UNIVERSITAS INDONESIA
Veritas, Probitas, Iustitia

UI GreenMetric
World University Rankings

Proceeding of
The 3rd International Workshop on UI GreenMetric
Global Campus Partnership for Sustainable Future

Istanbul University, Istanbul Turkey
April, 9th - 10th 2017

Hosted by:

Bülent Ecevit Universitesi

T.C. İstanbul Universitesi

UNIVERSITAS INDONESIA

PROCEEDING OF THE 3RD INTERNATIONAL WORKSHOP ON UI GREENMETRIC 2017

Global Campus Partnership for Sustainable Future

Editors:
Riri Fitri Sari
Nyoman Suwartha

ISBN 978-605-9678-14-8
Bülent Ecevit University Press

For Information:
UI GreenMetric
Integrated Laboratory and Research Center (ILRC) Building 4th Fl., Universitas Indonesia,
Depok 16424, Indonesia
Telephone +622129120936
Email: greenmetric@ui.ac.id
Website: http://iwgm.ui.ac.id

Preface

This proceeding contains invited papers from the International Workshop on UI GreenMetric (IWGM) 2017. This 3rd International Workshop on UI GreenMetric 2017 is organized by the Bülent Ecevit University and Istanbul University. The first and second IWGM were hold at Indonesia in November 2013 and April 2016, respectively. This 3rd IWGM is the first event to be conducted outside Indonesia.

The workshop is an academic forum for Rectors, Vice Rectors, and Director of Sustainability and Facilities, of UI GreenMetric participants. These universities have shown a lot of development in achieving best positions in each category at the UI GreenMetric Rankings of World University.

In this workshop university leaders share their experience and effort 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 hope that this event will provide an opportunity for cooperation in sustainability management in campuses. We also hope that this workshop will also be a media in which we can hear and accommodate some comments for the participants to improve our tools to evaluate university performance. This year there are 30 invited speakers from 19 countries, which will shares their best practices in respective universities.

We convey our greatest appreciation to all distinguished speakers from National Chi Nan University – Taiwan, Institute for Financial Management and Research – India, Universiti Malaysia Pahang - Malaysia, Suranaree University of Technology – Thailand, University of Zanjan – Iran, IFSULDEMINAS – Brazil, Bogor Agricultural University – Indonesia, University of Silpakorn – Thailand, Universidad del Rosario – Colombia, Universidad Nacional de Colombia - Colombia, Jordan University of Science & Technology – Jordan, King Abdulaziz University - Saudi Arabia, Universitas Diponegoro – Indonesia, Institut Teknologi Sepuluh November – Indonesia, Al-Balqa Applied University(BAU) – Jordan, Universitas Sebelas Maret – Indonesia, Universitas Negeri Semarang – Indonesia, Universiti Malaysia Sabah – Malaysia, Da-Yeh University – Taiwan, National Pingtung University of Science and Technology (NPUST) – Taiwan, USP - University of Sao Paulo – Brazil, National Autonomous University of Mexico - Mexico Peoples' Friendship University of Russia (RUDN-University) – Russia, Bülent Ecevit University – Turkey, KAZNAU - Kazakhistan. We thank the conference proceedings contributor for their papers. This conference has attracted active participation from many high rank officials from many universities. In total, we have participants from 43 universities of 19 countries, in which we have Mexico, Colombia, Latvia, Hongaria, Kazakhtan, Morroco, and Bahrain on the list. This has shown that ranking has been a great tool for improving standard of university infrastructure management. We thank all participants and all stakeholders for making this International Workshop on UI GreenMetric 2017 a fruitful and memorable event.

Editorial Team

Riri Fitri Sari
Nyoman Suwartha

The 3rd International Workshop on UI GreenMetric (IWGM) World University Rankings

Istanbul University, Turkey, 9-10 April 2017

Rector's Welcome

Prof. Dr. Ir. Muhammad Anis. M. Met
Rector of Universitas Indonesia
(Steering Commitee of the IWGM 2017 Organizing Committee)

We thank the government of Republic of Turkey and government of Republic of Indonesia, Bülent Ecevit University, Istanbul University and many universities for the support for our common goal of establish global forum for university leader on sustainable campus practices. Welcome to Istanbul, Turkey and the 3rd International Workshop on UI GreenMetric 2017. We are very pleased to greet all of you, and we are especially proud that this workshop also marks the inaugural conference of the UI GreenMetric workshop – a network that we initiated to share best practices towards going green and environmental sustainability on campus.

It is tremendously positive to see that many university leaders show their concern on environmental sustainability campus. More than 50 universities attending this workshop. Today more than 515 universities from 75 countries join UI GreenMetric rankings. We hope that Universitas Indonesia's initiative to draw attention to the sustainability issues will lead social change with regard to sustainability goals.

The findings from UI GreenMetric 2016 survey shown that most universities had implemented good waste management. However, energy and climate change was still an issue. In order to make make better impact to the global sustainability environment, university need to put more efforts on implementing renewable energy program, limitation of electricity usage, and carbon footprint policy.

We look forward the presentations and discussions on the issues of environmental sustainability on campus. I wish you all a constructive and productive time during the workshop and hope your stay in the beautiful and city of old Constantine is enjoyable and memorable.

Istanbul, 9 April 2017
Best wishes

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

The 3rd International Workshop on UI GreenMetric World University Rankings (IWGM)

Istanbul University, Turkey, 9-10 April 2017

Rector's Welcome

Prof. Dr. Mahmut ÖZER
Rector of Bülent Ecevit University
(National Coordinator of UI GreenMetric Network Hub for Turkey)

Prof. Dr. Mahmut AK
Rector of Istanbul University

We warmly welcome you to 2017. International Workshop on UI GreenMetric World University Rankings.This event is hosted by Istanbul University, one of the oldest and most prestigious universities in Turkey and organised by Bülent Ecevit University which has the greenest campuses in Turkey.

UI GreenMetric movement draws attention to sustainability and environment in higher education institutions in the world which are supposed to come up with solutions to significant worldwide problems by means of research. The aim of this conference is to provide an opportunity for universities that get top position in UI GreenMetric to explain their university's excellence in UI GreenMetric and also to provide an opportunity for cooperation in sustainability management in campuses. They will share their efforts in improving sustainable environment in their campuses. The conference program is comprised of keynote talks, invited speakers talks, and discussion among many universities.

Together with Rector of Istanbul University, as the Rector of Bülent Ecevit University and National Coordinator of UI GreenMetric in Turkey, I am pleased to welcome you at the International Workshop on UI GreenMetric 2017 to be held on 9-10 April in Istanbul.

Istanbul, 9 April 2017
Kind regards,

Prof. Dr. Mahmut ÖZER - Rector of Bülent Ecevit University

Prof. Dr. Mahmut AK - Rector of Istanbul University

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 IWGM 2017 Organizing Committee)

We warmly welcome you to the 3rd International Workshop on UI GreenMetric 2017. This marks the end of the 7th year since we started our university ranking. The venue for the event will be at Baltalimanı Social Facilities, Istanbul University, a historic place composed of picturesque buildings near the Bosphorus Strait. 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 a network of universities that connects many universities in the world becomes a reality. We thank the Rectors and high rank officers from more than 19 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 panel 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 of IWGM 2017 which consists of 28 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 the 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 and Higher Education of Republic of Indonesia, Prof. M. Nasir for the Indonesian government to the UI GreenMetric as one of 20 university rankings in IREG inventory. We would like to thank Prof. Dr. Klaus Rick - Representative of Rector of Hochschule Trier Umwelt Campus Birkenfeld – Germany, Prof. Dr. Bambang Wibawarta - Vice of Rector of University of Indonesia - Indonesia, Dr. Yuhlong Oliver Su – President of National Chi Nan University – Taiwan, Mr. Satya Saran - Representative of President of Institute for Financial Management and Research – India, Prof. Dato' Dr Daing Nasir Ibrahim - Vice Chancellor of Universiti Malaysia Pahang - Malaysia, Prof. Dr. Prasart Suebka - Rector of Suranaree University of Technology – Thailand, Prof. Bahram Maleki - Representative of President of University of Zanjan – Iran, Prof. Marcelo Bregagnoli, Rector of Instituto Federal de Educação, Ciência e Tecnologia do Sul de Minas IFSULDEMINAS – Brazil, Prof. Dr. Ir. Herry Suhardiyanto, M.Sc – Rector of Bogor Agricultural University – Indonesia, Prof. Chaicharn Thavaravej – President of University of Silpakorn – Thailand,

Jenny Andrea Diaz Pulido - Representative of Rector of Universidad del Rosario – Colombia, Prof. Chiara Mio - Representative of Rector of Universita Ca Foscari Venezia – Italy, Jose Herney Ramirez Franco - Representative of Rector of Universidad Nacional de Colombia - Colombia, Brother Augustine L. Boquer, FSC – President of De La Salle University Dasmarinas – Philipine, Prof. Triantafyllos A.D. Albanis – Rector of University of Ioannina – Greece, Dr. Jamal Abu-Ashour - Representative of Rector of Jordan University of Science & Technology – Jordan, Dr. Amin Yousef M. Noaman - Vice President for Development of King Abdulaziz University - Saudi Arabia, Prof. Dr. Ir. Ambariyanto, M.Sc. - Representative of Rector of Universitas Diponegoro – Indonesia, Prof. Ir. Joni Hermana, M.Sc.ES. Ph.D – Rector of Institut Teknologi Sepuluh November – Indonesia, Dr. Noor Al-Kharabsheh - Representative of Rector of Al-Balqa Applied University(BAU) – Jordan, Prof. Okid Parama Astirin - Representative of Rector of Universitas Sebelas Maret – Indonesia, Prof. Dr. Fathur Rokhman, M.Hum - Rector of Universitas Negeri Semarang – Indonesia, Assc. Prof. Dr. How Siew Eng - Representative of Rector of Universiti Malaysia Sabah – Malaysia, Dr. Yi-Ching Chen - Representative of President of Da-Yeh University – Taiwan, Dr. Chang Hsien Tai – President of National Pingtung University of Science and Technology (NPUST) – Taiwan, Prof. Patricia Iglecias - Representative of President of University of Sao Paulo (USP) – Brazil, Mireya Imaz Gisper - Representative of Rector of National Autonomous University of Mexico – Mexico, Dr.Sc. Econ Margarita Redina - Representative of Rector of Peoples' Friendship University of Russia (RUDN-University) – Russia, Asst. Prof. Dr. Sefa Kocabaş - Representative of Rector of Bülent Ecevit University – Turkey, Dr. Khaled Tarabieh - Representative of Rector of The American University – Egypt for their contribution to this workshop and the proceedings.

We would like to thank all the speakers for their contribution to this workshop and the proceedings. We also thank all participants for attending this workshop for their active participation in the event. Enjoy your visit to Turkey and Istanbul University 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.

Program Committee

Steering Committee

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

Prof. Dr. Mahmut ÖZER
Rector of Bülent Ecevit University

Prof. Dr. Mahmut AK
Rector of Istanbul University

Prof. Tommy Ilyas,
Universitas Indonesia (Expert Member of UI GreenMetric)

Organizing Committee

Prof. Ir. Riri Fitri Sari MM., M.Sc., IP
Chairperson of UI GreenMetric

Dr. Nyoman Suwartha, ST., MT, MAgr.
Secretary of UI GreenMetric

Junaidi S.S., M.A
Expert Member of UI GreenMetric

Sabrina Hikmah Ramadianti
Secretariat of UI GreenMetric

Dr. Budi Hartono, S.Si., M.K.M
Expert Member of UI GreenMetric

Arsy Imanda N. Raswati
Secretariat of UI GreenMetric

drg. Baiduri Widanarko, MKKK, Ph.D
Expert Member of UI GreenMetric

Hastin Setiani
Secretariat of UI GreenMetric

Organisation Committee:

Coord: Mr. Dinçer Biçer, Bülent Ecevit University

Member: Mr. Mustafa İnan, Bülent Ecevit University

Member: Mr. Murat İnce, Bülent Ecevit University

Events & Social Event:

Coord: Mr. Murat İnce, Bülent Ecevit University

Member: Mr. Mustafa İnan, Bülent Ecevit University

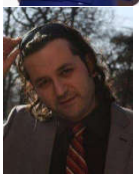
Media Publications:

BÜLENT ECEVİT ÜNİVERSİTESİ

Coord: Bülent Ecevit University Press and Public Relations Office &
Istanbul University Press and Public Relations Office

Accommodation:

Coord: Mr. Murat İnce, Bülent Ecevit University



Member: Mr. Mustafa İnan, Bülent Ecevit University

Transportation:

Coord: Mr. Mustafa İnan, Bülent Ecevit University

Member: Mr. Murat İnce, Bülent Ecevit University

Table of Contents

UI GreenMetric World University Ranking: Background of the Ranking

1. Initiation 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 The 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 of the year, from the universities we have contacted and who are willing to provide information.

4.7 The results announcement

The results of the metrics is usually released in December.

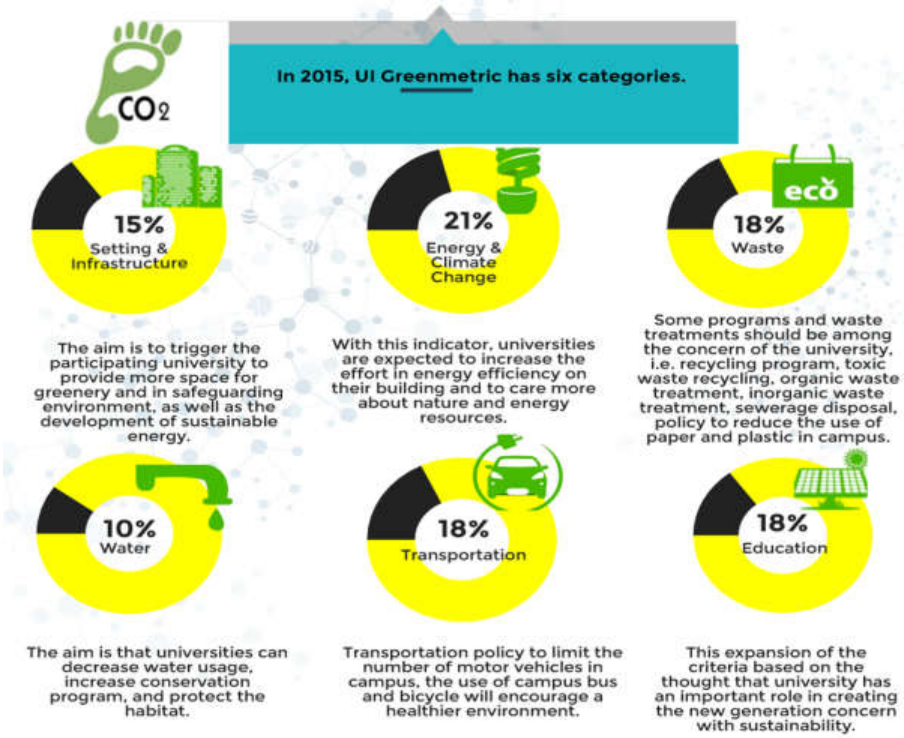
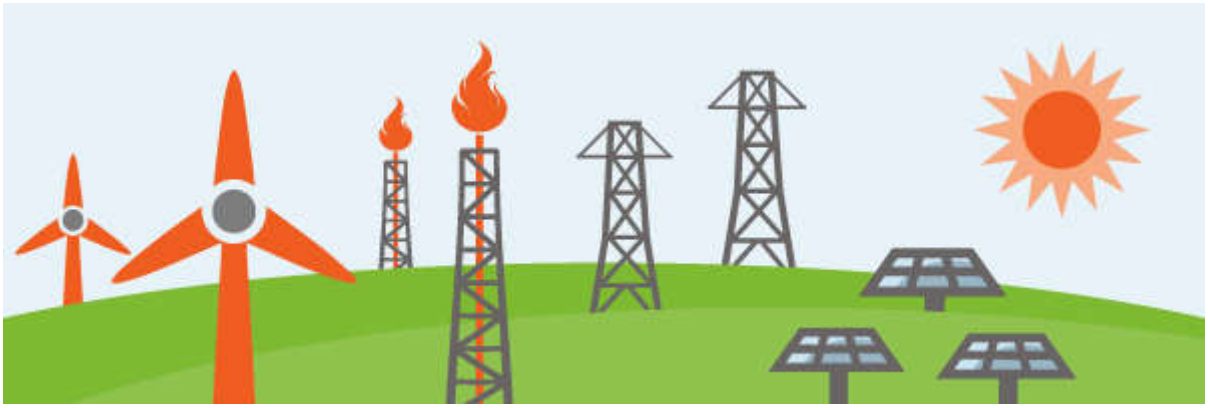


Figure 1. Indicators and Weightings of UI GreenMetric World University Ranking 2015-2016

Panel Session 1
Issues and Innovation in Managing Energy



Carbon Footprint of Bulent Ecevit University, Devrek Campus: A Case Study

Sefa Kocabaş[*1, a] and Serkan Ören[2, b]
[1] *Department of Environmental Engineering, Faculty of Engineering, Bülent Ecevit University, İncivez 67100, Zonguldak, Turkey*
[2] *Devrek Vocational School, Bülent Ecevit University, 67800 Devrek, Zonguldak Turkey.*
[a]sefa@beun.edu.tr, [b]oren.serkan@beun.edu.tr

Abstract. The amount of greenhouse gases in the Earth's atmosphere is increasing rapidly as a result of energy demand and the usage of fossil fuels since industrial revolution. Greenhouse gases (GHG) causes the global warming and climate change due to capability of their heat absorption. The higher education institutions not only have a research and education role but also have a role on exploring and practicing environmental sustainability. The calculation of carbon footprint which is the measure of carbon dioxide or greenhouse gases (GHGs) emissions by an individual, organization, event or product expressed in CO_2 equivalents [1].
Institutions are working to become carbon neutral by reducing their GHG's. They are lowering energy usage, using renewable energy and points the importance of sustainable living. The measurement and calculation of the CO_2 emission during activities at institutional level is a very important starting point and the data obtained by carbon footprint calculations may helpful to reduce the environmental impacts of institutions.
In this study, the carbon footprint of Bülent Ecevit University Devrek Campus, calculated by DEFRA method for the years 2012 and 2016. The number of students, the infrastructural changes, transport, waste management, recycling, electricity and fuel consumptions have analyzed for the years 2012 and 2016. Devrek Vocational School's carbon footprint for the years 2012 and 2016 was found to be about 557 and 492 tons CO_2-eq, with heating, transportation and other activities contributing about 50- 35%, 37 -49% and 13-15% respectively.

Keywords: Carbon Footprint, Greenhouse Gas Emissions, Devrek Campus.

1. Introduction

The term carbon footprint have been introduced about more than two decades ago and become a very useful tool to measure/calculate the GHG emissions by an individual, organization, event or product, and expressed in CO_2 equivalents.
Not only the corporations and universities but also Universities are working to become carbon neutral, and working to reduce their greenhouse gases emissions, lower their use of energy, use more renewable energy, and points the importance of sustainable living. The measurement and calculation of the CO_2 emission during activities at institutional level is a very important starting point and the data obtained by carbon footprint calculations may helpful to reduce the environmental impacts of institutional activities.
Bulent Ecevit University was established in Zonguldak, where one finds a harmonious union between nature's green and blue, in 1992. Bülent Ecevit University is recognized as a regional university that also operates in five nearby towns. With an academic staff of 1107 and 1,245 administrative staff, it continues to develop by establishing new departments and master programs. For last 3 years 2014, 2015 and 2016 BEU is the first university in the UI GreenMetric World University Ranking.
Devrek Vocational School is established at Devrek District of Zonguldak in year 2001 and have a green campus with an area of 230.950 m^2 with the ratio of 4 % to universities all campuses areas. In 13 programs with 1547 students, environmental sustainability is the must course in all programs.

Since 2012 BEU begun the work of ”being a sustainable” university, calculating Devrek Vocational School’s carbon footprint was the first attempt on collecting data about GHG’s. In this study, the carbon footprint of Bülent Ecevit University Devrek Campus calculated by DEFRA method and data are compared for the years 2012 and 2016.

2. Materials and Methods

Throughout the work mainly; the energy consumptions; transportation activities and electricity for office works and coal consumption for heating were taken into account. A numerical overview about Campus given in Table 1. Namely, number of students and stuff, number of vehicles, consumption of electricity, water and coal data obtained for the years 2012 and 2016.

Table 1. Devrek Campus data for the years 2012 and 2016

	2012	**2016**
Number of Students	1101	1547
Number of Stuff	50	60
Number of Active programs	10	13
Vehicles	28	36
Number of vehicles from Zonguldak to Devrek	3	6
Distance for appointment of staff (km/year)	13200	11790
Organic Waste (tons/year)	2.8	2.5
Electricity (kwh/year)	133306	152105
Water (tons/year)	9000	7514
Coal (tons/year)	80	60
Official Vehicle Fuel (L/year)	720	-

During the work detailed data collected for the vehicles of stuff.
There are many different methodologies for calculation of Carbon foot print in literature [2]. In this work Defra (Department for Environment Food and Rural Affairs, UK) ‘Guidance on how to measure and report your greenhouse gas emission conversion factors used for the calculations [3]. This Guide is designed to support businesses and other private or public sector organizations in reporting their greenhouse gas emissions. The guidance is accompanied by annually updated emissions conversion factors and calculation tool. In this study 2012 and 2016 revised emission factors used for the calculations. Scopes 1, 2 and 3 used for the determination of direct and indirect emissions during activities at Devrek Campus. Also GHG Protocol Website has been used to obtain 2016 emission factors.

3. Results and Discussion

Direct energy usage as electricity and coal consumption included to determine the energy emissions. A detailed work done in order to understand the vehicle specifications, fuel type and distance traveled for the transportation activities. In the scoping stages of this work good and services emissions delivered to campus and water usage did not included.

3.1 Energy emissions

Devrek Campus energy emissions originate from direct energy consumption of electricity and coal used for heating system. To determine the carbon footprint associated with the use of electricity on campus, the amount of electricity in kWh was multiplied by the CO_2 emissions factor obtained from DEFRA methodology and GHG Protocol Website.
The annual electricity consumption of Devrek Campus for the year 2012 and 2016 are 133306 kWh/year and 152105 kWh/year respectively and GHG emissions in CO_2-eq from electricity consumed on Devrek campus range from about 70.2 tons CO_2-eq in 2012 to about 72.9 tons CO_2-eq in 2016, given in Table 2.

Table 2. Electricity consumption and GHG emissions for the years 2012 and 2016

	2012	2016
Electricity (kWh/year)	133 306	152 105
GHG (kg CO_2-eq)	70 204	72 858

The heating of Campus buildings provided by a coal fired plant, the coal consumption data and the calculated GHG emissions in CO_2-eq given in Table 3 for the years 2012 and 2016. Thermal insulation construction done for the Campus main building leads the decrease in emission.

Table 3. Coal consumption and GHG emissions in CO_2-eq for the years 2012 and 2016

	2012	2016
Coal (tons/year)	80	60
GHG (kg CO_2-eq)	276 004	171 402

3.2 Transportation Emissions

The transportation emissions cover emissions from commuting to and from Devrek Campus. Emissions from stuff and students' vehicles, shuttle between campus and Devrek city center, fleet for stuff after 2013 and official travels considered. For calculations of 2012 the size of car and fuel type obtained by a survey. The vehicles identified by market segment for the carbon footprint calculations of the year 2016. For all transportation activities at Devrek Campus GHG's in CO_2-eq given in Table 4,

Table 4. GHG emissions by transportation activity in CO_2-eq for years 2012 and 2016.

	2012(kg CO_2-eq)	2016(kg CO_2-eq)
Staff and students vehicles	27 504	23 232
Public transportation	177 870	220 305
Fleet for staff	-	967
Official travels	3 290	1 199
Total	208 664	245 703

The total emissions from the travel of staff and students to Devrek Campus for 2012 has found about 208.6 tons of CO_2-eq. 85 % of the total emissions is from commuting of students to Campus by public transportation. Private vehicles, fleet for staff, official travel depended emissions are the rest.

3.3 Organic Waste Emissions:

The activity related with solid waste disposal from the campus are also taken into account. Quantities and types of organic waste removed from the campus identified for the years 2012 and 2016. Table 5 presents the greenhouse gas emissions in CO_2-eq related with organic waste disposal.

Table 5. Organic waste related GHG emissions in kg CO_2-eq

	2012	2016
Organic waste GHG (ton CO_2-eq)	1 698	1 820

3.4 Total Carbon Footprint of Bülent Ecevit University Devrek Campus

Total carbon footprint of the Bülent Ecevit University Devrek Campus can be seen in Table 6. It shows that the activities in year 2012 release about 556 tons of CO_2-eq emissions, with about % 50 of those emissions related with the consumption of coal for heating. Commuting of students to campus is the second most carbon source activity.

Table 6. Total GHG emissions in kg CO_2-eq

	2012	2016
Heating	276 004	171 402
Electricity	70 204	72 858
Transport	208 664	245 703
Organic waste	1 698	1 820
	556 570	491 3

4. Summary/ Concluding Remarks

In order to clear out the carbon footprint of Campuses it is recommended that all activity data should constantly be monitored and updated. Since 2013 a detailed data collection is going in university departments. For future planning reliable and precise data would be essential. The purpose of this work is to determine the carbon footprint at Devrek Campus for the year 2012 and 2016. It was the first step to understand the impacts of activities on environment.

Insulation and sealing of the main building at Devrek Campus have a positive impact on the decrease of carbon footprint since 2012. A lower carbon fuel like biomass or natural gas should be considered for future. Bicycle is the best alternative to driving and transportation by fossil fuel engine coaches. For 2017 new bicycle parking constructed in campus and a bicycle road between campus and Devrek city center was planned. Also reuse and recycling activities begun at campus should be improved.

In order to implement a carbon neutral campus, with in the continuous improvements, the annual changes on GHG emissions can be used for the suggestion of feasible reduction goals and keep the GHG emissions under control. Mainly the green campuses will be in action with the awareness of high school students about Carbon Footprint and best practices must be shared.

References

[1] Carbon Footprinting: An Introduction for Organisations, The Carbon Trust 2007, CTV033, Available online at http://www.sustainabilityexchange.ac.uk, accessed on 20.03.2017

[2] Analysis of Existing Environmental Footprint Methodologies for Products and Organizations: Recommendations, Rationale, and Alignment, European Commission, Joint Research Centre, Institute for Environment and Sustainability (IES), 2011.

[3] Environmental Reporting Guidelines: Including mandatory greenhouse gas emissions reporting guidance, Department for Environment Food & Rural Affairs, June 2013

[4] GHG Protocol, Calculation tool for GHG emissions from purchased electricity, http://www.ghgprotocol.org/calculation-tools/all-tools, accessed on 20.03.2017

Energy and Climate Management Techniques Employed by Institute for Financial Management and Research (IFMR) at its New Greenfield Campus

Mr CV Krishnan*[1, a], Lt Col Satya Saran*[1,b], Mr D Ramakrishnan[1,c]
[1]*IFMR University, 5655, Central Expressway, Sector 14, Sri City, Andhra Pradesh, India -517541*
[a]cvk@ifmr.ac.in, [b]satya.saran@ifmr.ac.in, [c]ramakrishnan.d@ifmr.ac.in

Abstract. Institute for Financial Management and Research was set up as a Not for profit society in 1970 with the vision of Shri H.T. Parekh and ICICI. From 1970 till 2014, IFMR was located at Chennai in India. Keeping in tune with its expansion plans IFMR relocated to Sri City in Andhra Pradesh, India. The year 2014 at IFMR is momentous in its glorious history because IFMR was welcoming young minds to its new campus at Sri City. IFMR consciously embarked on this path of change, fully realizing that managing such changes was increasingly becoming crucial. IFMR views Incorporating Sustainability at multiple levels and is not just a buzzword or something just cool to be associated with. IFMR sincerely believes at its core that implementation of Sustainable and Green Practices are the only way to develop and grow in real terms.

Keywords: Green Campus, Sustainability, Renewable, Energy, Climate Change, Smart Campus, IFMR University

1. Introduction

1.1 About IFMR

Institute for Financial Management and Research was set up as a Not for profit society in 1970 with the vision of Shri H.T. Parekh and ICICI. Ever since IFMR has had a rich track record of 46 years in research and education. IFMR has been performing India's largest and most impactful research work in Financial Inclusion, impact evaluation of development programs, evidence for policy making and digital financial payments. IFMR is also the South Asia centre for MIT's Laboratory for Poverty Alleviation and Gates centre for Digital Financial Inclusion.

1.2 Necessity for Relocation of IFMR to New Greenfield Campus

From 1970 till 2014, IFMR was located at Chennai in India. Keeping in tune with its expansion plans IFMR relocated to Sri City in Andhra Pradesh, India. The year 2014 at IFMR is momentous in its glorious history because IFMR was welcoming young minds to its new campus at Sri City. IFMR consciously embarked on this path of change, fully realizing that managing such changes was increasingly becoming crucial. An essential step to put location/place in the strategic context is to accept that the place is of no value to an organization regardless of its economic value in an external market if it does not support the objectives of the organization. In his influential writing, Thomas Markus [1] argued that buildings are usually treated as art, technical or investment objects, rarely as Social Objects. While the form and space of a building are almost permanent, their function as 'the social practice of use' is divined into the building and can change. He implies that buildings in a sense are shaped by their users, by occupants and visitors in the past and by us, as soon as we arrive. Tom Peters [2] likewise argues - 'In fact Space Management may well be the most ignored- and most powerful- tool for inducing culture change, speeding up innovation projects, and enhancing the learning process in far-flung organizations. While we fret about facilities issues such as office square footage allotted, we all but ignore the key strategic issue – the parameters of intermingling.' We are now placed at this critical juncture where we can leverage the space and location advantage to build and enhance our core skills as an organization exponentially while being sustainable in growth. The journey though from here is as every Greenfield Project is: no need to work within the constraints of existing buildings or infrastructure, a huge canvas to work on, decision making under uncertainty, urgency of immediate requirements, balancing and sustaining the long-term viability while navigating through the short-term issues. IFMR

Campus at Sri City is ideally poised to build on this next phase of growth. There is no set of rules that we can follow for developing the optimum physical configuration to enhance the learning environment, instead it is a constantly evolving effort to find the best fit which meets current and future demands. What it requires making it successful and sustainable, is, that all the stakeholders are unified in undertaking that effort.

1.3 Attributes of IFMR's New Greenfield Campus at Sri City

IFMR's New Campus at Sri City in the State of Andhra Pradesh, India was a site that met the objectives that were considered essential for relocation. While the site offered the flexibility of having a clean canvas to paint on as per the growth plans envisaged, it also required clear plans on the ways to achieve it within the constraints of budget in the real world. Jeremy Myerson [3] described the process of cultural change among staff to introduce new business practices to respond to new challenges, linking cultural change directly to a redesign of the physical work environment. He suggested four generic organizational models – the 'monolith', the 'makeshift', the 'moderniser' and the 'mould breaker' of which the latter two could be described as progressive models while the former were entrenched in soon to be outdated status quo. It is against this backdrop that IFMR saw itself as a 'moderniser' and moved from being a traditional 'monolith' organization and was determined to change its traits by relocation from a city centre to a greenfield campus. This move was the impetus for a new culture to flourish amid bright, new modern surroundings. The climate at the new location is tropical. When compared with winter, the summers have much more rainfall. The climate here is classified as Aw by the Köppen-Geiger system with the average annual temperature at 28.8 °C and the average annual rainfall is 1167 mm. The driest month is February, with 4 mm of rain. In November, the precipitation reaches its peak, with an average of 288 mm. May is the warmest month of the year. The temperature in May averages 33.5 °C. At 24.5 °C on average, January is the coldest month of the year. There is a difference of 284 mm of precipitation between the driest and wettest months. The variation in annual temperature is around 9.0 °C. The average humidity at the location is 75 % and ranges between 55 and 88 %. The soils of the area can be broadly classified as Latosolic developed on the coastal laterite, Yellow podzolic soils formed on the sandy sheet of alluvium. The transition located at the contact of laterite and alluvium is podozolic–latosolic soil.

1.4 Importance of Sustainability Initiatives at IFMR.

IFMR views Incorporating Sustainability at multiple levels and is not just a buzzword or something just cool to be associated with. IFMR sincerely believes at its core that implementation of Sustainable and Green Practices are the only way to develop and grow in real terms. Energy and Water Costs were an area of concern right from the start of the University Project at the New Location and IFMR chose to address this methodically in a manner that would ensure that the gains are permanent. IFMR recognises Sustainability improvements are a collaborative effort and deliberately planned to ensure that employees work together to identify and implement green and sustainable initiatives and it has quickly achieved dividends in fostering a culture of teamwork and continuous improvement. By internally communicating the importance of changes and the impact they are having on the business and environment, we sought to positively influence the organisational culture. Along the journey, we also noticed that Sustainability ignited innovation. Acknowledging the Societal impact of such initiatives was in the DNA of IFMR being involved with various research projects across India on sustainability and development. IFMR views environmentally sustainable economic growth and Sustainable Development as the two sides to a coin, the goal of which is to achieve balance/harmony between environment sustainability, economic sustainability and socio-political sustainability. IFMR drew upon the large repository of Indian culture and drafted its vision for Sustainable Development which also resonated with its ambitions for the growth of IFMR. It was on this bedrock that the Vision and Strategy for the growth of IFMR for the coming years was developed.

2. Vision-Strategy and Planning for a Sustainable Green Campus

2.1 Vision

While the Business Vision of IFMR University is summarised as under, how we intended to achieve that was the attribute of the vision that required a deeper understanding and commitment at the strategic level and clear focus at the planning and execution level.

- To provide world class education in India.
- To conduct high quality research with focus relevant to society and industry.
- To produce Tomorrow's leaders and to promote economic growth of the region.

2.2 Strategy

While grappling and understanding the Vision multiple courses were available to execute the vision through various stratagem. The innate strength and commitment of the organisation was its will to achieve the vision in a manner that is sustainable and organic. Pursuing the Vision without regard to the impact on future generations, the environment and the society was the easiest yet hazardous and unsustainable albeit showing the current incumbents in good light with impressive results and financials. But the hidden costs which do not show up in the balance sheet or the profit and loss account are much too large to give a wink by. While the need for Sustainable Growth and Development was deemed mandatory, it did not come without a few of the implementation issues such as uncertainty, shortage of finances, lack of expertise, need for early and quick results, a benign profit and loss account and creating awareness amongst all the stakeholders that are often associated with projects that share this vision. Being an institution that had the three mandates of achieving world class education, quality research aimed at society and industry and producing tomorrow's leaders - A grounding and real awareness and the commitment to sustainability over the long run was deemed essential. This was rightly so, since, gains that do not stand the test of time are irrelevant. Being an educational institution this responsibility was much greater since this was the cradle in which ideas and actions would take birth that establish best practices for generations and times to come. This formed the core of our Strategy. The Strategy that evolved was to imbibe the local nuances of culture, people, climate and resources and couple it with our own knowledge to create a Centre of Excellence that would serve as role model for emulation by the immediate and greater community around. By such inclusive growth within the greater community beyond the immediate University, partner with other leaders working on sustainability and build a society that is responsible at large.

2.3 Planning and Execution towards a 'World Class' Campus

The Vision and Strategy being what they are, it is at Planning and Execution where the rubber hits the road. The Choice of the Site was a Strategic Decision that had many factors associated with it, but it was mainly because, the location was a growing industrial and business hub and establishing a University amidst such a setting was considered beneficial to all the stakeholders of the society. The implementation of the Vision and the Strategy required clear planning and focussed execution because of the tight budgets and even tighter timelines. While those were such, the need for incorporating the best practices in the face of uncertainty required an approach that was optimal and phased which served as the guiding beacon during planning.

Boyd's Loop [refer Figure 1] was the model that was used for the planning and execution process to grapple with the uncertainty and the constraints imposed in building the 'World Class' Campus. With the acquisition of the site in 2012 and the intent to operationalise the campus from Jun 2014 it gave a window of less than three years to execute the project in sync with the Vision and the Strategy.

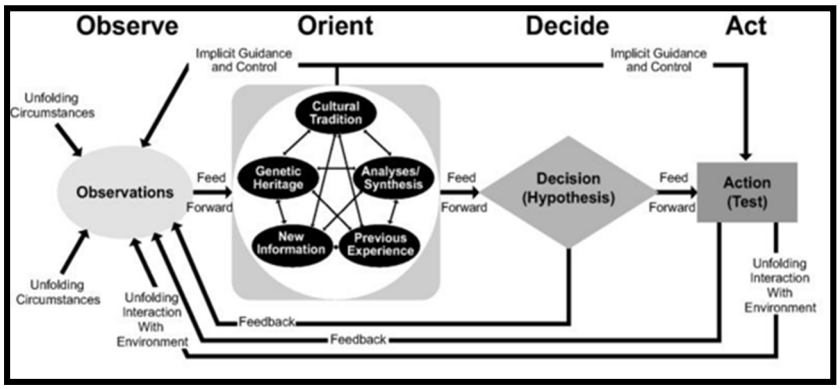


Figure 1. Use of Boyd's Loop in Planning and Execution Model for building the IFMR's Sri City Campus (Source: Col. John Boyd, U.S. Air Force, https://www.sans.edu/cyber-research/leadership-laboratory/article/ooda-richard-porter)

Before we proceed to see the instances of planning and execution in action, it is necessary we reiterate the broad intent drawn from the Vision and Strategy.

