified the sustainability relevance of all BOKU teaching courses. The objective was to evaluate the extent to which courses bear the concepts of sustainability, both in content and in teaching methods. For these assessments a criteria catalogue was developed and in more than 1700 courses both content (e.g.

environmental, social and economic topics/problems/impacts) as well as didactic aspects (inter- or trans-disciplinary lectures, project orientation, discursive and participatory teaching methods, etc.) were analyzed. As part of the sustainability classification some BOKU courses with outstanding sustainability knowledge both in terms of content and didactic measures were highlighted. An important common feature of these courses were the focus on up to date sustainability topics by concentrating on the interfaces between science, politics, society, economy and environment, as well as its strong interdisciplinary and discursive orientation - which supports the holistic and critical thinking among students. This systematic collection of teaching sustainability enabled a precise answer to the questions of UI GreenMetric World University Ranking. Results were presented to Vice-Rector for Education and published in the Sustainability Report 2012 as well as on sustainability website.

During 2014 a network for all teachers involved in the topic of *climate change* was established. The overall aim of this teaching network is a closer cooperation between those involved in climate teaching by facilitating the exchange of teaching materials, methods and experiences. The network is experimenting with an incentive system for the exchange of teaching activities – e.g. participants may trade guest lectures among themselves. The cross-linking of many different topics related to climate change should help identify redundancies as well as the absence of certain issues in the different curricula and eventually create a more systemic understanding of climate change by the students.

In order to achieve its networking goals gW/N also serves as a "coordination point" for a number of initiatives such as Sustainable BOKU, EU Joint Programming, Climate Service and the Austrian Climate Change Centre. Finally the centre is assisting with and preparing strategic, internal university decisions, particularly regarding the implementation of sustainability at BOKU such as the preparation and implementation of the so called sustainability strategy (see 3.1.).

2.2. Sustainability Activities of other BOKU organizations

Beside gW/N other institutional bodies and initiatives support the development of sustainability at BOKU. The technical environmental manager is implementing the *EMAS certification system* since 2010 while the project "*Healthy BOKU*" focuses on social responsibility towards the 2,000 employees by awareness rising through promoting a sound working environment to reduce physical and emotional stress.

The Centre for Development Research is a scientific unit devoted to applied development research and training. CDR contributes to the quest for new and better strategies to increase well-being through the sustainable management of natural resources. In cooperation with practitioners and development partners CDR translates research into development practice. Non-governmental organizations and farmer groups are key partners, as are national agricultural research and extension systems. Some of the network partners are donors, who support research and training programs on the ground. Others are universities and research centres under the Consultative Group on International Agricultural Research.

The Students' Union at the University serves as the legal, social and financial represent of the student body and has several departments. The social affairs department deals with the social and financial affairs of student life and assists students to find sources for financial aid. The office for feminist politics is concerned with equal treatment policies and injustice based on gender while the office for environmental and alternative affairs aims deal with the BOKU's research in a critical way from a student's perspective. It represents the students concerns on ecological issues within the university and also supports sustainable student initiatives with small grants.

3. Selected Sustainability Measures

3.1. Sustainability Strategy

In 2013/2014 gW/N implemented a comprehensive sustainability strategy with the following aims:

- Bring together relevant institutional bodies and initiatives dealing with sustainability at BOKU to jointly develop the next steps towards a sustainable university
- Assess ongoing strategic processes at the university and find synergies and co-benefits with sustainability strategy

- Develop the universities sustainability strategy, based on broad stakeholder engagement and backed by the directorate and find ways spreading sustainability into the whole institution
- Map out and rank sustainability measures in four key areas
- Implement measures and evaluate the success and process itself

The strategy covered four key fields at a university: research, teaching, university management and knowledge exchange with society. The sustainability strategy of each thematic field was structured in four workshops according to the AISHE tool (AISHE 2.0, 2012). The starting point was the joint assessment of the status quo and the desired situation in the future in the four fields. Based on this – subjective – appraisal the further discussions focused on measures that could be implemented to reach the desired situation. Each workshop was led by the rector or one of his vice-rectors and attended by 20-30 BOKU-members – covering academia, researchers, administration and students.

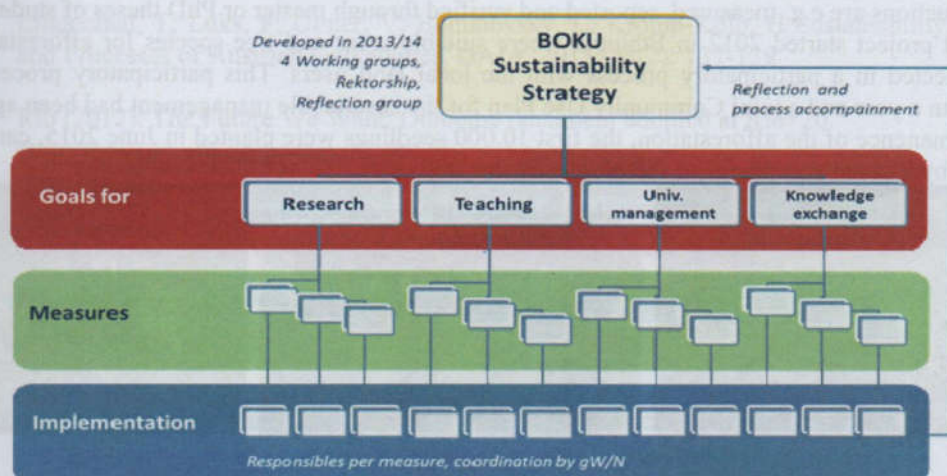


Figure 1. Structure of BOKU Sustainability Strategy

The implementation phase of the sustainability strategy started with a joint synthesis workshop which had the aim to give an overview of the outcomes from all four former workshops. The different measures of the four fields were prioritized and the sustainability strategy now covers more than 20 measures which are being implemented in the next years. The strong commitment of the university management, shown through the participation of the rector and all vice-rectors in the synthesis workshop was an important key factor. The measure that “each student should come in touch with the main ideas of sustainability at least once during his/her studies in a condensed form” was ranked highest by participants of the synthesis workshop.

3.2. CO₂ mitigation and CO₂ compensation at BOKU

In 2012 a master thesis calculated BOKUs CO₂ emissions according the Green House Gas Protocol standard for the years 2011 and 2012. It quantified emissions of about 8000 tons CO₂ annually. In Austria this was the first CO₂ emission calculation of a university. However several measures to improve the CO₂ assessment were identified. Together with partner universities gW/N is now developing a viable, internationally recognized calculation methodology to assess universities GHG emissions in a standardized manner. In a second step a roadmap to reduce 90% of BOKUs CO₂ emissions by 2050 will be developed, where possible linked to the sustainability strategy. This roadmap includes the determination of the business as usual scenario, as well as a viable strategy for identifying the cost-benefit ratio for key mitigation measures such as energy or air travel emissions.

In 2012 BOKU established a CO₂ compensation system. This system offers individuals, but also research projects or companies to offset e.g. their air traffic CO₂ emissions by paying a price for their emitted CO₂. The CO₂ price for BOKU climate mitigation projects is between 22€ and 65€. The costs represent the project development costs of each climate mitigation project. Until 2016 roughly 250.000€ had been collected.

To compensate the CO₂ emissions BOKU institutes develop new and additional climate mitigation projects which are long term, innovative and participatory, implemented in mainly least developed partner countries. Usually BOKU staff had been involved in the area through joint research projects already prior to project intervention. The projects selected and evaluated by the scientific CO₂ advisory board need to have a holistic approach as the goal of BOKUs CO₂ mitigation projects is not only climate protection, but also the structural and sustainable change in the area. BOKU climate mitigation project need to have varied positive benefits such as biodiversity, water and soil protection, gender equality, participation, education and training or entrepreneurship opportunities for the local economy.

The four BOKU climate mitigation projects are located in Ethiopia (two projects), Nepal and Costa Rica. All projects together reduce more than 30.000 tons CO₂ in their lifetime. Projects cost result to roughly 800.000€ in total, meaning very low cost initiatives. In order to reduce costs, the mitigated CO₂ reductions are e.g. measured, reported and verified through master or PhD theses of students.

The first project started 2012 in Ethiopia where suitable areas and tree species for afforestation had been selected in a participatory process with the local land users. This participatory process lasted more than a year and a joint Community Use Plan for the sustainable management had been agreed on. The permanence of the afforestation, the first 10.000 seedlings were planted in June 2015, can now be secured by a broad acceptance of the project by the land users.



Figure 2, 3, 4 Planting the first 10.000 seedlings at BOKU climate mitigation project in North Gondar, Ethiopia. Picture by Jonas Woglu

4. Summary/ Concluding Remarks

At BOKU sustainability issues have gained momentum in the last 10 years especially by founding BOKU's gW/N in 2010 and by implementing a comprehensive sustainability strategy in 2013/2014. Despite many successes, implementing sustainability is a long process and several institutional, administrative and personal barriers have yet to be overcome in the future.

After 5 years of operation and by end of 2015 28 persons were employed at gW/N. A key factor for its acceptance at the university is its function as a *sustainability innovation centre*. As such gW/N is developing new initiatives and formats which are being brought to gW/N by the directorate, senate, institutes, students or by public stakeholders. GW/N is then selecting and developing the best initiatives. Once developed gW/N is seeking university organizations where these new initiatives can be further taken up and institutionalized. Examples for a successful development and transfer are the BOKU Ethics Platform, now anchored at the university senate, or the Green Meeting Certification which is now being offered by BOKUs event management centre.

The sustainability strategy and the participatory process of fall and winter 2013/15 resulted in more than 30 sustainability measures. A key success factor of the strategy was that the university directorate strongly supported this initiative and that public acceptance was ensured through broad and open stakeholder participation. A synthesis workshop resulted in a clear ranking of all objectives and gave a good impression which measures are favoured by participants. Especially during the initial phase of sustainability projects, where immediate successes are absent, safeguarding permanent support by voluntary contributions is challenging.

A university being the implementing agency of a CO₂ carbon-offsetting scheme is unique and has specific benefits such as: basing the project on prior scientific research studies, a reduction of transaction costs, master and doctoral theses accompanying project implementation and last but not least, trust. In regards to long term climate mitigation projects a participatory approach fostering

strong ownership by local communities is key to sustainable improvements of livelihoods based on carbon sequestration projects.

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SESSION 3:
“Waste and Transportation”



**UI Green
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The Strategic Environmental Plan of Federal University of Lavras, Brazil: Who We Are, Where We Came From, Where We Want to Go

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Abstract. This paper highlights the key actions recently developed by Federal University of Lavras (UFLA) in order to deal with some of its environmental issues, such as setting and infrastructure, energy use, waste and water management, transportation, and education. We first describe the Strategic Environmental Plan (SEP) that was developed in 2008 by UFLA's Central Administration, which worked together with University and Community stakeholders to execute a award-winning project – award issued by the Brazilian Ministry of Planning, Budget, and Management – entitled “Eco-University: Environmental Plan for a Socially and Environmentally Friendly University”. Next, we detail the management actions that followed the initial project, emphasizing the challenges and opportunities of developing such initiative in a Public Federal Institution. Finally, we conclude presenting the main achievements of UFLA's SEP, with special emphasis to the international recognition given by UI GreenMetric, which recognized Federal University of Lavras as the top University in Latin America in 2014 and, for the fourth consecutive year (from 2012 to 2015), the top University in Brazil for campus sustainability and environment friendly university management. We are already among the top 10% institutions ranked by UI GreenMetric. Our goal is soon to be amongst the world's 10 best Green Campuses.

Keywords: Eco-University; UFLA; Brazil; Sustainability; Green Campus.

1. Introduction

The Federal University of Lavras (UFLA) was founded in 1908 as the Agricultural School of Lavras. It was renamed as the College of Agriculture of Lavras (ESAL) in 1938, federalized in 1963 and transformed into a university in 1994. The physical and personnel expansion experienced by UFLA throughout its history has required the adoption of new attitudes regarding environmental issues on campus. Until 1994, the College of Agriculture of Lavras had ~2,450 students and ~640 employees (faculty, technicians, and administrative staff). The year of 1994 was a landmark and a starting point for a pronounced growth. Currently, our academic community gathers ~13,000 students and ~1,300 employees.

UFLA's 650-hectare campus draws attention due to its modern infrastructure, encompassing 21 educational and scientific departments, more than 150 classrooms and 250 thematic laboratories fully equipped to ensure the progress of students. All this commitment has ensured that UFLA was first among all Brazilian universities that competed in the GreenMetric 2012 ranking, enacted by the Universitas Indonesia (UI) in order to highlight the efforts in sustainability and environmental management in the campuses of universities worldwide [1].

2. The Strategic Environmental Plan (SEP) of Federal University of Lavras (UFLA)

Environmental issues have always been a concern of UFLA's Central Administration. In 2008, UFLA elaborated its Strategic Environmental Plan (SEP), in order to create well-structured and -planned conditions for the expansion of higher education faced by many universities in Brazil at that time, UFLA included. The actions that were part of this plan emerged to solve current problems and to prevent future ones, with the aim of turning UFLA into a benchmark for a Green Campus, i.e., to make UFLA the most sustainable and environmentally friendly university in Brazil, and also creating de bases for us to be among the best ones in the World.

2.1. Setting and Infrastructure

As perceived elsewhere [2], UFLA recognizes green spaces as important for the image of the university and as an essential component of the campus environment. For that reason, we have developed a special plan for improving our green areas, which included an initial proposal for planting >90,000 native tree species that are essential for protecting water springs and riparian areas and for providing shadow, shelter, and a pleasant place to stay. UFLA also have very special care in building classrooms that take into account aspects such as natural lighting and ventilation in order to provide comfortable teaching environments.

2.2. Energy and climate change

With respect to clean energy and its efficient use – with a consequent decrease in GHG emissions – UFLA's main actions focused on: 1) building a new 13.8-kV protected electrical network; 2) replacing 400W lamps of lampposts for more-efficient 250W metal halide lamps and exchanging mixed bulbs with fluorescent lamps; 3) building solar water heating systems in all university-housing buildings; 4) adopting demand-controlled systems in air conditioning devices, to attain better efficiency; and, 5) testing LED street lights for public lighting. These actions provided us with less energy consumption, even with the growing number of buildings and students. We are now seeking energy self-sufficiency. For that, we are currently negotiating a photovoltaic power plant that will be able to generate 5 MW of energy and an integrated "Smart Grid" for the whole campus.

2.3. Waste management

UFLA has about 200 laboratories that generate chemical wastes, which raises concern about their appropriate management. For that reason, the Central Administration has set a comprehensive chemical waste management program for collection, segregation, storage, treatment, and final disposal of this chemical waste. A Chemical Waste Management Laboratory (LGRQ) was specially built for that. Now, much of the waste containing heavy metals and solvents is treated for recovery purposes and reuse of reagents in some classroom activities. The organic compounds that cannot be recovered are degraded.

Concerning biological waste, UFLA has a tissue digester working with chemical processes that convert animal tissues and microorganisms into a sterile aqueous solution that can be recycled as a fertilizer.

For treatment of organic waste, UFLA is implementing a Solid Waste Treatment Experimental Field, which in addition to providing environmentally soundly treatment for the organic waste generated in our campus, will also serve for educational purposes.

Recycling initiatives have Community support through a partnership with ACAMAR (Association of Recyclable Material Collectors of Lavras), for implementing a selective waste collection system on campus. ACAMAR also collects most materials generated by University activities such as paper, cardboard, reagent bottles and glass. This partnership provides a socially and environmentally friendly final destination for most dry waste generated in our campus. UFLA implemented also the campaign "UFLA RECICLA™" – *UFLA recycles* – to encourage the replacement of disposable cups for reusable mugs.

UFLA also has a sewage treatment plant that uses UASB (Upflow Anaerobic Sludge Blanket Reactors) and FBS (Submerged Biological Filters), a modern and efficient system for sewage

treatment. In addition, sewer from the main university restaurant is treated in an aerated grease trap box, using an automated system for removal of flotation foam by scraping.

2.4. Water usage

Almost all of the water consumed in UFLA comes from its water treatment plant, after being collected from clean and natural springs. Therefore, UFLA "produces" its water.

UFLA also uses rooftop rainwater harvesting systems that divert the water collected in gutters placed on the roof of the classrooms and the main restaurant to a containment basin with 1.6-million liters of storage capacity, thus preventing runoff and promoting groundwater recharge.

Traditional water distillation systems have been gradually replaced by reverse osmosis, bringing efficiency, economy, and environmental benefits, because the consumption of water by distillers is 8 times higher than that of reverse osmosis. In addition, the power consumption of the distillers is 320 times higher than that of reverse osmosis equipments.

2.5. Transportation

Besides constructing 8 kilometers of bike lanes on campus, to encourage bike users, UFLA has also built 6 bike parking facilities covered with solar panels (called "ecobicicletários") that generate electricity. On-campus transportation of students is done by articulated buses and the university encourages the practice of carpooling and also facilitates free rides by installing location-specific sites for hitchhiking.

2.6. Environmental Education

UFLA's awareness about the environment is also a major concern in its undergraduate and graduate programs. Undergraduate courses have in their curricula many courses dealing with environmental issues. In fact, concerning specifically undergraduate Business Administration programs of excellence in both public and private institutions in Brazil, Federal University of Lavras is the institution with the highest amount of courses (4) on the theme "sustainability" in the country, with a total program hours for all disciplines offered (204 h) corresponding to 10% of the total program hours for the Business Administration program [3]. Graduate students also have the option to attend many environmentally-driven courses, in addition to a compulsory course covering Laboratory Safety and Environment. UFLA also offers to Lab. Technicians courses about Laboratory Waste Management, Energy Management, Water Management, among others. Such actions are especially relevant taking into account results from recent studies applied to students in primary and higher education reporting clear evidences that those having deeper awareness (more complex view) on environment tend to develop more meaningful pro-environmental actions [4].

3. Main Achievements

Due to the successful implementation of its Strategic Environmental Plan, Federal University of Lavras has gained national recognition for its project entitled "Eco-University: Environmental Plan for a Socially and Environmentally Friendly University" [5], getting the 1st place in *Planning, Budget, and Institutional Performance* in a competition concerning *Innovation in Public Federal Institutions* set by the *Brazilian Ministry of Planning, Budget, and Management*, in 2013. UFLA also achieved international recognition during the past four years in the UI GreenMetric, being recognized as the top University in Latin America in 2014 [6] and the top University in Brazil for campus sustainability and environment friendly university management. Our records shown that we have started within the top 35% universities evaluated by UI GreenMetric in 2012 (UFLA was ranked 70th among 215 universities), changing to the top 14% in 2013 (ranked 42nd among 301 universities), and reaching the select group of top 10% universities listed in UI GreenMetrics in the last 2 years (ranked 26th within 361 universities in 2014, and 39th within 407, in 2015).