- Operationalize the Campus by Jun 2014.
- No Budget Overruns. (Both in Time and Money)
- Quality in Construction.
- Safe Campus.
- Capacity Expansion to be Need Based.
- Have an overall plan but tackle the areas individually so that everything is in harmony.
- Capital Expense to ensure revenue expenses are minimum.
- Capital Expenses should be dictated by utility to the maximum population.
- Reduce dependence on resources from external utility providers by promoting sustainability.
- All aspects must be locally viable with a global view.
- Build a platform for the maturity of the University Community towards sustainability.
- Consultative Decision making once the community matures.
- Involve the Local Community from whom the land was acquired as a part of the team working towards the Development of the University and their community.
- Knowledge Sharing amongst the entire community and make them partners in the Sustainability Initiative.

3. Challenges faced at IFMR University during the Sustainability Initiative Implementation Phase.

The main challenges faced during the implementation of sustainability initiatives at IFMR have been the following. While these are no means exhaustive, they are indicative of the issues that were typical to the location and the status of IMFR at the juncture.

- Tight Budgets.
- Strict Timelines for 'Go Live' dates.
- Lack of awareness about sustainability.
- Wide disparity between short term and long term priorities
- Poor Access to resources and execution agencies.
- Some hints of animosity/a feeling of deprivation amongst the locals whose land was acquired as a part of a greater initiative for the development of the business district.
- Uncertainty and lack of clear knowledge on the business growth at the new location.
- Poor quality awareness in the construction industry.
- Coastal Area and the geographical location was disaster prone with almost one major natural disaster due to cyclones/heavy winds every year.

- Semi-Arid/ Humid Sub tropical conditions with high humidity required acclimatization for residents not from the same geography leading to a higher demand on utilities and resource draining modern comforts.
- Poor Soil definition coupled with harsh weather leading to a narrow choice in the types of flora that thrive under such conditions. Required a deeper analysis and study to implement a sustainable campus forestry initiative.
- Change of land use from its historical use.

4. Development of IFMR Ecosystem and Results.

4.1 The Results Achieved by IFMR's in Sustainability Initiatives.

The progress achieved in all the parameters of the UI GreenMetric ranking are summarized below. This is still a work in progress and requires sustained efforts to achieve sustainability on ground and similar mind set towards sustainability in all stake holders.

4.2 Setting and Infrastructure at IFMR University

- Humid sub-tropical climate amidst a rural setting.
- Spread over 33,994 Sqm of area with a total built-up area of 3, 04.349 Sft.
- Natural forest cover accounts for about 2% of the total campus area with more than 17.5% of the area covered by planted vegetation.
- The total area available for water absorption besides forest and planted vegetation accounts for about 52 % of the area.
- The total number of residents within the campus is between 360 to 400.
- While rapidly changing competitive environments are an impediment to long term commitments on infrastructure, this has been overcome at IFMR University by growing the campus in phases and in a sustainable manner. The common thread in all the phases has been the will to stick to the sustainability plan that was charted to cater for the entire IFMR Eco system and the neighboring communities at large.

4.3 Energy and Climate change initiatives at IFMR University

- IFMR University's most impactful work has been in Energy and Climate change.
- Incorporation of modern appliances and comforts that were sustainable in the long run.
- Reduced the dependence of the community on this energy guzzling equipment.
- Investment of nearly 65% of its capital budget on energy efficient systems.
- Installation of a 0.5 MW Solar Power Plant was installed that caters to about 81% of the current consumption of electricity.
- To reduce the dependence on Liquefied Petroleum Gas in the campus kitchens a bio gas plant that generates about 500kg of organic fuel from organic waste was installed.
- Offset the carbon footprint due to the HVAC systems in campus with more than 2800 trees planted that are local to the area and consume high quantities of Carbon Dioxide.

4.4 Waste and Water Management at IFMR University

- Committed to achieving 100% recycling of water being used in the campus.
- Complete rain water harvesting and 100 % collection of all surface runoffs,
- Partner with the developers of the business district, M/S Sricity Pvt Ltd to treat and recycle all the grey and black water.
- Rain water harvesting systems by creation of suitably sited lakes, ponds and collection tanks to fully collect all the rain water recharge ground water and eradicate wasteful runoffs.
- Installation of water saving devices through float control systems in all Overhead Tanks, Auto Cutoff of water in all common toilets and usage of recycled/harvested water for garden sprinkler systems.

5. Summary/ Concluding Remarks

The confirmation that IFMR embarked on a path that is sustainable is borne out by its success reflected in its ranking performance during the Seventh UI GreenMetric world university ranking 2016. IFMR views this success as an encouragement and motivation to continue further on the path of Sustainability Initiatives. IFMR is also keenly desirous of exploring various partnerships with world leaders in the field to share and acquire knowledge and technology related to sustainability best practices. UI GreenMetric, Universitas Indonesia has been the beacon for many institutions across the world by building awareness, momentum and knowledge sharing that ensures that Global Concepts are available at local levels to further improve sustainable development across university campuses worldwide. The authors wish to place on record their thanks for the support and opportunities provided by UI GreenMetric. Universitas Indonesia in this seminal endeavor.

Martha A. O'Mara's [5] views are echoed at IFMR when she says –While the external strategic environment drives both the forecasting horizon and strategic goals of an organization's real estate and facilities, the internal dynamics of an organization determine how those are developed, designed and managed. This combination of demands from the strategic environment and the idiosyncrasies of each organization's culture, history, workforce, and leadership are what make a Universities' real estate and facilities unique to any other. There is no one set of guidelines that can be followed for developing the optimum physical configuration and environment. Instead, it is a constantly evolving effort to find the best fit that meets current and future demands. And while fit can be felt by the occupants and often seen by outsiders, it is hard to quantify and can even be difficult to articulate clearly.

IFMR recognizes the need for greater awareness of the initiative amongst all the stakeholders and towards this end is working on designing various workshops/information sessions/activities. These training and awareness initiatives seeks to empower and spread the knowledge of best practices in sustainability across various groups of stakeholders. These programs are planned to be designed taking due note of the background, age, awareness levels and education of the target groups. Much work in terms of creating awareness is to be undertaken by designing programs that will make these initiatives self-starting, self-sustaining and progressive. Partnerships in this area is a great way to build the momentum fast and achieve significant progress. Towards this end IFMR proposes possible collaboration in the areas of designing and delivering awareness programs, activity workshops, flagship events for various age groups, dissemination of information at the village and grass root level that will ensure that the road ahead will be inclusive.

References

[1] Markus, T.A., 1993. Buildings and power. London: Routledge.
[2] Peters, T., 1992. Liberation Management: Necessary disorganization for the nanosecond nineties. London: Macmillan.
[3] Myerson, J., 2012. Workplace Redesign to Support the 'Front End' of Innovation, Managing Organizational Ecologies. London, NY: Routledge
[4] UI GreenMetric, 2016. UI GreenMetric world university ranking. Available online at http://greenmetric.ui.ac.id/, accessed on 09, Dec, 2016
[5] Martha A. O'Mara., 1999. Strategy and Place: Managing Corporate Real Estate and Facilities for Competitive Advantage, NY: The Free Press.

Green NCNU in the Heart of Taiwan

Yuhlong Oliver Su[*1,a], I Chung Liu[2,3,b], Ku Fan Chen[2,3,c], Yen Tsung Chang[3,d]
[1]*Office of President, National Chi Nan University, 1 Road, Puli, Nantou 54561, Taiwan, ROC*
[2]*Department of Civil Engineering, National Chi Nan University, 1 University Road, Puli, Nantou 54561, Taiwan, ROC*
[3]*Environmental Protection and Occupational Safety and Health Center, National Chi Nan University, 1 University Road, Puli, Nantou 54561, Taiwan, ROC*
[a]yosu@ncnu.edu.tw, [b]icliu@ncnu.edu.tw, [c]kfchen@ncnu.edu.tw, [d]ycchang@ncnu.edu.tw

Abstract. National Chi Nan University (NCNU) was founded in Puli, Nantou County, Taiwan. NCNU campus is surrounded by a natural and ecological diversity. Thus, we have always valued and attached great importance to carbon reduction, environmental education and conservation. Since NCNU was officially established, we had completed the pollution control equipment, operation system and management in the campus. Buildings in NCNU were also designed to meet Green Building regulation with over 88% greening and natural ecosystem in campus. In order to maintain the environment and ecosystem in the campus, NCNU promoted the environmental education through academic research and in community, such as educating the faculty and students to get into the habit of conserving energy to reduce carbon emission in daily life and becoming environmentally-liable citizen to form the sustainable development culture, then influence other schools, communities and societies in the neighborhood. NCNU devotes itself to sustainable development as a community care provider, an environment friendly mover, a sustainable development educator, a comprehensive community development pilot, and a corporate social responsibility practitioner.
NCNU focus more on campus sustainable development movement recently. Firstly, we have signed The Talloires Declaration in 2009 to be one of the world leaders in developing, creating, supporting and maintaining sustainability. Secondly, we devote ourselves to social care issues, such as new immigrants, aborigines, disadvantaged students, geriatric care, and etc. Thirdly, we address social and environment issues by collaborating with 3 local sustainable communities- Tao-Mi, Lan-Cheng and Mei-Xi, in the aspects of eco-town, community care, green economy, culture promotion, and civic engagement, and as a result, we came out new comprehensive community development movement together. Fourthly, the sewage disposal in NCNU conformed to the regulation. Fifthly, total electricity and water usage remain the same without increase; Reclaimed water occupied 39.83% of the total water, established transparent solar collectors, built energy management system, and the treated wastewater reclamation and reuse. Sixthly, we have organized environmental education and compulsory occupational safety and health education and training. Seventhly, we have set up Green University team, gained ISO 14001 certificate of environmental management and joined some Green University Alliances, such as Green University Union of Taiwan and etc. NCNU has a strong tradition of outreach and public engagement that go back to the very beginning of the university. In the crisis of energy shortage and global warming, NCNU acting as an education institute will take its social responsibility to make every effort for earth sustainability.

Keywords: Green University, Green NCNU, Sustainable Development, The Talloires Declaration.

1. Global Environmental Changes

In 2014, the impact of global warming was faced by the world. Italy and France experienced heavy rainfall and floods in September, the Philippines was hit by a typhoon in December, and Northern China experienced the worst drought in 60 years, with USD1.2 billion worth of agricultural damages caused by drought in that year alone. These were all natural disasters caused by climate change in 2014. According to the assessment report of the "2014 Pan-Pacific International Conference on Climate Change", Taiwan will also face more extreme weather patterns as the global temperature rises by 1 degree Celsius, leading to more floods and droughts in the future.

Climate change is a global environmental issue that concerns the survival of 7 billion people and countless lives. The US has therefore raised concerns about the environment since the 1950s, and the energy crisis in the 1970s made the concepts of environmental protection and sustainability areas of focus in schools. In recent years, with the emergence of constant extreme weather in various parts of the world, people truly began to understand the importance of maintaining the environment. International organizations and ecological conservation scholars have urged world leaders to pay attention to the issues of ecology and environmental sustainability. Universities and colleges have come up with measures in response, forming the blueprints of "green universities".

2. The Emergence of Green Universities

The concept of "green university" was first developed in order to lower the negative impacts on the environment arising from the operating of schools. Universities run on a considerable amount of electricity, petroleum, natural gas, water and chemical resources. A university with a large campus and many students might use up more resources than simple communities, institutions, or corporate organizations. Operating a university generates large amounts of waste, wastewater, chemical materials, and toxic waste, eventually leading to environmental issues on the campus and in neighboring communities. Therefore, lowering the impact of campuses and communities on the environment was the fundamental problem that early 'green universities' aimed to solve, and university environmental movements in response to these issues emerged. (Creighton, 1998; Bartlett & Chase, 2004)

Higher education plays a very crucial role in the developmental process of human society and civilization, the notion of "green university" indicates that universities should conduct school activities with the concept of "sustainable development" in mind. The term also represents the important responsibility higher education has in the development of human society. In the past 20 years, universities around the world have been actively promoting the "greening" of schools, banding together to form coalitions promoting relevant projects, administrative and educational work.

3. How National Chi Nan University Became a Green University

National Chi Nan University (NCNU) is located on the terrace of Tao-Mi, Puli Township. Puli is located in Nantou County, the center of Taiwan. NCNU has abundant natural and cultural attractions. Snowy peaks of Hehuan Mountain can be viewed from the campus in winter, cloudless nights are perfect for stargazing, and clear rainbows arching across the skies can be seen after rainfalls. The beautiful campus (as shown in Figure 1) can be described as "Sniff the spring fragrance; behold the fall night glory. Meet the summer breeze; appreciate the winter flurry".

Figure 1. A view of NCNU campus

Thanks to the natural advantages of its geographical environment, Puli Township not only has the best water source in Taiwan, but is also an important center of agriculture, horticulture, traditional handmade

paper and a major production center of lacquer. Since the 921 Earthquake in 1999, the change of landscape and severe impacts on life have made local residents realize the importance of environmental protection and sustainable development. Built in 1995, NCNU also experienced the 921 Earthquake, and took part in the rebuilding of Puli Township. Thus the school deeply understands the importance of a sustainable environment.

4. Promotion in the Campus

To effectively implement the concept of a "green university", NCNU, with the cooperation of academic units, has fully enhanced the scope and depth of courses and/or extracurricular activities and events related to sustainable development, and encouraged relevant academic research to promote a comprehensive environmental education system. Furthermore, through overall campus arrangements, NCNU has integrated ecological considerations and environmental protection ideals with campus management, creating a biologically diverse campus and living environment. In addition, in order to maintain environmental quality, NCNU has not only conducted environmental management measures such as pollution control, but has also formulated an energy saving and carbon reduction policy, through these steps, a campus culture for sustainable development is emerging. As a provider of social care, an environmentally-friendly activist, an educator of sustainable development, a leader of community building, and a practitioner of corporate social responsibilities, NCNU is an integral part of planning and promoting sustainable development in the region, as can be seen in Figure 2. Therefore, in order to realize the concept of "green university", NCNU first needs to reduce environmental risks and costs which might be caused by academic research, and to minimize the possibilities of accident for protecting environmental safety or health. This is why the NCNU has set up a school-wide green university promotional system (as shown in Table 1) that can help in promoting environmental protection projects.

Figure 2. NCNU Sustainable Development Diagram

Table 1. Green University Management System Overview

Name of Management Systems	Contents
Green University Union of Taiwan	The Green University Union of Taiwan held its inaugural meeting on July 22, 2013, where its director, supervisor, chairman, executive director, and executive supervisor were elected for the first time. NCNU president Yuhlong Su was elected as one of the directors.

ISO14001 Environmental Management System	NCNU obtained the ISO14001 Environmental Management System certification on May 9, 2012.
Gender Equity Education Committee	The Gender Equity Education Committee was set up to promote gender equity education, and to create educational resources and environments without gender discrimination.
Green University Promotion Committee	The Green University Promotion Committee was set up to protect the earth, enforce energy conservation and carbon reduction, foster citizens that are responsible to the environment, and maintain biodiversity.
Energy Conservation Promotion Team	Allocate budgets to execute annual energy conservation goals and project plans; to promote energy conservation measures; to keep regular records and conducts reviews and self-assessments.
Environmental Protection and Health and Safety Committee	The Environmental Protection and Health and Safety Committee was set up to protect the environment, prevent occupational hazards, and safeguard the safety and health of teaching staff.

4.1 An Environmentally-friendly activist

NCNU founded the "Environmental Protection and Health and Safety Center" as a unit overseeing environmental protection that actively promotes environment management and carbon reduction work. The main tasks concerning environmental protection and sustainable development around the campus are: (1) Setting up a sewage system for wastewater to protect nearby bodies of water, (2) Recycling, and disposing of waste adequately, (3) Striving to conserve energy and reduce carbon, to lower negative impacts on the environment brought about by operating the university. Energy conservation at NCNU is directed towards ecology and environmental protection, using as little resources as possible and minimizing waste, conserving energy with low pollution, low energy consumption, and low environmental impact, and striving for zero growth in electricity and water consumption. Short-term policies focus on reaching a school-wide consensus, promoting energy conservation ideas and practices, getting students and staff to get in the habit of turning off water and electricity as soon as they are finished using it, and setting up related measures for monitoring the progress. Mid-term policies focus on creating an outstanding environment for campus development, converting to water-conserving equipments, rainwater collection installations, recycling water and managing water usage efficiently, raising the goals of green campus energy policies and setting up concrete measures to conserve energy, speed up the usage of high-efficiency equipment and systems, promoting energy conservation management with supporting measures, raising incentives to conserve energy, promoting green architecture and renewable energy, and expanding the use of high-efficiency products such as energy labels and clean vehicles. Long-term policies include continuous implementation of energy conservation measures, strengthening energy management, and increasing educational efforts to achieve the goal of a comprehensive energy management system. The overall results of implementing all these policies on campus include: green purchasing makes up 90% of purchases, and recycling makes up 40%. Energy conservation over the past 10 years has reached 30% (won 1st place in the university and college division of the Ministry of Education's "The Excellent Energy Conservation Schools" in 2016), with renewable energy at 0.5%, and reclaimed water recycling at 80%.

4.2 An Educator of sustainable development

NCNU uses multiple methods to integrate concepts of environmental education and sustainable development into courses, so that students can learn about the environment through their courses and promote the ideas to nearby communities. Specifically, the methods include: (1) To turn the campus into a place of environmental education, (2) to promote learning cities, and build green towns, and (3) to provide courses on sustainable development, as well as a community building program, cultural industry policy program, green environmental protection program, and urban-rural ecology program,

integrating the idea of sustainable development into different programs. For example, the urban-rural ecology program (see Figure 3) offers courses on environmental protection and sustainable development as a basis, supported by courses on civic participation, community management, environmental economics, and local industries. Students can put what they have learned into practice in communities to further community development. The implementation of these courses can help students as they assist in the development of local communities and industries to evaluate possible impacts on the environment and come up with solutions. Making it possible for them to plan and organize a better community environment, take part in community management, develop local industries, revitalize local economy, and build an ecologically sustainable community while pursuing goals of sustainable environment development. Courses related to the environment and sustainability make up 26% of all courses.

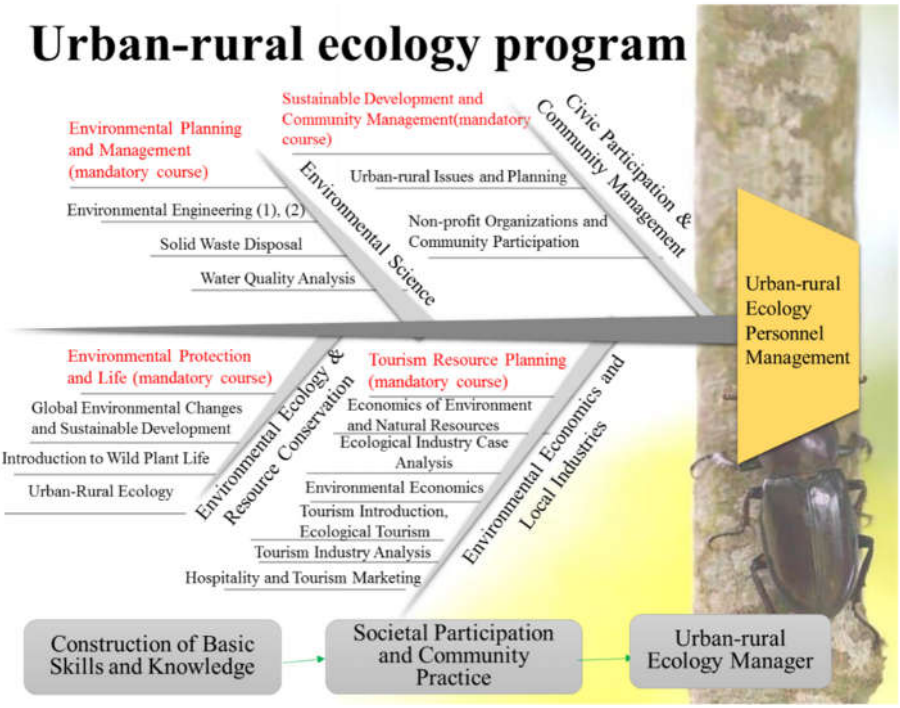


Figure 3. Urban-rural ecology program

4.3 A Provider of Social Care

The area in which NCNU is located has very diverse cultures, but lacks resources due to the urban-rural gap. Shouldering the societal responsibility of universities, the teachers and students of NCNU take up roles as social workers, taking care of aboriginal people, immigrants, the elderly, and in children's education. An education program specially designed for aboriginal youths and an Aboriginal Cultural and Educational Development Center were set up to raise incentives and capabilities of the targeted students to assist in the development of their communities and to pass on their culture respectively. The Southeast Asia Department and Southeast Asia Research Center were founded to educate local students to aware of Southeast Asian cultures and societies, as well as to show concern for how Southeast Asian immigrants in the area are making a living and adapting to life in Nantou. “Bodhi Chang Ching Village”, an experimental project for elderly care was launched, featuring a neighborhood mutual living assistance network, public gardens, community meals, and senior counseling sessions. In recent years, NCNU has continuously arranged for professional teachers and students to conduct regional and rural basic/innovative classes and tutoring to bridge the urban-rural gap. Since 2006, NCNU has had 10 years of experience for providing online tutorial program for more than 1,260 school children in rural areas.

4.4 A leader in community building

In terms of scope, population and scale, NCNU and Puli are very suitable to design and create a "University Town" together. The development of NCNU departments and programs and the future of Puli township have much in common so that a development strategy should be initiated jointly. The intention of University Town is one where NCNU and Puli township work together to bring out the best in one another. As a carrier of formal knowledge, a university still needs to make knowledge publicly available; for the same token, through the application of knowledge within local contexts, they can be thoroughly re-examined, reflected on, and re-constructed accordingly. On the other hand, as the result of constructing various kinds of "public space" from the community to cross-community level, domains for public discussion of emerging issues at the township level become possible. After all, the daily lives of local residents are roughly centered around Puli township, and issues concerning the community usually need to be discussed in detail at the township level. Therefore, the responsibility of being accessible to the public, and to act as an advisory body in the process, is inevitable for NCNU. The "University Town" tries to transform Puli Township into a touchstone of civic participation and decision-making on a township scope through the efforts devoted by NCNU. In this way, highly-involved residents will become equal partners with the university in the process of local community development. The concept of "University Town" can be fully realized in the project of "Call Spring for Shui-Sha-Lian[1]: Transition and Governance of a Livable Township". It is based field works conducted on three locations: Tao-Mi Community, Lan-Cheng Community, and Mei-Xi tribal community. Teams from RCHISPS (Research Center for the Humanities Innovation and Social Practice in Shui-Sha-Lian, NCNU) stayed in each location to work with the community, hosting seminars and actions about topics such as "ecology town, social care, green economics, cultural revival, civic participation". It is hoped that, through these efforts, energies for community development can be accumulated, and individual communities can be connected to developing a cross-community issues network for their future development. Individual communities are the dots, NCNU serves as the connecting line through which these communities can be webbed together, the transformation of Puli township to a livable town become possible (Figure 4).

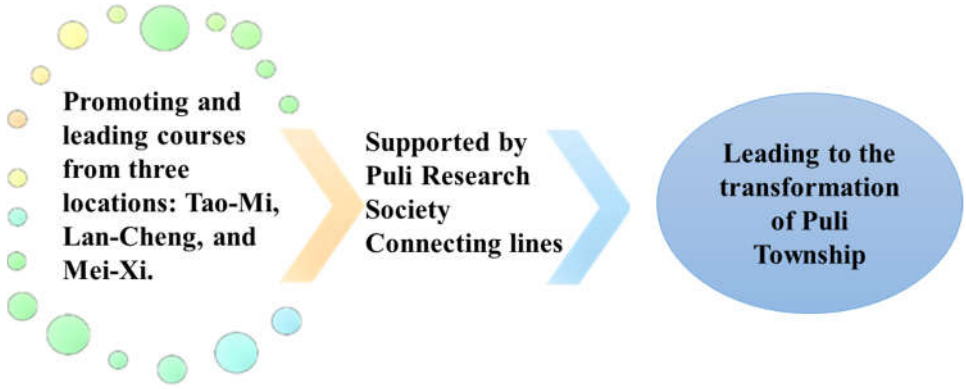


Figure 4. Call Spring for Shui-Sha-Lian: Transition and Governance of a Livable Township

4.5 A Practitioner of social responsibilities

NCNU has founded the "Shui-sha-lian Regional Cooperation Promotion Committee" in Nantou County. Members include the President of NCNU and educational administrative manager, as well as representatives from the Sun Moon Lake National Scenic Area Administration, Nantou County government, the Endemic Species Research Institute, Shui-Sha-Lian District Office, and local communities. Members span across central and local governments, as well as regional industries and

[1] Shui-Sha-Lian is an aboriginal name for the area of Puli and nearby Guoxing and Yuchi townships

organizations, making communication and cooperation on each side more efficient. In addition, NCNU has set up RCHISPS, with "Call Spring for Shui-Sha-Lian" as the ultimate goal, actively building mutual trust between the school and local communities, using humanistic care and innovative views of society to integrate research communities between each department and graduate programs, as well as local organizations. Regarding social problems in Shui-Sha-Lian, NCNU analyzes the situations with active research surveys, collecting all kinds of information and databases. NCNU students also work with communities, creating communication channels independently. For example, "Puli Research Society" is a non-government organization formed by NCNU students and Puli residents who are passionate about discussing public issues of Puli. It offers a platform for officials and citizens to share their opinions regarding concerned public issues. Acting as a local think tank, NCNU plays the consultation and advisory roles in the regional development of Nantou County. In recent years, all kinds of cross-boundary collaboration plans have been formed, creating more student-teacher teams that are willing to participate in community projects. There are also start-up teams with green economic qualities that offer new solutions to regional development issues. Overall, there are 45 teachers working on local community projects (roughly 1/5 of NCNU faculty members), and each year, 11,000 students attend community project courses (roughly 1/5 of NCNU student body), leading to 30 relevant social research topics, and connecting with 12 government departments (Figure 5).

Figure 5. NCNU Cultural Innovation Community Project Tasks and Results Since 2013

5. Conclusion

Human beings are at the core of the issue of sustainable development, and human attitude is the key to its success (Wang Min, 2002). From this point of view, education plays an important role in sustainable development; only by realizing sustainable development in education, can society achieve the goal of sustainability. Therefore, in response to the rapidly-changing environment, universities and colleges should uphold the spirit of higher education and comprehensively integrate the idea of sustainable environment to courses and campus life, thereby spreading the idea to nearby communities, and strengthening the important ties between education and environmental protection.

Because the logic behind how schools operate is a socialization process (Cortese, 2003), schools have the potential function of social operation, financial stability, and community environmental protection, and the responsibility of leading society to sustainable development. Thus, schools have undeniable influence on the direction in which society as a whole develops. When mankind faces major environmental issues, implementing environmental education in schools becomes all the more important.

NCNU upholds the ideals of maintaining campus environment and ecological sustainability. By integrating environmental education with research studies and daily life, and applying administrative measures, NCNU leads students and staff to actively take part in conserving energy and reducing carbon emission. NCNU also educates citizens to act responsibly to the environment, thereby realizing a sustainable campus culture, influencing nearby elementary and junior high schools, communities, society, and even international society to work hard for our precious earth.

References

[1] Bartlett, P. F., & Chase, G. W, 2004. Sustainability on campus: stories and stragegies for change. Cambride, Mass: MIT Press.

[2] Creighton, S. H, 1998. Greening the Ivory Tower: Improing the environmental track record of universities, colleges, and other institutions. Cambridge, Massachusetts: MIT Press.

[3] Cortese, A, 2003. The critical role of higher education in creating a sustainable future, Planning for Higher Education. March-May 2003: 15-22

[4] Wang Min (translation), 2002. Education for Sustainable Development. China: China Light Industry Press. (Huckle, J., & Sterling, S., 1996)

[5] National Chi Nan University Environmental Protection and Health and Safety Committee, 2015. "2015 Campus Environment Report" (unpublished), National Chi Nan University.

The 3rd International Workshop on UI GreenMetric
Istanbul, Turkey, 09 - 10 April 2017

Cultivating Green Energy at the Universitas Indonesia Towards Sustainable Campus

Nyoman Suwartha*[1, a], Riri Fitri Sari[2,b], Baiduri Widanarko[3,c], Tommy Ilyas[1,d]
[1]*Department of Civil Engineering, Faculty of Engineering, Universitas Indonesia, Kampus UI Depok, Depok 16424, Indonesia*
[2]*Department of Electrical Engineering, Faculty of Engineering, Universitas Indonesia, Kampus UI Depok, Depok 16424, Indonesia*
[3]*Department of Occupational Health and Safety, Faculty of Public Health, Universitas Indonesia, Kampus UI Depok, Depok 16424, Indonesia*
[a]nsuwartha@eng.ui.ac.id, [b]riri@ui.ac.id, [c]baiduri@ui.ac.id, [d]tommy.ilyas@eng.ui.ac.id

Abstract. This paper focused on the energy management in Universitas Indonesia (UI) Depok Campus based on the Master Plan and the implementation since 2013 to present. Some developments and improvements have been made during the last four years. Since 2014, there are some infrastructures have been installed inside such as LED lamps, real-time energy metering and monitoring system, green chilling system installment, solar photo-voltaic development, Solar cooling absorption chiller system, Air conditioning with VRF/VRV system, and green certified building. Considering these challenges on renewable energy development in initial stage has resulting UI stays at rank #125 in UI GreenMetric 2016 for "energy and climate change" 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 energy management at Universitas Indonesia towards sustainable campus in the ever competing environments around the globe.

Keywords: Climate change; Green campus; Renewable energy; Sustainable university; Universitas Indonesia

1. Introduction

Known as the best campus in Indonesia according to the QS World Universities Ranking 2015/2016 (1st ranked in Indonesia, 79th in Asia and 358th in the world) [1] and be the only university in Indonesia ranked in the THEs ranking 2015/2016 (#601-800 world university ranking)[2], UI kept its predicate being the nation's oldest, most prestigious, and greenest campus. 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.

In order to achieving a green and sustainable campus, since 2011, numbers 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, and renewable energy development[3].

As the number of students and staff being increase annually, and the commitment to support world class research university program, has lead UI's energy demand increases especially electricity consumption. This is due to the development of tools, laboratory equipment's and offices that almost all requiring electricity as the main energy sources of the operation.

The annual energy demand tends to increase as to covers and support the daily academic-based activities inside Universitas Indonesia, whereas Depok campus has higher electricity consumption than Salemba campus about 14 MW as shown in Table 1.

Table 1. Distribution of electricity consumption in UI campus

Users	Electricity consumption (MW)	
	Salemba campus	Depok campus
Existing buildings	3.836	10.380
Health Science Cluster	-	3.895
Road lighting	-	0.066
UI Hospital	-	3.250
Rector house	-	0.033
UI Guest house	-	0.033
Integrated Faculty Club	-	0.230
Student dormitory	-	0.630
Total	3.836	14.279

2. University Policy on Energy and Climate Change

In line with the first weighted category in UI GreenMetric that is energy and climate change, UI policy in managing energy to mitigate climate change has been initiated since 2011. Data collection of energy consumption is the basis activities required to identify baseline data and set the savings target of electricity usage per year. The electricity savings can be achieved by replacing conventional appliances with energy efficient appliances, developing smart buildings which include elements of green building concept for a new and renovated building, as well as promoting renewable energy development. In addition, to reduce greenhouse gas emission that contribute to carbon footprint and climate change, UI providing public transportation (more than 20 bus campus) that operates inside campus, more than 400 bicycles, and pedestrian paths.

2.1 Identification and Energy Management

Energy consumption. Universitas Indonesia Depok campus since 1986 has only about 6.5 MW of electricity consumption, while as the population and energy demand developed in 2015 the electricity power of middle voltage demand rise up to about 10.38 MW. In the last two years, the rate of electricity consumption in monthly period is presented in Figure 1.

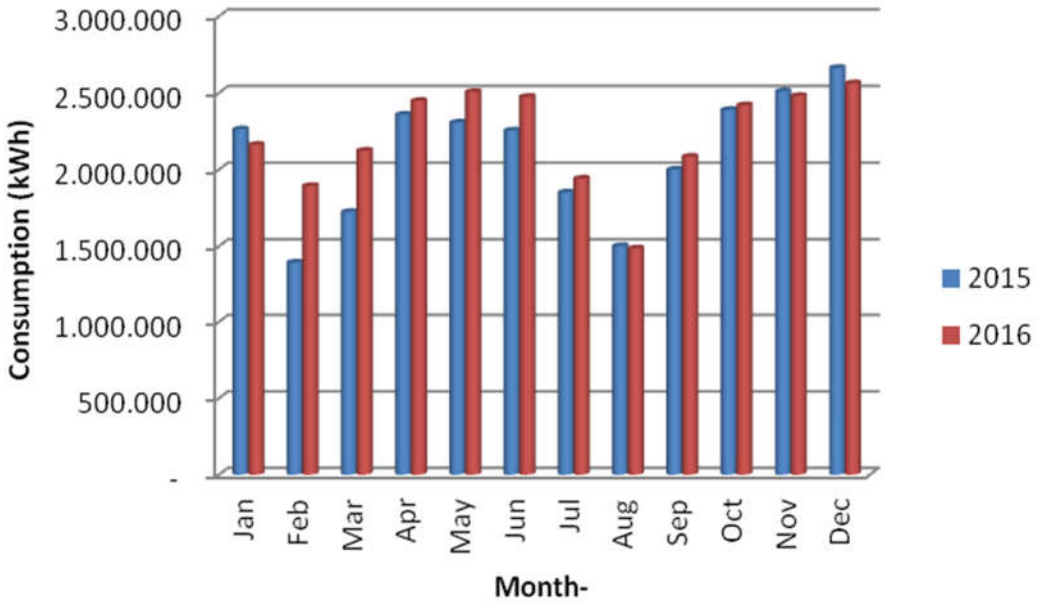


Figure 1. Electricity consumption (kWh) of UI Depok campus in 2015-2016

In general, obviously we can see similar pattern of consumption usage. The energy consumption will rise at the early stage of each semester (February and September) and gradually decline by the end of

semester (July and January). Annual electricity consumption of UI Depok campus in 2016 is about 26,583,252 kWh, with monthly average of about 2,215,271 kWh. In total, there is an increased energy consumption from 2015 to 2016 though only about 5% within a year, which is due to increasing number of students and several development of new buildings and facilities in 2016.

Forming the electricity energy management team. The electricity energy management team was created by involving related teams from University Administration Center and the Faculties inside Univesitas Indonesia. The energy management team program was proposed in March 2015, and some achievement were reported from the energy savings management and sustainability section.

Policy arrangement for electricity energy management. The arrangement of electricity energy savings policy was referring to: (1) Rectore Decree No. 1310/SK/R/UI/2011 regarding the Energy Conservation in UI Campus; (2) UI Strategic Plan (Renstra UI) 2015-2020 regarding Energy Savings; and (3) Minister Acts of Ministry of Energy and Mineral Resources (ESDM) regarding Energy Management and Energy Savings. The electricity energy management policy was then issued and signed on August 2015 through Rector Decree No. 1327/SK/R/UI/2015 regarding Management and Savings of Electricity Power in Universitas Indonesia.

In order to reduce the energy (electricity) consumption, the university leader through Directorate Management and Facilities Maintenance (DPPF) proclaim energy savings target of 15% in 2017, that's mean reducing monthly average of energy consumption to be 1,882,981 kWh per month.

With this target of energy savings, the average monthly payment of electricity consumption is estimated to decrease around IDR 2,074,504,110 which can reduce the operational cost about 12%, from IDR 28,287,100,963 in 2016 becomes IDR 24,894,049,322 in 2017 (with assumption the electricity basic tarrif is constant). Figure 2 shows the energy savings scenario for 2017 target from the 12 faculties and Center of Administration University's buildings (PAU).

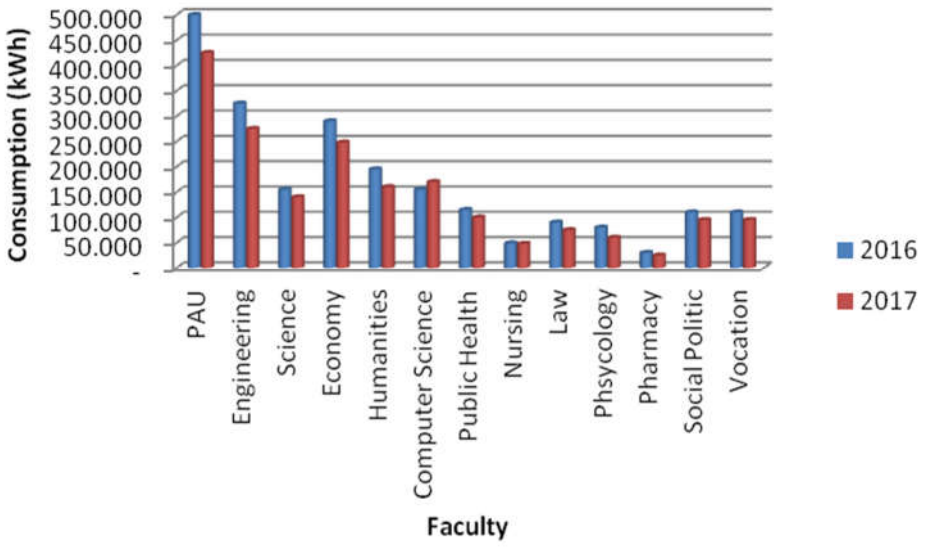


Figure 2. Target of energy savings (kWh) in UI Depok campus for 2017

Sustainability program. One of the main jobs and function of the Directorate Management and Facilities Maintenance (DPPF) is to making plans and implementing sustainability program in Universitas Indonesia. There are 3 main program of sustainability promote by DPPF, namely: (1) Energy and Climate Change; (2) Waster and Energy; and (3) Infrastructures and Environmental. The program was proposed based on the UI Strategic Plan (Renstra UI 2014-2019), and also referring to the UI GreenMetric category.