A few figures related to some of our main achievements with the SEP follow:

- A total investment of 25 million reais (~10 million US dollars);
- Planting of >90,000 native and fruit trees (53 species), providing shelter, shadow, ecosystems restoration, as well as protection of 15 water springs;

- With the installation of the Sewage Treatment Plant on campus, about 80% of the average 600 thousand liters of water consumed per day are treated and return to strategic consumption, such as toilets flushing, external cleaning and irrigation;
- The roofs of new buildings, including all classrooms, are now designed for rooftop rainwater harvesting and the water is stored in a reservoir with a capacity of 1.6 million liters;
- In the last four years we have collected and processed over 40 tons of chemical waste from research carried out in ~200 laboratories. The Chemical Waste Management Program (CWMP), a pioneer initiative in public institutions of the state of Minas Gerais, provides proper storage conditions and recovers reagents so that they can return for laboratory reuse;
- Currently 30 volunteers and trained firefighters make up UFLA's Fire Brigade to fight the constant fires that occur in our campus, especially during the dry season. Since 2009, there are no records of the presence of the City's Fire Department in UFLA;
- With the *UFLA Recycles* campaign, we avoid the consumption of ~15,000 plastic cups in just one week in the main University Restaurant. Such initiative represents savings of ~22,000 reais per year;
- The Office of Endemic Disease Prevention (COPE), which is linked to the Office of Environment, is responsible for a systematic control to prevent zoonoses and endemic diseases on campus, such as dengue fever, rabies, Chagas disease, leishmaniasis, intestinal parasites, and angiostrongylosis, among others. COPE's workforce relies on the involvement of faculty, administrative staff, and students to carry out a preventive action involving problem identification, risk assessment, and presentation of strategic solutions. This group assembles 20 weekly traps at strategic points of the university, counting eggs and identifying species present in each environment. Until now, there were 1920 laboratory analysis and evaluations of time series. These analyzes allow us to identify critical areas, thus addressing specific control actions.

UFLA is a pioneer university in Brazil in carrying out projects involving virtually all environmental issues that need to be addressed in higher education, which also express the public interest and are aimed at the common good.

So, at this point of our evolution, after a successful period, our institution is strategically prepared for new challenges. We are in our way for achieving full sustainability. Moreover, thanks to the educational nature of our activities and due to our commitment to society, UFLA is driving environmental issues beyond its frontier, influencing the surrounding community towards a responsible use of the environment. With that, we want to be consolidated as a global benchmark of sustainability.

We are already among the top 10% institutions ranked by UI GreenMetric. Our goal is to be amongst the world's 10 best Green Campuses.

4. Summary/Concluding Remarks

UFLA recognizes its responsibility to promote a sustainable environment. This responsibility includes actions addressing most of the environmental issues covered by the main categories ranked by UI GreenMetrics, i.e., setting and infrastructure, energy and climate change, waste management, water usage, transportation, and environmental education. Therefore, the right to water, to clean energy and to a safe environment is among the main goals of UFLA. The water issue is already being taken care of, as the university facilities offer water from public taps and research are focused on its sustainable governance and management. As for clean energy, UFLA is on its way to having a power plant to generate electricity from solar energy, as well as to build an "Integrated Smart Grid" for management and distribution of electricity all over the campus. That includes replacing old and high-power-demand equipments and lamps in order to achieve sustainability. Water and waste treatment and recycling, protection of water springs and riparian areas, promotion of groundwater recharge, and prevention of soil erosion are actions strongly stimulated all over the campus, not only by the campus community but also by the external community, since we have a widely open-to-community campus. Therefore, respecting the concept of having a "Green Campus" is a huge issue at Federal University of Lavras (UFLA).

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Thammasat University Implementation on Sustainability: Natural Resources, Energy, and Environmental Conservation

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Abstract. Thammasat University has the mission that not only to provide equal educational opportunity in various fields, to produce graduates who are competent, committed to fairness and the public interests, but also to provide educational services to the society focusing on services for sustainable development which concerned on *Natural Resources, Energy, and Environmental Conservation*. This paper will explain some success cases such as making the happy place to work and to live by providing the green area per head of 58.71 m², reducing the use of piped water for 20%, managing toxic waste by applying the “*Enhancement of Safety Practices in Research Laboratory in Thailand project, ESPReL*” for clearing the chemical waste accumulation up to 1,500 kg, and applying active learning and service learning program to many courses, most of them related to the conservation of energy and environment.

1. Introduction

It is more than 10 years that Thammasat University has given the priority to the issues about *Green, Sustainability, and Happy Place to Work, to Play and to Study*. These issues could be found on the Policy, Strategic Plan, and Action Plan of the university since 2004. The innovative and creative activities that have been conducted by university staffs, students, groups, faculties, colleges, and institutes could also be seen.

In the first period, 2004 to 2010, when Thammasat people were familiar with the word “*Green*”, which conveyed the meaning of planting more trees, collecting recycled garbage and selling it to the “*Garbage Bank*”, in 2006. This was later expanded to be “*Zero Waste Shop*”. Apart from that, Thammasat people was introduced to very important issues, it is *Natural Resources, Energy, and Environmental Conservation*, which led to the numerous activities and campaigns throughout the university. But in 2011, these activities was interrupted by the *Big Flood*, causing damaged to many trees, infrastructure systems, including bicycle lanes in main campus, including the plan to announce the “*Sustainability Policy*”. However, after 30 days in water, Rangsit Campus, the biggest campus, has begun to start its restoration program.

In the second period, 2012-present, after fully recovered from the flood, Thammasat in 2013 was first to join UI Green University Ranking. In 2014, Thammasat had celebrated the 80th Anniversary with launching, the project “*Thammasat University Master Plan 2034*” towards 100th Anniversary in 2034. The vision of TU 2034 report will reveal the preliminary concept of Rangsit Campus Master Plan in 2034, which the problems, opportunities and limitations are analyzed and explained. In the same year the University Council approved the “*Action Plan for Sustainable University (2014 – 2017)*”. This Action Plan consists of the categories listed on both Green and Sustainable Criteria; Energy and Climate Change, Water and Waste Management, Transportation, Health Wellness, and Education. The detail is shown in Table 1.

2. Setting and Infrastructure

Thammasat University comprises of 4 campuses: Tha Prachan Campus, the main campus, located in Bagkok is the first campus, Rangsit Campus, the biggest campus located in Pathum Thani province 40 km from Bangkok is the second campus, Pattaya campus located in Pattaya Chonburi province, 150 km eastbound from Bangkok is the third campus, and Lampang campus located in Lampang province, Northern part of Thailand. The university has made the land in all campuses to have more green area causing in 2015, university could

increase the planted area and non-retentive surface area up to 3 and 4 percent, respectively. The detail is shown in Fig. 1. and Fig. 2.

Table 1. Action Plan for "SUSTAINABLE UNIVERSITY" (2014 – 2017)

Category	Target	Project	Progress
1. Energy	Saving energy	1. Change electrical appliances. 2. 5% reduction for electrical usage payment support for faculties / colleges / institutes	1. On progress 2. Start in 2015
	Use renewable energy	1. Solar rooftop project at Rangsit Campus 2. Finding the other sources of alternative energy for Thammasat University.	1. On progress 2. Start in 2015
2. Green Building	New building	All new buildings built from 2015 have to rely on the Green Building Standard and /or Energy Saving Standard.	Start in 2015
	Renovated building	All renovated buildings have to concern on Energy Saving and Environmental Conservation.	Start in 2015
3. Garbage Management	Reduce solid waste and garbage	1. Launching campaign to change human behavior	1. On progress
	Waste separation	2. To improve and rebuild Separating Waste System and its building	2. Start in 2015
	Toxic waste management	Setting an appropriate toxic waste management system for university	Started in April 2015 and Completed in February 2016
4. Water Management	Reduce piped water loss	Launching campaign to change human behavior	On progress
	Increase the ratio of natural and piped water usage	Use rain water and canal water	On progress
	Waste water treatment	To improve the waste water treatment plant	Start in 2015
5. Transportation	To be "Bicycle University"	1. To improve bicycle lane 2. To install bicycle signpost 3. Bike sharing system 4. Bike Café 5. Launching campaign to change human behavior	On progress
		Pedestrian and bicycle lanes extension	Start in 2015
		Transportation system improvement	On progress
		Bus terminal project	On progress

Having safe and environmental friendly transportation system	20 seats Minibus NGV	Start in 2016
Car park building links to internal transportation system	1. Aquatic Center car park project 2. Hospital car park project	Start in 2015

Table 1. Action Plan for “SUSTAINABLE UNIVERSITY” (2014 – 2017)

Category	Target	Project	Progress
6. Natural Area Conservation and Management	Green reservation area	1. 900 meters garden 2. Natural conservation plants in university	1. On progress 2. On Study
	Plants and big trees	Campus in the park project	On progress
7. Health and Wellness	Good health	Sport service improvement	On progress
	Food safety	1. Organic food canteen 2. Organic produces shop 3. Organic central market	1. Start August 2014 2. Start January 2015 3. On progress
8. Academic and Research	Teaching	1. TU 100 2. Service Learning	On progress
	Research	Increasing budget to sustainability research	Start in 2015
9. Social Justice		To improve welfare system in university	On Progress
		Community and social service	On Progress

3. Water Management

Thammasat University was success in using treated water for gardening in replace of piped water, the volume (m^3) use in 2015 was 20% higher than that of 2014. This has been done by launching water scarcity campaign throughout university for convincing people to concern about unnecessary use of water, including observing the water leakage. All used water from building will be sent to waste water treatment before discharged to the university canal (Fig. 3).

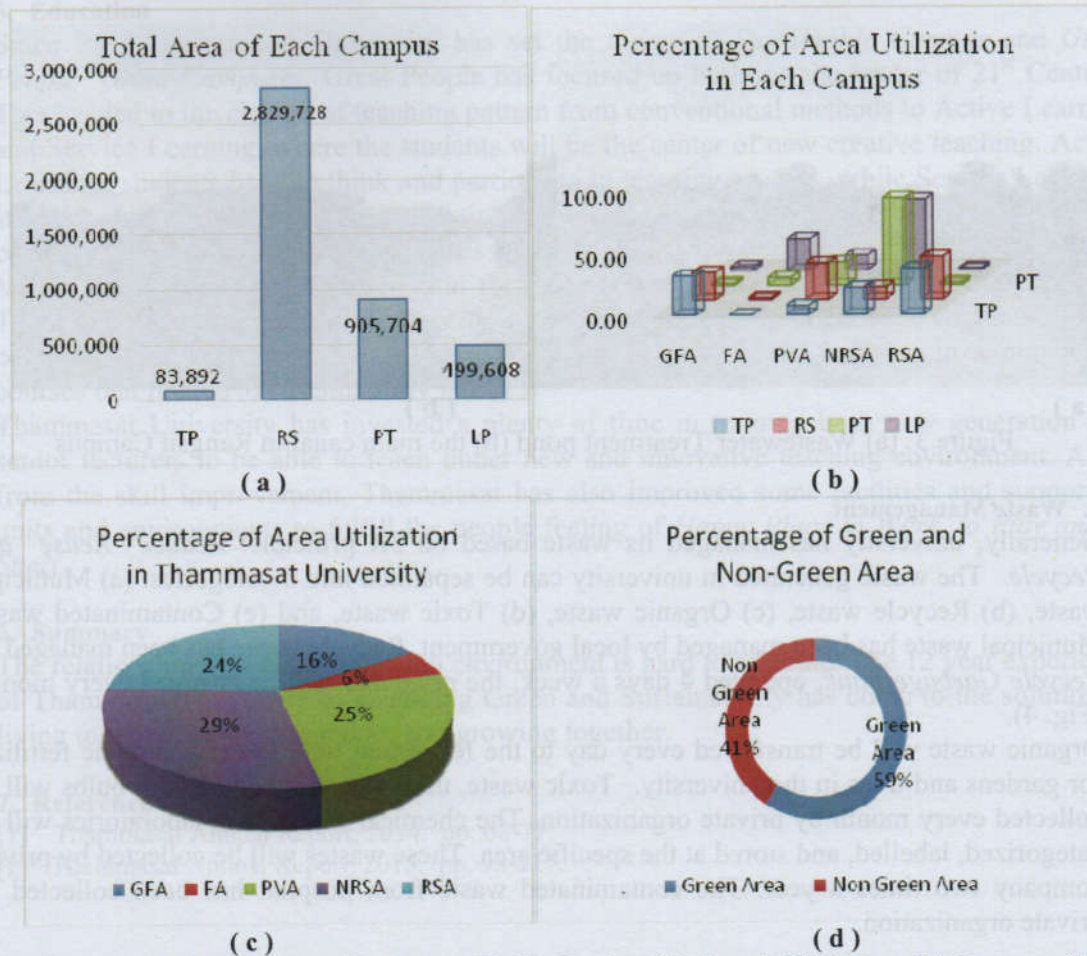


Figure 1. The area utilization in each campus: TP: Tha Prachan, RS: Rangsit, PT: Pattaya, LP: Lampang, GFA: Ground Floor Area, FA: Forested Area, PVA: Planted Vegetative Area, NRSA: Non Retentive Surface Area, RSA: Retentive Area.



Figure 2. (a) Garden with non-retentive surface (b) Bicycle lane in Rangsit Campus

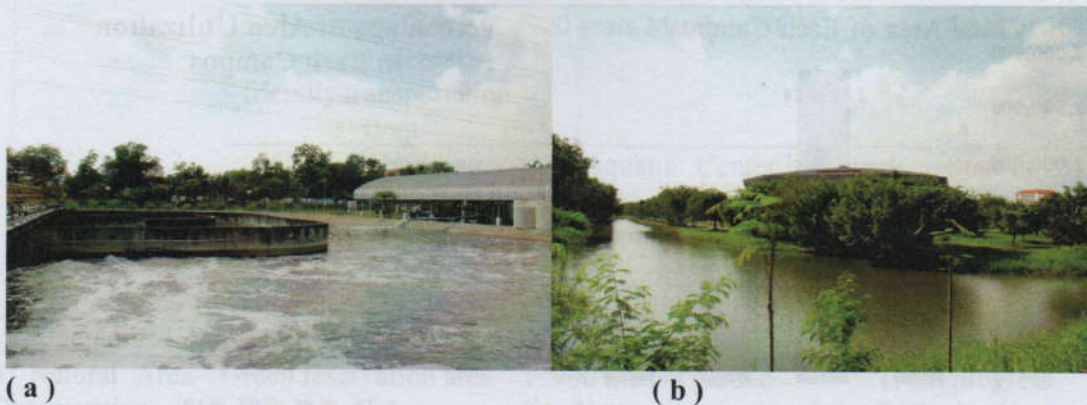


Figure 3. (a) Wastewater Treatment pond (b) the main canal in Rangsit Campus

4. Waste Management

Generally, university has managed its waste based on 3R principle: *Reduce Reuse and Recycle*. The waste generated in university can be separated into 5 categories: (a) Municipal waste, (b) Recycle waste, (c) Organic waste, (d) Toxic waste, and (e) Contaminated waste. Municipal waste has been managed by local government. Recycle waste has been managed by *Recycle Garbage Bank*, operated 4 days a week, the price rate will be changed every months (Fig. 4).

Organic waste will be transferred every day to the fermented field to make organic fertilizer for gardens and trees in the university. Toxic waste, used batteries and electric bulbs will be collected every month by private organization. The chemical waste from laboratories will be categorized, labelled, and stored at the specific area. These wastes will be collected by private company two times a year. The contaminated waste from hospital has been collected by private organization.

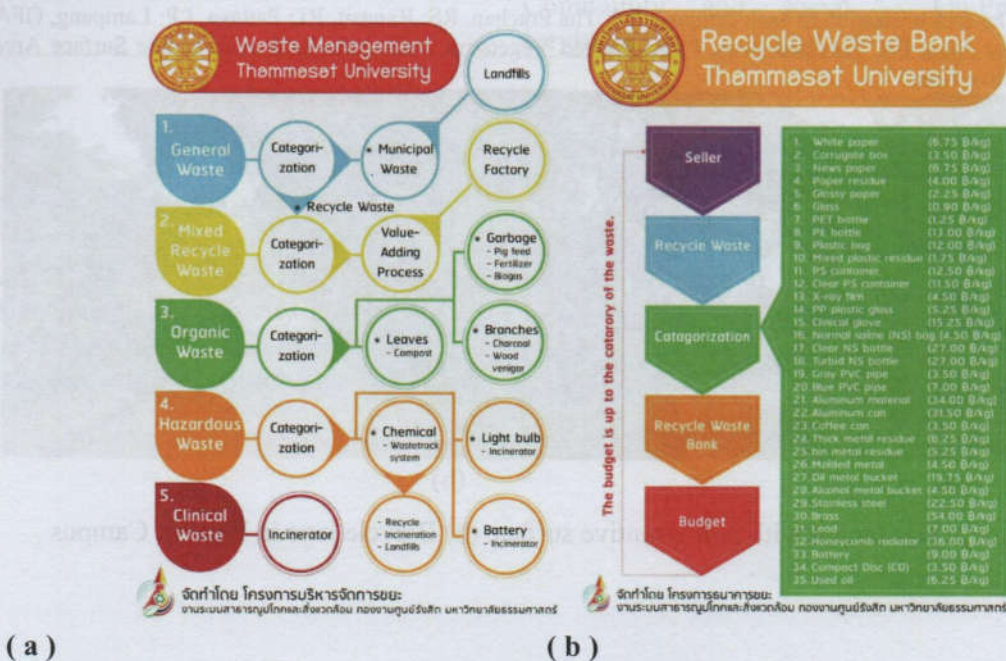


Figure 4. (a) Waste Management Diagram (b) Work Flow of Recycle Waste Bank and the Price List

5. Education

Since 2014, Thammasat University has set the theme of *Sustainable Campus and Great People Great Campuses*. Great People has focused on building the leader of 21st Century. This has led to the change of teaching pattern from conventional methods to Active Learning and Service Learning, where the students will be the center of new creative teaching. Active Learning, students have to think and participate in learning process, while Service Learning, students have to seek their interesting problems from real life and solving them in collaborating with the people who owns that problems, supported by supervisors or advisors. Many problems are related to Natural Resource, Energy, and Environmental Conservation. These changes have had an influence on many lecturers who improved the contents in their courses to fit with the sustainable aspects. This has caused an increase in a number of courses that related to sustainability in 2015.

Thammasat University has invested a plenty of time in training both new generation and senior lecturers to be able to teach under new and innovative teaching environment. Apart from the skill improvement, Thammasat has also improved some facilities and supporting units and environments to fulfill the people feeling of *Happy Place to Work, to Play and to Study*.

6. Summary

The relationship between people and environment is hard to separate. The 12 year experience of Thammasat University in managing Green and Sustainability has come to the solution of living together, support together, and growing together.