Energy metering. In 2014, the Faculty of Engineering, Universitas Indonesia received grant from the university that lead to implementing Green Society program. The program aimed to develop necessary

supporting infrastructure, discusses opportunities and challenges in establishing a green environment[4]. It covers 5 specific fields: groundwater conservation and monitoring; wastewater treatment unit; organic waste composting; solid waste recycling; and a model for smart building energy-efficient.

As part of creating smart building model a strategy that has been implemented in term of energy savings system inside the Faculty of Engineering UI was development of electricity energy consumption monitoring system to measures the successful rate of energy savings program, as well as to decide percentage of energy savings target going to reach. Concrete activities for supporting this strategy are by changing the culture/manner of energy usage from all academia society in the Faculty of Engineering UI, replacing conventional lamp by LED lamp, setting up an automated AC and lamps, as well as utilizing alternative (renewable) energy.

The monitoring system of energy consumption in the Faculty of Engineering UI was installed at the S-Building aimed to monitor the AC consumption and lighting lamps. Those energy consumption data are saved in a server placed at the Department of Electrical Engineering, Faculty of Engineering, Universitas Indonesia, which can be accessed through www.ee.ui.ac.id/power. In that website we can see the online monitoring of energy consumption at S-Building (Real Time Power Consumption Monitoring Web). Considering the benefit and best practice of this online monitoring system, similar method and unit was also installed at the Rectorat building. Beside of the energy consumption monitoring system, automated lamps were installed at some aisle inside the Faculty of engineering UI. Figure 3 and Figure 4 shows the example of real-time monitoring of electricity consumption on daily basis (dated March 1, 2017) at Dean building, Faculty of Engineering and Rectorat building 3rd floor, respectively.

In the same year, the Faculty of Engineering UI also received grant from PT. INILED Indonesia industry in the form of LED lamp, around 206 unit LED T-Max Tube 18 watt and 67 unit LED T-Max Tube 9 watt. Those lamp were utilized to replacing the conventional lamp at several class room in the faculty. By utilizing these LED lamps, it is expected that the faculty could savings energy consumption by 60% more than the conventional system.

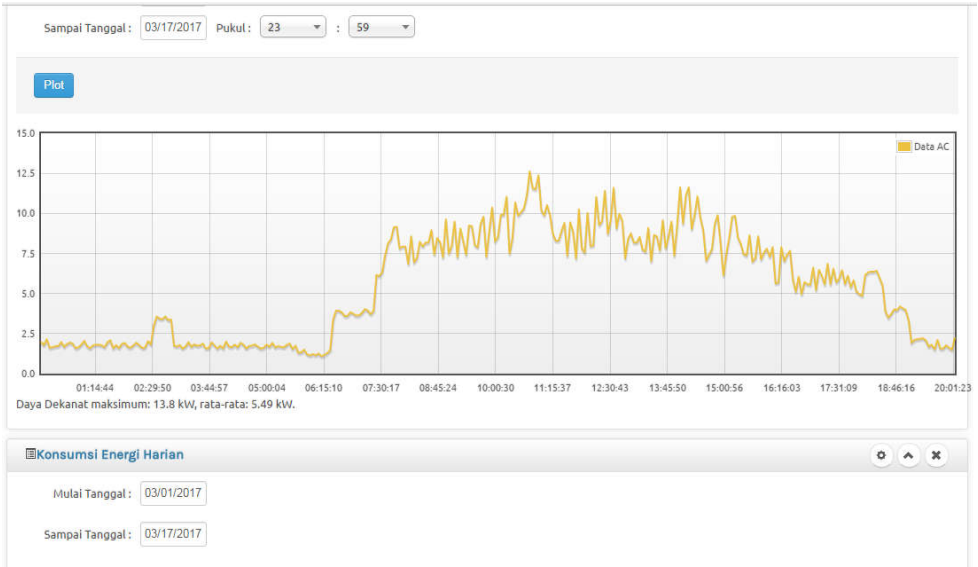


Figure 3. An example of energy consumption real-time monitoring at the Faculty Engineering, Dean building (Source: http://www.ee.ui.ac.id/power/)

Figure 4. An example of energy consumption real-time monitoring at the Rectorate building 3rd Fl. (Source: http://sinergi.ui.ac.id/new_rektorat/)

2.2 Renewable Energy Development and Efficiency

To implement the UI policy and commitment towards achieving green campus, several new buildings were constructed by adopting green and sustainable building concept. The structures and some efficient system were installed with careful processes and environmentally considered as much as possible. Energy production form alternative (renewable) energy is also installed at some suitable place.

Green chilling system. A green Chillers is part of Refrigeration and Air Conditioning (RAC); a refrigerant technology which is environmental-friendly and thus significantly contribute to achieving target of greenhouse gas emission reduction. Several buildings in UI Depok campus are equipped with this Green Chilling System, such as at the:

1) *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.
2) *New library building*; the new integrated library located in UI Depok campus was launched on May 13, 2011. Built on a 33,000 m^2 area, it is considered as the largest library in Southeast Asia. Designed according to a sustainable building concept, the library is smoke-free, green-roof coverage, and using a cooling system water cooled chiller.
3) *Art and Culture Center*; the 11.600 m^2 building is aimed to as media for enhancing students' soft skill competency. It is expected that the unique building will motivate and encourage students' talent on arts world. The building, like new library building, is using Green Chiller System to reduce the electricity usage for air conditioning. In addition, the air conditionings are CFC free; and using hydrocarbon instead.

Solar photo-voltaic. Several buildings in UI Depok campus which are equipped with Solar Photo Voltaic (PV), are promoted as model in generating electricity power from solar energy that can be expanded to the other buildings and faculties. They are located at the:

1) *MRPQ building*; as the commitment of Faculty of Engineering, UI to implement renewable energy, a series of polycrystallyn Solar PV with capacity of 2.5 kW peak were installed at the roof top of MRPQ building, Department of Electrical Engineering, Faculty of Engineering, Universitas Indonesia. The produced energy is utilized to supply faculty's electricity energy demand

2) *Integrated Faculty Club (IFC) 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.). Thin film solar PV were installed with capacity 25 kW peak, to supply university's electricity energy demand.

(a) (b)

Figure 5. Solar PV system at: (a) the MRPQ building, Faculty of Engineering; and (b) the Integrated Faculty Club (IFC) building, Universitas Indonesia

Solar cooling absorption chiller system. Since the end of 2014, a solar cooling absorption chiller system (double effect absorption chiller) was installed at the Manufacturing Research Center (MRC) Building, Faculty of Engineering, Universitas Indonesia. This system uses two condensers to improve its efficiency, with a maximum cooling capacity of 240 kW thermal or 68 TR. The primary source is solar energy absorbed by the heat pipe evacuated tubular solar collector type, consisting of 60 modules (1 module contains 16 tubes) having an area of 240 m^2 mounted atop the MRC building, and able to produce hot water at a temperature of 75°C–90°C. The cold water produced by the absorption chiller is channeled towards hybrid fan coil units inside the building. Additional energy is used compressed natural gas (CNG), which will work when the energy from the sun is insufficient to produce hot water. CNG is stored in high-pressure tubes with a total capacity of 450 m^3. Heat from the condenser released into the surroundings by the cooling tower has a capacity of 442.8 kW thermal [5, 6].

Figure 6. Solar cooling absorption chiller system at the Manufacturing Research Center (MRC) building, Faculty of Engineering, Universitas Indonesia

Air conditioning with VRF/VRV system. By using air conditioning with VRF/VRV system, where the Coefficient of Performance (COP) will lead the AC energy savings more than the existing installed conventional AC. Technology AC with VRF/VRV system are installed at several new buildings such as in ILRC building, Health Scince Cluster (RIK) building, UI Hospital (RSUI), and University Andminstration Center (PAU).

Green certified building. Student activity center (Pusgiwa) building with an area of 13,296 m^2 (GFA) is provided as the secretariat office of the various student organizations that exist in Universitas Indonesia. Currently, the building was renovated and equipped with efficient lamp, to be registered as one of Leadership in Energy and Environmental Design (LEED)-certified building.

3. Results of UI GreenMetric 2016

Energy and climate change is one of the 6 main categories in UI GreenMetric rankings that contributes the most significant score (21% of the overall score). Based on the results of UI GreenMetric rankings 2016, UI ranked at 31 based on overall ranking with a total score of 6,571. However, if we look detail into energy and climate change category, UI stays at rank #125 having score 973 of 2100 total score [7]. This is because, though UI has lower score in energy and climate change category, but the rest of 5 categories relatively shows better score so that in total score UI kept the position in top 40.

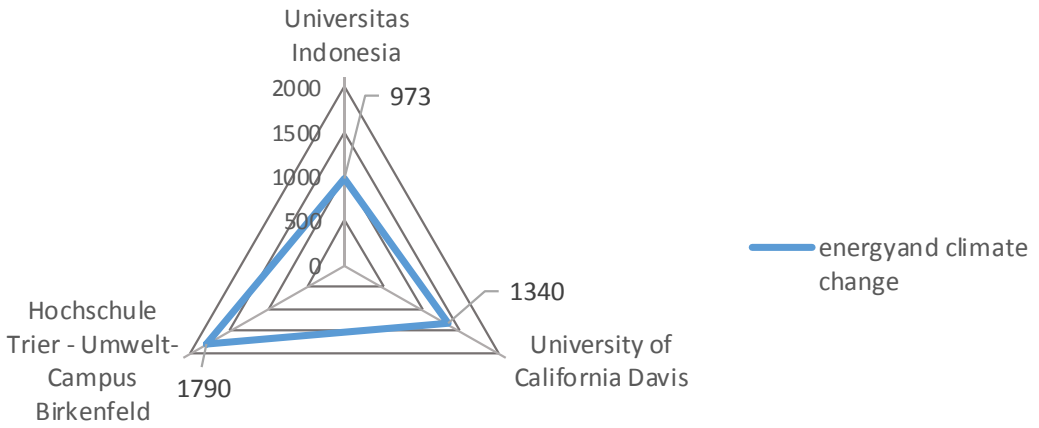


Figure 7. Comparison between Universitas Indonesia, the 1st ranked university, and the highest score for energy and climate change category (UI GreenMetric 2016 results)

Figure 7 shows the positioning of UI relative to 2 other universities; University of California Davis (the 1st ranked in overall ranking) and Hochschule Trier – Umwelt-Campus Birkenfeld (the 1st ranked in the indicator of energy and climate change ranking). Hochschule Trier – Umwelt-Campus Birkenfeld obviously approaching the maximum score (>85%) though in total ranking stays at rank #21 compare to University of California Davis in ranked #1. More efforts should be addressed by UI on this category in order to increase the score (around 54% more to reach the maximum score).

Table 2. Universitas Indonesia scores for energy and climate change (UI GreenMetric 2016 results)

Indicators	2016 Score	Maximum Score
Energy efficient appliances usage are replacing conventional appliances	30	200
Smart Building implementation	150	300
Renewable energy produce inside campus	129	300
Electricity usage per year (in kilo watt hour)	220	300
Ratio of renewable energy produce/production towards total energy usage per year	30	200
Elements of green building implementation as reflected in all construction and renovation policy	225	300
Greenhouse gas emission reductions program	134	200
Total carbon footprint (CO_2 emission in the last 12 months)	56	300

There are 8 indicators in the energy and climate change category, such as energy efficient appliances, smart building implementation, renewable energy production, annual electricity consumption, ratio of

renewable energy production to the energy consumption, green building implementation, reduction of greenhouse gas emission, and total carbon foot print [8]. Based on these indicators, the components that contribute to minimum score can be identified as shown in Table 2. At least 3 indicators should be improved to gain more scores such as energy efficient appliances are replacing conventional appliances; ratio of renewable energy produce/production towards total energy usage per year; and total carbon footprint (CO_2 emission in the last 12 months). Meanwhile, the other 5 indicators should also be maintained and be enhanced gradually up to the maximum scores [9].

4. Future Works and Challenges

The implementation of the UI Depok Campus Master Plan drives the entire campus community to actively involve in the program. Despite several achievements and efforts have been conducted in managing energy toward sustainable campus, there are some near future works need to carry out gradually in 2017/2018.

Integrated monitoring system. For the near future development of renewable energy and energy usage monitoring system, a prototype of automated AC savings system and smart grid prototype which can be accessed online via internet is currently undergoing project. In addition, several monitoring system of energy consumption will be installed at Dean office and at each Department building in Faculty of Engineering; empowering the electricity energy savings by manual system; fabrication and installment of automated AC system as well as integrating existing energy system with any alternative energy sources.

Electricity generation of gas power. As to support fulfilling part of the high energy demand inside the campus, Universitas Indonesia plan to build gas power electricity generation unit (PLTMG) with minimum capacity of 12 MW, by adding cubical switchgear 20 kV at GH UI-0 and GH UI-0A. The electricity current from National Electricity Company (PLN) is still connected into the system to ensure electricity supply continuously available (or can be used as back-up), considering that PLTMG also requires shutdown for periodical maintenance.

Research center. In order to support renewable energy development and green technology expansion in Universitas Indonesia, several relevant research centers have been established. Tropical Renewable Energy Center (TREC) was initiated in 2012 by Faculty of Engineering, consist of 6 main cluster: (1) Solar Thermal Cooling & Refrigeration; (2) Biological Energy Conversion; (3) Energy Storage Technology; (4) Nanostructured Energy Materials; (5) Fluid and Thermodynamics; and (6) Power Electronics and Control. Detail information can be found in http://www.uitrec.com/. Although categorized as new center, TREC quite well acknowledged national and internationally. Periodically, the organized International Tropical Renewable Energy Conference (i-TREC) as medium to share recent researches and networking development for future collaboration. The 2nd i-TREC entitled “Towards Tropical Renewable Energy Innovation and Technology Integration” will be held on 2-4 October 2017, Discovery Hotel, Ancol, Jakarta (https://i-trec.ui.ac.id/). Research Center for Climate Change (http://rccc.ui.ac.id/) focused in Basic and Applied Research such as biodiversity and climate change, gas and chemical related to climate change, Design and understanding technology, settlement design, alternative energy usage, geothermal, solar, and windfall.

Considering all the efforts have been done, some achievement, and future works need to do, it is a challenges for UI to keep implementing the policy in energy management especially to reduce energy consumption, while on the other hand number of population (students) and infrastructure, facility, and buildings are seems to increases annually. Enhancing and expanding renewable energy development also another challenge, since it is requires high cost investment. Yet, maintenance activities of those tools/technology as part of daily operation, as well as data collection and analysis of the energy consumption, energy demand, are essential things to be conducted periodically.

5. Concluding Remarks

Align with the UI Strategic Plan 2012-2017 and the Rector Decree, several achievements particularly in energy and climate change aspect have shown a positive trend. Though it can be classified into initial stage, green energy development are continuously being promoted and extended as much as possible. UI will keep the energy management policy on the track so that improving UI rank in UI GreenMetric, especially for energy and climate change category. Furthermore, expectation to achieve sustainable campus as an eco-friendly based education infrastructure in the form of eco-science-park can be realized in very near future.

References

[1] QS World University Rankings 2015/16. Available at http://www.topuniversities.com/university-rankings/world-university-rankings/2015#sorting=rank+region=+country=+faculty=+stars=false+search=indonesia

[2] The Times Higher Education World University Rankings 2015-2016. Available at https://www.timeshighereducation.com/world-university-rankings/2016/world-ranking#!/page/0/length/25/country/16/sort_by/rank_label/sort_order/asc/cols/rank_only

[3] Suwartha, N., Sari, R.F., Widanarko, B., Rarasati, A., Zakaria, A.A., 2016. Towards Sustainable University through Setting and Infrastructure Development at the Universitas Indonesia. *In*: Proceedings of the 2nd International Workshop on UI GreenMetric (IWGM 2016), Universitas Indonesia, Indonesia.

[4] Kristanto, G.A., Priadi, C.R., Suwartha, N., Bahsan, E., Udhiarto, A., 2016. Lessons learned in developing a green environment at the Engineering Faculty, University of Indonesia. *MATEC Web of Conferences (SICEST 2016)*, Volume 101, pp. 1–6

[5] Alhamid, M.I., et al., 2015. Solar Thermal Cooling System at Universitas Indonesia using Absorption Chiller. *In*: Proceeding of the 14th International Conference on QiR (Quality in Research), Lombok, Indonesia

[6] Hajime Yabase, H., Saito, K., Lubis, A., Alhamid, I., Nasruddin, 2016. Solar Air-Conditioning System at the University of Indonesia. *International Journal of Technology*, Volume 7(2), pp. 212-218

[7] UI GreenMetric, 2016. UI GreenMetric World University Ranking. Available online at http://greenmetric.ui.ac.id/

[8] Suwartha, N., Sari, R. F., 2013. Evaluating UI GreenMetric as a tool to support green universities development: assessment of the year 2011 ranking. *Journal of Cleaner Production*, Vol. 61, pp. 46-53

[9] Lauder, A., Sari, R.F., Suwartha, N., Tjahjono, G., 2015. Critical review of a global campus sustainability ranking: GreenMetric. *Journal of Cleaner Production* Volume 108, pp. 852–863

The 3rd International Workshop on UI GreenMetric
Istanbul, Turkey, 09 - 10 April 2017

Environmental Campus Birkenfeld – A Model University Site Successfully Combining Theory and Practice for a Sustainable Future

Klaus Helling [1, a], Klaus Rick [2, b]
[1]*Prof. Dr. Klaus Helling, Umwelt-Campus Birkenfeld, University of Applied Sciences Trier*
Campusallee 9912, D-55761 Birkenfeld/Nahe, Germany
[2]*Prof. Dr. Wirtsch.-Ing. Klaus Rick, Umwelt-Campus Birkenfeld, University of Applied Sciences Trier*
Campusallee 9913, D-55761 Birkenfeld/Nahe, Germany
[a]k.helling@umwelt-campus.de, [b]k.rick@umwelt-campus.de

Abstract. To augment sustainability standards into reality it is indispensable for a contemporary education facility to combine theoretical approach and practical action. In the 21st century forward-looking universities have the obligation to demonstrate and express realised and well performing sustainable solutions in their sites as well as in their lecture and research subjects: building services, supply and technology should show the benefits while researching and teaching resource efficiency, zero emission, social or ecological progress - on a high international level.
Besides it is uncontended that environmental and social issues cannot simply be 'added' to basic economic needs. We all know that new solutions have to be found, main stream has to be rethought, reengineered cross-linked and reassessed to lead to substancial progress. So in our networks and projects together with our students we act and decide free-spirited while we cooperate internationally and interdisciplinary developing our scientific contents and the university itself with ethical responsibility.
Environmental Campus Birkenfeld tries to live all these ideas since foundation in 1996. So in all our curriculas we consequently integrate classical education with tailor-made important fields of sustainability: low carb, new solar or water technologies and engineering standards etc. are always combined with greener business, technology and management.
Finally, the site itself is a highly efficient facility well equipped with environmentally friendly advanced technologies. As a will of policy it is a demonstration model for Europe's first "zero emission campus" and in this respect unique. It is one of the greenest universities in Germany.

Keywords: Umwelt-Campus Birkenfeld, zero emission campus, sustainable building infrastructure, and sustainability oriented studies, green curriculum, sustainable development goals

1. Introduction

Sustainability activities are essential - they have become urgent and central topics of our time and people around the world are affected. Due to the amount of educated students as leaders of tomorrow, all kind of cooperation and initiatives with different actors *universities have per se a tremendous impact on sustainable development in society* (Leal Filho 2011). The contribution of education and research cannot be underrated in this context. Furthermore the operation of a university itself has to match with the requirements of our understanding of a sustainable development, including first and foremost ecological and economical aspects. Building concepts, infrastructure, mobility systems, heating and cooling, smart electronics, paper consumption etc. have to suit our learning and teaching contents.
The Environmental Campus Birkenfeld (ECB), located in western Rhineland Palatinate, Germany (see Figure 1) is an outstanding example of innovative sustainability: 'classic' subject research and teaching is implemented and interconnected directly with practical social and environmental issues. The students as citizens of our future are involved in the processes of implementation in comprehensive courses of our degree programs, full of interdisciplinary team work, in seminars regarding the integration of students from different courses, studies and countries. The implementations take place in national and international projects and degrees: we cooperate with companies, municipalities, regional authorities, governmental authorities, ministries, the EU government and various established scientific institutions. Besides, the campus site itself is from the drawing board on a zero emission campus.

This document is structured as follows: in Chapter #2 a short history of the Environmental Campus Birkenfeld is provided. ECB was founded in 1996 as a branch of the Universtity of Applied Sciences Trier, having 7.800 students overall. Chapter #3 explicates more detailed how sustainability is embedded in the facilities and explains some *selected state of the art green technologies* which are installed. The following part #4 gives an overview on the *amount of integration of sustainability in the study courses* of our University of Applied Sciences. Chapter #5 focuses on research projects for sustainable development in regions and exemplifies how students are integrated in interdisciplinary research based on material flow management.

Figure 1. Location of ECB in the South West of Germany

2. A Zero Emission Campus?

Due to the amount of installed sustainable technologies and procedures, ECB is known as the *first Zero-Emission Campus in Germany*. Being so *young and compared to others rather small with less than 3.000 students* at our site the campus design offered the chance to be smart from the first day on. Some examples: energy and heat are completely supplied by a *biomass combined heat and power station* directly built in the neighborhood that uses *waste wood and biogas as substrate* respectively as only primary energy source. *Advanced thermal insulation standards, earth cooling air conditioning* are standards of our buildings and facilities combined with a bunch of other environmentally friendly and decarbonising technologies legitimating the claim of being a real Zero-Emission Campus.
The following Figure 2 gives a first impression of the university from above. All roofs are completely full of installations: different techniques and technologies are capturing solar energy, most of them are research subjects. Wind mills and smart water systems are also part of the realised design, see below.

Figure 2. Aerial view of the Environmental Campus Birkenfeld (Source: ECB 2017)

In the vicinity of the campus areal a symbiotic working *eco-industrial park* is constructed optimizing *regional materials and energy flows* connecting the campus via a district heating and low voltage

electricity transmission. As an example of sustainble material flow all organic fractions and waste wood components are 100% input for our power station - regionally collected and reused for energy production without greenhouse gas emission in balance. Besides the production of heat and energy for our site the power station even charges the local electricity grid due to our savings. The next Figure #3 gives a principal overview on the circular economy concept of ECB, exemplified here related to energy.

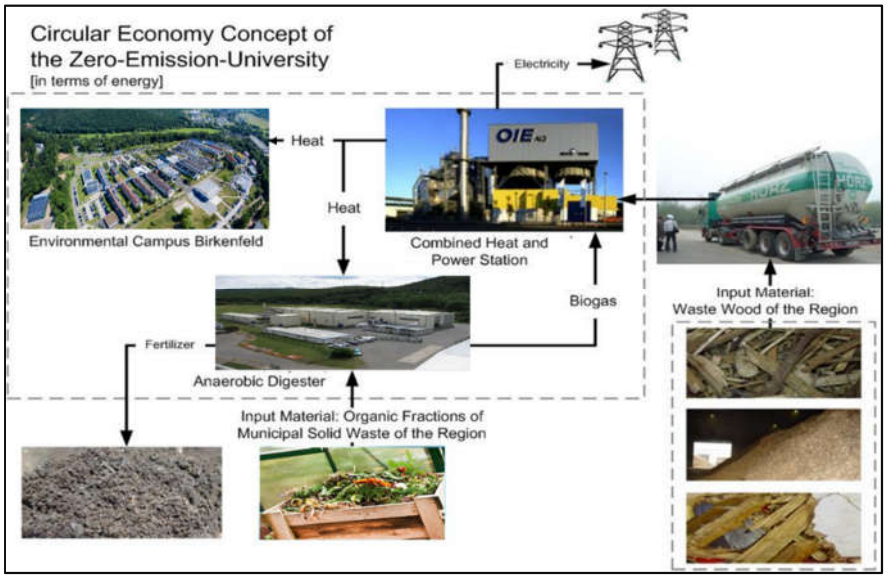


Figure 3. Realised Zero-Emission Energy Concept of our Campus (Source: ECB 2017)

The technical features at the ECB include the following (extract, more details see below):

- Ground collectors using earth cooling: supply with intaking and tempering outside air for natural climatization, in summer to support cooling, in winter to help warming the class rooms, no further electrical air-conditioning, no compressors or comparables on the entire site,
- Different heat exchangers and absorbers for outgoing air to absorb thermal energy in colder months,
- Transparent thermal insulation, e.g. in front of massive walls up to extreme passive standards,
- Daylight guidance systems,
- Automatic aeration systems,
- Thermal concrete activation in walls, warm or cool water flushes through the walls of lecturing rooms
- Presence detectors for all rooms and floors, switching light and other useful settings,
- Programmable, individually addressable and remotable heating radiators and thermostats in all offices and class rooms,
- Extensive use of all kinds of solar collectors, solar cells/ photo-voltaics, solar-thermal elements on all roofs, south windows and additional places,
- Storm water system which charges the pond at the main entrance,
- Several detention storage basins for rainwater, biotops for rare plants cared by students,
- Extensive roof greening supporting biotops for insects, numerous bee yards,
- Adsorption cooling unit, newest standard, for cooling the computing center.

The *wood-chip power station* was installed with a thermal capacity of 28 MW utilizing annually 65,000 tons of waste wood from forestry, agriculture, landscape gardening and industry to produce up to 8 MW heat, 37.5 tons per hour of steam and up to 8.3 MW electricity for the Environmental Campus plus the neighboring industry facilities and the electricity grid. Furthermore, a *cogeneration unit* utilizes the

biogas output of the nearby *anaerobic digestion plant* treating annually *40,000 tons* of organic municipal solid waste collected in the rural districts of Birkenfeld and Bad Kreuznach.
As much energy as possible of the ECB energy demand is covered by our renewable energy installations at the campus itself. The various *photovoltaic systems* installed on the rooftops and in the hallways supply an installed capacity of *510 kWp covering annualy 40% of the total electricity demand*. The performance of different photovoltaics (PV) module types and mounting systems is continuously researched and monitored, displayed and employed as a subject for teaching, demonstrating and R&D. The use of solar energy is completed by various *solar thermal installations* with a total of *135 kW and a collection area of 270 sq* m augmenting the cooling system.
The Zero-Emission concept of the ECB is also extended towards *biotope and biodiversity management creating and maintaining protected areas and green rooftops*. Rainwater is received onto retention surfaces and infiltrated into natural water bodies or allowed to channel towards the ground water. Parts of the rainwater are collected after a mechanical purification in two tanks and used for various *grey water applications* such as toilet flushing, irrigation and as a coolant for the adsorption cooling system. The discharge of rainwater to the sewer system is already avoided in the present system. A major number of toilets separates yellow water from solids. Currently we are planning to invest on a zero sewer water campus with a biological clarification plant for sewer and greywater.

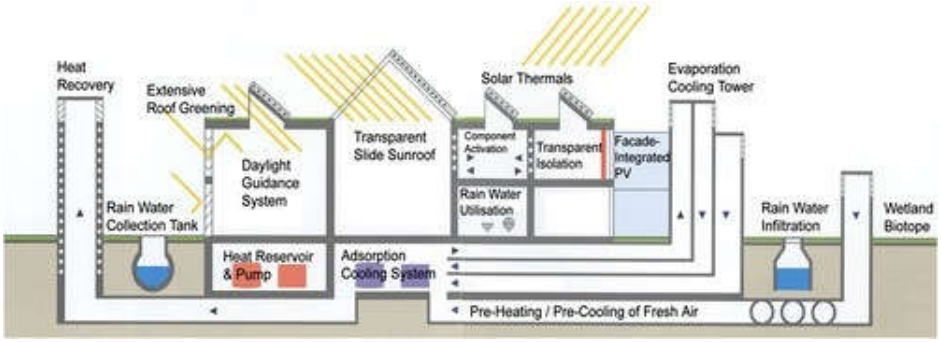


Figure 4. Scheme of Main Environmental Technologies running in Birkenfeld (Source: ECB 2017)

Another item for our sustainability orientation is the aim *'Zero Emission Mobility'*. We support this future oriented topic by giving everyone at the campus the opportunity to comfortably rent battery-driven *e-bikes*. Besides we experiment with different *e-car concepts* in our labs and presently are converting a conventional combustion engine car into an e-car. Our newest acquisition in our biggest non profit institute, the IfaS, see below in chapter #5, are two different BMW i3 each with a range over 250 km fully electrical. *High speed electrical chargers, solardriven and loading cost-free* will be mountet until June 2017 at prominent parking lots. In addition a successful e-mobility platform for smartphones programmed by students is in realisation with a demonstration unit that attracts a lot of attention at present. In order to demonstrate and minimize even more greenhouse gas emissions resulting from commuting, a *car share system* based on electric vehicles is planned. As a step towards the infrastructure development in zero-emission mobility - our existing PV-car ports will be moved on campus to prime parking places to gain maximum attention. For ECB's technical features in more detailed description the authors recommend the *documentation "Environmental Campus – Experience Green Technologies"* for more information (Hartard and te Heesen 2016). Finally ECB has been publishing enviromental reports since the year 2004. This reporting tradition has been based on students work coordinated by professors. In the first years they have been based on ISO 14 001, later ISO 50 001 standards and/or EMAS[2] management schemes and afterwards further developed in recent years to *sustainability reports based on standards from the Global Reporting Initiative (GRI)* (see download of

[2] Environmental Management Audit Scheme valid in the European Union.

selected reports at: www.umwelt-campus.de). As a remark ECB students live and learn at a unique university.

3. Education for Sustainability - Study Courses at ECB

The *2030 Agenda for Sustainable Development* contains *17 Sustainable Development Goals* (SDG's) including new areas such as climate change, economic inequality, innovation, sustainable consumption, peace and justice, among other priorities. These goals are interconnected and often the key to success.
In a spirit of partnership and pragmatism the SDG's work is to offer the right choices to improve a more sustainable life and welfare for future generations. Clear guidelines and targets for all countries are provided to adopt in accordance with their own priorities and the environmental challenges of the entire world (www.un.org/sustainabledevelopment). The international community having accepted the new agenda in September 2015 recognizes that education is essential for the success of all 17 of its goals. Education represents Sustainable Development Goal #4 which aims to 'ensure inclusive and equitable quality education and promote lifelong learning opportunities for all'. *Education stays the key for sustainable development*. The *declaration signed in Incheon* includes principles for the integration of sustainability oriented knowledge in all stages of education with access for everyone, starting with work life balance options like kindergartens and schools followed by vocational trainings, academic programs and advanced courses. The Education 2030 Agenda signed there was entrusted to lead and coordinate by UNESCO with its partners (UNESCO 2015).
The clear concept of two faculties named "Environmental Business Management/Environmental Law" and "Environmental Planning/Environmental Technology" provides interdisciplinary education in the framework of material cycles. *All courses focus on environmental or sustainbility issues* besides core subject contents and illustrate by vivid examples the implementation of Sustainable Development. *Life Cycle Assessments, Integrated Product Planning, Material Flow Management, Sustainable Balanced Scorecard, Green Procurement, Green IT, Eco-Management, project management for Environmental Technology mounting and operation, sustainability oriented Corporate Governance and Business Ethics*, just to mention a few, are only some of the widely used elements emphasizing the importance of another mentality here at the ECB. The students also practice thisway of thinking by lecturing children in regional schools in terms of sustainabiliy.
Our *S.U.N. Project, 'students and ECB for sustainability'*, proofs every year that pupils and schools keep increasingly interested in being tought e.g. about waste or water management, green energy, bionics, but also about sweatshops, working poor, good management practice, food and nutrition problems, etc. prepared and conductet successfully by master students. This fruitful exchange is also honored and sponsored by the Government of Rhineland Palatinate (Rick 2014, 2015).

In addition to the established exchange programs "Principles of Sustainable Business" and "Environment and Technology" the new Bachelor course "Sustainable Business and Technology" (B. Eng.) is highly interesting for international students and university cooperation. In typical six semesters students can study business and engineering through innovative learning concepts. Focussing on sustainability, green technologies, and a globally interrelated perspective future graduates will be provided with excellent key qualifications and enabled to master the challenges of our time. Real-life business projects as well as training in organization, methods and communication skills complete our students' academic and personal profile. As a special benefit, German language and intercultural communication modules pave the way for a possible professional life in Germany or German enterprises abroad. Figure 5 summarizes the 2017 key elements of this bachelor course (www.umwelt-campus.de/sbt).
On the master's level ECB has been offering the English study IMAT courses for more than 10 years. The IMAT - Master in International Material Flow Management - trains young and motivated students from all over the world in International Material Flow Management based on the experiences that the lecturers gained through the project work with companies and city authorities all over the world. This project work helped to establish sound and sustainable waste management, energy or water management systems in different countries (www.stoffstrom.org).

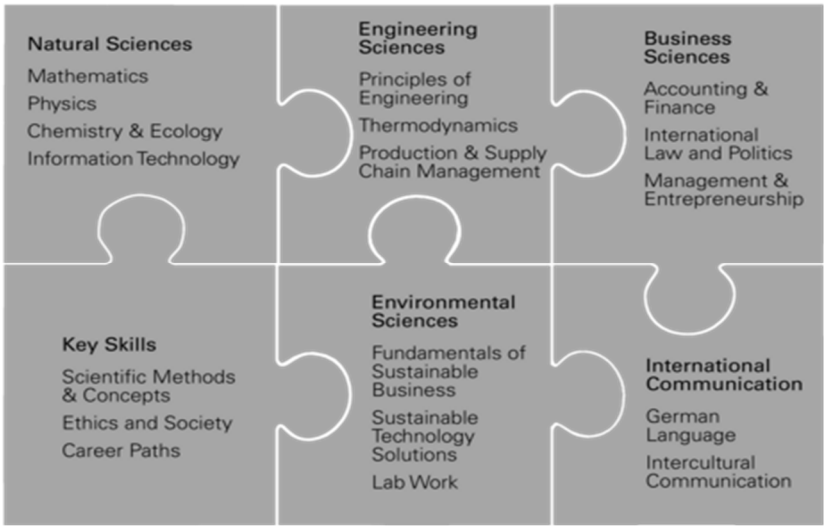


Figure 5. Key Elements of "Sustainable Business and Technolgy (B.Eng.)" (Source: ECB 2017)

4. Research for Sustainabilty - Institutes, Competence Centers and Concepts at the ECB

Advanced studies and research is a very important contribution to sustainable development. They are analysed, planned and implemented in existing institutes with numerous project team members. The following are leading research institutes at the ECB:

- Institute for Applied Material Flow Management (IfaS)
- Institute for Software Systems (ISS)
- Center for Land Research (CLR)
- Institute for Micro Process Engineering and Particle Technology (ImiP)
- Institute for Business and Technology Management (IBT)
- Institute for Renewable Energy Law, Energy Efficiency Law and Climate Protection Law (IREK)

The *Institute for Applied Material Flow Management (IfaS)* is the biggest research institute of the Trier University of Applied Sciences located at the ECB. IfaS was founded in 2001 thanks to the initiative of four committed professors from the disciplines of Material Flow Management, Ecology, Business Management, Physics/Process Engineering and Communication/Ethics. The aim of IfaS is to promote the sustainable optimisation of regional and operational material flows in specific and practice-oriented projects worldwide. Nowadays, the interdisciplinary team includes nine professors in the directorate and additional 55 professional full time research staff plus plus various interns, freelancers and student assistants from the following areas:

- Business Administration
- Environmental Sciences
- Systems and Supply Engineering
- Electrical Engineering
- Civil Engineering
- Energy Technology
- Industrial Engineering
- Mechanical Engineering
- Process Engineering
- Spatial and Environmental Planning
- Agricultural Engineering
- Biology/Ecology
- Environmental Law

The core working areas of IfaS are international material flow management, strategic material flow management and research on zero emission approaches, energy efficiency and renewable energies, sustainable mobility options, biomass use and cultural landscape management and public relation.
IfaS strives to integrate and strengthen sustainable structures on a communal and regional level by analysing and optimising material and energy flows. The institute applies innovative, interdisciplinary and holistic approaches to address environmental challenges and offers long term system optimisation, elaborating sustainable energy and regional development concepts.

Figure 7. Today's employees of our Institute for Applied Material Flow Management (Source: IfaS 2017)

IfaS uses the approach of material flow management (MFM) to optimise regions and companies in more than 30 countries all over the world (Heck 2002, IfaS 2017). For companies industrial MFM leads to cost savings, more sustainable products and production, reduction of risks and helps to develop cooperation with partners along the supply chain (vertical cooperation), within the same industry (horizontal cooperation) and with neighbors (diagonal/matrix cooperation, eco-industrial parcs). Industrial MFM is related to the cleaner production approach (Helling 2015, Rick 2005).
Furthermore IfaS uses MFM in a regional context to optimise material and energy flows within the region to use regional potentials and to generate regional added value (Helling/ Heck 2016). The Zero Emission Village (ZEV) Weilerbach was the first implementation of a regional material flow management concept (Helling 2012). The ZEV project began with an as-is analysis in 2001 which looked for the regional potentials and defined the target "Zero Emission". *IfaS has developed dozens of projects for a carbon neutral development* together with local stakeholders and investors. Since then, more than 200 million Euros have been invested and mainly steered by IfaS in cooperation with municipalities to reach the goal "Zero Emission".
IfaS also developed and established an educational concept to integrate students in applied research for MFM (IfaS 2016). The *Travelling University* (TU) is a study module at the ECB in which students from different backgrounds can participate. This transdisciplinary seminar is organised in form of a project and develops solutions for practical problems. The TU started in 1999, and since than this seminar has become a regular part of an interdisciplinary curriculum at the ECB. Owing to its reference and cross-linking to other projects held at the ECB with similar sustainable aims, the TU project was among others a part of the University of Applied Sciences' contribution to the EXPO-2000. Moreover this program was integrated in the IfaS activities in Sweden, China, Poland, Turkey, Brazil, Canada, Serbia, Cap Verde, Mexico, Sri Lanka and Morocco. Together with partners from municipalities, ministries, companies and many other stakeholders learn how to plan and to implement sustainable solutions for real world problems. The students have to collect data, discuss with stakeholders, develop technical solutions to solve the problems and last but not least they develop a business plan that should underline the feasibility of their ideas. The Travelling University represents best practice of project-based learning and gives students the opportunity to put their acquired knowledge into practice in real time. The following example describes the concept of TU:
After having successfully visited e.g. Brazil and Turkey for the travelling universtity together with the students in 2014, TU undertook a project in *Sri Lanka*. The main objective of this TU was to convert

one of IfaS' partner universities – the *Uva Wellassa University* of Sri Lanka (UWU) – to a 'Zero Emission Campus', which is to be modeled after the Environmental Campus Birkenfeld. Eleven students from different study programs with different nationalities made a ten days trip from Birkenfeld to Sri Lanka. The weeklong activities there included a number of meetings with the university and public officials including the Mayor of Badulla city, fact-finding missions to the neighboring communities and private sector stakeholders, field visits, public relations activities etc. Besides the preliminary task and the key objective of TU '14, it was also aimed to conceptualize a Regional Material Flow Management (RMFM) plan for Badulla Municipal territory of which UWU is a key stakeholder.
The RMFM aimed to provide the framework for the utilization of regional material flows (such as municipal solid waste, agricultural residue, regional biomass etc.) by creating synergy between local public and private organization with UWU. The results of the TU were presented in a public event by the students where the preliminary findings including the technical and financial feasibility of the project were shown. This occasion was graced by a large number of dignitaries including the Mayor of Badulla city and the Vice Chancellor of UWU and other representatives of the region and the university. The project was recognized as the first of its kind not only in Sri Lanka but also in South Asia (Dasanayake, 2014).

5. Conclusion and Outlook

The Environmental Campus Birkenfeld has established sustainabilty in the operation of the university and also in education and research. In Germany, the ECB has become a partner in the university initiative „HOCHn". This initiative should help to integrate sustainabilty in more and more universities in Germany. Furthermore, the German Sustainability Code will be further developed for the needs of universities and applied in the participating universities to improve their sustainability reports. The Sustainability Code for Higher Education Institutions seeks to strengthen this institutions in their role as agents of change and bearers of social responsibility (www.deutscher-nachhaltigkeitskodex.de/en).
As a zero emission campus, the ECB is one of the greenest campuses worldwide. An important task for the future is to transfer the Zero-Emission Campus concept to universities all over the world. To fulfil this goal, IfaS has established a university network to implement sustainable education in international material flow management in a global IMAT Master's program. The ECB is also establising study courses offered in English to educate students from abroad.
IfaS applied research aims to implement MFM solutions in projects in more and more countries and collaborates with different research partners. An example of this great partnership was a side event at the climate conference COP 2016 in Morocco on Zero Emission Universities.
In conclusion, universities play a vital role in implementing the new Sustainable Development Goals and they should improve their activities in all areas (operations, education and research). The graduates of today are the leaders of the future and they must be enabled and motivated to change our world towards the goals of Sustainable Development.

References

[1] Dasanayake R., (2014) Traveling University 2014 Sri Lanka: The Zero Emission concept for Uva Wellassa University. In: University of Applied Sciences Trier, *campino*, 2014/2 p. 70
[2] Enquête-Kommission „Schutz des Menschen und der Umwelt" des deutschen Bundestages (1994). Die Industriegesellschaft gestalten – Perspektiven für einen nachhaltigen Umgang mit Stoff- und Materialströmen. *Final report of the Enquête-Commission „Schutz des Menschen und der Umwelt – Bewertungskriterien und Perspektiven für umweltverträgliche Stoffkreisläufe in der Industriegesellschaft"* des 12. Deutschen Bundestages, Bonn, Drucksache 12/8260.
[3] Hartard S., te Heesen H. (2016) *Environmental Campus – Experience Green Technologies*, Birkenfeld
[4] Heck P., Bemmann U. (2002). *Praxishandbuch Stoffstrommanagement*. Cologne
[5] Helling K. (2012), *Zero Emmission-Strategien für Kommunen - Praxisbeispiel Zero-Emmission-Village Weilerbach*. In: Hauff, Isenmann, Müller-Christ (Ed.). Industrial Ecology Management S. 275-292

[6] Helling K., Heck P. (2016), *Stoffstrommanagement als Instrument zur nachhaltigen Schaffung von regionaler und betrieblicher Wertschöpfung*, in: Leal Filho, W. (Hrsg.), Forschung für Nachhaltigkeit an deutschen Hochschulen, Springer Spektrum, Berlin, S. 379-393
[7] Helling K., Weicht R. (2015) *Produktionsintegrierter Umweltschutz macht sich immer bezahlt: PIUS aus dem „Effeff"*, in: ENTSORGA Das Fachmagazin für Abfall, Abwasser, Luft und Boden, S. 29-32
[8] IfaS Institute for sustainable materialflow management (2016), *Travelling University*. Retrieved November 11 2016, from *Institut für angewandtes Stoffstrommanagement*: www.stoffstrom.org/en/studies-further-education/traveling-university, Birkenfeld
[9] Leal Filho W. (2011), *Role of universities and their contributions to sustainable development*. High Educ Policy 24, Hamburg, pp. 427-438
[10] Rick K. (2017), *Nachhaltigkeit im Beschaffungsmanagement*, in: TÜV-Rheinland, Der Umweltmanagementberater, Loseblattsammlung, erste Ergänzungslieferung 2017, Cologne, in press, est. April 2017
[11] Rick K. (2015), *S.U.N. - Nachhaltigkeit macht Schule,* in: Trier University of Applied Sciences, Annual Research Report for 2014, Forschungsbericht, publ. in Trier, pp. 204-212
[12] Rick K. (2014), *S.U.N. - Schulen und Umwelt-Campus pro Nachhaltigkeit,* in: Trier University of Applied Sciences, Campino Vol. 1/14, Birkenfeld pp. 54-55
[13] Rick K. (2006), *Greifbare Bildungsarbeit für Nachhaltigkeit: Die Projekte des Global Nature Fund*, in: Forum für angewandtes systemisches Stoffstrommanagement FasS, Institut für angewandtes Stoffstrommanagement IfaS, Birkenfeld
[14] Rick K. (2005), *Kritische Anmerkungen zu Wachstum, Nachhaltigkeit und Informations-technologie*, in: Forum für angewandtes systemisches Stoffstrommanagement FasS, Institut für angewandtes Stoffstrommanagement IfaS, Birkenfeld
[15] Rick K. (2004), *Produktionsbezogener Umweltschutz*, in: Arnold, U., Kasulke, G., Praxishandbuch Einkauf, Innovatives Beschaffungsmanagement, Deutscher Wirtschaftsdienst, 2. Ergänzungslieferung, Köln
[16] Rick K. (2003), *Kommunikation mit Innenwirkung: Schulen und Unternehmen für Nachhaltigkeit*, in: Myska, Martin (Hrsg.), Der TÜV-Umweltmanagement-Berater, TÜV-Verlag, Köln 2003
[17] Rick K. (2003) *Nachhaltigkeit – Verantwortung und Chance für die Deutsche Telekom*, in Angrick, Michael (Hrsg.): Auf dem Weg zur nachhaltigen Informationsgesellschaft, Metropolis-Verlag, Marburg 2003
[18] UNESCO (2015) Incheon Declaration Education 2030: *Towards inclusive and equitable quality education and lifelong learning for all*
[19] www.deutscher-nachhaltigkeitskodex.de/en
[20] www.imat-master.com
[21] www.stoffstrom.org
[22] www.umwelt-campus.de/sbt
[23] www.umwelt-campus.de/studysemester
[24] www.un.org/sustainabledevelopment

Panel Session 2
Issues and Innovation in Managing Setting and Infrastructure

The 3rd International Workshop on UI GreenMetric
Istanbul, Turkey, 09 - 10 April 2017

Challenges in Transformation into Green and Sustainable Campus: UMP's Experience

Daing Mohd Nasir Daing Ibrahim[1, a], Murad Abd. Ghani[1*,b], Hassan Ibrahim[1], Hazlina Faizal[1], Mohd Nurulakla Mohd Azlan[1], Muhammad Hairynizam Muhd Taib[1]
[1] *Universiti Malaysia Pahang, 26600 Pekan, Pahang, Malaysia*
[a]daing@ump.edu.my , [b]muradghani@ump.edu.my

Abstract. Green campus is one key initiative designed to promote the concept of sustainability among universities worldwide. Driven by Agenda 21 of the Earth Summit held in Rio de Janeiro in 1992, the concept has been adopted by many stakeholders globally and broadened to address a bigger agenda for green and sustainable development. The initiative has increasingly gained special attention from universities in many countries, in order to transform themselves into "Green Campus". Campus greening is often regarded as the first step universities take towards achieving sustainability. This paper focuses on challenges faced by Universiti Malaysia Pahang (UMP) in the effort of greening the campus. Various initiatives implemented under different clusters are discussed. Finally, the paper also highlights the commitment made by the university to ensure both short and long-term objectives of campus greening and sustainability are achieved.

Keywords: Sustainable development; Ecological approach to greening the campus; Tree planting programme; Green campus.

1. Introduction

Malaysia has been experiencing rapid urbanization in the last two decades where the percentage of the urban population has increased from 4.75 million (34.2% of the population) in 1980 to 14.7 million (58.5%) in 2000 [1]. The rate of urbanization is expected to increase to about 70% in the year 2020. However, this rapid urbanization process has resulted in many adverse impacts on the social, economic and natural environment of the nation, often resulted in a loss of either fertile prime agricultural land, forests cover, loss of biodiversity, environmental pollution and socio-economic inequality. This scenario urgently calls for a more serious review of the inherent impact of greenery upon the social, economic and environmental aspect pertaining to the sustainability of livelihood and lifestyles for the present and future generation. Therefore, universities are identified as key hubs within cities for innovation and environmental education, representing a precious opportunity for enabling the necessary generational behavioural change toward taking on more sustainable attitudes in daily lives [2, 3].Based on this, it is the responsibility of universities to take a holistic approach to integrating sustainability issues into all levels of their activities [4].

This paper highlights the major challenges experienced by UMP in transforming into green and sustainable campus through trees planting and landscaping programmes. Various commitment and policies undertaken to achieve a sustainable green development are also emphasized. Finally, this paper also discusses on the strategies and commitment by the university in becoming a major player in green and sustainable operations.

2. Green and Sustainable Campus: Why does it matter?

2.1 Federal Government Policies

2.1.1 National Landscape Policy - Garden Nation

Malaysia places great emphasis on environmental preservation and the creation of balanced and harmonized surroundings with the firm belief that these are the prerequisites for the formation of a developed nation. In Langkawi Declaration (1989), the Commonwealth Heads of Government including Malaysia signed a collective agreement for each member country to contribute towards the sustainable global development. The Malaysian Government fully supports the Agenda 21, which carries statements on the environment which was agreed by nations worldwide during the Rio de Janiero Earth Summit in

1992. In the Summit, Malaysia pledged to preserve 50 percent of its total land area as forest or greenery as compared to the target adopted by most countries (30 percent). In accordance with its stand on the environment and the greenery, the National Landscape Policy (NLP) was established as a guide to steer the National landscape development. Therefore, the Garden Nation vision represents a new thinking, which maintains a balance between the physical, social, economic and environmental development. Parks, landscapes, and green areas will always be an integral part of any development. It is not only about planting trees or landscaping, it involves creating a fundamental relationship between Man, Nature and the Creator in a holistic and comprehensive manner towards the survival of mankind.

2.1.2 Malaysia's Sustainable Energy and CO_2 Emissions Reduction Policy

The Efficient Management of Electrical Energy Regulation (EMEER) was enacted in 2008 (Electricity Act 2001), making it mandatory for any building, company and institution consuming a total of 3 million kWh over a period of 6 months to engage an Energy Manager. At the United Nations Climate Change Conference 2009, the Prime Minister of Malaysia made a pledge that Malaysia would adopt an indicator of a voluntary reduction of up to 40 percent in terms of emissions intensity of GDP by the year 2020 compared to the 2005 level. In 2016, four years before the target year, the Ministry of Energy, Green Technology and Water announced that the nation had achieved 37 percent reduction, well ahead of time.

2.2 University Energy and Environmental Policies

As an institution of higher learning UMP is entrusted with a bigger responsibility to make our institution operate sustainably, and to foster more programmes and initiatives towards making the university campuses green. As a university we embrace our responsibility to ensure that all students that we train become new breed of professionals with far-reaching conscience and responsibility for the benefits of the global world and for the future survival and comfort our future generation.

3 Challenges Towards Green and Sustainable Campus

3.1 Site Constraints

Physical characteristics of the site is a major obstacle to development and greenery effort and programmes. The development site was covered with large swampy area that was not suitable for plant growth due to constant water-logging. This would limit water infiltration rate as well as root depth. In order to solve this problem, the final grade of the area was also raised to 3.7m from the existing grade using reclaimed soil from the nearby sea. The soil properties mainly comprise of combination of fine sand particles and clay, are not suitable for plants growth due to low organic matter and fertility, low water retention, low drainage, high moisture loss and salinity. The use of heavy machineries during the construction also led to soil compaction and hardpan, which significantly limited soil oxygen content and increased soil bulk density. This limited root growth and penetration and led to poor growth and shallow root systems and finally caused trees uprooting especially during high winds or monsoon season.

4. Transformation into Green and Sustainable Campus: Our Strategies

4.1 Ecological Approach to Tree Planting

4.1.1 Planting a Right Tree at a Right Place Approach

This approach to successful tree planting that is "Planting the right tree at the right place" was the main tree planting concept adopted by UMP in the early stage of greening the campus, especially in Pekan Campus. We used native plants that can grow well under sandy coastal ecosystem. Some of the species include, *Casuarina equisetifolia, Syzygium grande, Azadirachta indica, Calophylum inophylum* and *Anacardium occidentale*.

4.1.2 Succession and Pioneer Species Concept

By adopting the concept of ecological succession through gradual process by which ecosystems change and develop over time, planted tree species can adapt, thrive and compete against other species under a very specific set of environmental conditions. Two pioneer tree species from Leguminosae (Fabaceae) family was planted, *Acacia mangium* and *Acacia auriculiformis*. These species are extremely fast growth species, tolerance to high pH level, low nutrient content, ability to grow well under high competition and relatively free from any disease. The trees also form a symbiosis with soil bacteria (genus Rhizobium) through root nodules to produce nitrogen thus enrich soil nutrients, thus making the environment condition ideal for the next stage of the trees planting programme.

4.2 Green Initiative

4.2.1 Trees Planting Programme

UMP is actively involved in trees planting programme since 2015 through various participations among staff and students. In 2015 the total number of trees planted was 1,435 followed by 979 in 2016. Our criteria in selecting the trees for these programme include aromatic and medicinal plants, native species, fast growing species, species that provide shade as well as trees that can grow in natural coastal ecosystem.

4.2.2 Bioaromatic Park

A land area of 72.8 hectares (180 acres) has been allocated to UMP by Pahang State Government to be developed into Pahang Bio Aromatics Park. The project is a comprehensive undertaking which involves the planting of patchouli (*Pogostemon cablin*) to extract essential oil.

4.2.3 Rare and Endangered Fruits Arboretum

The objective of this arboretum is to conserve genetic sources of rare fruits for the purpose of research and education for future generations with various native rare fruit trees species on 2.35 hectares (5.8 acres) of land.

4.2.4 Fruit Orchard

A total number of 49 fruit trees had been planted in the first stage of the development with various fruit trees on an area of 0.85 hectares (2.1 acres) for education and research for the benefit of future generations.

4.2.5 Aromatic Plants Arboretum

Aromatic Plants Arboretum is another UMP initiative to plant 2.35 hectares (5.8 acres) land with aromatics and medicinal plants. The area will serves as germplasm for genetic conservation of aromatic and medicinal plants for education and research purposes.

4.3 Others initiative: Energy

Having two large campuses, UMP's electricity consumption is huge. Initiatives to save energy and be more efficient in our use of electricity directly translates to our prudence in managing the university's operational budget, while at the same time contribute towards reducing the university's carbon footprint. In 2016, UMP has managed to save an average of 46,672 kWh monthly for the Pekan Campus, amounting to 20.1% savings, with an equivalent CO_2 emission reduction of 34,070 kg monthly.

5. Summary: Our Way Forward

Although we have moved up significantly in the UI GreenMetric Ranking, we are, however, still far from success. We have blended campus greening and sustainability in our Five Year Strategic Plan (2011-2015) in all four Key Result Areas (KRA), namely: Academic Quality Upgrade, Financial Perpetuity, Socio-Economic Development and Branding. This holistic effort is continued and further strengthened in our Strategic Plan 2016-2020 with five thrusts, namely; Academic Excellence, Financial Sustainability, Research and Innovation Sustainability, Socio-Economic and Environmental

Sustainability and its own UMP Prime Branding. As an institution of higher learning UMP is entrusted with even a bigger responsibility, conducting more actively frontier research to ensure the long-term sustainability of our beloved country and the world. Equally important is our teaching – to ensure that all graduates that we train will become new breed of professionals with far-reaching conscience and responsibility to continue the strife and struggle to make the Earth a beautiful and comfortable home to live.

Acknowledgement
We would like to express our sincere gratitude to Prof. Dr. Ir. Riri Fitri Sari, Chairperson, UI GreenMetric World University Rankings for inviting Universiti Malaysia Pahang (UMP) to present our paper in 3rd International Workshop in UI GreenMetric. We are also immensely grateful to all UMP staff who are directly and indirectly involved in making this paper possible.

References

[1] Ngah, I. (2005). Parks and Greenery towards Vision 2020. International Federation of Parks and Recreation Administration. Asia Pacific Congress, Kuala Lumpur
[2] Jackson, T. (2011). Prosperity without Growth: Economics for a Finite Planet, 2nd ed.; Routledge: New York, NY, USA
[3] Tukker, A.; Emmert, S.; Charter, M.; Vezzoli, C.; Sto, E.; Andersen, M.M.; Geerken, T.; Tischner, U.; Lahlou, S. (2008). Fostering change to sustainable consumption and production: An evidence based view. J. Clean. Prod., 16, 1218–1225
[4] Lisa Bohunovsky; Friedrich M. Zimmermann; Thomas Weiger; Fred Luks; Thomas Lindenthal and Helga Kromp-Kolb. (2014). Sustainable Universities in Austria. Building the Alliances and Clarifying the Concepts. 20th Annual International Sustainable Development Research Conference Norwegian University of Science and Technology, Trondheim, Norway, June 18-20, 2014

SUT as a Green and Clean University

Prasart Suebka*[1, a], Sittichai Seangatith[2,b]
[1 2]*Suranaree University of Technology, Nakhon Ratchsima, Thailand 30000*
[a]prasart@sut.ac.th, [b]sitichai@sut.ac.th

Abstract. Transforming a 1,100 hectares deforested area to to a "Green and Clean University" needs long-term commitments and implementations from all stakeholders of a university. For the past 20 years, SUT has achieved evidently from a number of Thailand National Awards and from the the UI GreenMetricWorld University Ranking. Many challenges have been overcomed by a good policy and implementation. But, many challenges are in the pipeline, especially on the mindset, attitude and behaviors the stakeholdes toward "sustainability" and financial support. SUT is willing to maintain a commitment to be a "World-class Sustainable University" within 2020 and a reliable pillar of society on sustainability.

Keywords: Green and Clean, University Policy, Setting and Infrastructure,

1. Introduction

Suranaree University of Technology (SUT) is the first Public Autonomous University in Thailand and located in Nakhonratchasima, 150 miles or 250 kilometers Northeastern of Bangkok. It was established in 1990 as the Science and Technology on 2,800 acres or 1,100 hectares deforested area as shown in Figure 1. By having Green and Clean policy since 1994 and continuously implemented, the green space and landscape and many supporting infrastructures have been developed by using science and technology and built and SUT has transformed the deforested area to a "Green and Clean University" as shown in Figure 2.

Figure 1. SUT has been developed from a deforested area.

Figure 2. SUT as a "Green and Clean University"

To evaluate the performance of policy implementation, in 2012 SUT has decided to participate the UI GreenMetricWorld University Ranking and was ranked No. 75 in the world or No. 8 in Thailand. Later, with a continuous improvement and development of the university for 3 years, SUT was ranked No. 52 in the world or No. 2 in Thailand in 2015. In 2016, a large number of developed university has involved in the ranking and SUT was ranked No. 102 in the world or No. 2 in Thailand, in which SUT was ranked No. 7 and 8 in the world on Setting and Infrastructure (SI) and Education (ED), respectivel, as shown in

Figure 3. More development on Waste (WS), Water (WR) and Transportation (TR) must be performed in the near coming future based upon the University of Science and Technology for sustainability. More challenging such as changing the mindset, attitude and behaviors of the people toward "sustainability" and finiancial support from the goverment must be overcomed.

World Ranking	102
World SI Ranking	7
World EC Ranking	131
World WS Ranking	355
World WR Ranking	307
World TR Ranking	318
World ED Ranking	8

UI Greenmetric Ranking, University of Indonesia, December 9th 2016
greenmetric@ui.ac.id
http://greenmetric.ui.ac.id

Figure 3. 2016 UI GreenMetricWorld University Ranking of SUT

2. SUT Green and Clean University Policy

Suranaree University of Technology (SUT) has announced the SUT Green and Clean University Policy since 1994. Accordingly, it was set as 1 of 5 development strategies of the university. In 2011, the policy had been revised by adapting the Policy Guidelines for Sustainable Practices from University of California. In 2015, The policy has included the green building standard (Thai's Rating of Energy and Environmental Sustainability) (http://www.tgbi.or.th) and UI GreenMetric World University Ranking. The implementation of such policy has been achieved evidently as seen from the number of national awards given by the Department of Environmental Quality Promotion, Ministry of Natural Resources and Environment, Thailand, (http://www.deqp.go.th) including 1) Green Office award with excellence (gold) level for the Division of Building and Land office in 2015 and Green Office award with good (bronze) level for Surapat 1 building, Technopolis in 2016.

The SUT Green and Clean University Policy has 8 main components including :

1. Green Education and Research such as offering more academic courses and more student activities on sustainability and increasing research budget on sustainability.
2. Clean Energy such as saving more energy, energy conservation and using more alternative energy and renewable energy in order to reduce the Greenhouse Gas (GHG) Emissions.
3. Sustainable Transportation such as improving transportation system, free public transportation, walking more and bicycling more and more enforcing parking policy.
4. Green Building such as repaired, renovated and rehabilitated buildings with energy saving and environmental conservation and new building complying with Thailand Green Building Standard.
5. Waste Management such as more enforcement on reduce, reuse and recycle policy, waste to fertilizer and energy and toxic waste management.
6. Water Management such as new reservoir and using more ground water, reducing the loss of piped water, reusing treated waste water and improving SUT waste water treatment system.
7. Area Conservation and Ground Management such as developing green reservation area and all-year-round tree planting activities.
8. Environmentally Preferable Purchasing Practices such as green procurement and green ICT and ICT for green.

3. Implementation

For the past 5 years that SUT has joined the the UI GreenMetric World University Ranking, in 2016 SUT has perfomed works according to the UI GreenMetric World University Ranking as followings:

3.1 Setting and Infrastructure

SUT is located in the outskirts of Nakhon Ratchasima city, having green area (natural and plant forests and water reservoir), accounting for 95% of the total area. The university aims to restore deforested area by planting new trees in it without destroying any former trees. This activity has been carried out continually in various events taking place in the university. Also, concepts of smart building are applied to the exist buildings on the campus with an achievement of 352,582 m2 currently, accounting for 72% of the total building area. Moreover, the university has set a budget for sustainable development project (the budget for the supporting and creating an environment for good living in campus), accounting for 30% of the total budget, which is about 6% higher than that given last year.

3.2 Energy and Climate Change Management

SUT also has a policy on energy conservation. This was performed by promoting the replacement of conventional appliances with energy efficient ones. Consequently, the average usage of energy efficient appliances i.e. air conditioner, office and street lamps is 92% at the present. In addition, smart building concepts was applied in conventional buildings by installing smart devices i.e. automatic fire alarm, centralized CCTV camera system and automatic switch system, etc. This included 44 buildings in the university, accounting for 72% of the total building area. Also, many relevant activities were carried out to promote energy conservation in the university i.e. green office, clean energy office, etc. The policy on promotion of the use of alternative energy has been applied in the university as well. This includes the use of alternative energy from solar cell, wind, biomass, biodiesel and biogas. The total energy produced was 104,308 kWh/year, accounting for 0.35 % of the total electricity used. Recently, SUT has been supported by the government to replace conventional appliances with energy efficient ones. This included the changes of 400 street light lamps and 80 air conditioners, capable of reducing the electricity cost up to 200,000 Baht/year and 1,100,000 Baht/year, respectively.

3.3 Energy and Climate Change Management

SUT has an efficient waste management system. The recyclable wastes were separated at the origin and handled through the recycle bank mechanisms. The rest was managed through an integrated waste management plant, which can separate wastes and create their value converting them to organic fertilizer and refuse-derived fuel (RDF). These by-products created return money to the university environmental fund around 725,983 Baht/year. The RDF was used as material to produce pyrolysis oil, which was subsequently used as fuel for vehicles in the university. The organic fertilizer was used to replace chemical fertilizer in the university and nearby communities. This waste management system can completely maximize values of wastes in SUT. Nowadays, the model of SUT waste management has been widely adopted for waste management in many municipalities in Thailand. In 2014, a hospital was founded in SUT, producing a great amount of infectious waste. SUT has decided to cope with this problem by supporting funds to conduct researches on a proper technology for infectious waste disposal. Subsequently, the research results were compiled and scaled up a prototype plant for infectious waste disposal in 2016. This plant now is not only used for infectious waste disposal from SUT hospital but also from other hospitals in the province. For the wastewater in SUT, it is collected and treated at the centralized wastewater plant of the university. The treated wastewater is reused for sanitary sewer system and watering trees in the university, recovering 100 of the total amount of wastewater. This management in SUT can reuse wastewater efficiently and does not cause a problem to environment.

3.4 Water Management

SUT has an efficient water management system. the university has recently evacuated a new reservoir to reserve water from rainfall. Also, underground water is used as much as possible to keep surface water available during the summer. The wastewater was treated and reused for sanitary sewer system, trees watering and cooling system, accounting for 100% of the total amount of wastewater produced. In addition, water efficient sanitary appliances were installed in replacement of conventional ones, accounting for 63% of the total sanitary appliances. The public awareness on water saving has been stimulated through various media as well. Continuously survey for water leakage has been carried out

in order to reduce the loss of water. With these efficient water management, the ratio of water usage per head was reduced by 5%.

3.5 Transportation

SUT has a policy to reduce the use of personal cars in the campus and promote the carpooling and the use of free service bus instead to reduce traffic and limit parking area. The vehicle access the campus was strictly controlled, requiring registration and display of vehicle pass card. Moreover, the university has provided 16 shuttle buses with fare-free service for accommodating both students and staff. Also, riding bicycle and walking are promoted by constructing new bicycle lanes and pedestrian roofs, covering a total length 22,700 meters and 2,500 meters, respectively. In addition, there is a rental service for bicycle with free of charge between each building under coral gold bike project. Currently, there are 246 bicycles available. With these promotions, the use of petroleum fuel was reduced by 2% compared with last year. And used natural gas 5% increase.

3.6 Education

SUT is the university of advance science and technology but the curriculums have included an idea of environment and sustainable development in the offered courses. Currently, the courses related to environment and sustainable development in the university account for 38% of the total number of courses offered, which is 5% increase compared with those offered last year. In addition, there is an increase in funding supports for conducting researches related to environment and sustainable development, accounting for 42% of the total research fund, increased by 17% compared with that of the last year. Moreover, the university has established “environmental fund” in order to promote and create awareness on sustainably environmental conservation on the campus. This environmental fund will support research projects and activities as well as inventions regarding improvement of environment on the campus. In this year, 9 projects are supported by the environmental fund with the total amount of 498,000 Baht. Moreover, in 2016 SUT has performed several activities regarding environment and sustainable development including seminar and training, academic services and site visit services, especially the learning center of the “Plant Genetic Conservation Project Under the Royal Initiation of Her Royal Highness Princess Maha Chakri Sirindhorn (RSPG)” (http://rspg.sut.ac.th/index.php/component/content/category/14-sample-data-articles) with the total number of 141 activities, increasing by 23% compared with those of the previous year. Finally, the SUT green university website (http://green.sut.ac.th) has been developed and updated continuously.

3.7 Challenges for Green and Clean University Implementation

Implementation of the SUT Green and Clean University Policy has many challenges since it involve with man, money, mangement and materials. The challenges that SUT confront with can be concluded as followings:

1) Changing the mindset, attitude and behaviors of the stakeholdes toward “sustainability”. More educations must be given to all stakeholders. University activities should contain the green and clean way of life.
2) Sustainability comes with cost. The development and the maintenance of the environmental-friendly infrastructure comes with higher prices such as on GREEN appliances, devices and instruments. More research and development on “sustainability” must be performed with well planned projects.
3) More support from the government to ensure the sustainability of the implementation.

4. Summary/ Concluding Remarks

It can be concluded from the past experiences that "a well plan is a half done". For the course of 20 more years, SUT has transform a deforested area to a "Green and Clean University". SUT's performance in Setting and Infrastructure and Education (ED) of UI Greenmetric 2016 ranking has been achieved from our long-term commitments and implementations. SUT is willing to maintain a commitment to be a "World-class Sustainable University" within 2020 and a reliable pillar of society on sustainability.

References

[1] Green and Clean University committee, 2016. SUT Green University Report 2016. Suranaree University of Technology.

[2] UI GreenMetric, 2016. UI GreenMetric world university ranking. Available online at http://greenmetric.ui.ac.id/, accessed on March 3, 2017.

The Green Road of the University of Zanjan to Sustainable Development

Bahram Maleki Zanjani[1*], Mahdi Moghimi[2]
[1*]*Associate professor, Administrative and Financial Affairs Vice President, University of Zanjan, Iran*
[2]*Assistant professor, Head of Design and Construction Management Office, University of Zanjan, Iran*

Abstract. The University of Zanjan, Iran, is a state university with one of the largest sites in the country. The nearly 400 hectares site creates opportunities and imposes challenges to the management system. The application of green management process helps to overcome the new and various environmental challenges caused by climate change. The practical measures of the process at the university include:

- Efficient usage of energy by improving the thermal insulation of existing buildings
- Considering architectural technologies in the design process of new developments aiming passive energy savings
- Applying modern HVAC systems for building services, which has improved energy efficiency
- Adjustments of the internal electricity grid of the university
- Adjustments of the internal water network, irrigation grid and sewage systems of the university, in order to reduce environmental impacts of human activities.

Planned arrangements include:

- Power generation by CHP plants in six months
- Installation of a large grid of solar panels and wind turbines to increase renewable energy generation to %20 of the regular demand in three years
- Modernising water and sewage systems

The green management process also covers a whole range of cultural movements and educational activities to increase social awareness and sensitivity among academics, students, officers and visitors about the importance of the environment and natural recourses for the long term sustainable development of the university as well as the Zanjan region.

Keywords: Sustainable development, green, water network, HVAC.

1. Introduction

The University of Zanjan, Iran, is a public university with one of the largest sites in the country. The nearly 400 hectares site creates opportunities and also imposes challenges to the management system. The Administrative and Financial Affairs Vice Presidency Department is responsible for managing the most challenging interactions with the local environment, the university organization as well as the outside world. Specifically, the Design and Construction Management Office coordinates the direct environmental interrelations of new university developments and the existing buildings and landscape.
Considering national economic complexities during last couple of years, a massive process of new developments has been carried out at the university, which included design and construction of nearly 100,000 square meters of new buildings. These developments comprise a number of student accommodations, restaurants, schools, laboratories and the university pool.

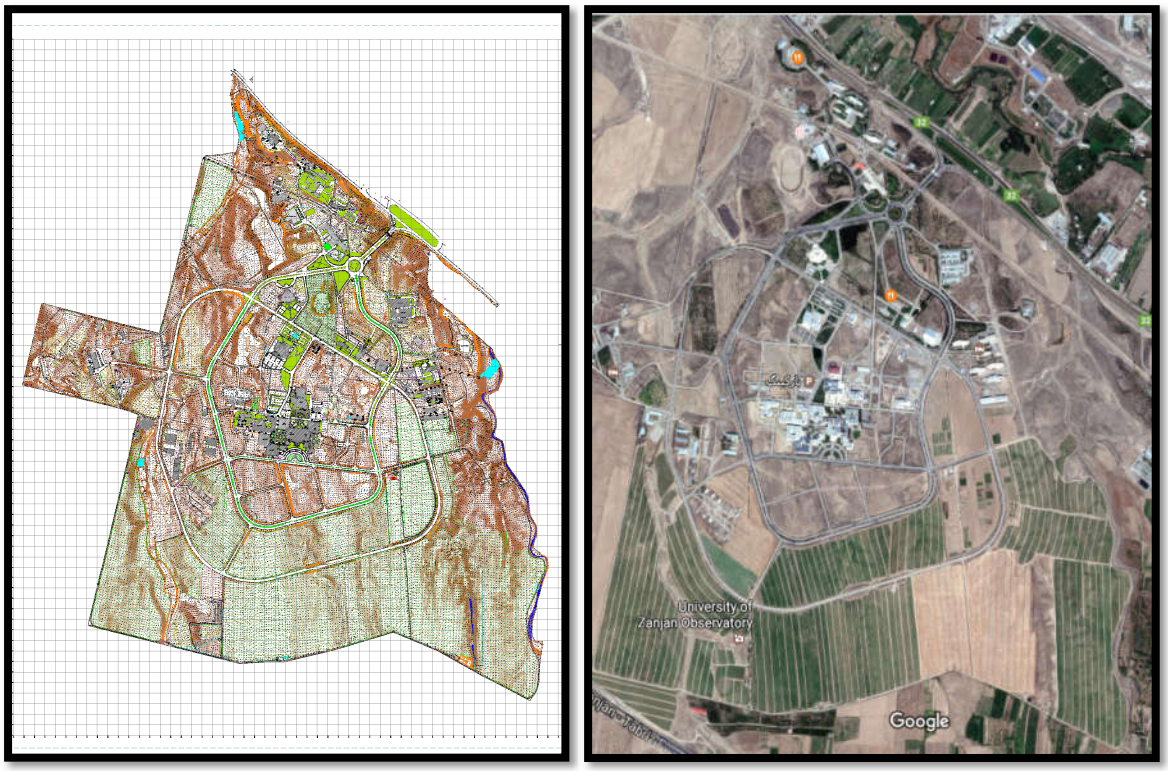


Figure 1. University of Zanjan Topography and Ariel view

Additionally, renovation and development of university infrastructure has been on top of agenda during past half-decade. Improvements have been done to the internal water network. The local 20KV power grid and the main electrical feeder post is also under an enhancement and expansion process. Major modifications have also been made and is continuously being done to the main refined water and natural gas pipelines as well as the pressure-reducing and metering stations. The old and decayed parts of the infrastructure facilities are being gradually replaced and refurbished by modern systems in order to reduce leakage and various possible pollutions, which can potentially harm human health and contaminate the environment. For instance, some old parts of the internal water system had been made of asbestos pipes that now have been replaced.

2. Green Management Strategies

It is now obvious that the life on Earth is changing by the effects of global warming. It is also scientifically clear that these effects are mainly because of human activities. Increasing heat waves and long term droughts are just some of these dangerous effects. The future forecasts of the climatic conditions prepared by statistical projections show that the living situation on the planet would get harsh and even uncontrollable, if immediate and adequate actions are not planned and executed in an international level. This important global program needs social evolution in all continents. It is believed that universities and the academic society can and should play a major role to pave the way to evolve the local communities, regional traditions and national culture as they also have an international obligation to prepare world population in the adaptation and mitigation process.