7. Reference

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Reduction of water resources consumption and the student-led environmental management system of Chiba University

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Abstract. Chiba University acquired ISO14001 certification in 2005 through the student-led environmental management system. Since then, it has continued commitment to the environment and succeeded in reducing its energy consumption and waste emissions, such as the 37% reduction of the use of water resources. In addition, maintenance of the ISO14001 is incorporated into the university's primary operation as part of the curricula, and the student-led environmental management system serves as a "training ground for practical education." Owing to the student-led environmental management system, the university has not only reduced its energy consumption and waste emissions but also upgraded its positive external assessments and generated practical educational effects for students.

Keywords: ISO14001, environmental management system, Student-led, practical education

1. Introduction

This paper focuses on reduction of energy and resource consumption of Chiba University and presents schemes and characteristics of the environmental management system (EMS). Its EMS has been run by mainly the Environmental ISO Student Committee since 2003. This student-led EMS were reported in "ISO Management Systems," a publication of the International Organization for Standardization, as an example of the use of acquiring ISO 14001 certification in higher education centers in 2006 [1]. In addition, Chiba University has achieved certification of ISO 50001 in 2013. As a result, environmental and educational effects have also been appearing. This paper summarizes these achievements since 2004 based on data and questionnaire survey results.

2. Overview of Chiba University and its EMS

There are 781 universities in Japan including national, public and private universities [2]. Chiba University is one of the 86 national universities among these, and was founded in 1949. The university was incorporated in 2004, and is currently a leading center of higher education in Japan, with approximately 14,700 students and 3,350 faculty members [3].

Chiba University established the Environment ISO Student Committee in 2003 with students mainly running the EMS. In 2005 the Nishi-Chiba Campus of Chiba University acquired ISO14001 certification. Then, the scope of application for the system has been progressively expanded to the other Campuses and currently, all of the four main campuses are operating the ISO 14001-compliant EMS. Furthermore, ISO50001, an international standard for energy management systems, was adopted in 2013 first for a Japanese university.

3. Reduction of energy and resource consumption

First, when considering the energy and resource conservation effect, it is important to examine the changes in the floor area of the university's buildings and in the number of its members (teaching staff and students). The floor area of the university in academic year 2013 (excluding the ancillary hospital, which lies outside the scope of ISO application) increased by 19,921 m² (106%) from that in academic year 2004, prior to ISO 14001 acquisition. Meanwhile, the number of its members (including the

ancillary hospital, as a number of members belong to both faculty and hospital) increased by 312 from that in academic year 2005 [4].

3.1 Water resource conservation effect

Comparing the water consumption in academic year 2004 and 10 years later in academic year 2013 (excluding the area of the ancillary hospital), tap water (prefectural water and bore water) input decreased by about 37% ($161,530\text{ m}^3$), and emissions of sewage decreased by about 54% ($212,324\text{ m}^3$). Usage of tap water and emissions of sewage showed a broad declining trend over the 10-year period on both a total and per-unit basis. (refer with: Figs. 1~3) [5]

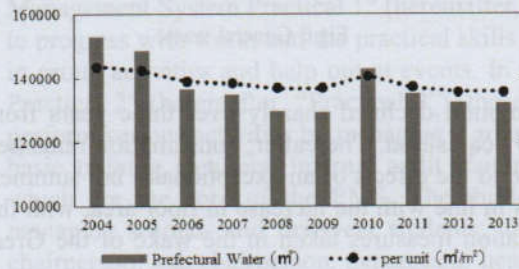


Figure 1. Prefectural water

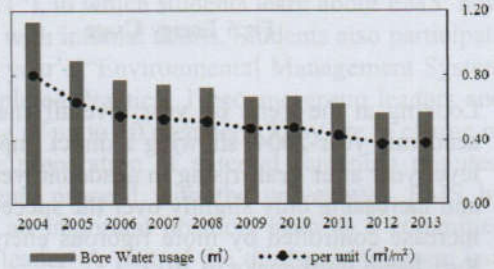


Figure 2. Bore water

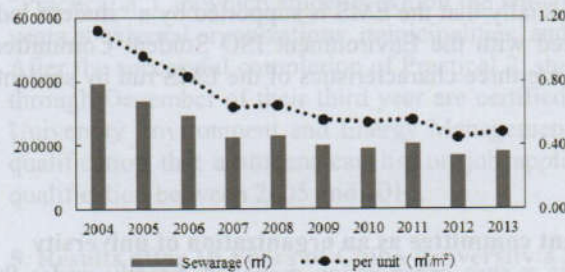


Figure 3. Emissions of sewage

There are three factors in the reduction of the use of water resources. First with the introduction of EMS the university changed the frequency and scope of measurement of water usage from yearly for each campus to monthly for each building, so it has become possible to discover the leakage earlier. Second, for water saving experimental coolants was reused and equipment adjusting water quantity and pressure was introduced to faucets, toilets and showerheads. The third is awareness-raising activities for water-saving by the Environmental ISO Student Committee (ex. Fig 4).



Figure 4. Water-saving awareness sticker

3.2 Other energy and resource conservation effects

Comparing the energy consumption and waste emission in academic year 2004 and 2013, the overall amount of energy (electricity, gas and fuel oil) input decreased by about 8% ($38,247,109\text{ MJ}$) despite the increase in floor area and university population, which directly impacts energy and resource consumption. In terms of unit consumption by area, this figure corresponds to a reduction of about 13% (174 MJ/m^2). Moreover, in waste emissions, industrial waste increased with the new construction and renovation of buildings, but general waste declined by about 50% (771 t). (refer with: Figs. 5,6) [6]

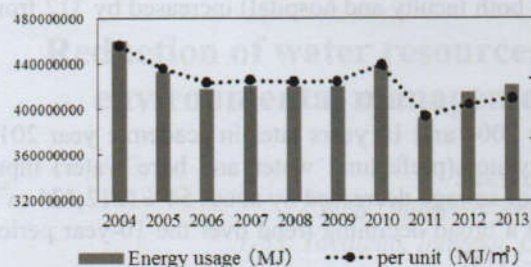


Fig.5 Energy Usage

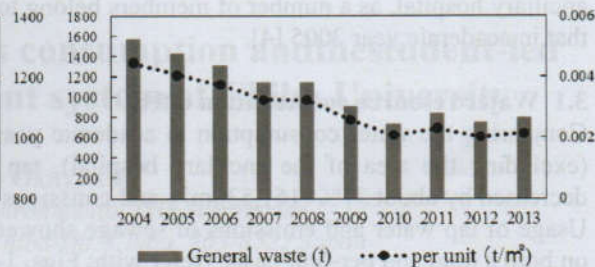


Fig.6 General waste

Looking at the trend by year, overall energy consumption declined sharply over three years from academic year 2004, showing a direct impact by ISO acquisition. Thereafter, consumption remained level year after year, rising in academic year 2010 due to the effects of an exceptionally hot summer, and increasing only slightly over the succeeding years in line with the increase in floor area, with the increase controlled by more rigorous energy conservation measures taken in the wake of the Great East Japan Earthquake in 2011.

The reason why Chiba University has been able to conserve energy and resource so much is that it has continued its EMS for more than a decade and especially that the EMS is supported by a “student-led” organization. About 150-200 students are affiliated with the Environment ISO Student Committee, performing EMS operations autonomously. There are three characteristics of the EMS run by students in Chiba University, discussed in what follows.

4. Student-led EMS at Chiba University

4.1 The positioning of the organization: A student committee as an organization of university

The Student Committee has been incorporated as a core organization managed directly under the university president as part of the university’s EMS operations organization, rather than as a student club. Furthermore, the student committee is in charge of the Environment ISO Office, employing a “practical” format. The Student Committee performs its tasks through various departments, and oversees various groups. In order to execute its tasks, a group meeting is held once a week, with a general assembly—in which everyone comes together—held once a month. During such meetings, the progress of each group is presented and information is shared.

4.2 Task details: Students are in charge of tasks related to the core of the EMS

The Student Committee is in charge of tasks related to the PDCA (plan-do-check-act) cycle, a foundation of the EMS, as a part of practical education. As part of PLAN, the students perform the development of environment objectives, environment goals, and action plan drafts. The following activities are included in the DO component: activities for increasing environmental awareness on campus, including creating and distributing stickers and posters, and holding events related to energy and resource conservation; making green walls; creating fertilizer from dead leaves; campus environment improvement activities that target abandoned bicycles; anti-smoking measures; environmental education activities involving going to the Chiba University-affiliated kindergarten, elementary, and middle schools, as well as going to the neighboring elementary and middle schools; and collaborative activities with the local community, including tree-planting and community gardening. Basic training for all students and faculty members on EMS and environmental awareness are conducted at the beginning of the year. During this training, students serve as lecturers. The CHECK components refer to the students performing such tasks as the collection of audit measurement records; preparation of internal audit plans, checklists, and internal audit reports; and conducting audits in a team with faculty members during the day of audits. Furthermore, students even serve as the head editor for creating environmental reports, in which the students come up with the structure, conduct the interviews, write, and even direct the design. With the ACT component, the students create the draft plan of such tasks as the revision of the environmental management manual as

necessary. In addition, the students prepare documents for universities that are required for external ISO screening, accompanying the screening, recording the minutes, and also recording observations from visits and interviews on EMS from outside parties.

4.3 Part of the curriculum: Turning activities into credits and qualification certification system

Chiba University perceives the construction and operation of EMS as "a practical business education opportunity for students," giving class credits for the activities and even giving certificates for on-campus qualifications.

The general academics subject taught in the first year include a subject called "Environmental Management System Practical 1" (hereinafter, "Practical 1"), in which students learn about EMS, how to progress with work, and the practical skills associated with internal audits. Students also participate in group activities and help out at events. In the second year's "Environmental Management System Practical 2" (hereinafter, "Practical 2"), those who completed Practical 1 become group leaders and perform various activities by managing a group consisting of up to 10 members. They are in charge of basic training lecturers, internal audit training, and the preparation of external screening minutes, which are the core of the EMS. The third-year students proceed with the university's EMS by managing second- and first-year students; they assume an important position, such as a committee chairperson, sub-chairperson, department head, and the leader. A part of the third-year program is a five-day internship as part of the Environmental Management System Practical 3 (hereinafter, "Practical 3"), in which students exhibit the knowledge and experience they accumulated through their years at external organizations, municipalities, and corporate EMS-related departments.

After the successful completion of Practical 2, students who have contributed to the university's EMS through December of their third year are certified and awarded an in-campus qualification, the Chiba University Environment and Energy Management Practitioner, by the university president. This is a qualification that a student can list on job applications. There were 357 students who earned this qualification between 2005 and 2015.

5. Results after 10 Years of Chiba University's Student-led EMS

Chiba University has continued to run the student-led EMS for 10 years. As a result, there are not only the energy and resource conservation effects, as mentioned in the beginning, but the effects as follows:

5.1 External evaluation of Chiba University

Since Chiba university acquired ISO 14001, it has received inquiries and requests from universities throughout Japan and overseas. The inquiries vary in content. Some are on the structure and operation of the EMS itself, whereas others are questions on the environmental aspects of the facilities, initiatives of the Student Committee, and other matters. Examples of independent evaluations of Chiba University include receiving various awards and media attention.

In terms of the prizes won in recent years, and considering that students have been shouldering the main burden of the university's environmental activities for many years, they are implementing an EMS in a stable manner via course credit and qualification systems. In addition, the students are continuing their activities, not only inside the university, but also more widely in the region. Their actions have been positively assessed. Since many of the awards received involve the commendation system that is sponsored or supported by government ministries and agencies, one can say that Chiba University's efforts have been acknowledged nationwide.

5.2 Effect of practical education on students

As mentioned above, students at Chiba University who participate in the Student Committee activities for three years from their first to third years as undergraduates are awarded the Chiba University Environment and Energy Management Practitioner qualification ("Practitioner").

From July to September 2014, a questionnaire survey was carried out for alumni of the Student Committee who hold the Practitioner qualification, 112 of whom responded. After excluding the students respondent, a further questionnaire survey was conducted for the 85 Practitioners who were currently pursuing professional careers.

In response to the following question, more than 80% of the respondents replied in the affirmative ("very much"31% and "a little"50%): "Please recall your initial one to two years as a working adult. Did your activities in the Environmental ISO Student Committee during your student years aid you in your work?".

Further, when the 69 respondents who replied in the affirmative were asked "What specific experiences were helpful?," approximately half of them responded that the experience of document creation, exchanges with teaching staff and external people ("adults"), running an organization, and chairing meetings were useful when they started their working lives.

Moreover, when the working adults were asked "Looking back, what kind of skills do you think one can acquire from conducting Student Committee activities with passion?," over half of them responded with "communication skills," "the ability to set goals, take action, and finish a task," and "the ability to work in a team".

From the above results, it is clear that graduated members of the Student Committee who had been involved in leading the Chiba University EMS for three years felt that their experience of committee activities had been beneficial on joining the adult working world, and that participation in the EMS had a positive impact as an opportunity to gain practical experience.

6. Conclusion

Owing to the student-led EMS at Chiba University, the university reduced its energy consumption and waste emissions. Furthermore, it raised its positive external assessments generated practical educational effects for the students. Nowadays, it is taken for granted that the students are engaged in the university's EMS. The university recognizes the value of keeping the ISO14001 by running the EMS led by the students and practical education effects will serve to fulfill their role as an educational institution. So it would be also very useful for other universities to give it a try.

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Chulalongkorn University Development: Approaches and Achievements to Sustainability Campus

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Abstract. Chulalongkorn University has always taken pride as one of the leading universities of Thailand. With the country facing various issues needing strong leadership in sustainable development movement, Chula has been working hard to set standards and to prepare their students well in this issue. With its “Green University” policy, started in year 2004, and its participation of the UI GreenMetric World University Ranking, which is every year since 2011, Chulalongkorn University has prided itself in the path to become a sustainable university. We have been working very hard and improving every year. Beyond the ranking and the scores though, the university’s main concern is the wellbeing of its members. The sustainable practice of CU, therefore, has also extended beyond their “Green University” policy and the UI GreenMetric to include safe & healthy environment and quality life for students, faculty, and staff.

Keywords: sustainable society, sustainable university, Chulalongkorn University

5. The Beginning of Sustainable Development Movement in CU

Sustainable development is one of the most challenging issues facing mankind. According to United Nation Environment Programme (UNEP) Green University Tool Kit, there are no other institutions in modern society more suitable in facilitating the transition to sustainable future than universities [1]. As the oldest university in Thai modern educational system, Chulalongkorn University, known to be “the Pillar of the Kingdom” [2], has been working rigorously to become a sustainable university and to drive Thailand toward sustainable future. Since implementing the “Green University” policy in year 2004 and joining the UI GreenMetric ranking in 2011, Chula has achieved and progressed enormously in term of sustainable development. The university’s efforts have also extended beyond “greenery & shade” and UI GreenMetric criteria to include safe & healthy environment and quality life for students, faculty, and staff.

The idea of “Sustainable Development” was first introduced to Chula’s community in year 2004 through “Green University” policy. To further emphasize the university’s commitment, the policy was officially included in Chulalongkorn University 100 year Anniversary Development plan in year 2008 [3]. The “Green University” policy goal has been to transform the university into “Chamchuri Park”, a very pleasant and conducive environment for study. One example of successful projects created under the “Green University” policy is the “Chula Cares for the World” where students, faculty and staffs come together annually to plant trees within the university grounds. The goal is not just to increase the shade throughout the campus, but to also teach the value of trees and foliage and the importance of cooperation in creating and maintaining a pleasing environment for learning within Chulalongkorn University. From the “Green University” policy, Chulalongkorn has earned a great reputation as a city center university with very lush and shaded grounds. But the sustainable movement in Chulalongkorn University has gained its momentum after the university joined the UI GreenMetric Ranking in year 2011.

6. Joining the UI GreenMetric World University Ranking

Chulalongkorn University’s participation of the UI (the University of Indonesia) GreenMetric World University Ranking has broadened & strengthened its commitment to sustainable development. This is because UI GreenMetric Ranking criteria does not just consider shade and greenery on campus, but also a number of systems and services that relate to the environment and sustainability (including: 1. Setting & Infrastructure, 2. Energy and Climate Change, 3. Water Management, 4. Water Usage, 5.

Transportation, and 6. Education) [4]. With these new criteria in mind, Chulalongkorn University has worked very hard to achieve much wider aspects of sustainability.

For instance, in the first “setting & infrastructure” category, the UI GreenMetric considers the percentage of open area of total space, public areas, amount of green area, water absorption area, and the percentage of the university’s total budget allocated to sustainability. Because Chulalongkorn University is located right in the heart of Bangkok, it has a very fixed amount of space. Just over 500 rai (200 acres) has to be allocated to education and research as well as other activities to serve 38,000 students and over 7,800 faculty and staff. Since it is virtually impossible to expand the green and water absorption areas, the university has focused strongly on land-use to improve efficiency. One example of such project is the construction of the “Chakraphongse Plaza” (refer with: figure 1), a shaded activities and public common that can also absorb rainwater to replace the aging swimming pool and adjacent greenhouses and nursery across from the Faculty of Engineering.



Figure 1. Physical environment of Chulalongkorn University.

Another aspect of the UI GreenMetric is “energy efficiency”, therefore Chulalongkorn University has stressed its efforts on this important issue campus-wide. One example of the projects is the installation of a university network to control centralized air conditioning to reduce energy demand. Through a computerized system, units can be controlled so they are not all operating simultaneously. This has greatly reduced university energy consumption and, so, expenditure. Also, the university has been renovating buildings on campus to make them more energy efficient. Because of these efforts, in 2010, the Central Library (Mahathirachanusorn Building) (refer with: figure 2a) won the Building Energy Award Thailand: BEAT 2010. Improvement included changing to energy efficient light bulbs and installation of a control system with movement sensors in book stacks to save on energy. While this building and others have had improvements made to their air conditioning and control systems to make them more efficient, landscaping has also been improved around the buildings to reduce heat exchange from the exterior and thus demand on air conditioning. In addition, Chula has introduced renewable energy projects to reduce costs and provide clean energy within the university grounds. One of these is the solar energy project in which solar panels have been installed on the roof of Chamchuri 5 (refer with: figure 2b) to provide power for the building’s systems. Other renewable energy projects include the production of biogas from cafeteria food waste to be used for cooking. There is also a project producing geothermal energy to fuel the air conditioning system of the Ruen Perdraracha (Royal Building).



a) The Central Library



b) Solar Roof at Chamchuri 5 Building

Figure 2. Energy Conservation Project

Also, following the UI GreenMetric criteria, Chulalongkorn University has greatly emphasized “waste management” as a university-wide policy. Every faculty, institute, center, building and department is responsible for trash separation and, therefore, they have marked bins strategically located by their buildings and in public areas. The university also promotes this policy through public relations campaigns to encourage everyone to throw their trash in the correct bin. Once the trash has been collected, it is taken to a central separation and recycling center for a final separation to remove recyclable materials that were originally placed in the incorrect bin. In addition, the university has a special waste management system for toxic chemicals and hazardous materials to ensure the utmost safety of all. Strict procedures must be followed when the toxic chemicals and hazardous waste are stored and then collected from laboratories and departments. A private company has been contracted to dispose of these dangerous materials. The university also collects used batteries and florescent light bulbs for safe disposal to protect the environment and health of Chula students, faculty and staff as well as surrounding communities. Furthermore, the university is cooperating with the Bangkok Metropolitan Administration’s Environmental Department to meet the highest environmental protection standards. When it comes to organic waste management, for example, leaves, this refuse is taken to a processing site to produce mulch, or fertilizer, for the university’s trees and greenery. While providing necessary nutrients, this also helps reduce costs for grounds upkeep. As far as food waste from the university canteens and cafeterias, it is collected and taken to produce biogas, which can then be used to cook food. Currently, the food stalls at three of university’s cafeterias are participating in this project.