To be prepared for playing this vital multilevel role, first universities need to educate and train their own organizations and working processes in a systematic and long-lasting way. This requires a long-term strategic plan and a clear vision for each university, based on its own possibilities and limitations.

Fortunately, the Iranian Ministry of Science, Research and Technology (MSRT) ordered all universities and research centres to implement their own strategic councils of 'Green Management', at the end of 2016. These university councils are responsible to interact with the related national council based at the MSRT. The University of Zanjan realized its council in November 2016, which has held a number of

meetings, involving all related offices and professional departments of the university. The council is now focused on preparing a practical draft for the general green vision and 'green management strategies' for the university, which will lead to arrange the local action plan.
The application of 'green management strategies' helps to overcome the new and various environmental challenges, mainly caused by climate change and the changing lifestyles. The range of these challenges involves increasing yearly droughts to rising car park requests by private car owners. In addition, lack of sufficient funds and timely resources limits the prospects of responding to rising requests (for energy, clean water and efficient infrastructure) and tackling the effects of the changing climate.

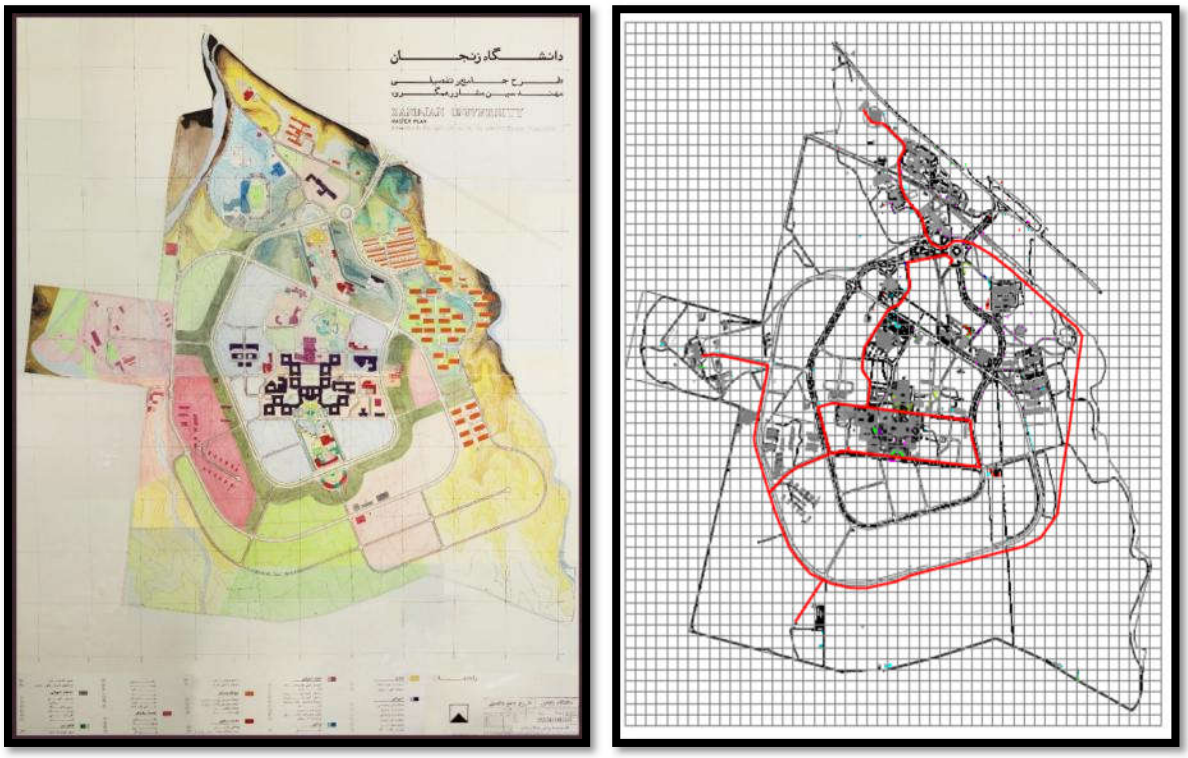


Figure 2. University of Zanjan Master Plan and Internal Water Network

The practical measures of the process at the university include:

- Recovering the energy efficiency by improving the thermal insulation of existing buildings
- Considering architectural technologies in the design and construction process of new developments aiming passive energy savings
- Applying modern HVAC systems for building services, which has improved energy efficiency
- Adjustments of the internal electricity grid of the university and the main feeder post,
- Adjustments of the internal water network, irrigation grid and sewage systems of the university, in order to reduce environmental impacts of human activities.
- Modification of natural gas pressure-reducing and metering station,
- Modernising refined water and sewage systems during a long-term plan.

The vast university landscape with scattered buildings and some forty years old infrastructure network needs a long-term strategic plan to be actually considered a green university. Fortunately, the University of Zanjan has a master plan, by which, the arrangement of buildings and road networks have been developed during past twenty years.
However, the master plan needs to be updated based on new requirements of the current higher education atmosphere. To keep moving on the roadmap to a sustainable future, the university will need huge investments in the next ten years to modernize its facilities according to the Iranian National Building Provisions.

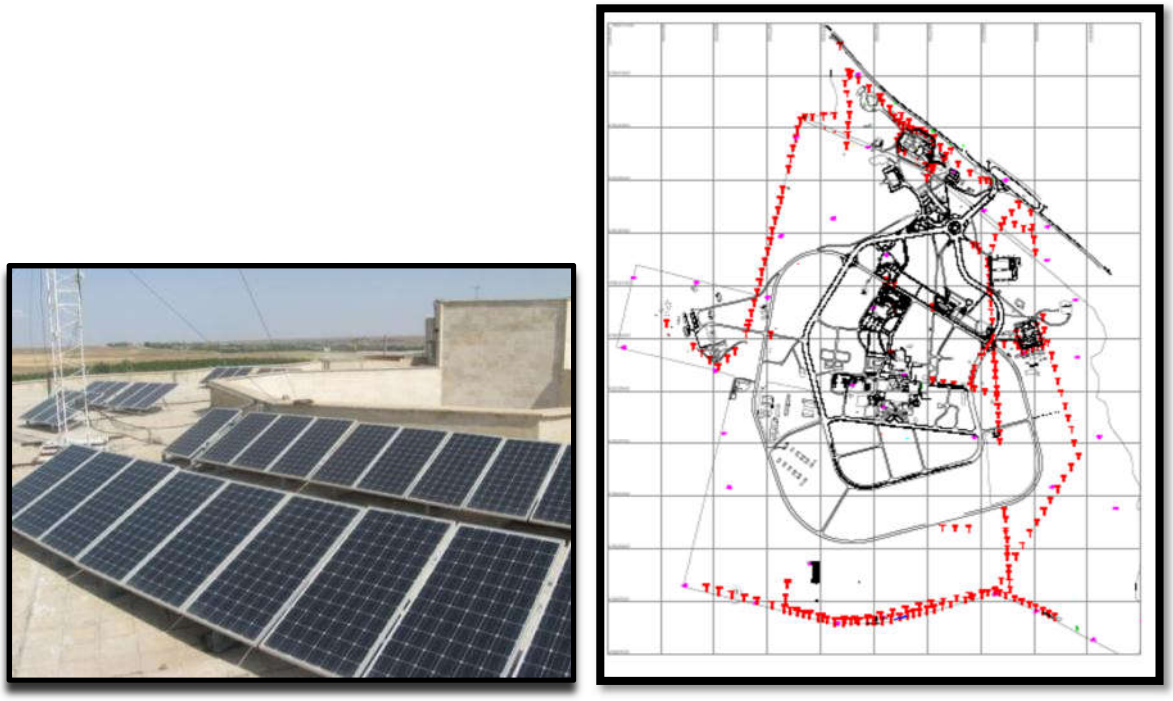


Figure 2. University Power Grid and PV Plant

Planned arrangements include:

- Controlling and redesigning of main structures of older buildings to make them resistant to earthquakes, according to the new edition of Iranian 2800 standard,
- Double-glazing the openings of previously built faculties, departments and office buildings,
- Repairing and/or installing thermal insulating panels on external walls and roofs,
- Optimising the suspended ceiling systems to improve their functionality, preferably by using recycled parts of the old system,
- Planning for power generation by CCHP power plants by private sector investments,
- Official negotiations for installation of a large network of solar panels and wind turbines to increase renewable energy generation to %20 of the regular demand in three years. The plan is a part of a larger joint program with the Ministry of Energy, to establish an eco-park with education, research and power generation purposes.
- Studies for a pilot plan to use refined water in the irrigation of university green lands for growing agricultural crops and maintaining the landscape. It will also be used in flash tanks at the major water-consuming student accommodations.
- Restoring biodiversity and supporting local wildlife.

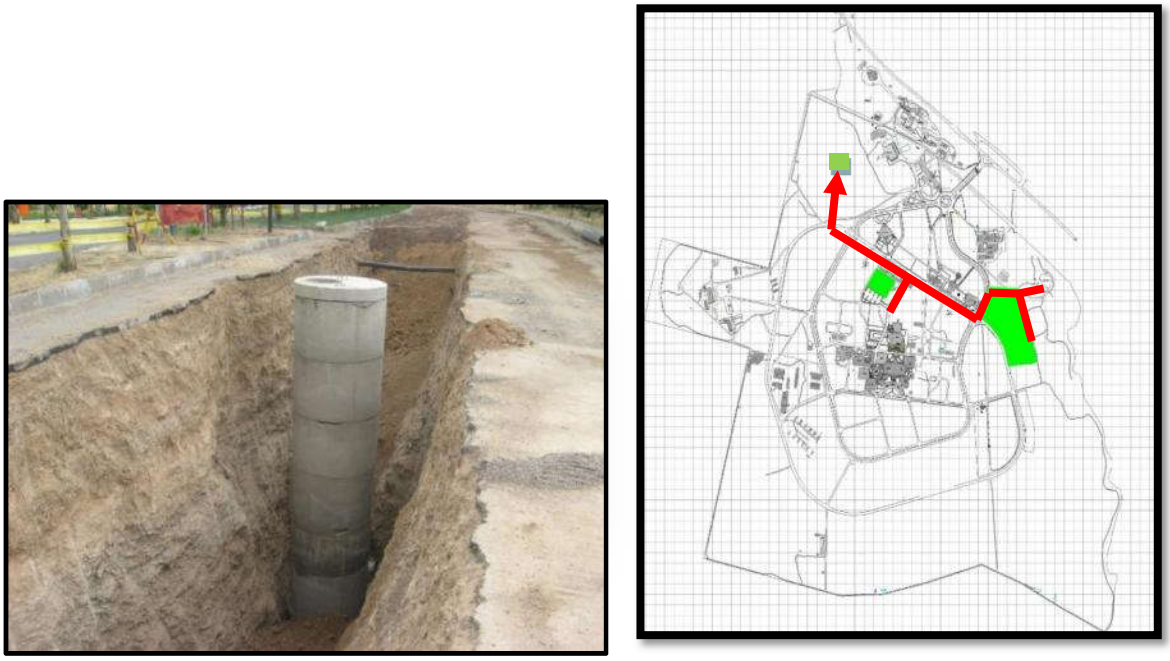


Figure 4. University Sewage 1st Line and a Typical Prefab Concrete Manhole

3. Conclusion: Green Culture

The green management strategy, in addition to its administrative process and physical effects, covers a whole range of cultural engagements and educational activities to increase social awareness and common sensitivity. The academic society including professors, students, officers and visitors need to know more about the importance of the environment and limitations of natural recourses. For the long-term goals of the sustainable development to be achieved, this trend should be spread out as common-knowledge, not only for academia, but also for the public. Therefore, the concepts of green development are going to be more general rather than professional, to make them a non-renounceable part of social culture.

Universities play a decisive role in this significant cultural movement. Their sites are naturally models for the urban environment. For this obvious reason, the University of Zanjan is working jointly with the Iranian Ministry of Power to build up an eco-park as a research-educational park for professionals and the public. To realize the Sustainable Development Goals set by the UN for 2030 in a local level, the university must remodel and renovate its managerial procedures as well as its physical and cultural landscape, to affect the local region, which is working hard towards it.

The 3rd International Workshop on UI GreenMetric
Istanbul, Turkey, 09 - 10 April 2017

Multidisciplinary Actions as an Instrument of Sustainable Development

Marcelo Bregagnoli*[1, a], Pamela Oliveira[2,b], Paulo Ceccon[3,c]
[1] *Rector, Rectory, IFSULDEMINAS, Avenue Vicente Simões, 1111 – Pouso Alegre / Minas Gerais, Brazil.*
[2] *Member of Sustainable Logistics Plan, Rectory, IFSULDEMINAS, Avenue Vicente Simões, 1111 – Pouso Alegre / Minas Gerais, Brazil.*
[3] *Institucional Development Director, Rectory, IFSULDEMINAS, Avenue Vicente Simões, 1111 – Pouso Alegre / Minas Gerais, Brazil.*
[a]marcelo.bregagnoli@ifsuldeminas.edu.br, [b]pamela.oliveira@ifsuldeminas.edu.br,
[c]paulo.ceccon@ifsudeminas.edu.br

Abstract. This article presents a theoretical review of the formation of the Federal Network of Vocational, Scientific and Technological Education. In this context, through a qualitative study, a bibliographical survey of work policies and multidisciplinary actions was carried out, focusing on sustainable development. Finally, this article shows that the sustainable growth policy is part of the IFSULDEMINAS mission and, for this reason, has been betting on investments in infrastructure, because it believes actions of this type have great examples to stimulate the academic community to walk together, Towards a sustainable culture march.

Keywords: Federal Institute, Development, Sustainability, Policy, Actions.

1. Introduction

Brazil is the largest country in South America, with more than 200 million inhabitants and occupies the fifth place in the world of territorial extension with an area of 8,515,767,049 km2, GDP (Gross Domestic Product) is 2.4 trillion Dollars and the average per capita income of US $ 11,067. According to the United Nations Development Program (UNDP), the country ranks 75th in the ranking of human development index [1]. In the current scenario, Brazil is going through a period of economic restraint, and in this way, it is set in yet another reason for establishing increasingly good management practices based on the principles of sustainability for the maintenance of the quality of life of the Brazilian population.

The 21st century Brazilian is pre-eminently urban (85%), rural environments have been replaced by urban environments, due to the effect of the "swelling" of cities (rural exodus), and in this new scenario. In this way, there are many imminent issues to be addressed Such as water, sewage, food, energy, raw materials, transportation, waste, among others that are consumed and needed to meet the demands of society and contemporary culture.

In this context, given the high environmental costs and catastrophic environmental consequences of the urban system, it is imperative that each individual, institution and nation incorporates their responsibility in regulating, undertaking and implementing management models that aim at environmental protection and sustainable development.

Contemporary society needs to develop a more forceful awareness of environmental issues and the scarcity of natural resources, it is necessary, therefore, increasingly for the formation of the student-citizen. So, this person has full understanding of its role in relation to the environment and develop in this educational process concrete actions that have a positive impact on the social sphere for this and for the next generations.

2. The IFSULDEMINAS

2.1 Background and training

Based on a policy of the Federal Government, in an unprecedented arrangement in the organization of Brazilian professional education, Law No. 11,892 / 2008 was instituted, which established the Federal Network of Vocational, Scientific and Technological Education composed at the time by several units. : 31 Federal Centers of Technological Education (Cefets), 75 decentralized Units of Education (Uneds), 39 Agrotechnical Schools, 7 Federal Technical Schools and 8 Schools linked to Universities, which no longer exist to form the Federal Institutes of Education, Science and Technology.

In the South of Minas Gerais, the Federal Agrotechnical Schools of Inconfidentes (1918), Machado (1957) and Muzambinho (1952), traditionally recognized for quality in the offer of High School and technical courses, were unified. Thus, the Federal Institute of Education, Science and Technology of the South of Minas Gerais (IFSULDEMINAS), which currently has campuses in Passos, Poços de Caldas, Pouso Alegre (created in 2011) and advanced campuses in Carmo de Mines and Três Corações (created in 2014), as well as advanced cores and network poles in several cities of the region.

The operations and work of IFSULDEMINAS covers 178 municipalities, with 3.5 million inhabitants. During 2009 and 2015, the total number of students increased from 4 thousand to more than 32 thousand students. The educational provision has added undergraduate, graduate, research and extension programs to the regular supply of technical courses. More than 55 technical courses, 37 undergraduate courses, 10 specializations (*Lato sensu*) and 1 specialization (*Stricto sensu*) are offered here. The institution also offers Continuing Initial Training (FIC) and Pronatec courses. Its administrative staff members surpasses the quantity of 1110 servers, including teachers and administrative technicians. In the year 2016, more than 24 thousand students were registered (in person and at distance).

The Rectory (2009) interconnects the entire administrative and educational structure of the campuses of the Federal Institute of South of Minas located in the city of Pouso Alegre.

2.2 Infrastructure

The units of IFSULDEMINAS have an area of 7,056,949.53 m2. The area corresponding to the Inconfidentes campus is 21,986.10 m2; Machado campus of 1,629,242.2m2; Muzambinho campus of 3,003,964.33 m2; Campus Steps of 30,446.79m2; Poços de Caldas campus of 67,284.66m2; Pouso Alegre campus of 15,000.00m2; Advanced campus of Carmo de Minas of 104,867.00 m2; Advanced campus Three Hearts of 4,076.55 m2 and Rectory of 3,458.00 m2. The units of IFSULDEMINAS (Figure 4) have several sectors to serve the academic community, such as: slaughterhouse, administration, warehouse, housing, football field, auditorium, poultry, restrooms, libraries, teachers' rooms, bio fuel, Boiler, soccer field, canteens, experimental kitchens, Rabbit breeding , ration factory, refrigerator, fertilizer shed, heritage shed, garage and storage, multi-gymnasiums, guards, laboratories: biology, biotechnology, coffee, physics and biology, Soils, food, computer science, dairy, laundries, leisure, carpentry, agricultural mechanization, bakeries, walking, patios, pedagogical, fish farming, vegetable processing, sports courts, cafeterias, lodgings, rooms: audio, class, field class, video, Drying of coffee, secretaries, pig farms, coffee gardens, roasting, transport, changing rooms for women and men, nurseries, etc.

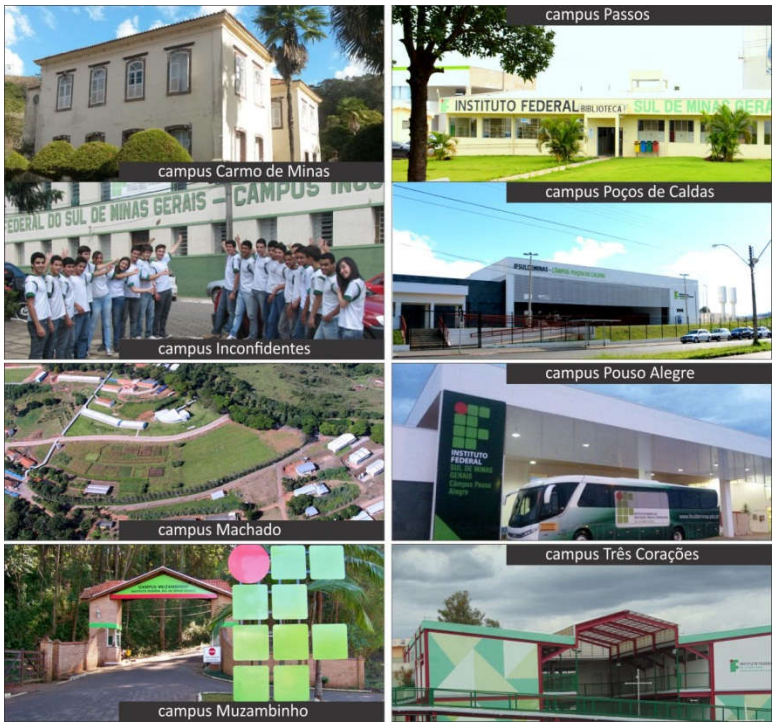


Figure 1. campuses.

2.3 Institution's commitment to sustainable development

It is part of the principles of the "Carta da Terra" [2] to integrate, in formal education and lifelong learning, the knowledge, values and skills necessary for a sustainable way of life. Implicitly, the document shows how important it is that educational institutions actively contribute to the formation of the population so that they become more aware and prepared citizens to solve issues of the most varied, related to sustainability, in a positive and collaborative way for the Preservation of the environment, and collectively build basic values to serve a sustainable way of life, wherever they are located: organizations, companies, governments, institutions and so on. Environmental Education is a frequent theme in the intergovernmental conferences held by Unesco, based on the results of these events, Unesco launched the Decade Program on Education for Sustainable Development with the proposal to stimulate changes in the attitude and behavior of society in the face of the depletion of natural resources Of the planet. The program also emphasizes that education, as well as being a fundamental right, is a necessary instrument for good governance and decision-making for the real reach of sustainable development, and also presents the idea that there is no sustainable development without education, Mentions vocational and technical education in the formation of value judgment and to make choices and attitudes concerning sustainable development [3]. Commitment to sustainable development is part of the mission of the Federal Institute of South of Minas Gerais (IFSULDEMINAS):

"To promote excellence in the provision of vocational and technological education at all levels, forming critical, creative, competent and humanistic citizens, articulating teaching, research and extension and contributing to the sustainable development of the South of Minas Gerais." [4].

In Brazil, the agricultural question has always been linked to the history of land occupation, and, consequently, associated with socioeconomic factors for the rural exodus. In this way, the models of sustainability construction were established based on the socioeconomic reorganization focused on the self-sustainability of the productive processes and associated with the transversality of environmental issues. The Federal Agrotechnical Schools of South Minas Gerais (Inconfidentes, Machado and Muzambinho) are part of these processes, since they have promoted the offer of technical and higher education in different modalities and since their formation are incorporated to the paradigms of

sustainable development in the human and (Agroforestry, agroecology, organic food production, composting, reforestation, minhocary, agroforestry systems among others) (Figure 5).
Through this contextualization with the diverse environmental, agricultural and forestry knowledge developed by the old schools, in 2010 the first institutional initiative was launched to formalize the Institute's commitment to the preservation of the environment. The highest body of the Institution, the Conselho Superior (CONSUP), approved the resolution that regulated the Sustainable Logistics Plan that encourages and monitors annually the sustainable actions carried out in its units throughout the academic community and is organized in the following thematic axes: Collection Selective, Electrical Energy and Water, Consumption Material and Quality of Life at Work.
The selective collection in IFSULDEMINAS takes place in each campus that has a local selective collection commission that aims to help the academic community to fulfill its social and environmental responsibility, in accordance with the norms indicated in Federal Decree No. 5.940 / 2006. The committee articulates with the associations and cooperatives of recyclable materials collectors, develops technical cooperation terms, implements collectors and mobilizes the academic community to carry out proper waste disposal. Through this action the Institution collaborates with the generation of income for the cooperatives, in total, there are six associations that receive the recyclable materials generated by IFSULDEMINAS: Jacutinga Recycling Production Cooperative; Machadense Association for the Recycling of Solid Waste; Organization Center for Recyclers of the Southwest Mining; Cooperative of recyclable materials workers of Poços de Caldas - Recycling Action; Association of Collectors of Recyclable Material of Pouso Alegre; Association of Collectors of Recyclable Material of Three Hearts (ASCAMT).
In IFSULDEMINAS, there are several initiatives and projects with the aim of saving water. Through a system of reuse of rainwater, the Pouso Alegre Campus significantly reduces water consumption in the unit. In Campus Inconfidentes, environmental extension projects contribute to the conscious use of resources. In Passos, an interdisciplinary project mobilized and sensitized students to the rational consumption of water. A sewage and water treatment plant, hydroelectric plant and a hydraulics and irrigation laboratory at the Muzambinho Campus contribute to sustainability. In Machado, a rainwater harvesting station allows the reuse of water. In the Rectory of IFSULDEMINAS, there is also a rainwater harvesting system for reuse, in an underground water box 40,000 liters of water are stored for use in toilets and external irrigation taps in the garden. The construction department has carried out new projects for the implementation of more rainwater harvesting systems for reuse in all units.
IFSULDEMINAS has become a partner of the Mantiqueira's Conservative Project. Its goal is to attend approximately 120 municipalities in the south and southwest of Minas Gerais through each campus. The objectives of this plan are to improve the production capacity of the environmental services, such as: water, soil conservation, biodiversity, carbon sequestration and landscape maintenance; Promote a regional plan with the participation of various actors; Improve resilience capacity of municipalities to address the damage caused by climate change; Strengthen environmental governance in municipalities and enhance the environmental services produced in rural properties and in integral protection conservation units.
The management of IFSULDEMINAS is also motivated by constantly making employees and students aware of the conscious use of paper and cartridges. In addition, the institution does not purchase disposable cups (Figure 2) and therefore provides individual mugs for all servers and students. The vast majority of printed materials use recycled raw material as a priority. In all the purchases of the institution, the observation of sustainability criteria is mandatory. In the year 2016, 2,400 adhesives were distributed in all units of IFSULDEMINAS to be fixed in strategic locations, aiming to raise awareness about the importance of reducing water consumption, electricity and the correct disposal of electronic waste. In the same year, the Sustainable Logistics Management Plan commission, through all the units, prepared and disseminated, through its page, reports on sustainability practices, all matters of sustainability actions of the units, consumption report, Week of the Garbage Collection, Christmas Campaign: Recycling gifts (Figure 3) .

Figure 2. Student kit.

Figure 3. Social christmas campaign, recycling gifts.

2.4 Pioneer Project in Brazil: IFSOLAR.

With the institution's notorious growth, a great challenge has been faced: reducing spending on electricity consumption. In order to maintain sustainable growth in 2016, the Rector of IFSULDEMINAS, Marcelo Bregagnoli, presented the IFSOLAR project for the National Council of Institutions of the Federal Network (Conif) and the Secretariat of Professional and Technological Education (Setec / MEC), for Through an innovative study carried out by the Institutional Development Board of the institution, which he held together with several companies and professors of the Institute. The project has the installation of eighty-two (82) photovoltaic solar power generators with 70 kWp power for solar energy, in total there will be 20,172 photovoltaic panels of 265 watts each and the capacity of Power generation of all power plants will be 5,470 MWw, which allows it to serve a city with more than 16,000 inhabitants, meaning it will be able to generate clean energy for 2,600 homes. The value of the investment will exceed 39 million reais.

2.4.1 Solar energy

Solar energy is clean and renewable, therefore it has many advantages for the environment and for the health of the people, since it does not emit polluting gases or other types of waste. Each proposed system will generate an average of 104.88 MWh per year. In this way, each installed plant will avoid the emission of 30,608 kilograms of carbon dioxide (CO2) per year in the environment. In the photovoltaic system, the electric energy is produced by solar radiation. Photovoltaic cells (or solar cells) are made from semiconductor materials (usually silicon). When the cell is exposed to light, some of the electrons in the illuminated material absorb photons (particles of energy in sunlight).

The free electrons are transported by the semiconductor until they are drawn by an electric field that is formed in the area of junction of the materials, by a difference of electrical potential existing between the semiconductor materials. The free electrons are taken out of the solar cell and are available to be used in the form of electric energy.
One of the advantages of the solar photovoltaic system is that it does not require high solar radiation to function. However, the amount of energy generated depends on the density of the clouds, which in smaller numbers can result in a higher electricity production, when compared to days of completely open sky, due to the phenomenon of sunlight reflection.

2.4.2 Integrated procurement

After approval of the project that provided for investment of 41 million reais, 15 institutes from different regions of Brazil joined the process presented by IFSULDEMINAS. In order to carry out the contracting of the service, technological innovation was not restricted only to the use of photovoltaic panels, IFSULDEMINAS adopted a new modality of purchase, the differentiated regime of public contracting (RDC) and through the integrated contracting regime. This modality of purchase, recent in the country's purchasing processes, allowed any entity in the country's federal sphere to also make the joint purchase

2.4.3 The deployment process

On September 26, 2016 the order of service for the installation of the photovoltaic panels was made, the company started the work in 10 (ten) days. The implementation process was carried out in two stages, the first one being through the preparation of the basic and executive projects and the second stage in the supply of materials and equipment, construction, assembly and start-up, testing, pre- Operation and all other operations necessary and sufficient to put in full operation 09 (nine) modules of Solar Photovoltaic Generators, according to the preliminary design and other documents of the process N ° 23343.001270 / 2016-28, RDC / INTEGRAL BY SRP PRESENTIA Nº01 / 2016, destined to attend to the rectory and to the campuses of Passos, Poços de Caldas, Pouso Alegre (2), Inconfidentes, Machado, Muzambinho, Três Corações and Carmo de Minas.
In the scope of IFSULDEMINAS, to date, photovoltaic panels have already been installed in the covered parking of the Muzambinho Campus, in the administrative building of the Pouso Alegre campus, on the roof of the main building and next to the water boxes On the floor of the Poços de Caldas campus (Figure 24) and in the administrative building of the Machado campus. IFBAIANO deployed 256 photovoltaic panels in the Guanambi campus classroom (Figure 26).

Figure 4. Photovoltaic panels in Poços de Caldas campus.

Figure 5. Photovoltaic panels installed in the classroom building campus Guanambi/Bahia.

All systems will have their consumption and production monitored, in real time, by the unit and by the contracted company, through a cellular application that provides the information of the plant via wireless. It will be possible, therefore, to determine the institution's saving capacity and to analyze the power generation status of the plant by remote access.
The head of the project at the Campus Muzambinho and employee of the contracted company, Domingos Mendes Machado, reported that the plant works in parallel with the grid that provides energy to the municipality, and therefore, if there is more energy production than is consumed, the system Throws the energy in the net that turns a credit so that it is used the next day, if it does not produce enough, There is an exchange of energy.

2.4.4 Expected results

The first result to be mentioned will be the financial savings of R $ 64,000.00 per month of electricity in the IFSULDEMINAS campuses and rectory, and if all the plants are installed, the savings will be of R $ 656,000.00 of electric power per Month and R $ 7,872,000.00 per year. Another result that can be instantly measured is to avoid the emission of 32 tons of CO2 in the atmosphere from the IFSULDEMINAS units and with the effective operation of all the plants, leaving to emit no more 215,168 tons of CO2 in the atmosphere. Still, because it is an integrated contracting, new government units will be able to join the project, which will increase the estimation of financial savings and CO2 emissions.

3. Concluding Remarks

The world in which we are inserted has put society on the path to sustainable development. Environmental and nature limits have already been exceeded, and the time to reverse this is little. Aware of these issues, IFSULDEMINAS uses a variety of tools to make work policies active and effective, with a view to making such changes happen. With an infrastructure that allows reaching a large part of Brazilian society, IFSULDEMINAS found in the environmental knowledge of the old agrotechnical schools a great support to implement a strong institutional policy of preservation of the environment.
According to anthropologist Margaret Mead, "Never doubt that a small group of concerned citizens can change the world. In fact, this is what has always happened ", for this reason, IFSULDEMINAS is based on a multidisciplinary management team and engaged with the proposal to involve and share with the entire academic community (servers, teachers, students and etc), actions Which aim at sustainable growth and improvement in the various sectors, such as: selective collection, electric energy and water, consumer material, quality of life at work, transportation, among others.
The IFSULDEMINAS bet is incisive. Through the Department of Institutional Development, it has elaborated several studies and projects that contemplate actions aimed at improving the existing infrastructure and that, in general, it encompasses the partnership with other organs of the government.

Thus, it has presented satisfactory results, since the reuse of rainwater, the implementation of the project "Conservative of the waters" that will ally the partnership with the city halls, as well as the use of solar energy through the installation of photovoltaic.
For the thinker Albert Schweitzer, the example is not the best way to influence others, but rather is the only one, concerned with its performance, the Institute seeks to collaborate in the training of students, accompanied by actions that involve teaching, research and extension . Promoted by state-of-the-art technology and financial resources, the Institution believes that it is through sustainable actions that a good example can be delivered to help the academic community and society to walk together in the march of sustainable culture. And, thus, achieve the commitment stipulated in its institutional mission.

References

[1] United Nations Development Programme (Org**.).** Key to HDI countries and ranks, 2014**.** 2014. Available online at: http://hdr.undp.org/sites/default/files/ranking.pdf. Accessed on 10, March, 2017.
[2] UNESCO-UNEVOC International Centre (Org.). Orienting Technical and Vocational Education and Training for Sustainable Development: A Dicussion Paper. Germany: Carthaus, 2006. 48 p. (ISSN 1817-0374).
[3] BRASÍLIA. Brazil. Ministry of the Environment(Org.) Earth Charter. 2000. Avaliable online at http://www.mma.gov.br/responsabilidade-socioambiental/agenda-21/carta-da-terra. Accessed on 10, March, 2017.
[4] BRAZIL. IFSULDEMINAS. Ministry of Education (Org.). O Instituto. IFSULDEMINAS. Missão Institucional. Available online at: http://portal.ifsuldeminas.edu.br/o-instituto. Accessed on: 10 March. 2017.

Panel Session 3
Issues and Innovation in Managing Transportation

The 3rd International Workshop on UI GreenMetric
Istanbul, Turkey, 09 - 10 April 2017

Implementing Green Transportation in University Level: a Case Study from Bogor Agricultural University, Indonesia

[1]Herry Suhardiyanto, [2] Dr. Ir. Yusli Wardiatno, M.Sc.,
Bogor Agricultural University, Kampus IPB Dramaga, Bogor 16680, Jawa Barat, Indonesia
[1]herrysuhardiyanto@yahoo.com, [2]wardiatno@gmail.com

Abstract. One of main concerns and issues facing modern world is global warming and escalated of greenhouse effect. Worldwide researchers and environmental activist has been seeking revolutionary answers and encouraging our daily lifestyle to more environmental friendly. Bogor Agricultural University as one of the biggest universities in Indonesia actively playsthe significant role to contribute environmental friendly movement. Since 2015 Bogor Agricultural University (IPB) has launched a new program called IPB Green Transportation, and the ultimate goal of the program is to reduce greenhouse gas emission. The program has three main elements development, i.e. 1) Mass Transportation System, 2) Non-Motorize Commuter, 3) Verification Gate and Parking System. One of the excellent results of the program implementation is greenhouse gas emission reduction up to 47% in two years.

Keywords: environmental friendly, green campus, greenhouse gas emission, global warming

1. Introduction

The change in global climate is a major significant issue in this world which causes several urgent environmental impacts to be handled collectively. The decrease in sea level, the increase in the number of storms, crop and energy resilience directly or indirectly affected human life requires a brilliant solution through a systematical approach, sustainable, and participative in several levels of life along with the consciousness to inherit a healthy environment for the next generation (Hamin and Gurran, 2009). Bogor Agricultural University(IPB) as a higher educational institution has a social responsibility to respond and contribute to prevent global climatic change. As a university that holds the three dharma mission, IPB has a great capacity to provide moral forces in the scope of environmental awareness to the entire academic entityand also to the entire related elements of the society, and to be a leader in implementing green campus through "Green transportation" which has been implemented since 2015.Bogor Agricultural University (IPB) has more than 25,000 students with various interestswith high mobility have activity inside IPB Dramaga campus. Moreover the citizen of seventeenlocal villages who lived in surrounding campus using road inside Dramaga Campus as alternatives ways to reach neighbor villages,has caused a continuous increase of traffic in IPB Dramaga Campus.

Based on the 2015 research byPPLH, a research center of IPB, in the last two years the average daily motorized vehicles that enter the campus area of IPB Dramaga Campus has increased more than three times from 3,076 motorcycles in 2014 to 10,619 in 2015. In addition, there are 140 public vehicles that pass and 217 taxibike (ojek) that are in service (PPLH IPB, 2015). This condition indicates the high amount of emission, noise, irregularity, illegal parking, unsafe condition, traffic accidents, social insecurity and the increase amount of crime in the campus area. Therefore, forming the transportation system in campus area should be done immediately. Based on Letter of Decree by Rector of IPB No 240/IT3/LK/2015 on article of the Implementation of Green Transportation in IPB Dramaga Campus, The Program is carried out by encouraging people to walk, ride a bike, electric car, take a bus in campus road networks and make a free certain lanes from motorcycles and cars to reduce the consumption of fuel in IPB Dramaga Campus.IPB's *Green Transportation* Program consists of three major elements which are: 1) mass transportation system which is a transportation system that can carry numerous people from one place to another within campus areas by providing facilities such as electric cars and buses, 2) encourage non-motorized commuter which is a transportation system that provides public facilities in utilizing an environmental-friendly transportation by providing facilities for pedestrians and rental bicycle, and 3) limiting the use of motorized vehicles by providing parking space, manage by parking systemservice, and a verification gate system. By applying this system, it is expected to limit

the use of motorized vehicles in campus area, the unauthorized vehicles that enters area, must be park a vehicle in the provided location. Thus, this implementation will reduce the amount of emission. The research finding by PPLH (unpublished; 2015)showed that the implementation of*Green Transportation* at present has reduced the amount of emission by 47%. In 2020 IPB aims to reduce the amount of emission to 70% and the bicycle become the main transportation and the gas fueled bus or gas fuel buses (BBG) will be the main mass transportation.

2. Three main elements of IPB's Green Transportation

2.1 Mass Transportation System

The Green Transportation (GT) Program provides several public vehicles to support the academic entity daily activities in IPB Dramaga Campus. The GT Program Bus and Electric Cart serve on weekdays start from early morning until afternoon. The Green Transportation (GT) system has the function to serve the academic entity activities in campus areas, and guest who enter campus area by walking or parking their vehicles in the parking grounds. This system is supported by bus and electric car.In common, every bus has the capacity of 40 passengers, but modified to be 27 seated and the rest space for standing passengers in the middle of vehicle. At present,GT bus services use 5 IPB's buses and 1 DAMRI bus. There are 5 corridors (Fixed Route) for the Green Transportation services (see Figure 1).

Figure 1. Map of IPB campus showing bus corridors.

Bus commuter service in IPB campus is divided into 4 routes that cover the entire area of IPB Dramaga campus. These 4 routes are as follow: Corridor (1): Grha Widya Wisuda (GWW, an inaguration hall) to Faculty of Veterinary via Women Dormitory. This corridor is served by 4 buses, and is the largest number of passenger amongst all the corridors. Corridor (3): GWW to Faculty of Veterinary via University Library.This corridor is served by 3 buses. One trip (commuting back and forth) takes 8 minutes and a total of 90 daily trips. Corridor (4): GWW to Faculty of Veterinary via Rectorate Building. This corridor is served by 1 bus. One trip (commuting back and forth) takes 20 minutes and a total of 30 daily trips. The bus service in IPB has a charge 1,000 rupiah per passenger per trip. Passengers pay on the bus while getting in with the assistance of IPB's Green Transportation staffs.

On the beginning of the program, the **Electric car** is designed to support the buses and serve passengers with a corridor system (corridor 1, 2, 4, and 5). But on the implementation, due to many complains from the passengers that they have to change many times for a relatively short distance trip, Electric car service has been changed from initially corridor based to non-corridor based. The Electric car may serve

to wherever destination requested by passengers as long as still within the campus areas. This change of service effective started since October 2016. This new system of Electric car transportation mode showed a significant increase of users with an average of 800 people per day. Electric car is an interesting transportation mode which popular for its high flexibility in taking passengers, easy access and can go anywhere according to the request, and last but not least with a relative cheap price.Figure 2 shows the monthly number of electric car user in 2016.

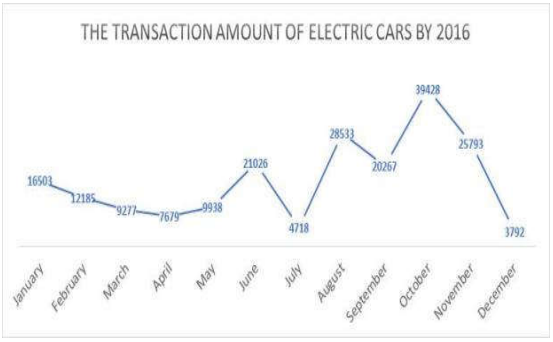


Figure 2. Electric car user in 2016

Figure 3. Bicycle borrower in IPB campus

2.2 Non- Motorized Commuter

The IPB Campus's environment also can be categorized as **pedestrian** supporting activity. Building inside IPB's Campus in Dramaga is designed to connect faculties, department through corridor, wing, and hallways. Pedestrian lane has also been provided on the side of roads. The trees and the natural green habitat of IPB's Campus in Dramaga could be a natural umbrellato supporting and encouraging people to walk in IPB. However, the Green Transportation program until 2016 has not contributed to developing the culture of pedestrians directly. Large direct investment for construction and development of mass transportation system, verification gate system and a smart bike system leaves limited space of fund for pedestrian development program.

The number of **bicycles** in IPB's Campus is relatively sufficient to cover the needs. Borrowing and returning bicycles could be arranging at the same shelter, where the borrower must leave a student identity or an employee card in the shelter. The card left as a guarantee and the bicycles only be returned at the same shelter. This borrowing concept provides guarantee that each bicycle will be return at the location and in a good condition. The development of data of people who borrow bikes each month can be seen in Figure 3 above. The average of borrowing of bicycles by November 2016 reached 78 units of bicycle per day, or about 15% from the available bikes (*oversupply*). The online bike system is able to electronically to maintain borrowing information that occurs in every shelter. The application is now ready and applied under the system IPB's Green Transportation. An important note in applying the online system is it still sensitive to interruption and disconnection. The system still requires an improvement by developing a high capacity server, data package/wifi network and backup system. The online system is showed in Figure 4.

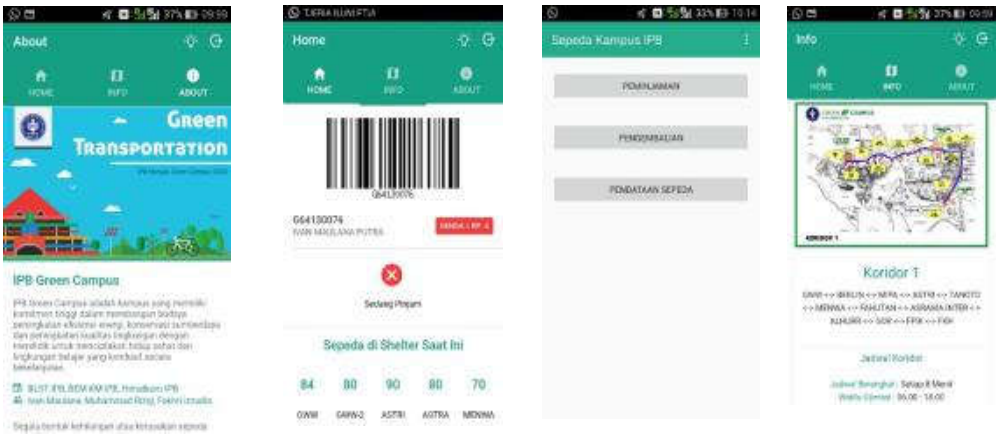


Figure 4. Smart Bike Applicationin mobilephone

3. The Limitation for Using Personal Vehicles inside Campus

Gate Verification Systemhas a function to verify every vehicle that going to enter IPB's Dramaga Campus Area. This system is carried out through verifying facilities placed in the Main Gate and Sub-Gate.

Several activities in verifying the gate system consists of A) Registering allvehicle owned by IPB's employee, academic citizens, IPB's partners, residents of IPB's University Housing at the Main Gate and Sub-Gate. B) Treating unregistered vehicles as a guest in the server Verification Gate System. C) Perform more frequent Server Updating which is fromonce in every two weeks to once in every day. The updating is needed due to the fact that the number of vehicles changing is very dynamics and complex due to large number of freshman and alumni students. And the main objectives are to reducing emission, and increasing security also reduced social conflict in the IPB's Dramaga Campus area.**Parking System**has the function of allowing vehicles to park in the campus areas after pass the Verification Gate System. The parking area is prepared in the certain location to accommodate people that enter from both, main gate or sub-gate.The user must park in the designated location. In 2015 total parking space can accommodateup to 2.680 motorcycles and in 2016 increases to 4.660 motorcycles. Figure 6 shows one of parking area in IPB campus.

Figure 5. Verification Gate System in IPB campus.

Figure 6. Parking area in IPB campus

4. Summary/ Concluding Remarks

The IPB Green Transportation Program implementing with three elements, i.e. Mass Transportation System, Non-Motorized Travel and Limit the Use of Personal Vehicles is the answer to the problems that appear from large and increasing number of vehicles in IPB's Campus, and also as an attempt to reduce greenhouse gas emission as IPB's social responsibility and real contribution to slow down the change in global climate. Further strong execution is needed to bringing the Campus Student and Entity to obey the decided rules. Thus innovative green movement method could be applied to make students aware and interested in Climate Changing Issues.

References

[1] Chang Y, Ries R.J., Wang Y. 2010. The embodied energy and environmental emissions of construction projects in china: an economic input–output LCA model. Journal of Energy Policy 38 (11), 6597–6603.
[2] ECOFYS. 2010. World GHG Emissions Flow Chart 2010, Kanaalweg 15-G, 3526 KL Utrecht, the Netherlands.
[3] FTA US. 2010. Public Transportation's Role in Responding to Climate Change. Department of Transportation: United State.
[4] Guo Z, Zhang D, Liu H, He Z, Shi L. 2016. Green transportation scheduling with pickup time and transport mode selections using a novel multi-objective memetic optimization approach. Transportation Research Part D. (In Press, Corrected Proof)
[5] Gusnita D. 2010. Green Transport: Transportasi ramah lingkungan dan kontribusinya dalam mengurangi polusi udara. Berita Dirgantara 11 (2): 66-71.
[6] Hamin E, Gurran N. 2009. Urban Form and Climate Change: Balancing adaptation and mitigation in U.S. and Australia. Habitat International 33 (3): 238-245.
[7] Li H. 2016. Study on Green Transportation System of International Metropolies. Procedia Engineering 137 (2016): 762-771.
[8] Measey M. 2010. Indonesia: A Vulnerable Country in the Face of Climate Change. Global Majority 1(1): 31-45.
[9] Trappey A.J.C, Trappey C., Hsiao C.T., Ou J.J.R., Li S.J., Chen K. W.P. 2012. An evaluation model for low carbon island policy: The case of Taiwan's green transportation policy. Energy Policy 45(2012): 510–515.
[10] WHO. 2016. Urban Green Spaces and Health: A review of evidence. WHO: United State.

The 3rd International Workshop on UI GreenMetric
Istanbul, Turkey, 09 - 10 April 2017

Environmental Management System - Air Program

Miguel Diago*[1, a], Jenny Diaz[2, b], David Diaz[3, c]
[1] *Universidad del Rosario, Vice-rector, Bogotá, Colombia*
[2] *Universidad del Rosario, Sustainability Coordinator, Bogotá, Colombia*
[3] *Universidad del Rosario, Director of campus, Bogotá, Colombia*
[a]miguel.diago@urosario.edu.co, [b]jenny.diazp@urosario.edu.co, [c]davidal.diaz@urosario.edu.co

Abstract. Universidad del Rosario is a private institution founded in 1653, located in Bogotá, Colombia. The University has a total number of 13,000 students in three campuses around the city. The main campus is an urban campus in the city center comprising historical buildings; the second campus is in the middle of a residential area; and the third campus is in the outskirts of the city. The University understands that our activities must be socially fair, economically viable and environmentally safe, and that we are responsible for preserving the environment for future generations in a city that does not offer good public transportation.
In this sense, within the framework of the environmental management system (EMS), we have established six (6) programs of environmental management: solid waste, water consumption, energy, air, flora-fauna and education. Each one of these programs makes use of a group of strategies aiming to prevent, mitigate, correct, control or compensate any potential and generated impact, covering social, environmental and economic variables.
The objective of the air program is to implement strategies that seek to improve air quality in the areas of influence of the University by reducing the consumption of fuel and encouraging the local community to use alternative means of transportation such as: walking, bicycles, carpooling, public transportation and reducing the use of private cars which are widely used in Bogotá.

Keywords: sustainability, historical center, mobility, bicycles.

1. Introduction

In Bogotá, air pollution has become one of the main environmental problems. Air quality deterioration has led to an increase in the negative effects on human health and the environment. Universidad del Rosario in coherence with its environmental policy and under the sustainability approach, has developed an air program. The program first characterizes the areas of influence in which the University operates daily in order to obtain an integral vision of the environmental problem of the air resource, identifying as accurately as possible the associated environmental aspects and quantifying the demand of atmospheric resources required for the sustenance of its activities.

2. Planning of EMS

At Universidad del Rosario we are acutely aware of the institutional and local context in which we operate and, in order to obtain an integral vision of the environmental problems, we have structured a methodology to determine the environmental aspects and the demand of natural resources that we require to function. Concurrently, we established the applicable legal requirements and assessed the environmental impact in the atmospheric component. As a result of this analysis we get the hierarchical ranks of the environmental management programs to be implemented.

2.1 Environmental Policy

At Universidad del Rosario, as an educational community we focus on acting for the benefit of society with a maximum sense of responsibility. That is why we commit ourselves to implementing and maintaining at all levels of the organization an Environmental Management System. By doing so, we guarantee strict compliance with current regulations. We also undertake programs that allow us to prevent and control the sources of pollution resulting from our activities. As a consequence, we contribute to sustainable development, assuming environmental management and continuous

improvement as an integral part of our internal processes. For this we have established measurable environmental objectives and evaluate the progress of our programs.

2.2 Characterization Areas of Indirect Influence (Neighborhoods)[3] and Areas of Direct Influence (Headquarters) [4]

2.2.1 Main campus - Historical Center

The EMS is not intended to be an exhaustive analysis of the areas of indirect influence of the University. In this section we present an objective understanding of the local context in a more general one. For this, we describe the local environmental situation, considering cultural, economic, social and institutional aspects; as well as the state of their physical, natural or constructed resources, and how they interact with urban elements and processes (society and nature).
In order to obtain a holistic view under the prism of sustainability, it is necessary to manage relevant information associated with the historical center that characterizes the social, economic, environmental and cultural conditions of the area in which Universidad del Rosario operates. These local data are compared with citywide data, which allows us to measure the influence of the historical center in Bogota city.

2.2.2 Infrastructure Universidad del Rosario

The main campus is a national architectural monument and symbol of the University. The campus is comprised of 7 adjacent buildings and in the surroundings there are 15 more, for a total of 22 buildings with an installed capacity of 56,280 m2.

2.2.3 Mobility component

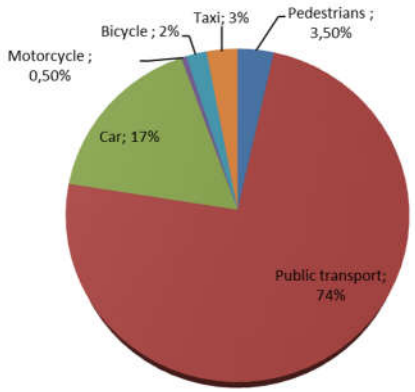


Figure 1. Classification of the university community by mode of transport.2014

3. Environmental Impacts

3.1 Per capita carbon emissions by mode

The per capita emission of the University is 2.12 kg / day according to the factor of occupation by mode of transport and the number of people transported as shown in Table 1.

[3] The indirect area of influence is defined as the physical space in which an impacted environmental factor, in turn affects another or others, not directly related to the organization.
[4] The area of direct influence constitutes the territory where the impacts originate and also, they have an impact on the environment close to the organization.

Table 1. Emission per capita by mode of transportation with factor of occupation of the university community

	# People transported	Ton CO2/ day	Emission per cápitaKg/día
Car (1.2)	1652	15.44	9,32
Campers (2)	207	1.40	6,80
Taxis (1)	310	2.94	9,49
Motorcycle (1)	155	0.16	1,04
Mini Bus (25)	413	0.23	0,56
Bus (64)	2954	1.00	0,34
Transmilenio (120)	4637	0.74	0,16
Total	**10.327**	**21.92**	**2.12**

4. Environmental Management Program - Air Program

Once the stage of identification of legal requirements and analysis of the local context has been completed, we proceeded to formulate what is considered to be maximum relevance and visibility: the Environmental Management Programs. The University has established six (6) programs of environmental management: solid waste, water, energy, air, flora-fauna and education (Fig. 3). Each one of these programs has a group of strategies aiming to prevent, mitigate, correct, control or compensate the potential and generated impacts covering social, environmental and economic variables.

4.1 Air program

The objective of the air program is to implement strategies that seek to improve air quality in the areas of influence of the university by reducing the consumption of fuel and encouraging the local community to use alternative means of transportation such as walking, bicycles, carpooling, public transportation and reducing the use of private cars which are widely used in Bogotá. The main strategies implemented by this program are presented below.

4.1.1 Stimulate the use of bicycle for the members of the university

In 2015, as part of these strategies the University decided to promote the use of bicycles and transformed 10 spaces in the parking lot into a bicycle parking lot with more than 186 spaces. An additional 300 spaces were also built in two extra parking lots. The University also provides a service of shared bicycles that can be used either by students or employees, a bicycle parking station, dressing room and bathrooms. (Fig. 4, Fig.5)

4.1.2 Caravans “UR en bici”

In consultation with the students, the EMS established cycle-routes to go to the University all over the city. This promotes the use of bicycles as a healthy, cheap and comfortable transportation alternative. Besides being a healthy activity, the students who join these routes help with decongesting the mobility of the city and reducing their carbon footprint. (Fig. 6)

4.1.3 Transport race

The objective of this race is to promote discussion and analysis of the advantages and disadvantages of each transport system. This activity also seeks to stimulate the use of bicycles, massive transport and the efficient use of private vehicles. (Fig. 7)

4.14 Shared Bicycle System

The shared bicycle system has been in operation since 2016. Every member of the university community has free access to a bicycle, where they can ride it home and return it the next day.

4.15 Certified bicycle parking

In January 2017 the Secretary of Mobility of the city awarded the University with the Gold Category Seal for the bicycle parking lot of the main campus, in recognition of the outstanding conditions with regards the infrastructure, furniture and complementary services such as: map of bicycle paths, lockers, bike station, dressing rooms, showers, hydration points, stretch zone, dashboard and a Shared Bicycle System effectively implemented, with percentages of use superior than 95%.

5. Conclusions

When speaking of sustainability, there is a need within institutions to move from discourse to project execution. A sustainable university can only be conceivable through tangible results with social, economic and environmental impacts that benefit the institution as well as local, regional, national and even international contexts.

The university is at a stage where it meets and rethinks as a collective, which is the right place to cultivate the habit of respect and daily commitment to life, and understanding ourselves as revitalizing agents of the spaces in which we live. This is why Universidad del Rosario has worked towards the EMS and its six (6) environmental management programs. Thanks to the program, we are generating a multiplier effect on the community. We are certain that, in time, the surrounding community will change the perception of the historical center (where the main campus is), and will move from the idea of an area in the midst of chaos, noise and insecurity to a transformed territory. We hope the community will feel proud and people will become knowers and defenders of the historical, cultural and environmental heritage intrinsic to the area.[1]

In 2012 Universidad del Rosario started an ambitious plan framed under the motto of sustainability, which, despite all existing city problems, is undoubtedly intended to make a leap forward from passivity and conformism to activity and entrepreneurship. We provide a replicable model of air quality improvement, where mobility strategies are similar to those of developed cities with a higher quality of life, whose common denominator is to have privileged non-motorized means in the company of a transport system that is organized, efficient and sustainable, without sacrificing competitiveness and productivity. These policies of urban development have led cities to become economic and social leaders at a worldwide level. [2]

According to the diagnosis of the areas of influence, we have solid technical arguments to maintain that the best strategy to develop a sustainable university in the medium and long term, is firstly to encourage the use of bicycles as an effective means of mobility and, secondly to provide a modern and attractive public transport system for the local population. Therefore, we promote not only the participation, but also the contribution of research into the design and construction of plans focused on the trips that can be made by bicycle and public transport to increase their percentage in the total demand for travel.

References

[1] DIAZ, A., (2014) Sustainable university, an active agent in the revitalization of La Candelaria, Urban environmental management in La Candelaria, Editorial Universidad del Rosario, Bogotá, Colombia, p 112-150

[2] Universidad del Rosario (2012) Environmental management system. Air Program. Bogotá

The 3rd International Workshop on UI GreenMetric
Istanbul, Turkey, 09 - 10 April 2017

Using Rankings as Picture of the Change in Universities: The Ca' Foscari University Experience

Chiara Mio*[1, a, b]
[1]*Ca' Foscari University of Venice, Department of Management, San Giobbe 873*
30121 Venice, Italy
[a]mio@unive.it, [b]sustainability@unive.it

Abstract. Sustainability represents the main challenge for the human society and for the entire Planet, as highlighted also by the Agenda 2030, which put the sustainable development as the target of actions at the global scale for the next 15 years. Analyzing the 17 Goals (SDGs) of the Agenda, it is clear the effort to move towards an integrated sustainability perspective.
The perspective of sustainability is essential for Universities, intrinsic to their mission: these institutions generate directly and indirectly environmental, social and economic impacts.
Universities play a fundamental role in educating future generations, contributing to the spreading of sustainability principles, so that sustainable behaviours are adopted by responsible citizens. From this perspective, the action of Universities must be pervasive, first of all considering their institutional pillars: from teaching, integrating sustainability in degree and professional master programs, to research, fostering projects focused on sustainability.
For these reasons also ranking systems must include sustainability as a metric that can give a real picture of what a university is and what a university does. Moreover rankings are important tools to bring changes in the higher education institutions, setting indicators and sharing good practice.
But rankings must be defined in order to consider the different contexts, in particular those rankings specialized in an issue like sustainability, where actions and policies are strongly influenced by the surrounding environment and socio-economic situations.
Venice is a place of strong contrasts and contradictions. Through the centuries, it has represented an example of sustainability, being the urban tissue co-evolved with surrounding lagoon, at present, however, it shows a highly critical condition of unsustainability, hosting more than 20 millions of tourists per year in spite of its extremely fragile tissue.
The case of Ca' Foscari University of Venice could be a good example of how an higher education can implement a strategy of sustainable development. Since 2010, Ca' Foscari assumed Sustainability as one of the pillar of its developing strategy for the future, directly assuming it in the Statute.

Keywords: Higher education, sustainable university, Ca' Foscari University, Venice, ranking

1. Introduction

Sustainability is one of the main challenge for our society, as stated in the 2030 Agenda for Sustainable Development.
The Incheon Declaration by UNESCO recognize the "education as the main driver of development and in achieving the SDGs. We commit with a sense of urgency to a single, renewed education agenda that is holistic, ambitious and aspirational, leaving no one behind." [1]
Universities have historically played a central role in transforming societies and are required to be incubators of change. The most important universities in the world have already decided to take part in the big challenge of changing the world for the future generations, implementing strategies and actions to protect the environment, spread human rights and promote sustainable development both locally and globally. [2]
The sustainable development should be a core issue that universities are expected to address by fostering research, spreading knowledge, and promoting new competencies and behavioural models in order to encourage more globally responsible actions by stakeholders and citizens [3].
Certainly teaching and researching are core activities of an academic institution, but we cannot forget that the operations have a great influence on these two activities. And this is even more visible if we are

talking about sustainability. Indeed if a university is committed in saving energy will be more easy to develop an awareness among students on topics of sustainability.

2. Ranking and sustainability

Implementing sustainability in a university means teaching inspired to sustainability, doing research on sustainability and rethinking the operations in a sustainable way. A university that asks its staff and students to do recycle without having implemented a clear recycling policy, is not credible and its promotional actions can be weaken by its operations.
A system of indicators plays a central role in a strategic and organisational approach to the sustainability, because it allows the University to address choices, behaviours, activities and to monitor the processes. Ranking systems must include sustainability as a metric to give a real picture of what a university is and what a university does. Indeed not only rankings can give relevance to the universities who decided to take a step towards a more sustainable future, but they can also be an important tool to bring changes in the academic culture of institutions, playing a big role in setting and sharing of best practices among universities, but not only. For all these reasons, university rankings should encourage universities around the world to carry out a self-assessment in relation to several quality issues, including sustainability.
Universitas Indonesia was the first one who decided to analyse how university implement sustainability in their operations and for this reason they built "UI GreenMetric World University Ranking". This ranking was developed in 2010 and at the very beginning, the ranking was especially focused on buildings and environmental aspects, and it was difficult to compare universities of different types, such as the ones inside European city centres and the large university campus typical of the Anglo-Saxon countries. Thanks to the feedback, comments and suggestions received from the participants, this ranking has been improved from then and it takes now into account more indicators, that can better measure how much the universities are committed to reduce their impact on the environment, and to help promote awareness of the importance of sustainability.
A limit is the lack of the social dimension of sustainability: there is no indicator that measures the social impacts of universities and social cohesion, although this dimension produces probably the most relevant and evident results for a community, also in the economic sphere.

3. Ca' Foscari University of Venice

3.1 Sustainability at Ca' Foscari

Ca' Foscari University of Venice is a medium size University established in 1868 as a Royal Business College, based on economically oriented subjects with a specific focus on Eastern and Western languages, reflecting the long-standing tradition of Venice as crossroads of culture, people and trade. Today the University offers courses at all levels, both in Italian and in English: 16 Bachelor's degrees, 30 Master's degrees and 34 Professional Master's Programmes, in addition to 14 Doctorate courses within the Doctorate School. The students enrolled are approximately 21,000 and more than 5% come from foreign countries.
Certainly the uniqueness that distinguishes the city of Venice has acted as a propelling factor for Ca' Foscari's embarking concretely on the challenging path of sustainability, well before the other Italian universities. The first step towards sustainability was in 2008, when the University voluntarily approved the Ethical Code, and in 2009 the Rector appointed his Delegate for Environmental Sustainability and Social Responsibility, a professor who was responsible for the sustainability of the University and coordinating activities and projects related to environmental and social sustainability. In 2010 was inaugurated the Sustainable Ca' Foscari programme, with the aim to include sustainability as a guiding principle for all University activities, and was approved the first Sustainability Commitments Charter (CIS - Carta degli Impegni di Sostenibilità), where mid-term actions and objectives were outlined. In 2011 the University approved its new Strategic Plan and sustainability was one of the ten strategic objectives. [4]
Along the way, Ca' Foscari has actively worked towards greater sustainability via activities and projects aimed at reducing the University's impact on the environment and on natural resources as well as

improving student, faculty and staff well-being. From 2010 to 2013 the Carbon Management Project took place, in agreement with the Italian Ministry of the Environment, in order to outline the Guidelines for Carbon Management in Italian Universities; since 2012 Ca' Foscari Sociale Project has been launched to boost the cooperation of University community with the non-profit organizations of the territory, just to name a few.
In six years Sustainable Ca' Foscari has become a model for sustainable administration within the spheres of environment, society and economics.

3.2 Context and peculiarities

The city of Venice represents an optimal case study within the sustainability implementation context, being a place of strong contrasts and contradictions. Depending on the point of view, Venice can be described as an example of sustainability, in terms of the presence of an urban tissue co-evolved with surrounding lagoon [5], or unsustainable exploitation, hosting millions of tourists per year within an extremely fragile context [6].
The city of Venice has characteristics profoundly different from any other in the world, at the level of its territorial morphology and of its infrastructures and structures, which affect the life and the activities of the people living, working and studying there.
There are various fields that require a sustainable approach: from morphologic aspects of the territory that affect the mobility of the people and goods, with problems that concern also the collection and handling of waste, to the protection of the town's precious artistic heritage, a source of world media exposure and an attraction for the millions of tourists which visit Venice every year. Venice also shows its vulnerability due to the high water phenomenon (high tide), making the consideration of such themes as environmental and social sustainability in everyday life evident and pressing all those who live and work in Venice (including institutions) to play a decisive role.
The challenge of the preservation and protection of the town, due to the difficult conditions that characterize the environmental and social context where Ca' Foscari operates, has been taken on by the university, starting an important path of interiorization of the cornerstones of sustainability its spread over the territory, making itself the protagonist in the community [4].

3.2.1 Infrastructures

Being located in a heritage city, the University is necessarily spread across the town, with almost 30 venues, often hosted in historical buildings, some old of centuries. All this, however, required a re-adaptation of these structures to new uses (e.g. classes and meeting halls), with many criticisms and limits — architectonic, historical and of safety — posed by the structures themselves and by local authorities. This high vulnerability and fragility claims for a great 'caution in handling'. In terms of the buildings management, the strategy is a sort of 'improving maintenance', with small scale interventions finalized towards objectives, like the reduction of energy consumes, working on the power supply, but also on architectonic solutions to increase thermal isolation.
Within this context, a good example is represented by application for the LEED certification to the Ca' Foscari main building. In September 2013, indeed, the Ca' Foscari headquarter, a 560 years old gothic palace on Canal Grande, was rewarded with the LEED EB: O&M Certificate, becoming the oldest "green" building in the world. This represented a double challenge: firstly to obtain the certification (e.g. adapting the LEED standard to a historical building) and then to adopt maintenance protocols able to improve the general state, allowing maintaining the certification through the time.
For Ca' Foscari, this was only the first step; the certification objectives represent now the guidelines on which operate in order to improve the performance and maintain the standards for the certification renewal.

3.2.2 Transportation

In Venice is not possible the use of cars and bicycles caused its geophysical conformation: Venice is a group of 118 small islands separated by waterways and linked each other by bridges, and it is like a huge pedestrian area. Therefore we can say that Venice is a sustainable city, especially considering the mobility; indeed people can move by foot or, as alternative, use the public transportation such as vaporetto (water bus), but in some case this results expensive and not efficient.
In this context our University introduced in 2003 the position of Mobility Manager, in order to "ensure the link between the initiatives proposed by the Area Mobility Manager to encourage sustainable mobility policies by means of new organisational and operational models enabling improved workplace accessibility." With the goal of developing a sustainable business mobility plan, the University seeks to minimise the environmental impact of staff and student mobility through projects and policies which obviously spring from interaction with other decision makers (the Region, Trenitalia, RFI, ACTV, private car owners, etc.).
Ca' Foscari has around 30 buildings spreaded mainly in the city of Venice and only two of them are in the mainland (in Mestre and Treviso). About these last two buildings, University has signed an agreement with the local transportation company to establish a special bus service and moreover the campus is served by a public bicycle lane.
Given these considerations, the use of bicycle is possible only in the mainland; recently, indeed, it has been forbidden the use in Venice. But this does not mean that the city, and thus University, is less sustainable. Considering this peculiarities it is evidence that some indicators such as "the ratio of bicycle found towards campus population" cannot be an appropriate measure of how much sustainable is Ca' Foscari. Indeed the ratio would be very low and this does not represent the real value of sustainable mobility that we have. These considerations have an impact also on those indicators relating the parking areas and policy for reducing parking areas.

3.2.3 Waste

The waste collection in Venice is more complicated than in other places. The separated collection has been done door to door and each day is dedicated to a particular category of waste. Every morning the garbage collectors pick up the waste passing with a hand-drawn carts to collect it and bring it to the barges moored on the nearest canal. This is what happen, more or less, every day independently from the weather, excluding days with the high tide.
Moreover, for sanitary reasons due to the high presence of rats and seagulls, the organic waste cannot be collected in the city of Venice.
Considering these limits, the waste collection management of Ca' Foscari has to follow the regulations of the municipality and indeed cannot separate or compost the organic waste. Therefore there are some actions that do not depend on the voluntary of the single institution but depend on the regulations present in that place.

3.3 Other ways to do sustainability

All these measures represent 'top down' interventions; the University governance decided to have the sustainability as key part of the strategic planning, and adopted necessary commitments to modify structures and infrastructures. It is, however, well-known that the success of management policies is related to the stakeholders' involvement [7]. Within this context, a 'bottom up' approach has been contextually implemented, directly involving people living the University, both personnel and students. Two ways has been adopted for increasing the awareness:

- Involving people in events and projects about sustainability issues;
- Engaging people to verify how their life style affects the Campus sustainability and how little changes in it can produce positive impacts.

One of the most successful experience realized by Ca' Foscari, in terms of students' and community involvement in the sustainability matters, is the connection between Sustainable Ca' Foscari and the Art world.

It is easy to understand the special connection between Venice and the Art World: the city has always been a destination for artists from Europe and beyond, as it is considered an open-air museum - in fact it is listed as a World Heritage Site - and even nowadays it is still rich in art museums and very important art initiatives, such as Peggy Guggenheim collection and the Biennale.
Ca' Foscari reflects this connection in its educational programmes, facing Art from different and interdisciplinary perspectives of study and research. Given this, developing art projects to promote sustainability and engage and educate students seemed like a natural path.
So far, Sustainable Ca' Foscari has hosted three art projects (the "Garbage Patch State" by Maria Cristina Finucci, the "Dancing Solar Flowers" by Alexandre Dang and "fifteenpercent – dialogue on disability in the world" by Christian Tasso), both with a wide participation of students from different disciplines. By taking part in these projects, students were given the opportunity not only to get to know international artists firsthand, but also to put in practice their own cross competencies and to give free reign to their own creativity, by actively working on the project.
On the other side, it has been launched the Ca' Foscari Carbon Footprint Calculator (http://virgo.unive.it/footprint/cfp/). It represents an output of a project funded by the Italian Ministry of the Environment and Protection of Land and Sea, which allows modeling the CO2 emission related to different life styles. The idea is to spur students, staff and faculty to check and reduce their own carbon emissions, helping them to adopt strategies and corrective actions. The present version is based on the gaming approach, trying to stimulate the competition among students and personnel belonging to different Departments.
Stakeholder engagement is an essential step to create and strengthen awareness about this issue, thus contributing to a more sustainable future, encouraging people to adopt more responsible lifestyles. The University has the task of educating and making the stakeholders aware of risks connected with the present development model, the importance of implementing a new one, inspired by sustainability. Ca' Foscari creates different occasions and modalities of dialogue with its stakeholders, in order to sensitize them on these issues but also to keep them informed on the results and initiatives. The management of a website dedicated to sustainable Ca' Foscari and the process of reporting are important tools to inform the stakeholders on the University's activities, but the dialogue must be biunivocal. To this purpose Ca' Foscari organise at least once a year, in occasion of the presentation of sustainability report, a panel of stakeholder to receive their expectation, suggestions and criticism. University take seriously in consideration the stakeholder engagement to plan its actions.

4. Conclusions

"Universities have a critical role to play in educating future generations, disseminating information about sustainability, and particularly by training leaders with the skills to solve regional and local problems from a global and interdisciplinary perspective. Especially crucial is the fostering of human resources to work toward sustainability in the developing nations that bear the brunt of global environmental problems. A network of networks can also provide opportunities for collaborating universities to develop and improve higher education capacity in their respective nations and regions" [8].
All this requires a deep change of the University, in terms of structures, research and teaching. As pointed out also by the modernisation agenda of European higher education (Commission of the European Communities 2006), Universities have to modify their public role, creating opportunities where things can be made public and can become a matter of public concern, and where publics can constitute themselves around such issues [9].
All the initiatives and projects above described are primarily reversed inside the University, in order to implement commitments towards a more sustainable Campus, but they can also become a reference for the surrounding city. Being innovative, creative, experimenting, indicating new ways, suggesting new strategies, being sentinel for changes, Ca' Foscari could affect the local and regional policies.
The LEED certification can be considered a clear signal to the town and policy makers, and explaining how is possible to conjugate heritage and the eco-efficiency and eco-innovations in Venice.

Rankings can play a big role to bring changes in academic institutions, as they can be important tools in setting and sharing of best practices among universities, stimulating the competition and then the desire to emulation. But rankings must consider that indicators can be heavily influenced from the context and cultural-economic situation and these differences must be taken into account. For instance, universities located in city centre or in historical cities could be disadvantaged because they have not a lot of leeway in making actions to reduce their environmental impacts through building works or enlarging green spaces. A similar consideration can be done for the indicator "percentage of area covered in vegetation", that in some countries is inevitably bigger than in countries with a high population density per square kilometer, or even the presence of a forest inside the campus.
In these sense GreenMetric attempted a normalization among universities trying to do a segmentation, based on climate zone, but this is not enough because does not measure weighting the actions taken.
UI GreenMetric World University Ranking has the merit of having first drawn the attention to the commitment of the universities for sustainability, building indicators that led to reflection on the subject and did reflect on the complexity of the subject, but also its importance.
Now it is important to continue this path in order to have a more accurate ranking, which allows to photograph the actions and progress of the universities in this field, and pushing academics to spread the change that also Agenda 2030 suggests.

References

[1] UNESCO, 2015. Education 2030. Incheon Declaration. Towards inclusive and equitable quality education and lifelong learning for all. World Education Forum 2015 in Incheon, Republic of Korea.
[2] Basso, A., Cardin, M., Giacometti, A., Mio, C., Sustainability indicators for university ranking. Forthcoming.
[3] Stephens, J. C., Hernandez, M. E., Roman, M., Graham, A. C., & Scholz, R. W., 2008. Higher education as a change agent for sustainability in different cultures and contexts. *International Journal of Sustainability in Higher Education*, Volume 9, pp. 317–338.
[4] Mio, C., 2013. *Towards a sustainable university: the Ca' Foscari experience*. UK: Palgrave Macmillan.
[5] Solidoro, C., Bandeli, V., Aubry Bernardi, F., Camatti, E., Ciavatta, S., Cossarini, G., et al., 2010. Response of Venice Lagoon Ecosystem to natural and anthropogenic pressures over the Last 50 Years. In H. Paerl & M. Kennish (Eds.), *Coastal Lagoons: Systems of natural and anthropogenic change*, pp. 483–511. Marine Science Book Series. New York: CRC Press, Taylor and Francis.
[6] Russo, A. P., 2002. The "vicious circle" of tourism development in heritage cities. *Annals of Tourism Research*, Volume 29, pp. 165–182.
[7] Freeman, R. E., 2010. *Strategic management. A stakeholder approach*. New York: Cambridge University Press.
[8] G8 University Summit, 2010. Sapporo Sustainability Declaration, Japan.
[9] Biesta, G., Kwiek, M., Lock, G., Martins, H., Masschelein, J., Papatsiba, V., et al., 2009. What is the public role of the University? A proposal for a public research Agenda. *European Educational Research Journal*, Volume 8, pp 249–254.