Another important aspect of Chulalongkorn University sustainable policy stemming from the UI GreenMetric is “transportation”. The university has implemented policies to limit the number of vehicles that enter and park on campus as well as to provide shuttle transport within the grounds and promote walking and riding bicycles. An important goal of the university’s 100-year plan is to reduce on-campus traffic. To do this, Chula has five parking garages on the fringes of each main campus to serve visitors in addition to students, faculty and staff who travel by private car. While providing added convenience, these reduce traffic on campus and, thus, harmful emissions. To encourage walking and cycling within the university and promote good health and fitness, the university has been constructing covered walkways throughout. Already, phases 1 through 4 have been completed, providing a metal awning on all the major pedestrian walkways to afford shade and protection from the rain. There is also a lighting system for evenings to ensure safety and security. To serve the university community, there is the CU Shuttle Bus service to provide free transport for the CU community and visitors. As it provides free public transport, it has helped to greatly reduce traffic and emissions. On the short on-campus routes, the shuttles are all electric (refer with: figure 3), while hybrid vehicles serve longer routes that include mass transit stations and faculties and departments

located outside the grounds where traffic is often congested. These two types of environment-friendly vehicles also contribute to reducing harmful emissions.



a) Electrical Shuttle Bus



b) Bike Sharing Program

Figure 3. Transportation Projects at Chulalongkorn University

The final aspect of sustainability that Chula have worked very hard for (following UI GreenMetric guideline) is “education” which covers the number of courses, research studies, publications, events, organizations and websites that focus on sustainability. In 2013, Chulalongkorn University offered a total of 596 courses dealing with the environment or sustainability of a total 11,603 courses that were offered. In the same year, there were grants totaling 618,721,730 baht allocated to research on the environment and sustainability. Among the different clusters and research groups, the university has one dedicated solely to energy and climate change.

7. Beyond “Green Policy” and the UI GreenMetric Index

And even though Chulalongkorn University has focused significantly on the 6 categories of the UI GreenMetric Ranking and “Green University” Policy, the university has extended their hard works beyond these set criteria as well, especially into providing a safe & healthy environment and quality life for students, faculty and staff as well as the surrounding community. To achieve this, the university has been conducting inspections and evaluations to develop an effective operation plan that covers laboratory facilities and management to ensure the safety of students, faculty and staff. There is also a project to promote good health and encourage community members to get fit, which should lead to better work performance, as well. Activities include organizing aerobics, yoga and ballroom dancing classes at 6 locations around the university, which have become quite popular. The university now promotes the campaign to walk for fitness “Chula 1 million steps” and a weight reduction

competition to encourage people to work out and lose weight as prevention against illness and disease. Another project promoted by the Office of Environmental and Health Promotion, "Chula Safety Project", encourages food stalls to stop reusing cooking oil or dispose of it with the trash as it can be a dangerous carcinogenic that can cause cancer as well as damage. Therefore, the department has entered an agreement with Bangjak Plc to come and purchase used vegetable oil from Chula to produce beneficial biodiesel fuel.

8. Conclusions

By enthusiastically following its "Green University" policy and the UI GreenMetric Ranking criteria, Chulalongkorn University has not only been proudly getting closer and closer to the goal of becoming a "Sustainable University", but also gaining international recognition as the top ranked Green University in Thailand and the 40th in the world. While the recognition is not our main objective, it does serve to inspire all CU members to continue to work very hard toward these important efforts. More important, though, is the university's commitment to preserve its environment and focus on sustainable development, which bring together the entire CU community (all departments, students, faculty, administrators and staff). CU students, during their studies and upon graduation, will contribute to enhancing the quality of life for the people of Thailand and the world. They will also raise awareness of sustainable development in their families and communities. Chulalongkorn University will not only celebrate the achievements of being a leading Green University but also producing these finest graduates who create changes everywhere there go. As the "Pillar of the Kingdom", Chula will serve as a flagship, an example for sustainable development. "Chamchuri Park" will be where all will look to find the very best environment for study, research and university life.

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SESSION 4:
“Water, Education and Research”



World University Ranking

PROCEEDINGS OF
INTERNATIONAL WORKSHOP
ON UI GREENMETRIC 2016

Fostering Sustainable Culture
in Global Universities

Universitas Indonesia, Depok, Indonesia April 21st 2016
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Developing Conservation in Semarang State University

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Abstract. Semarang State University (UNNES) as a Conservation Campus is determined to perform the Three Duties of University based on the principles of conservation (protecting, preserving and using well) for both natural and cultural resources. It is for achieving Unnes' vision as a university with the knowledge of conservation. The development of conservation is under the implementation of seven pillars of conservation consisting of biodiversity, green building and internal transportation system, waste management, paperless policy, clean energy, ethics, arts and culture, and conservation generation. In order to achieve this vision and to create a conservation society, the members of Unnes family have to implement those principles inside and outside of Unnes. In addition, proper planning and strategy should be done to assuring the success of this program.

Key words: Conservation society, conservation campus

1. Introduction

Environment has become the most crucial issue discussed both regionally and internationally in recent decade. It is normal with the fact that any damage caused by environmental issue will affect the entire world and the human within. Environmental issues included in this case are global warming, climate changes, biodiversity degradation, air and water pollution, flood, landslide, drought, and other kinds of environmental disasters. Unfortunately, human are the one behind all of this harms.

Environmental issues become more complex that it could not be left to be discussed alone. They are related to human's life dimensions. One of which is human environment ethics. The fact that human is lack of ethics toward the environment that can influence the massively and continuously exploitation resulting in environmental damage. Environmental ethics become human guideline in applying the values they understood about their surroundings. That is the reason why environmental ethics become the main factor affecting human's thinking and attitude in treating the environment (Setyowati, et al. 2014).

The low level of people's ethics is directly proportional to the low level of people's concern. Meanwhile, the low level of people's concern will increase the activities that can harm the environment. It can be seen from the total of environmental damages found globally nowadays. According to World Wild Life Fund (WWF) the problems faced in Indonesia related to the environment are deforestation, illegal resources trade, irresponsible marine resources exploitation and pollution (World Wildlife Fund, 2014).

In order to solve these problems, character values concerning attitudes toward the environment should be internalized to the community. This effort can be done through education since these harms are initially started by the advancement of education. Scientific method introduced by the institution of education via research has dominated the nature. Nevertheless, this success has its own drawbacks with the destruction of nature's balance.

As an educational institution, it is obvious for Semarang State University (UNNES) to lend a hand actively in conserving and preserving the environment. Answering this calling, our campus is determined to become a university with the knowledge of conservation and international recognition. Unnes as an institution producing professional educators plays a role of training teacher candidates to be the agent of conservation. It is done through various ways such as reforestation annually done since 2005. Then, as its peak, Unnes decided to become a University of Conservation.

In 2011, according to the decree of Minister of Education Number 8 year 2011 about Semarang State University Statutes, Unnes vision about Conservation becomes more absolute. Since then, Unnes vision is "becoming an international standard conservation university, in health, excellency, and

prosperous in 2020.” Along with this development and the dynamics, Unnes changed its logo in 2015. Unnes vision is: **“Becoming a Conservation University with International Recognition.** UNNES is determined, in the organization, to apply conservation principles (protecting, preserving, and utilizing it well) in natural resources and cultures, which are environmentally friendly in the process of undergoing University’s Three Duties. That is why the management of Conservation Campus has to be planned strategically to achieve the goal of Unnes as well as to become the guideline for:

- 1.1. Planning the implementation of conservation program well and comprehensive.
- 1.2. Each and every department along with academicians are working along with UNNES vision
- 1.3. Planning the steps and priority scales in implementing conservation in UNNES

2. Developing conservation and seven pillars of conservation

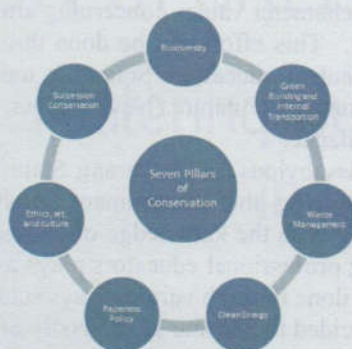
UNNES highly commits their work to conserve and preserve nature. On 12 March 2010, UNNES officially declared its new identity as a conservation university witnessed by the Minister of National Education, Prof. Muhammad Nuh. UNNES was appointed as Conservation University based on the Rector Decree of Semarang State University Number 22 year 2008 in 8 June 2009.

As a Conservation University, UNNES is determined to apply conservation principles (protecting, preserving, and utilizing it well) in natural resources and cultures, which are environmentally friendly in the process of implementing University’s Three Duties.

In 2011, in accordance to the decree of Minister of Education Number 8 year 2011 about Semarang State University Statutes, UNNES vision about conservation becomes more absolute. Since then, Unnes vision is “becoming an international standard conservation university, in health, excellency, and prosperous in 2020.” Along with this development and the dynamics, Unnes changed its logo in 2015. Unnes’ vision is: **“Becoming a Conservation University with International Recognition.”** It urged the formation of Conservation Development Committee in order to systematically achieve those visions. Then, Conservation Team was changed into Conservation Development Committee in 2011 according to Rector’s Letter of Assignment Number 924/H37/TU/2011.

The administration of Conservation University is done based on Rector decree Number 27 year 2012 about Administration of Conservation-based Campus. On article 2, it was mentioned that the administration supports the act of preserving, protecting and well use of biodiversity through continuous development with the concept of conservation. It will be done together by all members of UNNES. Suyitno et al. (2015) stated that Conservation is the efforts to protect and preserve cultural values and human’s attitude when interacting with both physical and non-physical environment.

The development of Conservation in UNNES is done in 7 management activities which are call 7 pillars of conservation consist of: Biodiversity, Green Building and Internal Transportation System, Waste Management, Paperless Policy, Clean Energy, Ethics, arts and culture, Conservation Generation. Every member of UNNES has the responsibility to keep the activities alive. Working units in UNNES have to implement those pillars in their programs. The seven pillars are completing, uniting and supporting one another as you can see on picture 1.



Picture 1. Seven Conservation Pillars

Biodiversity pillar aims to protect, preserve, well use and develop the biodiversity, flora and fauna in UNNES wisely and steadily. This pillar has some activities, such as: seedling, planting, growing plants, monitoring biodiversity on campus to keep the ecosystem. This pillar includes physical activities that aim to develop some characters, for example: caring for flora and fauna, planting, using the biodiversity wisely.

The second pillar, green building and internal transportation system aims to develop and to manage the buildings and its surroundings to support the idea of conservation. It is also to create a transportation system which is effective, efficient and environmentally friendly. The attitudes from this pillar are: smart in using the energy, smart in using water, smart in using building materials, and smart in choosing vehicles for transportation.

The next pillar is related to waste management. It means decreasing, managing, monitoring the waste process in order to improve UNNES becoming a clean healthy place. The attitudes in this pillar are: living healthy and clean, taking advantages of recycling, and throwing rubbish in its proper place. Paperless policy has a goal to apply the management and administration based on conservation. It is done through: system optimization by using information technology, papers use efficiency, papers recycling, and the utilization of environmentally friendly papers. The target attitudes within this pillar are: doing things paperless and taking more advantage on technology. The next pillar is clean energy pillar. It aims to save the energy via a series of activities in utilizing the energy wisely, and to discover new environmentally friendly energy source.

The sixth pillar is ethics, arts, and culture. Its goals are to protect, preserve and promote local heritage to strengthen our identity. It can be done by practicing, documenting, education, publishing, and promoting its parts so it can create the behavior of loving cultures and local wisdom. The last pillar is creating a generation of conservation so the values can be inherited. The efforts in this pillar are socializing the values to the community as well as giving training and education about the importance of education. That way people will know how to live and work based on the values of conservation.

The result of those pillars can be seen from some innovation from UNNES, such as: Seed Conservatory, Compost House, Butterflies Conservatory, Education Park, Rain Harvesting Model, Solar Power Electricity Model, Waste Water Treatment Model, Infiltration Wells and Bio Pori, Culture Village, Biogas Reactor, Artificial Lake, and Policy Documents (Conservation Master Plan, Conservation Management Rules, and SOP). Facilities and infrastructures needed are elaborated in the following table (attached).

Starting in 2016, aside from those pillars some other values are developed to make the academicians better with the knowledge of conservation. There are 8 values as follows:

- 2.1. **Inspirational.** It means having the idea or thinking to do something, doing whatever coming in one's brain in any condition.
- 2.2. **Humanistic.** It is respecting others, wishing and struggling to create a better humanistic community.
- 2.3. **Caring.** It means being aware and care. Environmental can be shown by trying to stop destroying the surroundings and trying to fix the problems happened. Social care means giving helps for others.
- 2.4. **Innovative.** It refers to the way of thinking which is productive and imaginative in order to create something new.
- 2.5. **Sportive.** It is about being noble and honest. It means being fair to the competitor, accepting loses or other group's strength and ability.
- 2.6. **Creative.** It is about the ability to smartly solve a problem and to create a new way in doing things.
- 2.7. **Honesty.** It is when one is trying to think, talk and act without deceiving others, becoming someone who can be trusted.
- 2.8. **Justice.** Justice is about being fair and not biased.

3. Unnes Conservation Achievements

The achievements of UNNES in conservation have proven the power of UNNES vision which is internalized in the activities. In 2013, a series of activities were undergone to keep Unnes' vision as a

Conservation University strong. One innovation that has been invented in early 2013 is "No Vehicles in Campus". This policy is applied in the office hour and it has proven that it can increase the quality of air on campus. Empirical study on noise pollution, carbon monoxide (CO), sulfur dioxide (SO₂), nitrogen dioxide (NO₂), oxidants (O₃), lead (Pb), hydrogen sulfide (H₂S), and Ammonia on campus have shown a satisfying result. All of them are found less in the air.

Along 2013 also, a number of plantations have been done. Some of which were mahogany (300), guava (125), soursop (60), saga tree (90), screw pine (18), mango (48), citrus limetta (11), rain tree (20), longan (50), Indian-almond (20), avocado (50), yellow frangipani (25), Japanese frangipani (7), lemon grass (20), red ginger (40), chilies (250). In addition, some organic vegetables are produced such as: eggplants, chili peppers, red spinach, Chinese cabbage and water spinach. This planation was done by the students with *Siomon* (<http://siomon.unnes.ac.id>) as the monitoring system.

Related to waste management, some efforts have been done to actualize the idea of zero waste campus. These efforts include composting and researching on rubbish. In the study, it is found that UNNES produces 111 m³ trashes weekly which include organic, papers, plastics, and food waste. Thus, waste management training is established to decrease the number of unused waste. In 2013, training on waste management for both organic and inorganic was held for cleaning service in every units. In addition, composting training is also given to the students through a subject called environmental study/ conversation study.

Paperless policy produces some activities such as (1) the development of Green School Award; (2) the development of plantation information system; (3) the development of Green Unit Award; (4) *Siomon*. Not only that, UNNES also utilizes information technology for this policy. Up to now, UNNES has more than 120 systems and application supporting this program. It, then, places UNNES number 16 of Webometric rank in Indonesia.

Regeneration comes as a strategic role for the enhancement of conservation. In 2012, Unnes implemented Competence and Conservation based Curriculum and in 2015 it implements KKNi and Conservation Curriculum. All students have to take 2 credits for Environmental Study/ Study of Conservation. Conservation is also introduced to new students on their first day of orientation. It is also applied for new teachers and office workers. Mentoring and training are also given to Student Functionaries Committee (Lembaga Kemahasiswaan), Students Circles (Unit Kegiatan Mahasiswa), and environmental working group. Researches and community services which are related to conservation get the priority to be funded by DIPA Unnes.

To increase human resources, some activities like seminar, workshops and FGD about conservation are continually held. Some training that have been done are AMDAL Basic Training, Workshop on Seedling Media, TOT on Garden Guide, Training on Composting, Training on how to save energy, FGD on rain harvesting and waste management, etc.

The training of conservation successor has been done since 2013. The participants are students from Students Functionaries Committee and Students' Circles in both Faculty and University level. This training is a collaboration work between Unnes and Natural Resources Conservation Association (BKSD). Those who pass this training are given certificates and member card of National Conservation Agent. Monitoring and Training is done continuously and the members are to participate in various conservational activities (replantation etc.)

Wider communities are also being introduced to conservation in many ways. The first way is publication. The publication of Indonesian Journal of Conservation and essays compilation *Pelangi Konservasi* are some of the examples. The other way is publication via Unnes homepage <http://konservasi.unnes.ac.id> and bulletin. The last one is through direct socialization with the neighborhood in *Pasar Krempyeng* (local market near campus) in the form of sports, arts, trade (in order to help the economy of people around).

Unnes also gives appreciation toward school's principal who concerns with the nature in the program of Green School Award. This award was given to junior high school and senior high school in Central Java. It has been held for four years, from 2011-2014. In 2015 and 2016 this program is expanding covering Yogyakarta also. The mechanism for this program starts with online application. Ten nominees are chosen after that and are visited before the winner is decided.

The growth of Unnes as Conservation University has given Unnes the honor to get many positive feedbacks. Unnes was successfully ranked 48th in the world as green campus according to UI

Greenmetric in 2013. In national level UI got 4th. In 2012, Unnes was only ranked 82nd in world and 5th nationally. These achievements have urged Unnes to work more for conservation. In 2014, Unnes was ranked 73rd in the same award but this time more Universities took parts. It once again becomes Unnes motivation to prove the world that it can be better at conservation.

Unnes appreciates the figures who lend a hand to the success of conservation program. In 2015, those figures were given award. They were Zulkifli Hasan (The (Enviromental Conservation), Agus Hermanto (Conserving Values – Community Empowerment), Ganjar Pranowo (Culture Conservation: *Rembug*), Ki Dalang Manteb Sudarsono (Conserving Traditional Heritage). In 2016, Unnes gave the honour to Mr. Susilo Bambang Yudhoyono (The 6th President of Indonesia), for his contribution in conserving national value, Mr. Mohamad Nasir (Minister of Research, Technology and Higher Education of the Republic of Indonesia), Mr. Muhamad Nuh (the Former Minister of Education), Mrs. Riri Fitri Sari (the Founder of Greenmetric UI), and Mrs. Rita Subowo.

4. Conclusion

The development of conservation in order to achieve UNNES vision as well as to form Conservation Society should be continued and developed systematically and progressively. Conservation Society is a society built by the concept of conservation that can work together with the environment according to the ethics, rules and norms of the nature.

Conservation program has to be designed for a short term, mid-term and long term. It needs the support from all of the stakeholders and the coordination between committees and unit of works. Assessing the success of this program can be done through monitoring and evaluation regularly, systematically and continuously. In addition, more values, norms, and ethics should be discovered to create unique formulas for UNNES identity.

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Table 2. Analysis of The Facilities and Infrastructures in Conservation

No	Scope	Facilities Owned	Facilities Needed
1	Biodiversity Management	1. Scientific Garden 2. Orchid house 3. Butterflies Conservatory 4. Seedling Garden 5. Medicinal Plant garden 6. Well 7. Rain harvesting 8. Outbond area	1. Water instalation 2. Warehouse 3. Gazebou 4. Organic green house 5. Organic house 6. Composting house 7. Toilet in KWP 8. Fences and gate 9. Plants' labeling 10. "Kehati" board

No	Scope	Facilities Owned	Facilities Needed
			11. Rare plants garden (for guests)
			12. Rare plants garden (for professor)
2	Internal Transportation Management	1. Campus main road 2. Pedestrian 3. Shelter 4. Parking area 5. Signs 6. Bus 7. Bicycles 8. Gazebo	1. Electricity vehicles 2. Additional bus 3. Additional bicycles 4. Electronic parking 5. Green corridor 6. Additional of signs 7. Shelter fixing and adding 8. Optimalization of parking area
3	Energy Management	1. Solar Power System 2. Biogas 3. Biosolar	1. Solar Power Roof Building 2. Development of Solar Power 3. Automatic lamps 4. Building Metering 5. Additional biogas 6. Development of biosolar 7. Underground Electric Network 8. Lightning Rod
4	Green Building Management	1. Campus Buildings 2. Green Open Areas	1. Conservation House 2. Additional Natural Facilities 3. Additional lighting 4. Additional building safety tools 5. Hydran and fire protection installation 6. Naming streets and buildings
5	Water and Waste Administration	1. Composting House 2. Water treatment MUA 3. Drainage Network 4. Infiltration wells 5. Biopori 6. Artificial Lake 7. Dam 8. Rain harvesting	1. Ready to drink water 2. Additional of composting house 3. Additional water treatment 4. Additional of infiltration well , biopori and rain harvesting 5. Fixing drainage
6	Cultural Heritage Conservation	1. Theater 2. Musical and art instruments 3. Art Studio 4. Studio 5. Art properties	1. Cultural Village

UI GreenMetric sustainability indicators in the University of Castilla-La Mancha (Spain)

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Abstract

A presentation of the University of Castilla-La Mancha (UCLM) to UI GreenMetric is developed with relation to the following aspects: 1) geographical location of the UCLM campuses and main socioeconomic features of the Autonomous Community of Castilla-La Mancha; 2) academic organization of the UCLM (students, personnel, academic offer, research bodies and governance); 3) position of the UCLM in national and international university rankings; 4) objectives and actions carried out under the recently developed UCLM project of the Campus of International Excellence *Science and Technology on Energy and Environment* (CYTEMA); 5) achievements and pending tasks for future development with respect to UI GreenMetric criteria on setting and infrastructures, energy, waste, water and transportation, with a particular focus on 6) education and research, the subject in which the UCLM obtained a remarkable rating in the last edition of GreenMetric.

Integrated Water Treatment with Landscape Architecture and Ecological Education in NPUST: A Status Report

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Abstract. The National Pingtung University of Science and Technology (NPUST) has been engaging in wastewater treatment for more than 25 years. Not only so, rainwater treatment has also been emphasized for more than ten years. This paper aims to present a brief status report regarding the effort NPUST has invested in integrating wastewater management with university landscape design and ecological education.

Keywords: wastewater, wetland, rainwater, domestic, animal.

3. Introduction

Because of the increasing global population, the future world may inevitably experience greater fresh water scarcity. This implies that water treatment and recycling methods are the only alternatives to reduce our future dependence on fresh water. Therefore, there is a great contemporary need for the development of suitable, inexpensive and rapid wastewater treatment techniques. Of these techniques, constructed wetlands are among the recently proven efficient technologies for wastewater treatment. They are reliant on the actions of bacteria to remove contaminants from wastewater. Through a combination of physical, chemical and biological processes, they have been used to treat wastewater ranging from domestic to industrial and from urban to agricultural. Compared to conventional treatment systems, they are comparatively low cost in terms of installation, operation, and maintenance. In the last two decades, these advantages have earned them greater popularity for they have a strong potential for application in developing countries, particularly by small rural communities. Unfortunately, these systems have not been widely used due to the lack of awareness and local expertise [1].

Existent wastewater treatment involves a variety of different processes, such as photolysis, hydrolysis, biodegradation, volatilization, sorption, and simple dilution, to decrease the concentration of contaminants detected in the water. Among various systems, the biologically based wastewater treatment system is considered more sustainable and more cost-effective in comparison to conventional ones. It has been recently reported that not only can this system effectively remove emerging organic contaminants (EOCs) [2, 3], but also provide ecologically rich effluents [4]. EOCs are unregulated contaminants derived from domestic, trade, and industrial sources, including pharmaceutical and personal care products, veterinary products, some pesticides, and industrial compounds among other that are thought to have long-term adverse effects on human health and ecosystems.

Since 2004, several projects have been carried out to examine the feasibility of implementing low-cost wastewater treatment technology in Tunisia. In the beginning, a pilot-scale constructed wetland was designed to enhance the living sanitation conditions for several dwellings in the rural areas in northeastern Tunisia [5]. A few years later, similar projects were extended to serve a rural settlement of 50 houses with roughly 350 inhabitants [6] and in a primary school [7], both in 'Chorfech 24', Tunisia.

The purpose of this paper is to present a brief status report of the water management approaches in the National Pingtung University of Science and Technology (NPUST) and how the management has been successfully integrated with the university landscape design and ecological education. The design and implementation of NPUST wastewater management plants have focused on solving the problems of the uncontrolled wastewater discharged into drainage without treatment, and to demonstrate a practical sustainable water management solution to be recommended for application in other areas within Taiwan.

4. Categories and Approaches

The solution implemented in NPUST presents a practical approach for on-campus rainwater and wastewater management. Not only does NPUST put the water management into actual action, but also combine its water management with landscape architectural design. As an educational institution, NPUST also makes full use of these facilities to fulfill its social responsibility by provoking public awareness in ecological and environmental issues and demonstrating ways to promote sustainable habitat. The scopes of the programs include:

- implementation of water-saving devices,
- collection and reuse of rainwater in new buildings,
- treatment and reuse of on-campus wastewater,
- establishment of on-campus ecological parks and gardens, and
- promotion of public awareness on sustainability.

4.1. Rainwater

NPUST is located at southern Taiwan whose tropical monsoon climate is by warm winters and hot and wet summers with typhoons and thunderstorms. Since the average annual rainfall in this area is greater than 2,500 mm, collecting rainwater for reuse has been a compulsory requirement for all new NPUST buildings built since 2003.

Fig. 1 illustrates the two schemes employed for rainwater treatment. For new buildings without apparent vegetation, rainwater is collected on the roof, then drained and stored in underground storage tanks. Pumping devices are utilized to supply flushing water into the toilets. At the very same time, clean tap water is supplied to the restroom for washing. When rainwater is not enough, tap water is regulated to fill the storage tanks to ensure a stable supply of water for toilet flushing.

Another example for rainwater collection and reuse is demonstrated by the CEPSSH Demo House whose roof and partial walls are covered with vegetation. On rainy days, the vegetated roof and walls serve as filters when rainwater runs through them. As depicted in Fig. 1(b), the rainwater is then collected in a rainwater storage tank. On sunny days, rainwater is pumped to watering devices to keep the vegetation moist. If the rainwater storage tank is literally empty, tap water is supplied for watering.

4.2. On-Campus Wastewater

NPUST produces both domestic and agricultural wastewaters. Once a while, the scheduled disposal of water from the on-campus swimming pools also contributes a large amount of wastewater. Considering its biological and chemical contents, the wastewater is treated distinctly at different plants. The wastewater, depending on where the wastewater originates, can be categorized as:

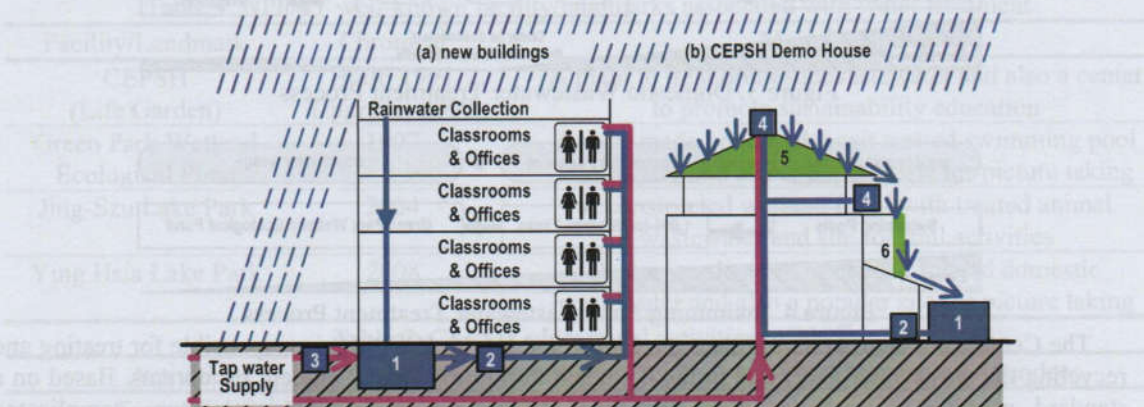


Figure 1. Rainwater Treatment Process: (1) rainwater storage tank; (2) pump; (3) regulator; (4) watering device; (5) vegetated roof; and (6) vegetated wall.

- Agricultural wastewater: poultry manure, swine manure, dairy manure, wash water, feedlot runoff, and fish pond water;
- Domestic wastewater: all sorts of sewage excluding the black water from toilets; and
- Swimming pool wastewater: water filled in the swimming pools.

The Departments of Animal Science and Aquaculture are two of the NPUST departments that mainly contribute to the generation of animal wastewater. A drainage system was connected to these departments allowing their animal wastewater to run downhill. In general, the animal waste from the livestock farms is separated through a mechanic solid-liquid separator. The solid waste is sent for composting to become good organic fertilizers for soil improvements. The liquid waste goes through anaerobic and aerobic processes to get rid of undesirable pollutants. After treatment, the liquid waste is used to watering the pasture that supplies important feed ingredients, i.e., Napier grass (*Pennisetum purpureum*) and Pangola grass (*Digitaria eriantha*), for the cattle in the Department of Animal Science. The overflow water from aquaculture pond, Department of Aquaculture is channeled to the wetland at NPUST backyard. At the nearby lowland, there constructed three man-made ponds, i.e., the purifying pond, the middle pond, and the lower pond. Except enriching the ecological environment for living organisms, these ponds are beneficial in terms of supporting underground water system and adjusting micro-climate. As a matter of fact, these ponds contribute to a constructed wetland system that is capable of reducing nutrient, biological oxygen demand (BOD), and suspended solid loads. Here, these contaminants are biologically transformed or inactivated.

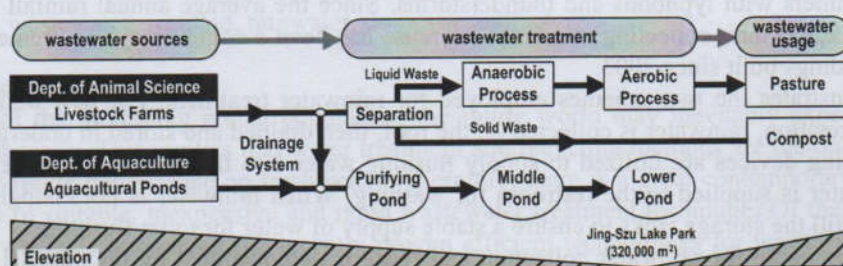


Figure 2. Agricultural Wastewater Treatment Process

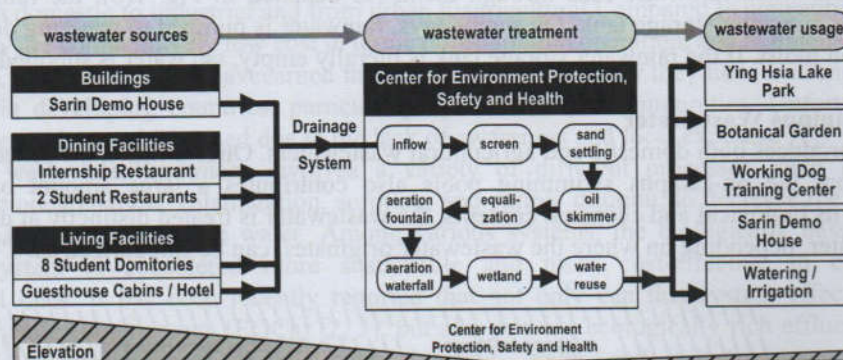


Figure 3. Domestic Wastewater Treatment Process

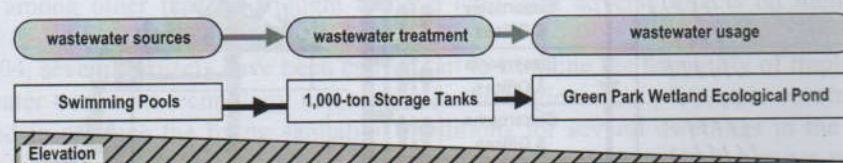


Figure 4. Swimming Pool Wastewater Treatment Process

The Center for Environment Protection, Safety and Health (CEPSH) is responsible for treating and recycling the wastewater generated in the 8 student dormitories and 2 student restaurants. Based on a standard wastewater treatment plant that used to require more electricity, more complicated maintenance, and more intensive labor force, it was carefully designed by a group of NPUST faculty members and staffs in 2008 for upgrade and eventually transformed into the Life Garden in its present form. This plant has an average daily capacity of 800 m³. The treatment process mainly depends on plants and bacteria to remove the contaminants in the water, leaving almost no sludge.

Before entering CEP SH, domestic wastewater leaves each building and flows to the center through an underground drainage system. In the center, unfavorable trash is first removed from the stream through screen filtration. Then, the sand in the wastewater is allowed to settle in a relatively still pond. Because the wastewater comes from dining and living facilities, the sand content in the wastewater is really low. After that, the oil content of the wastewater is segregated through an oil skimmer. These three facilities are grouped and named the decontamination equipment. Later, the wastewater is allowed to settle in an equalization basin where the pH level of the wastewater is regulated. Being chemically stable enough, the wastewater then enters an aeration process through which air is added into the wastewater to allow aerobic bio-degradation of the pollutant components. The center extended the concept of an oxidation ditch to transform into an aeration fountain and two aeration waterfalls. Two horizontal subsurface flow constructed wetlands then await the oxygen-rich wastewater. Various aquatic plants are introduced in this stage aiming to remove heavy metallic substances, inorganic compounds, and EOCs from the wastewater. Among the plants, *Irises* are planted in the first deeper constructed wetland. In the second swallow wetland, about 24 types of aquatic plants, including *Lobelia chinensis*, *Marsilea crenata*, and *Bacopa carolineana Robinson*, are displayed to the general public. The roots of the plants further help filtering the mud in the water. Finally, the completely treated wastewater is collected in an effluent basin ready to be reused for flushing water in the Sarin Demo House and filling Yin Hsia Lake as well as watering nearby plants, especially in the Botanical Garden.

4.3. Swimming Pool Wastewater

There are two internationally standardized swimming pools in NPUST with a capacity of about 1,700 m³ each. Whenever the swimming pool water is discharged, the wastewater is stored in a tank system with a 1,000 tons storage capacity. As swimming wastewater enters the storage system, the wastewater is allowed to flow out of the system at the same time. The storage only acts as a reservoir to supply to the Green Park Wetland Ecological Pond when its water level is low. As a matter of fact, the chlorine content in the water is not treated in the storage system. Instead, it is allowed to vaporize as the water flows around in the ecological pond.

5. Landscape Architecture

Because of the presence of the wastewater treatment plants, NPUST has combined these plants with the overall identity of the university. In fact, the university is regarded the *National Park University*, that is extremely well known in Taiwan for its greenness. For this reason, many measures have been carried

Table 1. NPUST well-known facility/landmarks associated with water treatment

Facility/Landmark	Chronical	Main Objective
CEPSH (Life Garden)	Built: 1991 Upgrade: 2008	A plant to treat domestic wastewater and also a center to promote sustainability education
Green Park Wetland Ecological Pond	1997	A man-made pond to deposit treated swimming pool wastewater and also a popular site for picture taking
Jing-Szu Lake Park	2004	A constructed wetland filled with treated animal wastewater and site for trail activities
Ying Hsia Lake Park	2008	A man-made pond to deposit treated domestic wastewater and also a popular site for picture taking

Table 2. CEP SH educational activities in 2015

Activities	Number	Total Number of Attendees
Tours/Visits	53	1,538
Workshops/Seminars	21	990

out in the university to integrate science and technology with natural landscape design that deals with ecological and environmental protection and awareness. Table 1 summarizes some information about the well-known on-campus facilities and landmarks that are related to various water treatments.

6. Education

Through CEP SH, NPUST organizes activities to educate both NPUST students and the public communities how natural environments function, and particularly, how human beings can manage behavior and ecosystems to attain sustainable mankind. This helps us transitioning to a society that is knowledgeable of the environment and its associated problems, aware of the solutions to these problems, and motivated enough to solve them. It is no doubt a complicated field integrating multiple disciplines ranging from science to engineering and management to humanity. Only through simple yet interesting activities, as listed in Table 2, can CEP SH help inject momentum into the public awareness on ecological, environmental, and social sustainability.

7. Concluding Remarks

Opportunities to expand these plants continue as the scale of research capacity is expanding rapidly. The university immediate projects include an extension in capacity of the on-campus guesthouse hotel for internship, the establishments of a multifunctional livestock production field plant for technology practice, a test center for animal adjuvant pilot production, and an aquatic fish farm, as well as fully operational GMP food production line facilities. Evaluation must continue to improve current wastewater management and develop early warning methods for any adverse impacts on current university recycling plant and constructed wetlands.