Panel Session 4
Issues and Innovation in Managing Water

The 3rd International Workshop on UI GreenMetric
Istanbul, Turkey, 09 - 10 April 2017

King Abdulaziz University Strategy for Water Management

Habib M. Fardoun*[1, a], Amin Noaman[1, b]
[1]*King Abdulaziz University, Jeddah, Saudi Arabia*
[a, b]{hfardoun, amoaman}@kau.edu.sa

Abstract. Water is essential for the survival of all forms of life on earth. There can be no better expression of this fact than the Qur'anic dictum: "From water, we have created every living thing." Almighty Allah has endowed water with physical characteristics that make it a basic component of all living creatures. In this context, King Abdulaziz University (KAU) in fulfilment of its mission in serving the society has given great importance to water research in its various spheres. More specifically, most KAU colleges have been devoting great attention to water studies and research in one form or another whether in exploration, assessment, modelling, management, or development. Moreover, KAU has striven to unify all such efforts by setting up a specialized university research center, which has been aptly dubbed as the "Water Research Center". This paper will present the work of the Water Research Center (WRC), and functionality, and how it provides support and help to the community and the university.

Keywords: King Abdulaziz University (KAU), Water Research Center (WRC), Water Management, and Saudi Arabia Water Resources.

1. Introduction[5]

Of all the manifestations of Saudi Arabia's spectacular development over the past half century, none presents a starker set of contrasts than water. Oil has helped finance rapid urban development and generous philanthropic and humanitarian projects around the world. But it has also allowed the Saudi government to provide a resource that is anything but plentiful in the country's arid environment. "Turning oil into water," as one historian puts it, has allowed the government to turn an environment of scarcity into an environment of plenty, with huge benefits for the kingdom's national security and national strength.

Saudi Arabia has about one seventy-fifth as much water per capita than the United States, but the average Saudi uses nearly half as much water as the average American. Despite Saudi Arabia's harsh natural environment, its government has a remarkable ability to make water available to a rapidly growing population. By investing in desalination on a massive scale, the government has invested in the potential of its inhabitants to lead the country forward. By undertaking vast agricultural projects, the government has avoided the overreliance on food imports that sets weak nations apart from strong ones. In an environment that just a century ago was conducive to neither great wealth nor great development, investing in water provision has allowed Saudi Arabia's leaders to guarantee both.

Saudi Arabia's success on water owes much to the visions of the Saudi kings throughout the country's modern history. Before American geologists found oil in the kingdom, King Abdulaziz Al Saud had charged them with looking for water [1]. Before most of the rest of the world had even heard of desalination, King Abdulaziz had already ordered that a desalination plant be built in Jeddah to facilitate that city's growth [2]. As time progressed, water came to feature prominently in the development strategies of King Faisal and King Fahd [3], as the government sought out the best avenues for distributing the benefits of oil wealth to the Saudi people. Saudi kings have long had a clear sense of water's ability to spur growth, and an equally long history of valuing technical guidance on water in addition to oil. Sustained investment has helped turn this vision into a reality. Over the past 80 years, Saudi Arabia has spent nearly $25 billion on building and operating desalination plants. It now has 30

[5] CSIS: Center for Strategic & International Studies. Middle East Program: Water and National Strength in Saudi Arabia. www.csis.org/mideast

desalination plants and more than 2,500 miles of pipeline to pump the water they produce around the kingdom.

Throughout this period, the kingdom's population grew at an average annual rate of nearly 3.5 percent, [4] and Saudi Arabia went from being a developing country to a modern nation within barely a quarter century. The government went from having no comprehensive water infrastructure or agricultural system to providing drinking water and food for nearly every citizen.

Such rapid development has gained the Saudi government—and especially the water sector—recognition in the international community. Since it was established in 2001, the Ministry of Water and Electricity has received four international awards for expert water management in an arid environment [5]. Saudi Arabia is now the world's largest single producer of desalinated water, accounting for about 30 percent of global capacity (fig. 1) [6]. The kingdom has used its expertise on desalination to help advance research on water production in other harsh natural environments [7], and in 2002 the government established the Prince Sultan bin Abdulaziz International Prize for Water to reward innovations by other countries [8]. Especially within the Gulf Cooperation Council (GCC) region, the Saudi government stands out as the government most capable of using water to spur growth and build a productive economy. The kingdom has twice the population of the rest of the GCC countries combined [9], but the government succeeds in providing about 50 percent more water per person than the average GCC country [10].

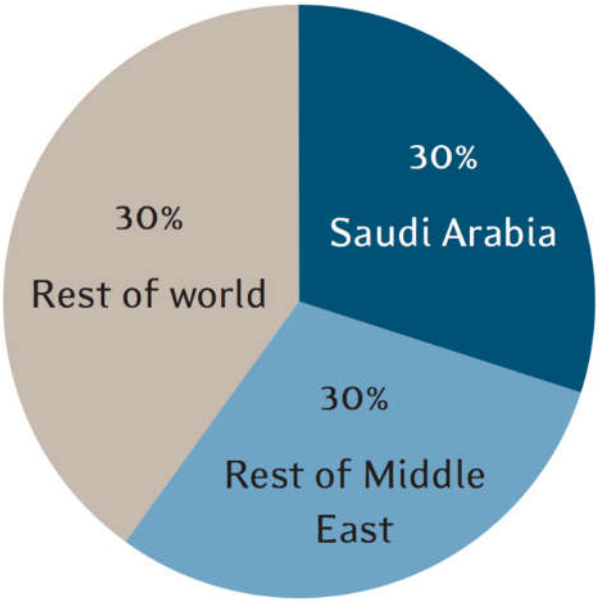


Figure 1. Global desalination capacity (source: CSIS)

2. King Abdulaziz University Water Management and Development Process

2.1 Water Research Center (WRC)

Since its inception, the Water Research Center (WRC) through its specialized research unites, scientific chairs and consultative services have played an active role in enhancing water related scientific research and studies. Moreover, it assumed a pioneering role in preparing and training future cadres of researcher and technicians, so as to develop national capabilities in the carious aspects of water research. While continuing its persistent efforts to find effective solutions to the community's water problems, the WRC has also had an enlightening and educational role vis-á-vis the various sectors of society in view of the tangible deficiencies in water resources endured by our country, which is situated in a geographical region with scarce natural resources. Fig 2.

Figure 2. King Abdulaziz University: Water Research Center (WRC)

The university has two main resources from which it got the water:

1) An external part comes from the National Water Company (10% - 15%)
2) An internal part is treated with the water used inside the university. This process is carried out through the treatment plant, by disposing of contaminated materials, obtaining usable water and re-adjusting the quantity of mineral salts according to international health standards. See Table 1.

Table 1. King Abdulaziz University main stations capacity

The University is fed by two main stations		
	Capacity up to	Consumption rate is up to
Campus Station	21,000 m3	4,200 m3
Medical Center Station	16,000 m3	2,000 m3
Gross monthly consumption of the university		186,000 m3
Gross annual consumption of the university		2,232,000 m3

2.2 University Innovative Water Management Methods

The University's has innovative water management methods to ensure a rich water future, throw the development of three projects, for the abundance of water resources:

1) KAU improved the Improve irrigation efficiency by using internal developed *suitable tools* that maintain water availability. Where these tools are offered to support water resources at the university, as the utility professionals with the challenge of severe drought. They help and assist in planning for water shortages by familiarizing users with alternative sources, treatment processes, distribution options, short term equipment solutions for treatment, and the regulatory process as it relates to emergency drought situations.
2) Rehabilitation of the *sewage treatment plants,* Fig 2., located west of the premises of the female students, inside the campus, and 2 other plants in each branch of the university, the three stages of the sewage treatment process are done locally at KAU campuses, including the pre-treatment process.
    a) Sewage Treatment Plant (6000 m3/day) Using Membrane Bioractor Technology: The 6000 project as it's known right now has a capacity of 6000 m3/day and can easily be upgraded to 8000 m3/day just by adding MBR Modules. The University had an existing STP in the 90s and it had been out of service since then. SKME proposed the use of the existing circular tanks previously used as clarifiers to be used as a complete system including equalization, aeration, filtration and anoxic. SKME is the first in the world to implement the MBR system in circular tank. This of course comes from SKME's quest to save the environment and to cut all costs in maintaining economic solutions. The project is currently in the commissioning phase and the treated water is well within guaranteed parameters, which are extremely strict in comparison with all MBR systems since BOD and TSS are maintained less than 3 mg/L. The footprint of this plant is 60% of the old STP while the capacity is 4 times the old capacity.
    b) Sewage Treatment Plant (500 m3/day) Using Membrane Bioractor Technology: This plant is located in the Marine Science College in North Obhur in Jeddah. The function of this STP is to serve the residence and offices in the college. Special measures have been taken to the material selection and painting in this STP due to the sites location which is only a few meters away from the sea. The project is 90% completed at this phase and just awaiting final steps.
    c) Hardness Removal Plant (100 m3/day) Using Reverse Osmosis Technology: The diversity of projects of SKME is essential to the Wastewater Treatment Area and to the company as well as we strive for solutions in all areas of sewage treatment, industrial wastewater treatment, and desalination. This plant has a capacity of 100 m3/day and is used to supply the boiler for King Abdulaziz University Hospital Boiler and is used for disinfection. The RO plant uses the MBR treated effluent water as its influent water, which results in a very purified water with a very low TDS, mineral, and chemical composition, which is well suited for disinfection and Hospital boilers.
3) Rehabilitation of the stream canal project, located south of the academic field.
4) Installation of faucets operated automatically in all new buildings leading to optimal use of water resources instead of manually used taps and consumes larger quantities of water.

2.3 Water Pollution Treatment at KAU

Water Pollution and how to treat this pollution: The University has implemented several solutions to reduce the pollution of water resources as follows:

a) The treatment plant refine and remove the wastewater in accordance with international standards
b) Ensure the storage of water resources in reservoirs that keep the water sealed and equipped with pneumatic filters
c) Ensure the separation of the network of floods and groundwater from the sewage network to ensure that it is not contaminated
d) Not to use the wastewater in watering plantations.

e) Rehabilitation and treatment of the water used in the university hospital before discharge into the sewage network.

Figure 3. King Abdulaziz University: Sewage Treatment Plant

2.4 The Method of Reuse of Water

The method of reuse of water: It is done through the treatment plant located west of the female students section in the university, where this plant treat wastewater from impurities and suspended materials, pollutants and organic materials to become reusable.

1) Monitoring and evaluation of water in the university: The water network is evaluated by taking meter readings, pressure and flow measuring instruments, data analysis and technical reporting, this helps to:
   a) Control the flow of water out of peak periods to preserve water resources.
   b) Know the presence of leaks in the main lines and networks
   c) Discovery of illegal use by the violators

2.5 Climate Change Impact on KAU Water Resources

The impact of climate change on water resources and their adaptation to this change: The high climatic temperatures faced by King Abdulaziz University do not affect the university water resources because the save of the water resources in two main reservoirs resistant to heat and with the best insulation specifications. (1) Medical Center Reservoir; (2) University City Reservoir. The distribution of water is done from two main stations: (1) Medical Center Station and (2) University Center Station. Where the medical Center Station is distributed to all the buildings of the Medical Center and the University Hospital through the ground pipes; while the rest of the university buildings import water from the university centre station through the ground pipes as well, see Fig 4.

Figure 4. King Abdulaziz University main reservoirs

3. Summary/ Concluding Remarks

As a result of KAU dedicated work and involvement in water management process. King Abdulaziz University is being distinguished in this field through its (1) *Hydrologic Department,* which focus on studies that are related to managing surface water, groundwater, water resources, irrigation, and drainage; (2) *Water Resource Unit,* which deals with integrated management and sustainable development of water resources as well as conducting studies and research on surface water (Rainfall surface runoff relationships), hydrological and environmental impact of the dams, as well as qualitative and quantitative evaluation of the aquifer and its relationship to surface water. It is worth to mention that because of this exhaustive and full commitment work that KAU is performing in this field there are no other identical programs, which are comprehensive in this specialization, in other universities in the kingdom of Saudi Arabia or in the Middle East area, making KAU a unique and distinguished leading university in this subject.

References

[1] W.A. Abderrahman: Water Management in ArRiyadh, International Journal of Water Resources Development, Vol. 22, No. 2, June 2006, p. 281
[2] Abdullah Al-Alshaikh. "Seawater Desalination in Saudi Arabia: An Overview". International Conference on Desalination and Sustainability, Casablanca, 1–2 March 2012. Retrieved 23 February 2013.
[3] Jones, Desert Kingdom, 79–83, 232–233.
[4] Worldometers statistics. Link: http://www.worldometers.info/world-population/saudi-arabia-population/. View: 1st of January of 2017
[5] "Creativity Prize Now a Part of Prince Sultan Bin Abdulaziz Prize for Water", Water and Wastes Digest 27 March 2007. Retrieved 29 December 2008.
[6] John Sfakianiakis, Turki A. Al Hugail, and Daliah Merzaban, "Full Steam Ahead: Saudi Power, Water Sectors Occupy Centre Stage as Demand Soars," Banque Saudi Fransi, Saudi Arabia Sector Analysis, March 14, 2010, 7, http://www.alfransi.com.sa/en/general/download/file/466.
[7] Al-Zubari, Waleed K. Sustainable water resources management in the Gulf Cooperation Council countries. In WWAP (United Nations World Water Assessment Programme). 2015. Facing the Challenges. Case Studies and Indicators. Paris, UNESCO. p. 13. ISBN 978-92-3-100072-0
[8] "Creativity Prize Now a Part of Prince Sultan Bin Abdulaziz Prize for Water".
[9] World Bank: A Water Sector Assessment Report on the Countries of the Cooperation Council of the Arab States of the Gulf, 2005, p. 27
[10] Dr. Abdullah Al-Alshaikh. "Seawater Desalination in Saudi Arabia: An Overview". International Conference on Desalination and Sustainability, Casablanca, 1–2 March 2012.

Programs for Clean, Healthy and Convenient Diponegoro University Campus: A GreenMetric Practices

Yos Johan Utama[1], Ambariyanto[2] and Hadiyanto[3]
[1]*The Rector of Diponegoro University, Jl. Prof. Soedarto, SH-Tembalang, Semarang Indonesia, email: rektor@undip.ac.id*
[2]*The Vice Rector of Research and Innovation, Diponegoro University, Jl. Prof. Soedarto, SH-Tembalang, Semarang Indonesia, email: ambariyanto@undip.ac.id*
[3]*The green metric task force, Diponegoro University, Jl. Prof. Soedarto, SH-Tembalang, Semarang Indonesia,* [3]hadiyanto@che.undip.ac.id

Abstract. A green-metric world university ranking has encouraged worldwide universities to improve their campus sustainability especially in environmental related issues. The eco-environmental friendly campus greatly affects the academic atmosphere. There is a strong needs of a clean, healthy and comfortable campus environment. In general, the fundamental environmental problems faced by Indonesian campuses are related to waste and pollutants, as well as the use of energy and water. Therefore, Diponegoro University has continuously attempted to develop environmental friendly campus, through implementation of campus policy in environmental management, waste and pollutants management and by reducing the use of energy and water in the campus. This is in line with the green-metric world university ranking criteria.

Keywords: environmental, sustainability, green campus

1. Introduction

The need of eco-friendly campus in the higher education is crucial aspect, especially in improvement of academic atmosphere i.e teaching and learning process [1], with the more demands on broader aspects. University campuses should be a modern campus with information technology ready to meet the needs of the academics (higher number of information and less time) [2]. In addition, campus should be managed based on environment principles [3] to become a sustainable campus. At the moment, good campus environment is needed and it was driven primarily by improvement of environmental awareness of all campus stakeholders [4]. A clean, healthy, and convenient campus should be established so that all t learning processes will be better and productive in terms of research and innovation which will be benefit to the community.

This awareness of clean and green campus is also growing in Indonesian university campuses. At the moment, this criteria has become important factor to be considered by all prospective students as well as general public in choosing which university they will study. Therefore, there is a need to establish a proper management of all aspects related to environmental conditions, as it will affect student learning processes and its outcomes [5].

Diponegoro University (Undip) is one of public universities in Semarang City that has area of 2,000,000 m^2. Undip has three main campus sites: Pleburan campus, Tembalang Campus and Teluk awur campus. With total student of 45,000 and 1700 faculty staffs, Undip becomes the largest university in Central Java province. Since 2012 the university participated in UI Green metric and resulted in the rank of 3rd (2015) and 4th (2016) among Indonesian universities.

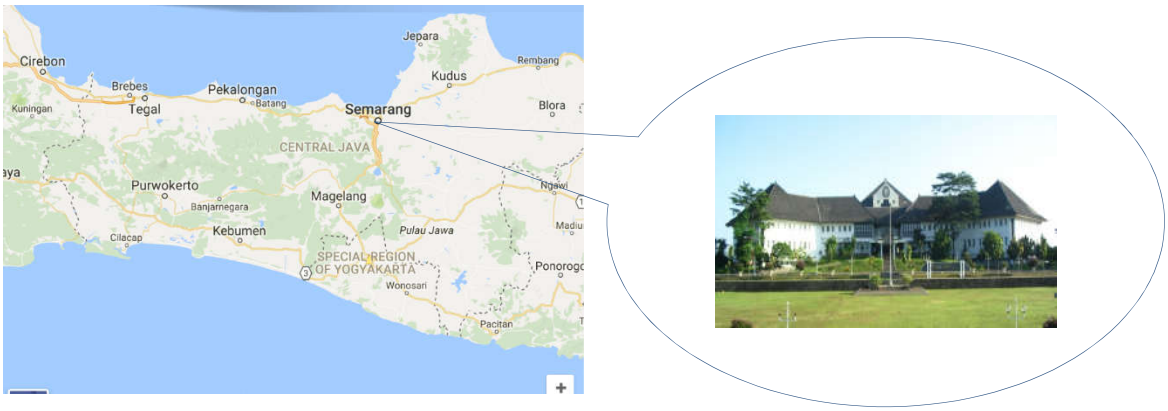


Figure 1. The location of Diponegoro University

This article will provide an overview of the experience of Undip in improving the environmental conditions in order to become a clean and green campus and will always be on the top ranking in the campus green-metrics.

2. General Environmental Issues of Indonesian Campuses

Environmental issues in Indonesian campuses generally associated with three main points as indicated by UI Greenmetric criteria: 1) University Environment, 2) Waste and Pollutants Issues, and 3) Energy and Water Issues, and 4) Academic

- **University Environment.** In terms of location, many campuses in Indonesia is located in the city center with limited area and is usually close to dense residences, commercial areas and other activities. For this type of campuses, they cannot do much with their in campus environment. They are strongly influenced by activities of the close neighbor. But for other campuses which located outside the city usually have much larger areas. For those campuses with larger area, they have the opportunity to have a much better environment. The have a buffer zone and the influence of the far neighbor is usually very small. However, unfortunately, not all campuses like this have a good environmental management system.
- **Waste and Pollutants Issues.** Waste and pollutants issues are known as important part of environmental problems [6]. These issues usually closely related to development of society, including campuses. Office activities, personal activities, as well as laboratories or university hospitals, and so on are the main sources of waste and pollutants in campus. For example, plastic waste has become very serious environmental problem [7]. In addition, wastes from laboratories and hospitals that are usually very hazardous have become toxic pollutants. For campuses which do not have proper management of waste and pollutants, they usually burn these waste in open area. Other air pollutants come from the use of cars and motorcycles on campus by students and university employees.
- **Energy and Water Issues**. Energy needs in Indonesia has doubled in the last two decades [8]. The construction of many buildings, housing, offices and shops including a campus building in various cities require a lot of electrical energy. Most of the activities undertaken within the campus for learning activities, research in the laboratory and office activities also require energy. In a tropical country like Indonesia, every building has air conditioner. Excessive use of the lights and air conditioner requires large electrical energy [9, 10]. Many of us are not trying to use energy to a minimum, resulting in high electrical energy needs. Similarly, all kinds of equipment in the laboratory require large electrical energy. Daily water use in the campus is also very large, especially for the needs of the laboratory, watering the plants in the garden, as well as other personal needs.

3. Diponegoro University Practices

Environmental management has become international issue, not only politically and economically, but also educationally related. Diponegoro University fully aware of this matter, therefore as higher education institution, Undip should become a role model in campus environmental management. Several efforts to improve campus environmental management have been done at Undip, namely:

- **Management of the Environment**. Our first attention was about in campus environment, mainly how to make our campus green. With an area of almost 200 ha, our program started with tree planting, which is known as one of the activities to improve the environment [11]. These activities are often carried out either by university management, or by other government and private institutions. Undip has regular program, where every Friday morning we organize sporting activities and planted trees (Figure 2). These planting activities are directed at specific location in accordance with the development plan of the campus and currently Undip has more than 70% total area covered in planted vegetation. Currently Undip has two gardens of rare plants. In order to manage campus environment, Undip also has a dedicated team responsible for the condition of the park and the existing trees. Such management is done by the University of Diponegoro in order to become clean, healthy, and convenient campus for anyone studying or visiting Undip.

Figure 2. The sport activity each Friday morning (left) and planting a tree (right)

- **Waste and Pollutants Management.** Separation of organic and non-organic garbage is one of the efforts in waste management [12, 13]. It has been done in Undip by a team of waste management. All the waste in the campus area has been separated and processed at the Waste Management Centre is also located within the campus. The street sweeper in Undip is no longer burning trash like that used them to do. Garbage is only collected in each unit and then sent to a waste processing center to be given further treatment (Figure 3). As for hazardous waste and toxic, there are requirements and procedures to manage them [14, 15]. Various types of waste are generally produced by laboratories and hospitals, have been treated exclusively in accordance with the instructions of this waste processing. In addition, Diponegoro University has also provided a parking deck and is planning to build another one. The use of vehicles and cars are currently being pursued to be limited. Based on calculations that we have done, it turns out the carbon dioxide produced by the vehicle Undip during peak hours, still much lower than the ability of all the trees in each unit to absorb the carbon dioxide. So far the air at Diponegoro University campus is still very clean and not polluted.

Figure 3. The final treatment of waste at Diponegoro University (left) and trucks for collecting the waste

- **Regulating the use of energy and water**. The development of green and smart building is one of the activities to reduce the use of electric energy [16, 17]. Until now, it was agreed that all new buildings to be constructed in Undip should refer to the methods and techniques of green building and smart building. So that all new buildings are expected to take into account to reduce the use of energy both for lighting and air conditioning. The old buildings will be renovated in order to minimize the use of electrical energy. Various instructions have been conducted by the university leadership to all personnel in Undip to use electric energy efficiently, by turning off the air conditioning and the room lights when they are not necessary. The use of energy-saving lamp is also one of the efforts to reduce the use of electric energy [18] as well as utilization of solar panel for electricity and biogas for cooking (Figure 4).

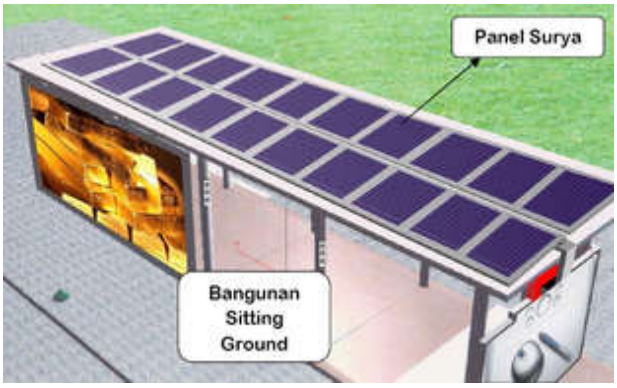


Figure 4. Sitting ground in Electrical Engineering Department attributed with solar energy

Undip is currently doing the replacement of conventional lamps with energy saving ones. Efficient use of energy in the campus will have a positive influence not only on the environment but it will also reduce costs[19]. Undip also planning to install water-saving toilet. Besides, currently being developed use of water from the reservoir Undip to reduce expenses as costs in the water. Another acts of water conservation is by developing a dam in the campus. This dam will be integrated with mini-hydro power generation.

Figure 5. Artificial dam at Diponegoro University as one of water conservation activities

We wanted to change the campus of University of Diponegoro to become environmentally sustainable campus, a clean healthy and comfortable for the educational process. Improvements that have been made can be seen from the increase in performance in Greenmetric ranking where in 2016 Undip are at level 3 in Indonesia and 44 in the world, rising from position 5 and 90 in previous year. Various efforts will continue to be done to make the campus Undip Tembalang becoming environmentally sound campus.

- **Integrating environmental issues in education system**. Several courses have been inserted in the curriculum of various study programs. Students are provided courses of environments both as theory or practical. To show their awareness to the green campus, each new student are encouraged to bring a small plant to the campus and they will plant in the campus site. Moreover, the students also actively participate in environmental events conducted by several the student organizations (Figure 6).
-

Figure 6. Students activities in Mangrove plantations (left) and making bio-pore (right)

Diponegoro University management has committed to improve environmental condition at the university campus [20], by continuously improving environmental management through several activities and programs. It is hope that we can keep Undip campus as clean, healthy, and convenient campus for all, and will also improve our productivity in research and innovation for the community.

References

[1] Alshuwaikhat, H.M. and Abubakar, I., 2008. An integrated approach to achieving campus sustainability: assessment of the current campus environmental management practices. Journal of Cleaner Production, 16(16), pp.1777-1785.
[2] Concannon, F., Flynn, A. and Campbell, M., 2005. What campus based students think about the quality and benefits of e-learning. British journal of educational technology, 36(3), pp.501-512.
[3] Dawe, G., Jucker, R. and Martin, S., 2005. Sustainable development in higher education: current practice and future developments. A report for the Higher Education Academy, p.87.
[4] Naibaho, H. and Adi, F., 2012.Pengaruh Lingkungan Kampus terhadap Motivasi Belajar Mahasiswa (Studi Kasus Universitas Pelita Harapan Surabaya).Jurnal Manajemen Pemasaran, 5(1), pp.22-26.
[5] Wong, K.K., 2003. The environmental awareness of university students in Beijing, China. Journal of Contemporary China, 12(36), pp.519-536.
[6] Zurbrugg, C., 2002. Urban solid waste management in low-income countries of Asia: How to cope with the garbage crisis. Presented for: Scientific Committee on Problems of the Environment (SCOPE) Urban Solid Waste Management Review Session, Durban, South Africa, pp.1-13.
[7] Sahwan, F.L., Martono, D.H., Wahyono, S., and Wisoyodharmo, L.A. 2011. Sistem Pengelolaan Limbah Plastik di Indonesia. Jurnal Teknologi Lingkungan, 6(1):311-318.
[8] Priatman, J., 2004. “Energy Conscious Design" Konsepsi Dan Strategi Perancangan Bangunan Di Indonesia. Dimensi (Journal of Architecture and Built Environment), 31(1):43-51.
[9] Hermawan, H., 2005. Perancangan Software Aplikasi Optimasi Penataan Lampu PJU Sebagai Upaya Penghematan Biaya Energi Listrik. TRANSMISI, 7(1), pp.15-21.
[10] Prianto, E., 2007. Rumah Tropis Hemat Energi Bentuk Keperdulian Global Warming. Jurnal Pembangunan Kota Semarang RIPTEK, 1(1), pp.1-10.
[11] Sulasmini, L.K., Mahendra, M.S. and Arthawa Lila, K., 2007. Peranan Tanaman Penghijauan Angsana, Bungur, dan Daun Kupu-Kupu Sebagai Penyerap Emisi Pb dan Debu Kendaraan Bermotor di Jalan Cokroaminoto, Melati, dan Cut Nyak Dien di Kota Denpasar. Ecotrophic: Journal of Environmental Science, 2(1).
[12] Artiningsih, N.K.A., 2008. Peran serta masyarakat dalam pengelolaan sampah rumah tangga (Studi kasus di Sampangan dan Jomblang, Kota Semarang. Thesis. Program Pascasarjana Universitas Diponegoro.110 pp.
[13] Riswan, R., Sunoko, H.R. and Hadiyarto, A., 2011. Pengelolaan sampah rumah tangga di Kecamatan Daha Selatan. *Jurnal Ilmu Lingkungan*, *9*(1), pp.31-38.
[14] Paramita, N., 2007. Evaluasi Pengelolaan Sampah Rumah Sakit Pusat Angkatan Darat Gatot Soebroto. *Jurnal Presipitasi*, *2*(1), pp.51-55.
[15] Harjanto, N.T., Suliyanto, S. and Ismojowati, E.S., 2013. Manajemen Bahan Kimia Berbahaya Dan Beracun Sebagai Upaya Keselamatan Dan Kesehatan Kerja Serta Perlindungan Lingkungan. PIN Pengelolaan Instalasi Nuklir, 8 (IV): 54-67.
[16] Boudreau, M.C., Chen, A. and Huber, M., 2008. Green IS: Building sustainable business practices. Information Systems: A Global Text, pp.1-17.
[17] Xu, Z., Guan, X., Jia, Q.S., Wu, J., Wang, D. and Chen, S., 2012.Performance analysis and comparison on energy storage devices for smart building energy management. IEEE Transactions on Smart Grid, 3(4), pp.2136-2147.
[18] Nugroho, A., 2006. Metode Pengaturan Penggunaan Tenaga Listrik Dalam Upaya Penghematan Bahan Bakar Pembangkit Dan Energi. TRANSMISI, 8(1), pp.45-51.
[19] Mukhlis, B., 2012. Evaluasi Penggunaan Listrik Pada Bangunan Gedung di Lingkungan Universitas Tadulako. FORISTEK, 1(1):33-42.
[20] Utama, Y.J., Purwanto, and Ambariyanto. 2016. Developing Environmentally Friendly Campus at Diponegoro University. International Seminar ICENIS. Postgraduate School, Diponegoro University, October 2016.

The 3rd International Workshop on UI GreenMetric
Istanbul, Turkey, 09 - 10 April 2017

Sustainable Water Management in Tropical Region Campus: Study Case of Institut Teknologi Sepuluh Nopember Indonesia

Joni Hermana*[1, a], Welly Herumurti[2,b] , Irhamah *[3,c]
[1]*Rector of Institut Teknologi Sepuluh Nopember, Surabaya 60111, Indonesia*
[2]*Department of Environmental Engineering, Institut Teknologi Sepuluh Nopember, Surabaya 60111, Indonesia*
[3]*Department of Statistics, Institut Teknologi Sepuluh Nopember, Surabaya 60111, Indonesia*
[a]hermana@its.ac.id, [b]herumurti@enviro.its.ac.id, [c]irhamah@statistika.its.ac.id

Abstract. Sustainable water management currently becomes more important because of water shortages and deteriorating its quality. This article reports the Smart Eco-campus program at the Institut Teknologi Sepuluh Nopember (ITS) for managing water resources by presenting a case study, including water conservation, wastewater treatment and water recycle within the campus area. ITS is one of the leading science and technological university in Indonesia which has many activities that cover teaching activity, laboratory and research works, student and other supporting activities. It is located in a coastal tropical area, mainly with dry and rainy seasons, although the seasonal period becomes uncertain nowadays. The campus area has a high level of ground water table with a high salinity concentration. It is less than 2 m depth and *oligohaline* salinity, respectively. Therefore, it is rather difficult to cultivate its water, even for gardening. However water management, in term of design, operation and maintenance is vital to sustain water availability for campus livelihoods. Several programs were implemented in ITS campus that includes water retention, water recycle, domestic and laboratory wastewater treatment. Another problem is that the distributed piping water which is provided by a municipal water company is not drinkable, hence the campus also has initiatives to construct some small drinking water treatment stations in several places, as the result of collaboration with alumni and university partners.

Keywords: campus, water management, sustainable, tropical region.

1. Introduction

The aim of campus sustainability program is to increase the consumption efficiency of our resources. For water sustainability program, this could be applied through integrated management processes such as: water reuse, water harvesting, wastewater treatment and minimizing water consumption [1]. Some methods of water sustainability application in campus, *i.e.* the use of plantations and green area to infiltrate water runoff, the use of natural drainage, grey water recycle and reuse program, and the use of selected plantation that tolerates low watering. Many benefits are gained from a storm water management system such as: reducing hazard of floods, recharging groundwater from storm water infiltration, reducing water consumption of potable water, providing ecosystem to support biodiversity and affording appropriate soil moistures.

Resembling with a community life pattern, the operation and maintenance of university activities are also a process of socioeconomic activity, taking in various raw material resources, energy and water, and at the end, converting them into wastes. This comprehensive management is required to manage all the sustainable indicators by minimizing materials, energy and water use, which is also the definition of a low carbon campus. Such a holistic approach requires that all factors related to university operation that should be considered in university management [2].

2. Campus profile

Institut Teknologi Sepuluh Nopember (ITS) is a leading science and technological university which is located in Surabaya, East Java, Indonesia. ITS was ranked in the 6th between all Indonesian universities, based on the Indonesian Ministry of Higher Education, Research and Technology during the year of 2016. Further, ITS has a strong commitment in the environmental management through its awareness which is implemented by Smart Eco-campus program. In 2017, ITS achieved the 2nd rank in Indonesia

and the 43rd rank in the world's greenest campus by the version of UI Green Metric World University Ranking.

The main campus of ITS is located in 187 Ha at the North-East of Surabaya which is also the capital city of East Java Province (Figure 1). The university has 32 departments that are distributed under eight faculties. The academic faculty members are 970 of lectures and professors, that are assisted by 1135 of academic supporting staffs, while the student body of ITS is approximate 20,000 students, that covers vocation, undergraduate, graduate and doctoral students.

ITS has seven strategies for campus management that one of them is a campus sustainable development. One of the main priority program is the development program and the land use planning based on environmental concept (Eco-campus)[3]. Therefore, the ITS Smart Eco-campus has implemented by means of four aspects:

- Operational and maintenance are concerned with sustainable development and environmental friendly approaches, *i.e.* energy saving, water saving and solid waste recycle.
- Development of academic faculty behavior which concerns towards environment in all academic activities.
- Development of researches and the implementation of science and technology that supports ITS Smart Eco-campus.
- Faculty and community empowerment in order to participate in that harmonizing ITS Smart Eco-campus, including empowering communities that live surrounding ITS campus in order to make improvement impacts.

Eco-campus program has been established by ITS since 2011. The program is to involve ITS as a higher education institution, to contribute to global programs that are related to environmental sustainability, as it also stated in the Sustainable Development Goals (SDGs). At ITS, Smart eco-campus program goals are planned to create campus infrastructures that support the appropriate living standard of comforts and productive activities. Smart eco-campus is an environmentally friendly and sustainable program, it is created to improve the member of faculty health and the natural environment.

Figure 3. Institut Teknologi Sepuluh Nopember taken from Google Earth 2016

Two main approaches in ITS Smart Eco-campus program that had been implemented are a program of physical development and social engineering development. ITS Smart Eco-campus focuses on the development of social engineering programs to create the change of attitudes and mindset shifting of faculty members whose love to environment in their daily activities is long-term and so the ITS Smart Eco-campus program will be sustainable. Many activities in the ITS Smart Eco-campus program *i.e.* planting tree seedlings for new students, the construction of Urban Farming, Campus Cycling program,

Safety Riding Campaign, Protection of Birds and Other Animals. Physical development program includes the construction of environmentally friendly buildings, construction of drainage to reduce flooding, dredging of drainage channel around campus and normalizing retention ponds to improve water flow and its capacity, integrated development of bike paths and the development of *wudhu* (ablution) water recycling at ITS Mosque for watering gardens and parks purposes.

Figure 4. Green Area and Parks of ITS Campus

3. Water Demand

Water is required not only for faculty members but also for laboratory purposes, academic supporting facilities, campus operation and maintenance, including for ITS mosque. The average water consumption at ITS is 32,627 m^3/month equal with 1,087 m^3/day (Figure 3). Therefore, the faculty members, academic staffs and students are only using one third of the total water demand.

A part from this, ITS uses non-drinkable tap water from Surabaya's municipal water supply company. Hence, ITS also constructed some drinkable tap water stations that are provided through the collaboration between ITS and Surabaya Water Supply Company (PDAM Surabaya). Tap water stations are provided by PDAM Surabaya through their Corporate Social Responsibility (CSR) program. The drinkable tap water stations are placed in several spots, such as student activity centre, mosque and some departments.

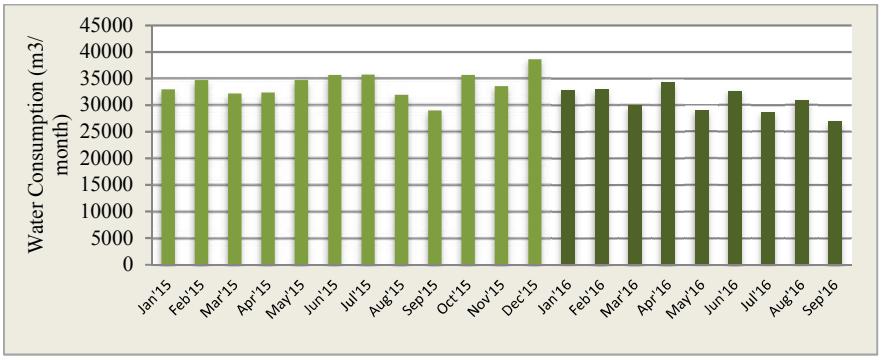


Figure 3. Campus ITS Monthly Water Supply Consumption

4. Stromwater Management

Retention ponds are important because they could be used as floods control, groundwater recharge; providing wildlife habitat that are reservoirs of biodiversity; retaining or transforming nutrients and sediments, providing occasions for fishing, bird watching and recreation area [4]. ITS has two types of retention ponds *i.e.* impermeable ground that is layered by concrete and HDPE geomembrane, and permeable ground.

Some retention ponds are utilized as recreation and sport area beside for floods control and water reuse. Providing the educational goals will support sustainability, used system should be noticeable and highlighted in order to increase and expand the knowledge about water sustainability. All drainage channels in ITS have permeable ground. Hence, it will increase infiltration and reduce water runoff.