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Water and Wastewater Management on Jordan University of Science and Technology Campus

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Abstract. JUST is one of the most advanced and professionally oriented universities in the region. The campus of Jordan University of Science and Technology is located at the northern part of Jordan, 80 km north of the capital city Amman, near Irbid city, the 2nd largest city in Jordan with about 500 thousands population. JUST enjoys a spacious, friendly and modern campus that spread over 1100 ha area, the largest in Jordan and probably the largest in the region with a boundary of 7 by 1.5 km. The campus buildings and life spread in an area of 200 ha and the rest are agricultural fields, experimental stations and scientific facilities. The total university community including students, faculty members, administrative staff and hospital employees is about 30000, which necessitate careful energy and water management within the campus. The annual average total water consumption is estimated at about 4500 m³/day and reached 5500 m³/day in the summer months from June to September; about 1500 m³ for drinking and domestic uses and the rest 3000 m³ goes for irrigation. The irrigation water is coming from two sources; 2000 m³/day is treated wastewater and 1000 m³/day is groundwater that irrigates about 510 ha of the campus land. There are about 47000 fruit trees planted at the campus with average annual return of about 400000 USD. The water supply for domestic use rely on three groundwater wells that are located inside or nearby the university campus with average daily rate of 2500 m³/day. The groundwater quality conforms to Jordanian drinking water standards and it is disinfected only by chlorination.

Keywords: Water harvesting, Wastewater, Reuse, Irrigation

1. Introduction

Jordan continuous efforts towards achieving distinction in education resulted in widespread of public and private universities in the country. Currently there are 10 public or state universities and 20 private universities educating about 350 thousands students. Public universities are characterized by large campus areas, since land is allocated by the government with small compensation for land owners, that results in large water and energy cost for the university. Therefore, public universities are taken as serious measures to better manage energy and water and to reduce water consumption.

Jordan University of science and technology has a large campus of about 1200 ha of which about 150 ha were allocated for industrial zone and experimental nuclear reactor. It is located at the northern part of Jordan where the average annual rainfall is about 210 mm and average temperature ranging from 10 in winter season to 30 in summer months [1]. Arable land is estimated at 600 ha but only 500 ha are cultivated mainly due to limited water resources. The campus total population is about 30000 including 23000 students. Large campus area and high population consume large amount of water that required careful management strategy. The objective of this paper is to analyze water management strategy adopted by JUST to secure sufficient water supply and meet water demand.

2. Water supply

Jordan University of Science and Technology has taken serious steps to secure sufficient water for domestic and agricultural demands. Domestic Water supply for the University is secured from three groundwater wells [2]. One well is located inside the campus with an average capacity of 70 m³/day. Due to increased salinity of the well it has been used for crop irrigation. The other two wells are located near the campus with total capacity of 1550 m³/day from which 240 m³/day is also used for

irrigation and the rest 1350 m³/day is used entirely for supplying water to the university buildings for domestic uses. With the total university community of 15000 individual (since only 50% of students came to class on alternating days), the estimated water consumption is equal to 90 L/capita. day; This amount is similar to the average national water consumption estimated at 90 L/capita/day which reflects the university high attention to its students and faculty members.

The university has taken innovative solutions to secure water for crop irrigation. The large cultivated area on the campus, estimated at 500 ha, requires a large amount of water to sustain green areas and orchard fields. Therefore the University secures irrigation water from groundwater, wastewater reuse and flood water harvesting.

A concrete-lined flood water harvesting pond has been constructed inside the campus with a storage volume of 140 thousand cubic meter [3]. The pond has become a favorite source for university community on break times and at the weekends and well known as the Duck pond. The watershed area of the pond is about 70 km². A drop inlet spillway has been constructed to discharge water when water depth reached certain level to prevent flooding of the university area. Despite that the level of the spillway is 80 cm below road level, the inflow discharge has exceeded the spillway capacity in two occasions and university flooding occurs. Some studies estimated that the inflow discharge must have been greater than 35 m³/s to exceed the spillway discharge capacity with water depth of 80 cm above the crest of the spillway. For that reason, in 2004, the university has constructed an earth dam 1 km above the stream of the pond to regulate water discharge to the pond and also for sedimentation. Since then flooding has not occurred and the pond was kept at its full capacity during most of the year.

The ponds are not only used for flood water storage but also to store treated wastewater. A wastewater treatment plant has been constructed during the university establishment in 1986. The treatment plant is operated with rotating biological reactors followed by aerated tank, sedimentation tank and chlorination tank. Wastewater from campus drains, toilets and showers is treated on site at a plant designed to manage up to 2,500 cubic meters of effluent per day. Reclaimed water, currently estimated at 1000 m³/day is then stored in the water harvesting pond. Water from the pond serves as a primary irrigation reserve for campus landscaping and agricultural fields. Providing a leafy campus canopy in a region where summer temperatures may reach 40 degrees is one tangible and very visible benefit of flood water combined with wastewater storage.

Due to the large water demands for irrigation, JUST has signed an agreement with the Ministry of Water and Irrigation to import treated wastewater from a nearby wastewater treatment plant, called Wadi Hassan. Treated wastewater is transported through a 4 km pressurized pipe line at a rate of 1400 m³/day and stored in the pond to be used for irrigation. The quality of the mixed water in the pond meets the Jordanian standards for irrigation water quality.

3. Agricultural Water demands

The average total amount of irrigation demand at the campus of JUST is estimated to be 2800 m³/day. About 90% is coming from treated wastewater and only 10% is groundwater and flood water. Irrigation demand increases in the summer months from May to October by 30% and decreases during winter from December to April by 50%. This amount of water is barely sufficient to keep a leafy and green campus at this dry land.

However, careful water management aiming at increasing water supply and reducing water demand makes this possible (Figure 1). The arable land at the campus is about 600 ha of which 510 is cultivated. Orchard fields cover 280 ha, mostly olive trees, 230 ha, followed by pistachio and Jojoba. The types of the trees were carefully selected because they are one of the most tolerant to water scarcity. Cash crops including alfalfa, barley covers 60 ha, green areas and gardens cover 55 ha and wind break trees area circulating the campus boundary covers more than 55 ha. These large numbers of trees, crops and fallow land make the campus flourish with natural habitats and nesting wild birds.

The whole area of cultivated land is irrigated with a modern net of drip system that not only saves water but also increases the production and minimizes the contact with reused wastewater. A quick calculation on the average daily depth of irrigated water across the university is equal to 1 mm/day. This is quite an achieving goal in a climate where potential evapotranspiration can reach up to 8 mm/day.

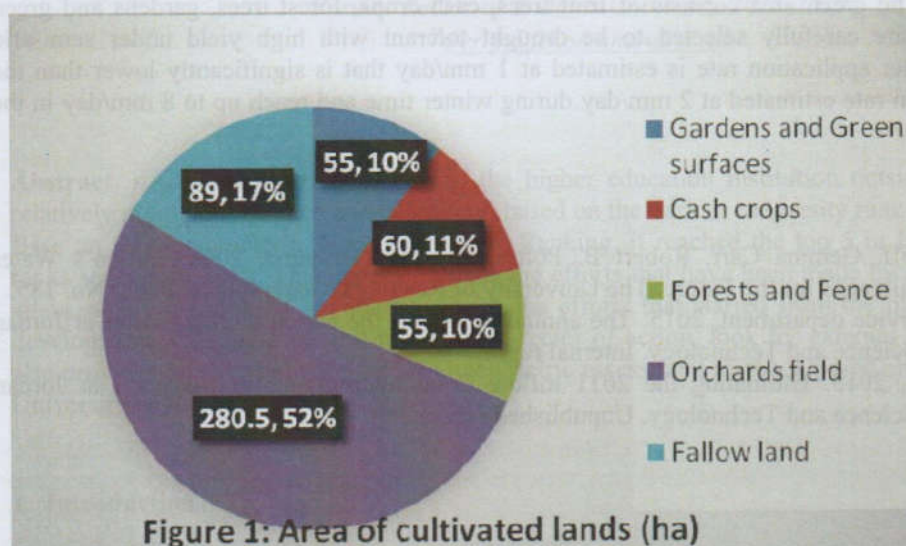


Figure 1: Area of cultivated lands (ha)

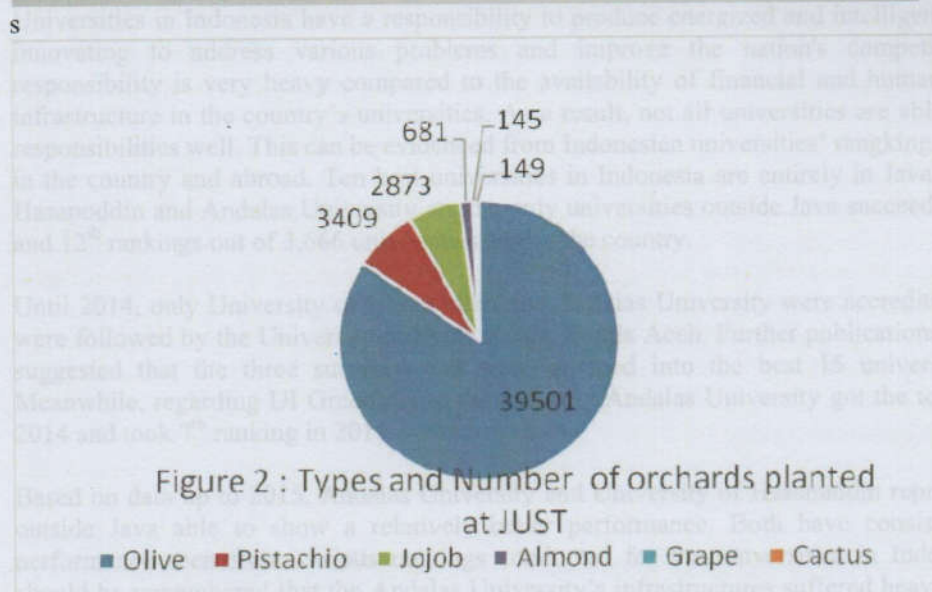


Figure 2 : Types and Number of orchards planted at JUST

4. Crop production

The number and types of orchard trees are shown in Figure 2. There are about 47000 fruit trees planted on JUST campus, 40000 of them are olive trees. Olive trees are planted in this semi-arid land due to their drought tolerance and high value fruit. The Jordanians consume a large amount of table olive oil and olive pickles. The second largest number of fruit is Pistachio, 3400, followed by jojoba,

2800 trees. The total amount of annual return for fruit and crop production at the campus is estimated at 300000 JD (415000 USD)

5. Conclusion

The campus of Jordan University of Science and Technology is a truly green campus covered by 600 ha of green area. The green area consists of fruit trees, cash crops, forest trees, gardens and green areas. Crop types are carefully selected to be drought tolerant with high yield under semi-arid conditions. The water application rate is estimated at 1 mm/day that is significantly lower than the potential evaporation rate estimated at 2 mm/day during winter time and reach up to 8 mm/day in the summer months.

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The ponds are not landscaped for aesthetic purposes. A wastewater treatment plant has been constructed during the university establishment in 1986. The treatment plant is operated with rotating biological reactors followed by aerated tank, sedimentation tank and chlorination tank. Wastewater from campus drains, toilets and showers is treated on site at a plant designed to manage up to 2,500 cubic meters of effluent per day. Reclaimed water, currently estimated at 1060 m³/day is then stored in the water harvesting pond. Water from the pond serves as a primary irrigation reserve for campus landscaping and agricultural fields. Providing a leafy campus canopy in a region where summer temperatures may reach 49 °C is a desirable and very visible benefit of flood water combined with wastewater storage.

Due to the large water demands for irrigation, an agreement with the Ministry of Water and Irrigation to import treated wastewater from the wastewater treatment plant, called Wadi Haseem, treated wastewater is transported through a pressurized pipe line at a rate of 1400 m³/day and stored in the pond for use as a reserve for irrigation. The pond is used to store the water until it is treated to the standards for irrigation.

Figure 3: Types and number of orchards planted



The average total amount of water used for irrigation is 1000 m³/day. About 90% is coming from treated wastewater and only 10% is groundwater and flood water. Irrigation demand increases in the summer months from May to October by 30% and decreases during winter from December to April by 50%. This amount of water is barely sufficient to keep a leafy and green campus at this dry land.

4. Crop production

However, careful water management aiming at increasing water supply and reducing water demand was implemented. The campus is divided into several zones for irrigation. The zones are divided into two main groups: the first group is for the fruit trees and the second group is for the cash crops. The fruit trees are irrigated by a drip system and the cash crops are irrigated by a furrow system. The furrow system is a traditional method of irrigation where the water is applied to the soil in long, narrow channels. The drip system is a modern method of irrigation where the water is applied directly to the roots of the plants. The furrow system is used for the cash crops and the drip system is used for the fruit trees. The furrow system is used for the cash crops because it is a simple and easy method of irrigation. The drip system is used for the fruit trees because it is a more efficient method of irrigation. The furrow system is used for the cash crops because it is a more traditional method of irrigation. The drip system is used for the fruit trees because it is a more modern method of irrigation.

Sustainable Initiatives to Improve Higher Education Performance

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Abstract. Andalas University is one of the higher education institution outside Java that shows a relatively good performance and consistent, based on the various university rankings held in Indonesia. Base on UI Greenmetric World University Ranking, it reached the top 5 in Indonesia in 2014 and ranks seventh in 2015. This paper describes the efforts that have been made by Andalas University to attain such a position. It is concerned with the efforts that started from the planning of sustainable development, creating a control mechanism, rector of action, look for external sources of funding. It also provides input to enhance the UI GreenMetric assessment methods based on the experience of the University of Andalas

1. Introduction

Universities in Indonesia have a responsibility to produce energized and intelligent people capable of innovating to address various problems and improve the nation's competitiveness. Yet this responsibility is very heavy compared to the availability of financial and human resources as well infrastructure in the country's universities. As a result, not all universities are able to carry out these responsibilities well. This can be evidenced from Indonesian universities' ranking held by institutions in the country and abroad. Ten best universities in Indonesia are entirely in Java. The University of Hasanuddin and Andalas University are the only universities outside Java succeeding in reaching 11th and 12th rankings out of 3,666 universities across the country.

Until 2014, only University of Hasanuddin and Andalas University were accredited A. In 2015, they were followed by the University of Syiah Kuala, Banda Aceh. Further publications indexed in Scopus suggested that the three survived and were grouped into the best 15 universities in Indonesia. Meanwhile, regarding UI GreenMetric rating, only Andalas University got the top 5 in Indonesia in 2014 and took 7th ranking in 2015.

Based on data up to 2015, Andalas University and University of Hasanuddin represented universities outside Java able to show a relatively better performance. Both have consistently shown good performance seen from various rankings conducted for the universities in Indonesia. However, it should be remembered that the Andalas University's infrastructures suffered heavy damage due to an earthquake that shook Padang to 7.9 on the richter scale on September 30, 2009. Therefore, it was a very tough job to say that Andalas University struggled harder than University of Hasanuddin to reach present performance.

This article examines and share Andalas University's efforts to improve its academic and non-academic achievements leading eventually into a relatively good position in UI GreenMetric ranking and any other ratings. It focuses on some of important aspects that affect the progress of Andalas University during 2011-2015 and provides necessary inputs into better the rating method of UI GreenMetric. It is likely that the experience of Andalas University may be adopted and applied in other universities aspiring to improve their performance.

2. Developing Campus Sustainability Plan

Andalas University strongly believes that *'good planning is half way to success.'* It inspired the university management to plan necessary documents to realize its vision. They consists of the university's road map as an excellent and dignified university, 2009-2028 long-term planning, Business Strategic Plan of Andalas University every five years. In a bid to realize the long-term plan, the Andalas University requires four periods of business strategic plans during 2009-2028 long term planning.

In preparation for the overall documents planning, Andalas University encountered both academic and non-academic problems that prevent it from enhancing its performance. On the academic side, it was yet to apply quality assurance system, ignored productivity rate, neglected the decreasing publication by lecturers and poor law enforcement against violations of academic rules. Meanwhile, in terms of non-academic issues, Andalas University has no far more appropriate infrastructures such as buildings, classrooms, laboratories and information technology system. This is not to mention that the campus has arid environment, no waste management system, worst water management system, unsettled transportation system and unequal development in the area of the campus and other issues. Andalas University did not occupie a satisfactory position pertaining to universities ranking in the country.

Anticipating the needs and standards of the future campus, documents of long-term planning and business strategic plan of 2009-2013 confirm that Andalas University is a green campus. In an attempt to achieve the objective, various policies, programs, events and activities have been formulated and implemented. They, in effect, included agenda related to sustainable development compatible with the guide books of UI GreenMetric issued in 2010 such as greening campus program, waste management, water management, transportation management and campus landscape structuring. Therefore, it can be concluded that the Andalas University has pioneered in development plan in line with the sustainable development agenda.

One of the factors that contribute to the success of Andalas University in taking fourth ranking of UI GreenMetric in 2014 in Indonesia is to do with its development plan that has put sustainable development agenda since 2009. Any universities that do not have sustainable development agenda will find it hard to meet standards or criteria established by UI GreenMetric. Each college requires a development plan by taking the sustainable development agenda into account to participate in the UI GreenMetric ranking of world

3. Establishing Control Mechanism

Despite having plans giving attention to the sustainable development agenda, there is no guarantee it will run if there are no control and direct commitment of the rector. To ensure the well prepared plan to be implemented at a fixed time, the next steps after setting up a good plan are to establish control and supervision mechanisms of the program implementation and to ensure budget availability. Both should be under the rector control.

Why should a rector have a direct control and supervision? Various practices at public universities, especially yet categorized into incorporated public universities (*PTN Badan Hukum*), have been marked by proposed annual programs and activities by each unit to the university rector. The experience of Andalas University, prior to 2011, suggested that each unit of work has proposed programs and activities irrelevant to the vision of the university, causing it to fail to realize its vision. Thus the rector applied strong and direct mechanism to avoid irrelevant programs and activities to achieve the vision of the university.

It is often the case that universities outside Java have a relatively low and limited budget (Taifur, 2014). Owing to budgetary constraints, programs and activities of sustainable development could be not a priority for the unit of work and vice rectors. Each vice rector seeks to get a large portion of budget to realize the proposed programs and activities. Seeking the budget allocation frequently sets the scene for conflict among vice-rectors, which is particularly true for those running for next rector. Thus, direct control of the rector is needed to keep the programs and activities related to sustainable development alive and do not go into lower unit of work, like faculty. In addition, it is imperative to inhibit likely collision or dissatisfaction among fellow vice-rectors in want of greater budget allocation.

Andalas University had had the control mechanism to ensure that each unit of work is able to implement the programs truly relevant to realize its vision since 2011. Each program or activity had its own code that may be proposed at each fiscal year. The vice rector responsible for planning sector can directly cancel the proposed program and budget activities not in accordance with the code of programs and activities that have been set. By doing this, rector has easily identified units of work that have not proposed programs and activities concerning the sustainable efforts.

4. Implementation

For the success of the programs and activities of the university, especially related to sustainable development efforts, the rector cannot just rely on his staff's reports or simply sit in the office. At various universities whose development is equivalent to the Andalas University, frequent violations and irregularities in the implementation of programs and activities are clear and inevitable in spite of established standard operating procedures. So rector needs to make impromptu visit (*blusukan*) around the campus.

Campus community may see that the rector is not necessary to go down to the field. Yet it must be remembered that going down to the field by a rector may not be necessary anymore, if all the systems have been running well, like in UI, ITB, IPB and other universities. For campuses whose progresses are not equal to UI or ITB, for example, and want to catch up in limited funds, there is no way but a rector must often go down to the field. Frequent field observation would make the rector easily know technical and straightforward difficulties encountered in the field and can find solutions well and quickly.

Field review is very heavy and might cause a variety of public negative perception. However, it is believed that if one university is not the same level as UI, ITB and the other campuses in Java, its rector must be in a position to encourage the implementation of all programs and activities and stay at the forefront. The performance of Andalas University would not have achieved today's level if its rector was only preoccupied with his subordinates' reports and never went to the field to ensure the implementation of programs and activities and perceived its problems in practice.

5. Taking Bold Acts to Save Campus

Public universities in Indonesia, especially outside Java, were still struggling with fundamental problems such as lack of infrastructure, human resources, low quality of student input, inadequate budget and others. It is not easy to get out of the vicious circle. In such a situation, the rector should dare bring an unpopular policy to get out it. The absence of rector's courage to take unpopular policy and leave comfort zone would only cause his/her university to confront unresolved fundamental issues.

Andalas University's own experiences indicated that unpopular policies and programs can improve its performance. During 2011-2015, there were at least four rector's unpopular policies igniting protests from various parties. *Firstly*, financial incentive-reducing policy, which was paid only 75% of the standard common cost (SBU). For efficiency, the honorarium cuts were diverted to finance programs and activities and to realize the vision of Andalas University. *Secondly*, law enforcement and

sanctions for violations of academic rules. The policies that have mostly triggered students' protest were to expel students exceeding the period of study and with very low academic index. Thirdly, reducing students admission and canceled '*independent program*' (jalur mandiri) for students admissions. Judging from an evaluation conducted in 2011, it showed that a major causal factor leading to students' lengthy study period and poor academic performance is bound to students admissions through independent program. *Fourthly*, a lecturer's allowance would not be paid if he/she has not met his/her load conditions.

The four less popular policies have been believed to have contributed to soaring performance of the Andalas University. Lecturers turned out to be more attentive to students and students were more industrious to preclude academic sanctions. Due to its various saving policies, Andalas University has been more capable of realizing assorted programs of campus greening, infrastructure improvement and environment betterment. The policies have led the university to undergo a much better transformation.

6. Involving many Stakeholders in the Greening of Campus

Due to its budget constraints, an university will be able to allocate a large sum of money for campus greening and sustainable development programs. One of the solutions to address the problem is that a rector needs to seek external sources of funding and approaches various parties or stakeholders to choose Andalas University as the location of their greening activities. In order for this goal to be realized, an university should have a grand design of the greening the campus and send its proposal to the various institutions, especially state-owned enterprises and large private companies to participate in campus greening program.

During the 2011-2015 period, Andalas University has enjoyed campus greening program from CSR programs of PT Pertamina, PT Semen Padang and numerous private companies, like tire company. It also received greening program of the Army, the Ministry of Environment and Forestry, Padang city and West Sumatra province governments.

Representing students' responsibility for campus greening program, each new student was required to donate tree seeds. Furthermore, Andalas University made efforts to ascertain that every event related to the greening program will be carried out at its area. For that purpose, it has requested not only limited seedlings but also the costs of planting and maintaining trees to avert possible failure. With a variety of activities held by parties outside the campus, the numbers of shade trees have increased very quickly and gave no financial burden to the university.

7. Proposed Assessment Criteria

Andalas University is attentive to University of Indonesia that has made the international ranking of universities focusing on green campus called the UI GreenMetric. It basically paves the way for universities outside Java to gain international recognition. Following strict criteria of universities ranking of the world—the Time Higher Education World University Rankings, QS World University Ranking and others—will give little chance for universities outside Java to stay at a high rank. Hence, Andalas University strongly supports UI GreenMetric to improve its ranking method.

One that needs to be considered for assessment is the geographic location of campus. Andalas University is located on a hill and the topography of its campus area is not flat. Following its geographical and topographical locations, lecturers and students may not use the bikes leaving for and coming back from the campus. So, it is necessary to balanced and altenartive figures for any universities located in the highlands or mountains.

Equally important, a lot of universities campuses in Indonesia are undergoing physical development concerning the campus infrastructure. One additional building, of course, will add to one additional parking area. It is not to mention that not all of the campuses get public transport service, which in

turn encourages lecturers and students to bring their own vehicles to campus. In such a situation, the campus finds it hard not to make the parking area. Do assessment methods miss such problems?

8. Closing

Each university faces different problems to achieve quality higher education and to participate in international rankings. But the rector should have appropriate policies and steps to get out of the problems so as to bring his/her university to receive international credit from global ratings agencies.

Andalas University has made a wide range of policies to get out of the vicious circle to achieve better performance thus far. Its experiences are subject to adoption and implementation by other universities. For universities struggling with their management system and human resources, their rectors need to continue to be in the front line and do not keep themselves in the comfort zone any longer.

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Paving the Way to a Green Campus: Kasetsart University

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Abstract. This paper presents how Kasetsart University has been attempting to become a green campus. Since 1969, KU Master Plan has been provided and revised according to higher number of students as well as urbanization around the campus. At present, two mass transit lines are being constructed beside KU. The Red Line will be opened in 2019 and Bang Khen station is located next to KU on Vibhavadi Road. The Green Line will be opened in 2020 and Kasetsart Station will be located next to KU above Phahonyothin Road. Therefore, revision of KU Master Plan is being studied. UI GreenMetric Guideline 2015 is considered in the Master Plan revision since KU has been joining the UI Green Campus program since 2011. This paper presents information and progress of the research in 5 parts that are Open Space- Green Area, Renewal Energy - Solar Rooftop and Solar Farm, Waste - Reuse of Durable Articles, Water and Transportation - Walking, Cycling, and Campus Bus Services.

Keywords: Green Campus, Sustainable Transportation, Kasetsart University, Bangkok

5. Introduction

In 1938, Kasetsart University (KU) main campus located in Central Agriculture Station in Bang Khen District, Bangkok as a College of Agriculture that offered three-year certificate programs in three fields: agriculture, cooperative science, and forestry (KU, 2016). At that time, the location was rural of Bangkok surrounded by rice fields. Main transportation was Phahonyothin Road and canals. Afterward, the surrounded road network was developed. The campus is bordered by main roads on three sides; these are Phahonyothin Road on the east side, Vibhavadi Road on the west side, and Ngamwongwan Road on the south side. Number of students was high and more academic buildings were required. Therefore, in 1969, KU assigned Cornell University with support from Rockefeller Foundation to provide KU Master Plan. The proposed master in 1969 plan is presented in Figure 1. In 1973, KU assigned Demonte - Chan / Rader Campus Planning Consultants, San Francisco, USA with support from World Bank to provide land use plan in Bang Khen and Kamphaengsan campus. Figure 2 presented the 1973 planning concept for Bang Khen campus.



Figure 1. KU Master Plan in 1969

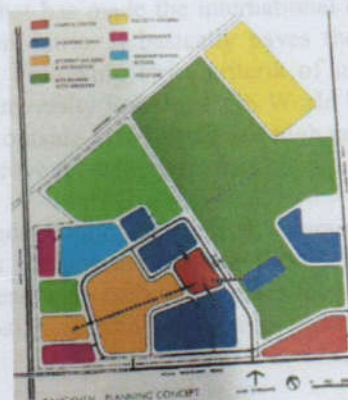


Figure 2. KU Planning Concept in 1973

In 1988, a master plan for the northern part of KU for the university extension was provided as presented in Figure 3. KU also has another piece of land in Soi Phahonyothin 45. This area was used as staff accommodation and abandoned. In 2003, the construction of Liab Khlong Bang Khen Road was announced. KU assigned Faculty of Architecture, KU (AKU) to prepare a master plan to develop the land in Soi Phahonyothin 45 as students and staff accommodation. Some commercial areas were provided at the new KU entrance. Figure 4 presents the Soi Phahonyothin 45 master plan.

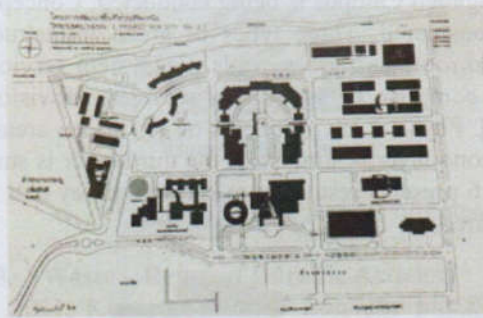


Figure 3. of KU Master Plan in 1988

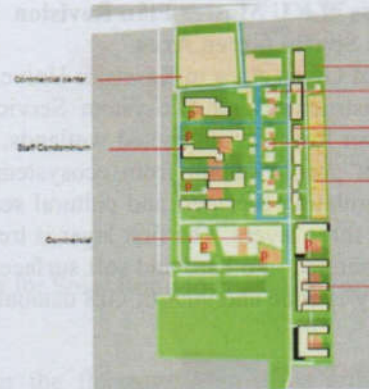


Figure 4. Soi Phahonyothin 45 Master Plan in 2003

At present, KU's surrounding area is an urban area where offices under Ministry of Agriculture, private offices, shops, and residents are located. Furthermore, two mass transit lines are being constructed beside KU. The Red Line that links between Bang Sue Grand Station and Rangsit, is being constructed along Vibhavadi Road and Bang Khen station is located next to KU. The Green Line that extended from Mochit Station to Saphanmai, is being constructed above Phahonyothin Road and Kasetsart Station will be located next to KU. Figure 5 presents KU existing road network, buildings (only in color, the rest area belong to Ministry of Agriculture) and the future mass transit stations. The Red line is scheduled to open in 2019 and the Green Line is scheduled to open in 2020. During the Green Line construction, road users in this area are suffered from traffic congestions. The newly opened road- Liab Khlong Bang Khen Road on the north side of KU can alleviate this problem.



Figure 5. KU existing road network, buildings, and the future mass transit stations

The opening of the mass transit lines will provide sustainable transportation mode choices for students and staff in KU. However, transportation network and land use in KU should be revised according to

the mass transit systems to bring benefits to KU. Therefore, a research for revision of KU Master Plan is proposed by AKU. UI GreenMetric Guideline 2015 [1] is considered in the Master Plan revision since KU has been joining the UI Green Campus program since 2011. This paper presents information and progress of the research in 5 parts that are Open Space- Green Area, Renewal Energy - Solar Rooftop and Solar Farm, Waste – Reuse of Durable Articles, Water and Transportation – Walking, Cycling, and Campus Bus Services.

6. Progress of KU Master Plan Revision

6.1. Open Space- Green Area

The Study of Green Area in Kasetsart University, Bangkok Campus is being conducted. Concepts of Green Infrastructure and Ecosystem Services are considered. Three types of green infrastructure include urban forests, constructed wetlands, and green roofs and green walls. Ecosystem services is benefits that people obtain from ecosystems which comprise of supporting services, provisioning services, regulating services, and cultural services [2]. Physical environments of KU green areas are surveyed in three layers. The first layer is tree, the second layer is shrub, and the third layer is surface which is separated into hard and soft surfaces. Figure 6 presents results from surface survey that 90% of the survey is done and 90% of GIS database is prepared.

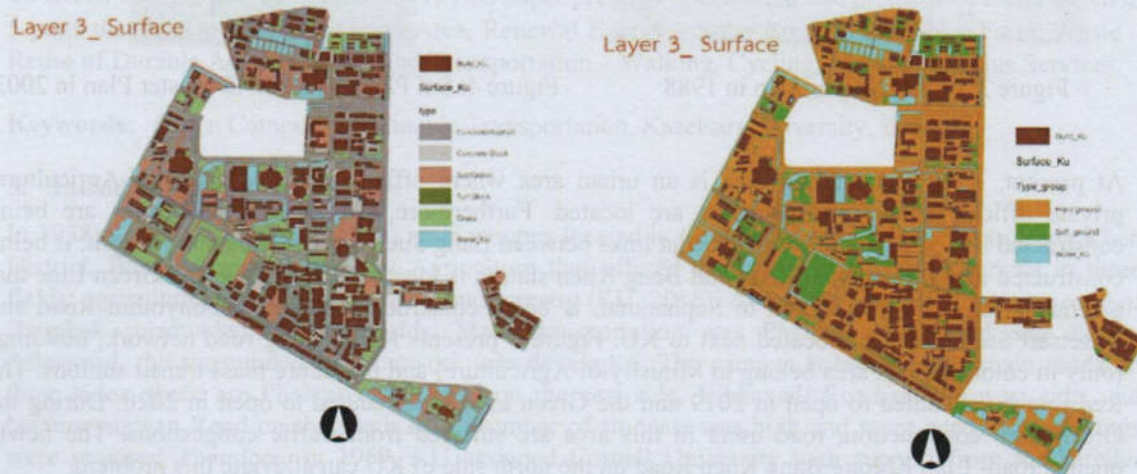


Figure 6 Results from Surface Survey

6.2. Renewal Energy- Solar rooftop and solar farm

Solar rooftop and solar farm potential for all KU campus is being studied. Apart from Bang Khen, KU has three campus outside Bangkok that are Kamphaengsan campus in Nakhonprathom province, Sri Racha Campus in Choburi province and Chalermprakiat Sakhon Nakorn province campus. Renewable energy production potential includes solar rooftop, solar parking and solar farm. Buildings, parking garages and open spaces in the four campuses are surveyed. Areas where solar panels can be installed are calculated to evaluate energy potential and costs of investments. At present, surveying in Bang Khen and Sri Racha Campuses is done. Figure 7 presents survey results in the two campuses. High potential areas are highlighted.

6.5. Transportation - Walking, Cycling, and Campus Bus Services

Since the two mass transit lines will be opened beside KU in the near future, transportation inside KU including walking, cycling and campus bus services should be improved and revised to links the university areas with the two mass transit stations. Accesses to stations are very important because conveniences of accesses influence passengers' satisfaction of the systems. Conveniences of accesses also encourage car users to be mass transit users and inspire non-regular mass transit users to be regular mass transit users. [3][4] At present, walking, cycling and bus services conditions in KU is surveyed. Concepts of connectivity, safety and convenient were applied to improve walking and cycling. Draft recommendations were prepared to be reviewed by stakeholders in KU. Figure 10 present existing conditions and proposed improvement of bicycle network that link KU areas to the mass transit stations.



Figure 10 Existing Conditions and Proposed Improvement of Bicycle Network

7. Summary/ Concluding Remarks

KU is committed to improve students and staff quality of lives. Becoming a Green Campus is a way to achieve the commitment. To be a green campus, a Green Master Plan is needed. Bang Khen campus is selected as a pilot study. After this, master plan for the other three campuses will be conducted. KU believe that green environments will educate students to have green mind, later after graduation, our alumni will generate their green businesses, and finally build a green society.

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APPENDIX

**UI Green
Metric**

World University Ranking

PROCEEDINGS OF
INTERNATIONAL WORKSHOP
ON UI GREENMETRIC 2016

Fostering Sustainable Culture
in Global Universities

Universitas Indonesia, Depok, Indonesia April 21st 2016

greenmetric@ui.ac.id

Speakers' and Authors' Profile



Prof. Dr. Ir. Muhammad Anis. M. Met
Rector of Universitas Indonesia.

Muhammad Anis graduated from the Faculty of Engineering, Universitas Indonesia majoring in metallurgy in 1983. He then continued his education and earned his doctoral and master's degrees in metallurgy from the School of Materials, University of Sheffield, UK. Muhammad Anis has held various positions within the Faculty of Engineering, among others as Vice Dean for Academic Affairs (1993–1997), Vice Dean for Cooperation (1997–2000) and Director of Extension Program for two terms (1993–2000). He has also held the positions Member of the University's Senate (1997–2000) and Member of the University's Academic Senate (2000–2007). He was Universitas Indonesia's Director of Education for the term 2003–2007 and was appointed Vice Rector for the term 2007–2012. In 2013, he was appointed as Interim Rector of Universitas Indonesia.



Prof. Dr. Adi Zakaria Afiff, S.E., M.B.A

Vice Rector of Finance, Logistic, and Facilities University Of Indonesia

Topic:

Towards Sustainable University through Setting and Infrastructure Development at the Universitas Indonesia

Biography

Adi Zakaria Afiff was born in Bandung on August 28, 1961. He earned his MBA Degree at University of Wisconsin in Madison with a double Major in Management Information System and Marketing in 1989 and his Doctorate degree in Marketing at Universitas Indonesia in 2003. Adi Zakaria Afiff had the opportunity of working at a number of companies such as PT USI IBM Indonesia, PT Procter and Gamble Indonesia and Karim Business Consulting. Currently Adi Zakaria Afiff is teaching number of marketing subject in the undergraduate, master and doctorate degree at Universitas Indonesia. His research interest covers areas such as Social Marketing, Service Marketing, Brand Management, Marketing Communication and Consumer Behavior.



Dr. Roseann Runte, CM, BA, MA, PhD
President of the Carleton University

Topic:

Carleton University's Integrated Vision for Sustainability in Research, Teaching, Campus Plan and Operations

Biography:

Roseann O'Reilly Runte is President and Vice-Chancellor of Carleton University. Dr. Runte graduated with a BA summa cum laude in French from the State University of New York and obtained her MA and PhD from the University of Kansas. She is the author of numerous scholarly works in the fields of French, comparative literature, economic and cultural development, higher education and the importance of research. In addition, she is a creative writer and has received a poetry prize from the Académie française.

**Mark Poland**

Director of Buildings and Estates University College Cork

Topic:

Development of Sustainability in University College Cork.

Biography

Mark Poland is a chartered civil engineer and Fellow of Engineers Ireland. He is a graduate of University College Cork and has experience in Ireland and the United Kingdom as a consulting engineer and project manager on commercial and industrial projects. He is currently Director of Buildings & Estates at UCC and leads a team of professionals involved in the management of the University's estate. The University is going through an ambitious €400m. capital development programme with a wide range of exciting academic and support facilities. UCC was the first University in the world to be awarded the Green Flag by FEE and the first University to achieve ISO 50,001.

**Dr. Musaad Abdullah Almosaind**

Vice Rector for Facilities & Operations Princess Nourah bent Abdulrahman University

Topic:

Sustainability in PNU Strategic Goals.

Biography:

He is Vice Rector for Facilities & Operations of Princess Nourah bent Abdulrahman University since 2013. He was Vice Rector for Projects of King Saud University in 2008 – 2012 and also General Supervisor, Operation and Supporting Services: General Supervisor of King Saud University from 2007 – 2008. He benefited from many trainings such as Executive Education Program from Harvard Kennedy School and Special Leadership Sessions for KSU Leaders from Edge Hill University.



Prof. Joni Hermana

Rector of Institut Teknologi Sepuluh Nopember

Topic :

The Future Challenge for the Implementation of Eco-Campus Programme at ITS Surabaya

Biography :

Joni HERMANA, is Rector of Institut Teknologi Sepuluh Nopember (ITS), Surabaya – Indonesia and the Professor at the Department of Environmental Engineering, Faculty of Civil Engineering and Planning (FTSP). 1986 He got PhD in Environmental Engineering from University of Newcastle, U.K (1994–1997). He has a higher degree of experience in training, research, and publishing; coupled with experience at institutional level as the Dean of the Civil Engineering and Planning Faculty (2007–2011), and as CKNet-INA Chairman (Collaborative Knowledge Network of 10 Indonesian Universities in Water Sectors and Infrastructures, IWEM 2008–2011). He is also a LEAD Fellow (Leadership for Environment and Development) since 2001.



Dr. Khalil Jamshidi

President of the University of Zanjan

Topic:

Sustainability Indicators of the University of Zanjan

Biography:

Khalil Jamshidi, PhD is the President of the University of Zanjan and Associate Professor of Agronomy with more than 30 years of academic experience, and a PHD degree in Agronomy: Intercropping Ecology from University of Tehran, Iran. He conducted 10 research projects and published 25 papers in peer-reviewed journals. He has teaching experiences in subjects such as: Environment Ecology, General Ecology, General Agronomy, Forage Agronomy, Sustainable Agriculture Foundation, New trends in Agronomy.



Dr. Jesús Cano Sierra.

Rector's delegate for the sustainability and environmental quality – Spain

Topic :

The University of Alcalá's efficient energy policies. Where are we? Where are we headed?

Biography :

He completed his PhD in Chemistry in the University of Alcalá under the supervision of Pascual Royo. He made a Postdoctoral research in the University of Münster (Germany) under the supervision of Prof. Erker. After obtaining the habilitation in the University of

Malaga he obtained a Professor Titular position in the University of Alcalá in 2008. He was Vicedean of the Faculty of chemistry (2009-2012) and since 2014 He is Rector's delegate for the sustainability and environmental quality in the UAH. His research interest is catalysis with metal complexes, in special, the synthesis of biopolymers with non-toxic metal catalysts. He has been codirector of 2 PhD thesis, 3 in course, one patent and more than twenty papers in different journals, most of them in the first quartile. In addition to his research activities, Dr. Jesús Cano is teaching to students of Chemistry, Pharmacy and Environmental Sciences in the University of Alcalá and also is participating in several Master Programs.



Prof. Dato' Seri Dr. Mohamed Mustafa B Ishak
Vice Chancellor of Universiti Utara Malaysia

Topic :

The University in a Green Forest – Towards Eco-Friendly Campus

Biography :

Prof. Dato' Seri Dr. Mohamed Mustafa B Ishak got his PhD in Political Sociology from University of Leeds, United Kingdom in 1999. He also took an Advanced Management Program in Harvard Business School since September 2013. Currently, he serves as Vice-Chancellor of Universiti Utara Malaysia and Pengerusi Majlis Peperiksaan Malaysia.



Mr. Dominik Schmitz

Senior Scientist and Expert at BOKU'S Center for Global Change and Sustainability Universität für Bodenkultur Wien

Topic :

The development of sustainability at BOKU University of Natural Resources and Life Sciences, Vienna Austria

Biography :

Dominik Schmitz works as University Assistant at Univ. of Natural Resources and Applied Life Sciences Vienna since November 2011. He has 10 years experience in international UN climate mitigation project development - Clean Development and Voluntary Carbon Mechanism projects, incl. methodology development, baseline setting, monitoring, validations and verifications. He is also university lecturer and teaches some subjects such as Sustainable entrepreneurship. He was also Key Expert of an EU funded project in Mexico and Indonesia.



Luiz Roberto Guimaraes Guilherme

Delegate of Rector of Federal University of Lavras

Topic :

The Strategic Environmental Plan of Federal University of Lavras, Brazil: Who We Are, Where We Came From, Where We Want to Go

Biography :

Agronomist; MSc in Soil Science at ESAL, Lavras, Brazil; PhD in Crop & Soil Science / Environmental Toxicology (Dual Major) at Michigan State University / Institute for Integrative Toxicology, Michigan (USA). Sabbatical leaves at University of California, Riverside (USA) and INRA d'Orléans (France). Professor at the Department of Soil Science, Federal University of Lavras (UFLA), Brazil. Vice-Director of UFLA's Office of International Affairs. Technical/scientific consultant of several sponsor agencies, scientific journals and public/private companies. Member of the Brazilian Society of Soil Science, Soil Science Society of America and the International Union of Soil Science. Experience in the fields of Soil Science and Environmental Toxicology, with emphasis in Soil Chemistry, acting mainly in the following subjects: soil fertility, soil pollution, environmental risk assessments, reaction of trace elements and plant nutrients in soils, food security.



Asst. Prof. Dr. Chanan Phonprapai

Assistant to the Rector for Administration of Thammasat University

Topic :

Thammasat University Implementation on Sustainability, Natural Resources, Energy, and Environmental Conservation

Biography:

Asst. Prof. Dr. Chanan Phonprapai got his Doctor of Philosophy in Biochemical Engineering from University College London, University of London, United Kingdom. He currently serves as

Assistant to the Rector for Administration (Rangsit Centre).



Sakiko Okayama

Chiba University Environmental ISO Secretariat

Topic :

Reduction of water resources consumption and the student-led environmental management system of Chiba University

Biography :

Sakiko Okayama is a Doctoral student, Graduate School of Humanities and Social Sciences, Chiba University. She also works as Chiba University Environmental ISO Secretariat 2014 and Chiba University Public Relations Advisor.



Assoc. Prof. Boonchai Stitmannathum, Ph.D
Vice President for Physical Resources Management
Chulalongkorn University

Topic:

Chulalongkorn University Development: Approaches and Achievements to Sustainability Campus

Biography:

Associate Professor Dr. Boonchai Stitmannathum is Associate Professor in Civil Engineering at Chulalongkorn University, Bangkok, Thailand. He graduated from University of Tokyo, Japan in 1992 as Doctor of Engineering. His research interest including: Sustainable Campus Planning and Management, Sustainable Construction Materials and Concrete, Building Information Modelling (BIM), Durability of Concrete Structures, Repair and Strengthening of Concrete Structures.



Prof Dr Fathur Rokhman M.hum
Rector of Universitas Negeri Semarang

Topic:

Developing Conservation in Semarang State University

Biography:

Prof. Dr. Fathur Rokhman, M.Hum. is a lecturer of Indonesian Studies, Languages and Arts Faculty, and Postgraduate Program of Semarang State University (Unnes). He currently serves as Rector of the university. He got his Doctor of Linguistics from Gadjah Mada University, Yogyakarta in 2003. before serving as rector he was in charge as Head of Research Centre of Unnes from 2004-2007 and Vice Rector for Development and Partnership of Unnes from 2007-2013.



Prof. Dr. Federico Fernandez

Delegate of the Rector of Universidad de Castilla la Mancha in Sustainability Issues

Topic:

UI GreenMetric sustainability indicators in the University of Castilla-La Mancha (Spain)

Biography

Full Professor of Botany and researcher at the Faculty of Environmental Sciences and Biochemistry of the University of Castilla-La Mancha (UCLM) since 1999 (before at the Complutense University of Madrid), and Head of the Section on Biodiversity and Sustainable Development of the Institute of Environmental Sciences of Toledo. Vice-Dean (2000-2004) and Dean (2004-2008) of the Faculty of Environmental

Sciences of the UCLM; currently Rector's Delegate for Sustainability and Coordinator of the Master on Environmental Sustainability.

Teaching subjects: botany, Mediterranean flora, vegetation ecology, conservation biology, protected areas, forest management, environmental impact assessment.



Prof. J.C. Leong

Dean of the Office of International Affairs – National Pingtung University

Topic:

Integrated Water Treatment with Landscape Architecture and Ecological Education in NPUST: A Status Report

Biography :

Prof J.C. Leong got his Ph.D. in Mechanical Engineering, from University of Oklahoma, USA in 2002 with his dissertation: Heat Transfer and Fluid Flow in Rotating Cylinders with a Porous Sleeve. He is a lecturer at Department of Vehicle Engineering National Pingtung University of Science and Technology and also Dean of the Office of International Affairs. His research interests are: Heat and Mass Transfer, Flow Visualization Techniques, Ventilation and Fire Safety in Long Tunnels, Car Cabin Air-Conditioning and Ventilation System, Magnetic Fluid Flow.



Majed M. Abu Zraig, PhD

Director of International Relations Office and Professor of Water and Environmental Engineering Department of Civil Engineering, Jordan University of Science and Technology

Topic :

Water and Wastewater Management on Jordan University of Science and Technology Campus

Biography :

Professor Majed Abu Zraig is Professor of Water and Environmental Engineering. He got his PhD in Water Resources Engineering from University of Guelph, Canada in 1995. He also works as Director of International Relations Office at Jordan University of Science and Technology. His research interest including: Higher Education system, University internationalization; Arid zone hydrology, Hydraulic Engineering, Wastewater treatment & reuse, Water harvesting, Soil erosion, Groundwater hydrology, Non-point source pollution modeling, integrated water resources management.



Prof. Dr. Werry Darta Taifur, S.E., M.A

Former Rector Universitas Andalas

Topic:

Sustainable Initiatives to improve Higher Education Performance

Preface

PROCEEDINGS OF INTERNATIONAL WORKSHOP ON UI GREENMETRIC 2016

This proceedings contains the results of the 2016 International Workshop on UI GreenMetric, held by the Universitas Indonesia. This is the 2nd International Workshop on UI GreenMetric. The first one was conducted in November 2013.

This workshop is an academic forum for Rectors, Vice Rectors, and Director of Sustainability and Facilities, of UI GreenMetric participant. They have shown a lot of development to achieve best positions in each category at the UI GreenMetric Ranking of World University.

In this workshop they share their efforts in improving sustainable environment in their campuses. This forum aimed at providing an opportunity for the top leaders of participating universities to explain their university's excellence in sustainability and Green Campus efforts. We also hope that this event will provide an opportunity for cooperation in sustainability management in campuses. We also hope that this event will also be a media in which we can hear and accommodate some comments from participants to improve our tools to evaluate university performance. There are 16 countries.

Editors:
Riri Fitri Sari
Nyoman Suwartha

Finally, we convey our greatest appreciation to all distinguished speakers from Carleton University - Canada, UCL - Ireland, Princess Nourah University - Saudi Arabia, Institut Teknologi Sepuluh Nopember - Indonesia, University of Zanjan - Iran, Universitas Indonesia - Indonesia, Universidad Castilla La Mancha - Spain, Universiti Utara Malaysia - Malaysia, Universität für Bodenkultur Wien - Austria, Federal University of Lavras - Brazil, Thammasat University - Thailand, Chiba University Chitralongkorn University - Japan, Universitas Negeri Semarang - Indonesia, National Pingtung University of Science and Technology - Taiwan, Jordan University of Science and Technology - Jordan, Universitas Andalas - Indonesia, the conference proceedings contributor. In total we have participants from 20 countries which we have Mexico, Ukraine, and Hungary on the list. We thank all the participants for making this International Workshop on UI GreenMetric a success.

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Biography

Professor Dr. Werry Darta Taifur, born in Kubang on 29 November 1960, is the tenth Rector of Andalas University. He is the first economist to serve in this position. He obtained his Master's degree from Flinders University in Australia and his PhD from the University of Malaysia. He was appointed as the Rector of Andalas University, 2011-2015 period, on 21 November 2011 by the Minister of Education and Culture, Muhammad Nuh.



Assist. Prof. Ratchot Chompunich

Vice President for Strategic Development and Organizational Communication

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Paving the Way to a Green Campus: Kasetsart University

Biography:

Assist. Prof. Ratchot Chompunich got his master degree in Architecture from Chulalongkorn University in 1998. He currently serves as Vice President for Strategic Development and Organizational Communication and Dean of Faculty of Architecture of Kasetsart University.



Prof. Dr. Ir. Riri Fitri Sari MM MSc

Chairperson of UI GreenMetric Ranking of World Universities
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Biography:

Riri Fitri Sari is a Professor of Computer Engineering at the Electrical Engineering Department, Faculty of Engineering, Universitas Indonesia (UI). She holds a PhD in Computer Networks from the School of Computing, University of Leeds, UK. Her current main teaching and research area includes Computer Network, Grid Computing, and ICT implementation. Since April 2010, she has been the Chairperson of UI GreenMetric Ranking of World Universities, a flagship program of the University of Indonesia to rank university worldwide based on their green campus and sustainability programs. Since September 2015, she has been appointed a member of Special Task Force for Improving Indonesian Universities Academic Reputation of the Ministry of Research and Higher Education.

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Profile of Universitas Indonesia

Universities, today, are uniquely positioned to address global challenges. As the result thereof, Universitas Indonesia (UI) is fully committed to seek solutions to the century's most pressing global challenges, enhance the education of future leaders and strengthen its academic endeavor. UI is innovative within our own institutions, in terms of how we are structured and governed and how we adapt to global challenge.

Having experience more than 160 years in higher education, our campus is rich in history, academic excellence and its contribution to both Indonesian and international society. UI is actively contributes to strengthen and enlarge international network by actively participating to both regional as well as international education and research association. UI plays an active role on higher learning associations in Asia Pacific, Europe, Southeast Asia, and worldwide association such as APRU (Association of Pacific Rim Universities), ASAIHL (Association of South East Asia Institution of Higher Learning), and AUN (ASEAN University Network), in which UI is the host for AUN Credit Transfer Secretariat.

Quality Culture is one of UI mottoes to preserve and improve the good quality in academic and non-academic aspects, in order to provide the best services to its stakeholders. In return, UI retains its position to be amongst the top 400 universities in the world. UI is also an active member of ASEAN University Network – Quality Assurance (AUN-QA) since 2002. Until 2015, 17 undergraduate study programmes have accomplished AUN-QA assessment, Magister Public Health Study Programme has achieved accreditation through Asia Pacific Academic Consortium for Public Health (APACPH), and Magister Management Study Programme has been accredited by The Alliance on Business Education and Scholarship for Tomorrow (ABEST 21).

Last but not least, the major campus of UI is located in greeneries consisting of 320 hectares with 6 lakes. The university maintains the ecology conservation while developing academic facilities. In addition to that, as a member of IREG Observatory on Academic Ranking and Excellence (IREG observatory), UI has released UI GreenMetric University Ranking that ranks universities throughout the world according to appointed indicators of campus environmental issues such as setting and infrastructure, energy, waste management, water, transportation, and education for the past 5 years.

Workshop Program

Time	Agenda
08.30am - 09.00am	Registration
09.00am - 09.15am	Opening By MC (Dr. Baiduri Widanarko) Report from Chairperson of UI GreenMetric, Prof. Dr. Ir. Riri Fitri Sari Welcoming Speech from the Rector of the University of Indonesia, Prof. Dr. Muhammad Anis
09.15am - 09.30am	Keynote Speech from Minister of Research and Higher Education , Represented by Prof. Intan Achmad, Director General of Learning and Student Affairs
09.30am - 09.45am	Formal Photo of Speakers and Participants & Networking Session
09.45am - 10.00am	Coffee Break
10.00am - 10.45am	Plenary Session: Dr. Roseann Runte, CM, BA, MA, PhD - President of the Carleton University – Canada (10 Minutes), Mr. Mark Poland - Director of Buildings and Estates UCC - Ireland (10 Minutes) Dr. Musaad A. Almosaind - Vice Rector for Facilities & Operations - Princess Nourah Bint Abdulrahman University - Saudi Arabia (10 Minutes)
10.45am - 11.40am	Panel Session I (Setting and Infrastructure) (Moderator: Prof. Gunawan Tjahjono) Prof. Joni Hermana - Rector of Institut Teknologi Sepuluh November - Indonesia (10 Minutes) Dr. Khalil Jamshidi - President of the University of Zanjan – Iran (10 Minutes) Prof. Dr. Adi Zakaria Afiff, S.E., M.B.A - Vice Rector for Finance, Logistic, and Facilities Universitas Indonesia – Indonesia (10 Minutes)
11.40am - 12.30pm	Panel Session II (Energy and Climate Change Policy) (Moderator: Prof Tommy Ilyas) Prof. Dr. Jesus Cano Sierra - Rector's delegate for the sustainability and environmental quality – Spain (10 Minutes) Prof. Dato' Seri Dr. Mohamed Mustafa B Ishak - Vice Chancellor of Universiti Utara Malaysia - Malaysia (10 Minutes) Mr. Dominik Schmitz - Senior Scientist and Expert at BOKU'S Center for Global Change and Sustainability Universitat fur Bodenkultur Wien – Austria (10 Minutes)
12.30pm - 1.15pm	Networking Luncheon MC: Ayomi Dita Rarasati Venue : VIP Room, Margo Hotel
01.15pm - 02.30pm	Panel Session III (Waste and Transportation) (Moderator: Dr. Nyoman Suwartha) Luiz Roberto Guimaraes Guilherme - Delegate of Rector of Federal University of Lavras - Brazil Asst. Prof. Dr. Chanan Phonprapai - Assistant to the Rector for Administration of Thammasat University (10 Minutes) Ms. Sakiko Okayama - Chiba University Environmental ISO Secretariat – Japan (10 Minutes) Assoc. Prof. Boonchai Stitmannathum, Ph.D - Vice President for Physical Resources Management Chulalongkorn University – Thailand (10 Minutes)

02.30pm - 02.45pm	Coffee break and Networking Session
02.45pm - 04.10pm	Panel Session IV (Water, Education and Research) (Moderator: Junaidi, MA) Prof. Dr Fathur Rokhman Mhum -Rector of Universitas Negeri Semarang - Indonesia (10 Minutes) Prof. Dr. Federico Fernandez - Delegate of the Rector of Universidad de Castilla la Mancha in Sustainability Issues – Spain (10 Minutes) Dr. JC Leong, Dean of the Office of International Affairs - National Pingtung University - Taiwan (10 Minutes) Prof. Majed Abu Zraig - Director of International Relations Office and Professor of Water and Enviromental Engineering Department of Civil Engineering, Jordan University of Science and Technology– Jordan (10 Minutes) Prof. Dr. Werry Darta Taifur, S.E, M.A Former Rector Universitas Andalas – Indonesia (10 Minutes)
04.10pm - 04.20pm	Closing Remarks from Chairperson of UI GreenMetric, Prof. Dr. Ir. Riri Fitri Sari, MM, MSc.
04.20pm - 04.40pm	Transfer to UI Campus
04.40pm - 05.30pm	UI Campus Tour (Led by Dr. Gandjar Kiswanto - Director of Facilities Management and Maintenance Universitas Indonesia- Indonesia)

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