Figure 4. Pond near Physic Department for fishery pond 2.5 m depth

Figure 5. Pond in student activities center for garden watering and recreation

Figure 6. The eight shaped retention pond which has jogging track for floods control, sport activities and recreation

Figure 7. Retention Pond for floods control and recreation

Figure 8. Retention pond in the Student Dormitory for floods control

Figure 9. Retention pond in Design and Interior Departement for floods control

Figure 10. Retention pond in Industrial Engineering Department for floods control

Figure 11. Lotus pond which close to Robotic building is operated for wetland and flood control

Figure 12. Rain water harvesting

5. Wastewater Management

Domestic wastewater is produced from academic buildings, canteens, student dormitory and other supporting buildings. Mainly, domestic wastewater flows by septic tank. However, wastewater that is produced from student dormitory and some departments, are treated by wastewater treatment plants such as Anaerobic Baffle Reactor (ABR), Anaerobic Filter (AF) and Constructed Wetlands. ITS has only science and engineering departments that many of them have laboratories that produce hazardous and non-hazardous waste. The hazardous waste was not treated inside campus but only for temporary storage due to the national regulation. While non-hazardous liquid waste is treated by laboratory liquid waste treatment.

(a)

(b)

Figure 13. (a) Anaerobic Baffle Reactor for waste water treatment; (b) Pond covered by HDPE membrane

(a) (b)

Figure 14. (a) Hazardous waste management (b) Mathematic and Science Faculty laboratories wastewater treatment

6. Water Reuse and Recycle

Manarul Ilmi Mosque is a mosque in ITS campus which requires abundant water every day. It requires water about 25 to 30 m^3 per day, while at Friday it increases about 45 to 50 m^3 due to Friday prayer. Beside it is utilized for wudhu or ablution, the water is used for cleaning the mosque and garden watering. Before 2013, the garden watering in the surrounding mosque, used water supply from municipal water company, and then the mosque water recycle had been established to reduce water consumption at present. Four chambers is used for water recycle program that one chamber is used for sedimentation and filtration processes while the others are used as water reservoirs (Figure 14). Each chamber has a capacity of 5,000 L and the water flows gravity. Automatic sprinklers with pumps are used for daily garden watering specially at the dry season.

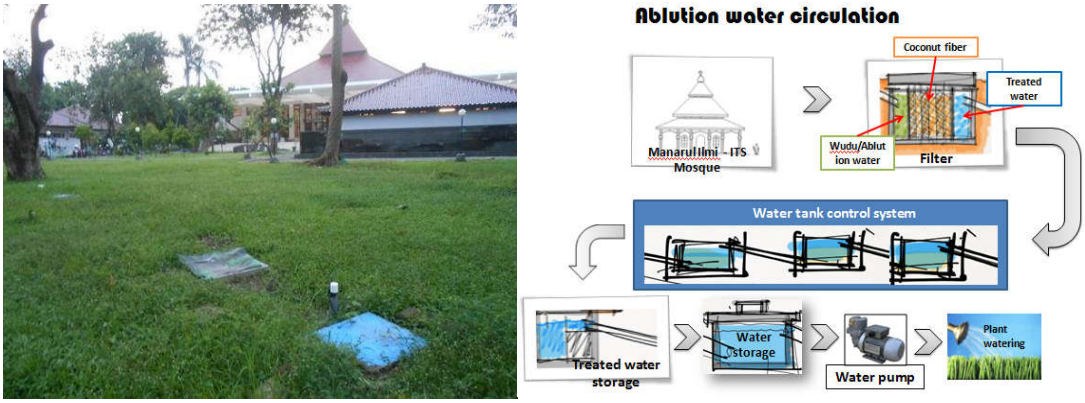


Figure 15. Mosque water recycle reservoirs

7. Summary

Many programs could be implemented that support sustainable water management within ITS campus, including the stimulation of onsite infiltration of rainfall and runoff, protecting and enhancing surface water quality, promoting ground water recharge, reuse and recycle wastewater, capturing and reuse rain water, and also treating grey water and black water.

References

[1] Amr AI, Kamel S, Gohary GE, Hamhaber J. Water as an Ecological Factor for a Sustainable Campus Landscape. Procedia - Social and Behavioral Sciences 2016; 216:181–93. doi:10.1016/j.sbspro.2015.12.027.

[2] Liu H, Wang X, Yang J, Zhou X, Liu Y. The ecological footprint evaluation of low carbon campuses based on life cycle assessment: A case study of Tianjin, China. Journal of Cleaner Production 2017; 144: 266–78. doi:10.1016/j.jclepro.2017.01.017.

[3] Rector of ITS. Laporan Tahunan Rektor 2015. ITS Surabaya: Badan Koordinasi, Pengendalian, dan Komunikasi Program; 2016.

[4] Burton TM, Tiner RW. Ecology of Wetlands A2 - Likens, Gene E. Encyclopedia of Inland Waters, Oxford: Academic Press; 2009, p. 507–15.

The 3rd International Workshop on UI GreenMetric
Istanbul, Turkey, 09 - 10 April 2017

Evaluation of Environmental Performance of BAU to Facilitate Ranking to a Higher Position among UI GreenMetric List

Noor M. Al-Kharabsheh*[1,a]
[1] *Department of Water Resources and Environmental Management, Faculty of Agricultuaral Technology, Al-Balqa Applied University*
[1] *International Research Center for Water, Environment and Energy, Al-Balqa Applied University*
Al-Salt 19117, Jordan
[a]noorkharabsheh@yahoo.com

Abstract. In compliance with UI GreenMetric to combat climate change, Al-Balqa Applied University (BAU) ranked to the position of 236 among 516 universities and 8th position among Arab World universities and the 4th among Jordanian universities for the year 2016. This paper was prepared to present the achievements of BAU regarding the issue of climate change, as well as the university's contribution, challenges and drawbacks.
This paper throws light in its first part on Jordan population [3], energy use per capita [4]; ecological footprint [6], and other relevant issues as well as the Jordanian measures taken in combating climate change. Whereas, the second part will focus on BAU and its commitment toward environment describing the most important achievements in this regard, particularly the establishment of International Research Center for Water, Environment, and Energy (IRCWEE) in 2009 and finally, the paper reviews the opportunities of improvements that are envisaged or it is being implemented during 2017 toward more compliance with UI GreenMetric list and subsequently, occupying a higher position among other universities.

Keywords: Al-Balqa Applied University, BAU, UI GreenMetric Ranking; Climate change; Jordan

1. Introduction

A remarkable initiative was taken in 2010 by the Indonesian Universities as a contribution to combat climate change, later known as UI (Universitas Indonesia) GreenMetric World Ranking. The initiative was specially designed to measure Universities sustainability efforts within their campuses along with other environmental issues such as water and energy conservation …etc [1]. The first step of this initiative was to publish an online survey to rank universities all over the world as functions of their internal sustainability programs and policies. The response was considerably amazing since the total number of universities recruited in the survey has reached 516 in 2016 [2].
Al-Balqa Applied University (BAU) in Jordan participated in this process and subsequently ranked to the position of 236, and 8th position among Arab World Universities. This may be considered as a promising achievement taking into consideration that Al-Balqa Applied University is a newly established one as compared to other well settled universities in UK or other European countries in the world.
The paper presents the achievements of BAU regarding the issues of climate change, as well as the university's contribution, challenges and drawbacks. It is a contribution to the third international Workshop on UI GreenMetric/Istanbul/Turkey during 10-12 April 2017.

2. Jordan Profile at a glance

As far as the issue of climate change is concerned, the following main features may best describe the situation in Jordan.

2.1 Location, Area and Population

Jordan is located in the south-eastern part of the Middle East (Figure 1) with an area of 88,778 km^2 among which, the forest area is estimated to be 1.1% of the total area of the country. Area of water bodies is approximately 482 km^2 that includes the Dead Sea and the Gulf of Aqaba.

Total population is 7.5 million according to UNDP [3] of which 83.4 % are urban. In addition to about 1.5 million refugees mostly from Syria are settled in Jordan.

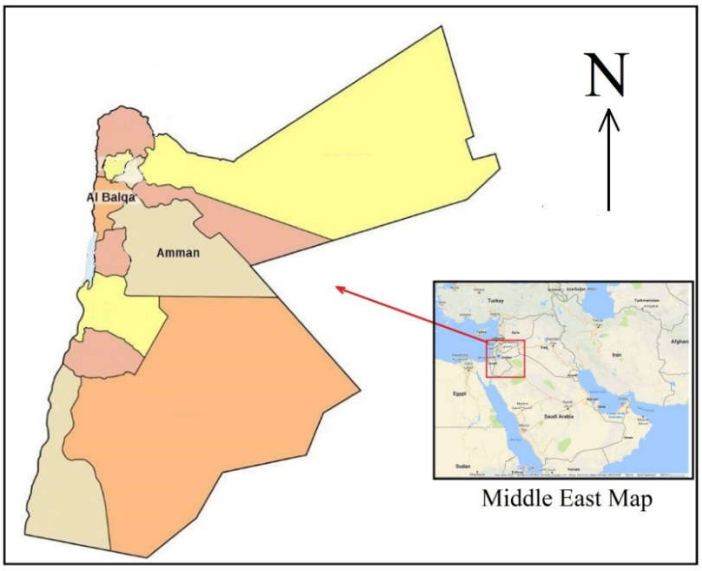


Figure 5. Al-Balqa province on Jordan map also showing the location in the Middle East.

The World Bank provided data about carbon dioxide emission for Jordan from 1960 to 2013. The average value during that period was 9846.85 kt with a *minimum of 744.4 kt in 1960* and a *maximum of 24858.59 kt in 2012 (Figure 2)*. The average value during that period was 2.47 metric tons with a minimum of 0.84 metric tons in 1960 and a maximum of 3.95 metric tons in 2005 [4].

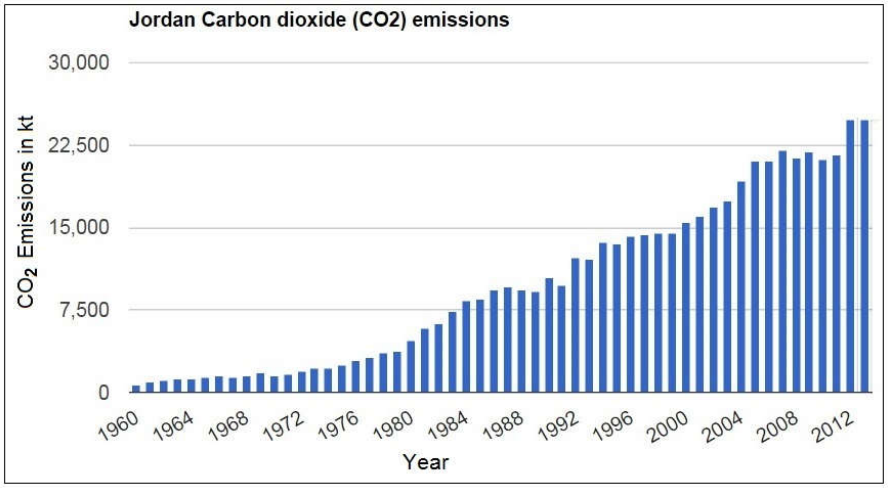


Figure 6. Jordan's carbon dioxide emissions, for the years 1960-2012 [4].

2.2 The Ecological Footprint of Jordan

The ecological footprint which represents the impact of a person or community on the environment, expressed as the amount of land required to sustain their use of natural resources is estimated as 2.1 global hectares (gha) per person based on 2012 data published in 2016. This is considerably lower than world-average of 2.84 gha/person. However, Jordan biocapacity of 2.1 gha/person is lower than the world-average biocapacity of 1.73 gha/person [5]. According to Namrouqa [6], the average footprint of an inhabitant in Jordan "is small, and for many, it is too small to meet basic food, shelter, health and sanitation needs," as the report of Namrouqa indicated [6].

2.3 Energy Use per Capita

The primary energy supply in Jordan is the fossil fuels (mainly oil and natural gas) which may reach 96% of the total [7], the rest of the percentage may account to non-commercial house-hold fuels that are mainly used in the rural areas. Figure 3 demonstrates the energy use per capita for the years 1971-2013 expressed in kilograms of oil equivalent.

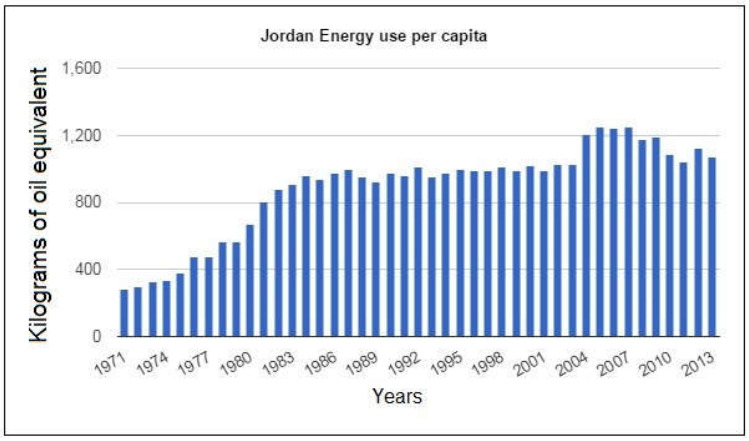


Figure 7. Jordan's Energy use per capita for the years 1971-2013 [7].

2.4 Clean Energy

Clean Energy use in Jordan was established by the end of 1980s As shown in Figure 4 expressed as percentage of total energy production [7].

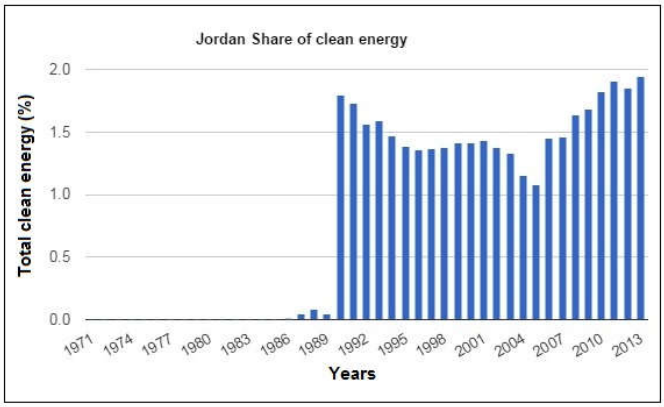


Figure 8. Jordan's Clean Energy use per capita which started by the end of 1980s [7].

2.5 Water Resources

2.5.1 The Jordan Red Sea Project (JRSP, Project)

JRSP is a water infrastructure and economic development project designed to assist the Jordan establish water independence that involves the connection of the Red Sea to the Dead Sea accompanied by the construction of large scale desalination plants. Excess seawater and desalination brine will be discharged to the Dead Sea. Hydropower stations, to the extent possible, will be used to help off-set the large energy needs of the project [8]. JRSP is a multilateral and interdisciplinary project of 25 partners from universities, research centers, water authorities, decision relevant institutions, external experts as well as industry partners from Jordan, Germany, the Palestinian Territories and Israel.

2.5.2 Other practices

There are many other different activities regarding water resources among them are brackish water usage, aquifer recharge…etc. which may be tackled in a different article.

3. Al-Balqa Applied University (BAU)

3.1 Background of BAU Establishment

Al-Balqa Applied University (BAU) is a government-supported university located in Salt, Jordan, was founded in 1997 by merging several colleges distributed over almost all of the Jordanian provinces (see Figure 1). Thus BAU was formed as a distinctive state university in the field of Bachelor and associate degree applied education, at the capacity of more than 21,000 students distributed into 10,000 at the bachelor's degree program and 11,000 at the associate degree program.
The university system has 11 Branches in every Jordanian governorate (except for Mafraq). However, the main BAU campus in Al-Salt city is located in Balqa province. Figure 5 demonstrates the location as seen by Google Earth.

Figure 9. Al-Balqa Applied University as seen by Google earth.

3.2 BAU Commitment toward Environment

BAU further manifested its commitment towards solving current local and global challenges by establishing the International Research Center for Water, Environment, and Energy (IRCWEE) in 2009. The establishment of the center is a result of collaboration between the university and the United Nations Education, Science and Culture Organization (UNESCO) with the contribution of the United Nations Special Fund to achieve the Millennium Development Goals. The center includes specialized human cadres of Ph.D's with extensive experience in different environmental fields (water, environment and energy).
The IRCWEE conducts researches on water, environment and the energy sector in Jordan and is a leading research center and consultancy services provider in the field of sustainable development. Its team is characterized by a multi-disciplinary background to offer a comprehensive approach for sustainability projects. Besides a focus on consulting the public and private sector in Jordan, the IRCWEE seeks to establish research and education cooperation with international partners around the globe.
The IRCWEE is currently implementing several development and research projects i.e.:

- Integrated water resources management (IWRM) in the Lower Jordan Valley: SMARTMOVE-Management of highly variable water resources in semi-arid regions (funded by Helmholtz Environmental Center (UFZ) from Germany, and in coordination with the Ministry of Water and Irrigation (MWI) in Jordan).
- Sustainability and tourism in the Mediterranean (S&T MED) (funded by ENPI/EU).

- Coastal environmental and socioeconomic monitoring at Aqaba/Jordan (funded by World Bank/ PERSGA).
- STS-Med Small scale thermal solar district units for Mediterranean (funded by ENPI/CBCMED).
- Monitoring of total suspended particles and PM10 in ambient air in the vicinity of Cement Factory in Rashadiya (funded by Lafarge/Jordan).
- Characterization of Solid Waste at Al-Balqa Applied University and the Potential for Reduction and Recycling (Initiative).

3.3 Challenges and drawbacks

University campus is located at semi-arid, which means in an area of scarce water resources; this impose the following necessities:

- Need to secure quite large quantities of water for drinking and household uses.
- Consequently, the necessity to discharge almost similar quantities of wastewater.
- A considerable degree of unawareness of water saving attitudes can be noticed among students. This is because of the poor syllabus used in the previous levels of education.

University offers education to a wider range of students of different municipalities. BAU is continuously working to raise the levels of environmental awareness among staff members in the first position and among students, however, some difficulty may be experience in this respect due to variations in the background of the stakeholders.

The use of buses and private car is a great challenge that the university is facing since bicycles are almost impossible to use due to the mountainous nature of the area as well as the location of the campus

It is envisaged that considerable expansion of the green areas around the campus should be achieved, however, this target is greatly hindered back by the problem of water scarcity, the low annual rainfall, and limited area allocated for the campus.

3.4 BAU Initiative to follow up UI GreenMetric

As a part of BAU commitments toward a perfect implementation of UI GreenMetric ranking, a system was invented in this work to estimate the possibility of ranking to a higher position among universities. This may be considered as a plan for improvements toward more compliance with UI GreenMetric Ranking.

Opportunities of Improvements that are envisaged or are being implemented during 2017 to improve indicators and criteria items in BAU are mentioned in Tables 1-6, which focus on the main BAU campus. The situation is expressed in either one of three letters to symbolize the following facts: difficult to be changed for the time being (D); changes and/or implementation are envisaged (E) and the changes are already in progress (P).

Table 1. Opportunities of Improvements for Setting and Infrastructure (SI) during 2017.

No.	Criteria and Indicators	Points	Opportunity
SI1	The ratio of open space area towards total area	300	E
SI2	The ratio of open space area towards campus population	300	D
SI3	Area on campus covered in forested vegetation	200	D
SI4	Area on campus covered in planted vegetation	200	P
SI5	Area on campus for water absorbance	300	D
SI6	University budget for sustainable effort	200	P
	Total	1500	

D: difficult to change for the time being; E: changes are envisaged; and P: changes are in progress

Table 2. Opportunities of Improvements for Energy and Climate Change (EC) during 2017.

No.	Criteria and Indicators	Points	Opportunity
EC1	Energy efficient appliances usage	200	P
EC2	Smart building implementation	300	E
EC3	Renewable energy usage	300	P
EC4	The ratio of total electricity usage towards campus population	300	P
EC5	The ratio of renewable energy produce towards energy usage	200	P
EC6	Element of green building implementation	300	P
EC7	Greenhouse gas emission reduction program	200	E
EC8	The ratio of total carbon footprint towards campus	300	E
	Total	2100	

D: difficult to change for the time being; E: changes are envisaged; and P: changes are in progress.

Table 3. Opportunities of Improvements for Waste (WS) during 2017.

No.	Criteria and Indicators	Points	Opportunity
WS1	Program to reduce the use of paper and plastic in campus	300	P
WS2	Recycling program for university waste	300	P
WS3	Toxic waste handled	300	E
WS4	Organic waste treatment	300	E
WS5	Inorganic waste treatment	300	E
WS6	Sewerage disposal	300	P
	Total	1800	

D: difficult to change for the time being; E: changes are envisaged; and P: changes are in progress

Table 4. Opportunities of Improvements for Water (WR) during 2017.

No.	Criteria and Indicators	Points	Opportunity
WR1	Water conservation program	300	D
WR2	Water recycling program	300	E
WR3	The use of water efficient appliances	200	E
WR4	Treated water consumed	200	E
	Total	2000	

D: difficult to change for the time being; E: changes are envisaged; and P: changes are in progress

Table 5. Opportunities of Improvements for Transportation (TR) during 2017.

No.	Criteria and Indicators	Points	Opportunity
TR1	The ratio of vehicles (cars and motorcycles) towards campus population	200	P
TR2	The ratio of campus bus services towards campus population	200	P
TR3	The ratio of bicycles found towards campus population	200	D
TR4	Parking area type	200	D
TR5	Initiatives to decrease private vehicles on campus	200	P
TR6	Parking area reduction for private vehicles	200	P
TR7	Campus bus services	300	D
TR8	Bicycle and pedestrian policy on campus	300	D
	Total	1800	

D: difficult to change for the time being; E: changes are envisaged; and P: changes are in progress

Table 6. Opportunities of Improvements for Education (ED) during 2017.

No.	Criteria and Indicators	Points	Opportunity
ED1	The ratio of sustainability courses towards total courses	300	P
ED2	The ratio of sustainability research funding towards total research funding	300	P
ED3	Sustainability publications	300	P
ED4	Sustainability events	300	P
ED5	Sustainability student organizations	300	P
ED6	Sustainability website	300	P
	Total	1800	

D: difficult to change for the time being; E: changes are envisaged; and P: changes are in progress

Table 7. Summary of opportunities of Improvement.

Criteria and Indicators	*difficult to change*	*changes are envisaged*	*changes in progress*
Setting and Infrastructure (SI)	3	1	2
Energy and Climate Change (EC)	-	5	3
Waste (WS)	-	3	3
Water (WR	1	3	-
Transportation (TR)	4	-	4
Education (ED)	-	-	6
Total out of 38	8	12	18

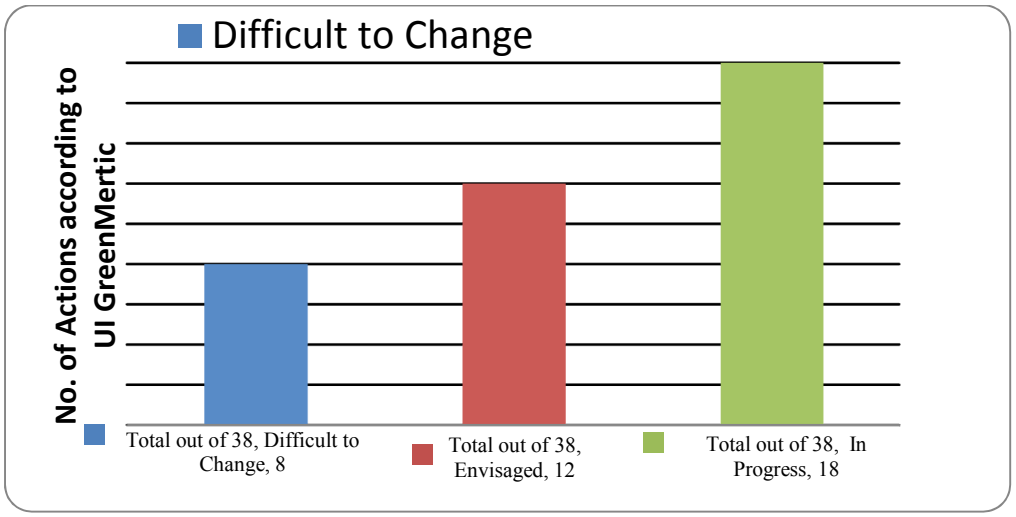


Figure 10. Actions either in Progress, Envisaged or Difficult to implement.

4. Summary/ Concluding Remarks

Despite the facts that Jordan is a semi arid environment yet its adverse impact on the environment is considerably low, based on many observations among which is the Ecological Footprint of 2.1 Global hectares.

The UI GreenMetric Ranking is an excellent tool to measure contributions to combat climate changes. When applied to our Al-Balqa Applied University (BAU), remarkable findings were observed. BAU ranked to the position of 236, this position was beyond our ambitions. Consequently a quick review was recently done and is presented in this paper which indicated that the total number of actions need to be taken are 38 belonging to 6 Indicators. Majority of those actions (18) are already in progress (marked in letter P) ; 12 actions can easily be implemented and are marked with letter E (envisaged) during 2017;

whereas 8 actions cannot be implemented for the time being (marked with D) due to many constraints. BAU is deeply concerned to rise in its position to a higher one in the near future.

References

[1] Sari, R. F., Widanarko, B., 2016. Evaluation of UI GreenMetric2010 –2015: Challenges and Opportunity, available at http://www.ireg-observatory.org/ireg-8/presentations/V/Riri-Fitri-Sari-UI-GreenMetric-PPT_IREG8_06052016.pdf

[2] UI GreenMetric World University Ranking, 2016. Technical Workshop on UI GreenMetric. Hosted by Bülent Ecevit University, Zonguldak, Turkey , 3rd October 2016 Available at http://web.beun.edu.tr/greenmetrics/wp-content/uploads/2016/10/Tommy_Ilyas_University_of_Indonesia.pdf

[3] UNDP, 2015. Human Development Report. United Nations Development Program; available at http://hdr.undp.org/en/countries/profiles/JOR

[4] The World Bank, 2017. Carbon Dioxide Emissions: The Global Economy Website, available online at http://www.theglobaleconomy.com/Jordan/Carbon_dioxide_emissions/

[5] Jordan Ecological Footprint Network, 2017. Available online at http://www.footprintnetwork.org/content/images/article_uploads/Jordan.pdf

[6] Namrouqa, H., 2017. Jordan's Average Ecological Footprint per Capita 'too small" The Jordan Times. 13th March 2017. Available at http://vista.sahafi.jo/art.php?id=ff376e34e278ab6934ae6673601895381cade304

[7] The World Bank, 2017. Energy Use per Capita: The Global Economy Website, available online at http://www.theglobaleconomy.com/Jordan/Energy_use_per_capita/

[8] The Jordan Red Sea Project Ministry of Water and Irrigation Hashemite Kingdom of Jordan, 2017. Available online at http://www.jva.gov.jo/sites/en-us/RSDS/SiteAssets/rsds%20phase1.aspx?PageView=Shared

Parallel Session 1
Issues and Innovation in Managing Waste

The 3rd International Workshop on UI GreenMetric
Istanbul, Turkey, 09 - 10 April 2017

Implementation of the Environmental Management System at the Universidad Nacional de Colombia.

Liven Fernando Martínez Bernal[1 a], José Javier Toro Calderón[2 b], José Herney Ramírez Franco[3 c *]
[1]*Institute of Environmental Studies, Universidad Nacional de Colombia – Bogotá*
[2]*Institute of Environmental Studies, Universidad Nacional de Colombia – Bogotá*
[3]*Department of Chemical and Environmental Engineering, Universidad Nacional de Colombia – Bogotá**
[a]*lfmartinezb@unal.edu.co*, [b] *jjtoroca@unal.edu.co*, [c] *jhramirezfra@unal.edu.co*

Abstract. The Universidad Nacional de Colombia is a public educational institution founded in 1867. It has currently 8 seats located in different regions of the country, where 53,000 students are formed per year. The environmental management is an essential part of its foundations and it is reflected in the environmental training offered to all academic programs and the environmental policy, adopted since 2011. 25% of its seats has an environmental management system certified by the ISO 14001 regulation, and the remaining 75% is currently in the implementation process. The surface of the Universidad Nacional reaches 4,191,906 m^2, out of which 28.67% is covered by forest vegetation and 48.97% by planted vegetation. The good environmental practices developed inside the Universidad Nacional include: the separation of organic waste, which is composted and then employed for the maintenance of gardens, thus reducing the use of fertilizers and chemicals; the implementation of programs to reduce the consumption of disposable cups by providing free reusable glasses; and the collection and treatment of hazardous waste, including those generated in more than 500 laboratories.
Likewise, the collection and use of rainwater and the generation of electrical energy from solar panels is carried out. The main seats of the University are integrated to the public transportation systems and cycling infrastructure of the cities, and there is also a bicycle loan service for the internal transit. Bioclimatic elements have been incorporated in the most recent buildings, where natural lighting and ventilation have been included since the design stage.

Keywords: environmental management system, environment, and good practices.

1. Introduction

The Universidad Nacional de Colombia (UNAL) is the largest public higher education institution in the country and has presence in several regions in Colombia with eight seats: Amazonia, Bogotá, Caribe, Manizales, Medellín, Orinoquia, Palmira and Tumaco. With regard to the environmental perspective, one of the missional purposes of the UNAL is "to study and enrich the cultural, natural and environmental patrimony of the Nation, and to contribute to its conservation" [1].

For the UNAL, it is essential that the best conditions for the teaching, research and extension activities are supported by the existence of environmentally optimal campuses, where each member of the university is able to enjoy green spaces, clean air, low noise levels and interaction with wild flora and fauna. This position led to the formulation of UNAL's environmental policy through the Agreement 016 of 2011, which aims at promoting a healthy environmental surrounding and proposing sustainable alternatives to solve the environmental problems that may arise in the campuses, on the basis of a continuous improvement, prevention of pollution and compliance with the current legal environmental requirements
The objective of this article is presenting how the UNAL has structured and implemented a continuously improving environmental policy that has helped this institution to become a referent in the education sector in Colombia, because its mission is not only guaranteeing the right to education, but also a healthy environment (Figure 1 shows the evolution of UNAL in the GreenMetric world university ranking). Section 2 explains the structure and organization of the Environmental Management System (SGA, for

its initials in Spanish). Section 3 introduces the most relevant results in terms of environmental management and highlights the good practices implemented in each one of the items evaluated by the GreenMetric ranking. The conclusions about the implementation process of the SGA in the UNAL are presented in the last section.

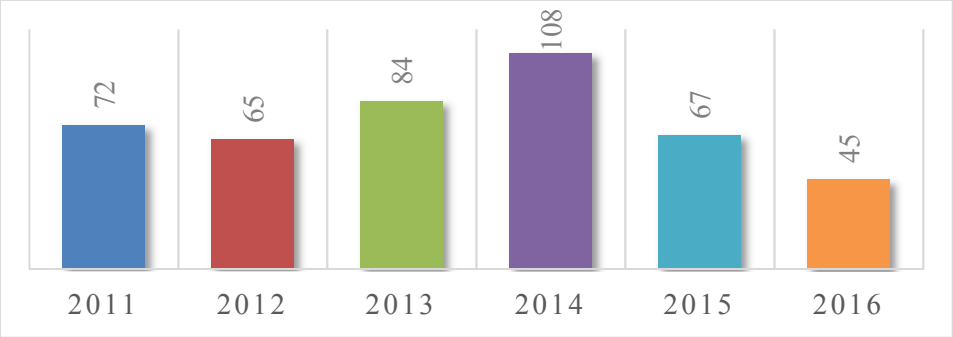


Figure 1. Evolution of the UNAL in the GreenMetric World University Ranking

2. Organization of the Environmental Management System (SGA)

The National Technical Committee of Environmental Management (CTNGA) was created through the Chancellor's Resolution 35 of April 30 2012 [2]. This Committee is supervised by the Vice-Chancellor and managed by the National Coordinator of the SGA. A full-term professor of the UNAL directs each Environmental Management Office (OGA) in each campus. These Directors must have knowledge and experience in the environmental field and a technical professional. The Director also coordinates the operational departments in charge of developing actions oriented to improve the environmental aspects.

3. Environmental Performance

The following are the most relevant results of the UNAL in terms of environmental management, particularly with regard to the good practices included in the items evaluated by the GreenMetric ranking.

3.1 Vegetal Cover

The UNAL has an area of 4.191.906 m^2, out of which 55.1% corresponds to the Bogotá Seat, followed by the Orinoquia Seat with 11.9%, and the Tumaco Seat with 10.5%. The other five seats represent the remaining 22.5%. The significance of this area relies on the fact that 28.67% corresponds to forests and 48.97% to planted vegetation. There is a collection of trees and palms exhibited to students and visitors that has become an academic and cultural attraction.

The Amazonas Seat has 125.153 m^2 of forest. The Palmira and Orinoquia Seats have similar amounts of forest areas, with 110.895 m^2 and 100.000 m^2, respectively. The Orinoquia campus has an ecological trail with a longitude of 2.2 kilometers, which allows observing the typical features of this region's ecosystems. This spot is also the home to 144 species of birds (43 families and 21 orders). The Caribe Seat occupies the second place in terms of the largest proportion of forest area, with 92%. This includes a botanical garden of 79.718 m^2, which has been open to the public since 2008 and shelters 423 vegetal species and 18.500 plants [3].

3.2 Waste

With regard to the management of solid waste, the UNAL has implemented programs that aim at their reduction. One of them is the decrease of paper use through the promotion of the electronic management of the information, printing only when it is necessary and the use of both sides of the paper. These good practices are adopted in all the seats of the UNAL.

The separation of recyclable waste is one of the main strategies to reduce the amount disposed in dumps or landfills. Only during 2015, 47.815 kg of waste were recycled in the Bogotá Seat; 6.004 kg in the Medellín Seat; and 666.14 kg in the Palmira Seat.
Regarding the management of hazardous waste, some efforts have been made in order to control the generated amounts, their temporary storage and adequate disposal. A good practice worth mentioning is the storage of the laboratories' reactive waste in only one space (the Palmira Seat), their registry and detailed quantification in the databases of the Bogotá and Medellín Seats.

3.3 Energy

The climatic conditions of the zones where the different seats are located determines the amount of the energy consumption: the seats based on places with cold or moderate climate have lower per capita consumption, whereas the ones with warmer temperatures present higher energy consumption levels.
The per capita energy consumption of the seats with cooler weather are: 29.79 kw/h for the Bogotá Seat; 29.47 kw/h for the Medellín Seat; and 29,59 kw/h for the Palmira Seat. On the other hand, the monthly per capita consumption for the rest is the following: 121.41 kw/h for the Amazonia Seat; 100.45 kw/h for the Caribe Seat; and 74.82 kw/h for the Orinoquia Seat. This consumption increase is associated to the use of refrigeration systems, such as air conditioning, fans and fridges, required for the temperature regulation of classrooms, offices, laboratories and storages, so that comfortable working and learning spaces can be guaranteed.

3.4 Transport

The UNAL has created several strategies oriented to the use reduction of private vehicles. Some examples are: the integration of the Manizales, Bogotá and Medellín campuses to the public transportation systems; the provision of a transportation service inside the Manizales, Palmira, Medellín and Bogotá campuses; the entrance restriction for some vehicles according to the numbers of the license plate in Medellín. The bicycle loan program has been designed in order to promote the use of bicycles for the internal transportation. This program has been implemented in the Bogotá Seat under the name of 'Bicirun', and also in the Palmira Seat.

3.5 Bioclimatics

In the Medellin Seat some ecological barriers have been installed on the fronts of the buildings that receive higher levels of solar radiation. These barriers are composed of metallic nets and several types of bindweeds, which are located in their base. When these plants grow up, they are able to generate a green cover that reduces the internal temperature of the buildings; they also contribute to the capture of CO_2 and the purification of the air without using electric energy. The Tumaco Seat is currently under construction, which has facilitated the incorporation of design elements that help reducing the energy and water consumption, as well as defining the landscape management of this Seat. These same elements have been copied in the building of more recent constructions in the Bogotá, Palmira and Manizales Seats.

3.6 Education

This is one of the aspects in which the UNAL has made a significant progress in the last years. The number of courses on environmental topics is an example: in 2015, 624 courses were offered and the figure rose to 824 in 2016, which represents a 32% increase.
In terms of the number of publications, these were reduced in 13.6% (from 1.190 in 2015 to 1.027 in 2016). However, it is important to point out that those numbers are not negligible and that it takes great effort to carry out more than a thousand publications on environmental topics.
Another important aspect is the number of student organizations related to environmental topics, which has increased from 41 in 2015, to 63 in 2016. This shows the growing interest of the students and the results of the actions implemented by the UNAL to generate awareness about the environmental problems and the responsibility of each member of this community in the design and promotion of plausible solutions.

4. Conclusions

The UNAL aims at strengthening all the environmental aspects in the eight seats through the SGA, particularly in the National seats, because they require more technical and financial support to obtain the ISO 14001 certification. The environmental performance of the UNAL has been improving progressively in the last years due to the commitment of its administrative board and the technical teams in charge of the environmental management in each seat. These experiences and practices have helped the UNAL to become a leading institution in terms of the environmental management in Colombia, and that is reflected on the society through its students and graduates.

References

[1] Decree 1210 of 1993, article 2.
[2] Chancellor's Resolution 35 of April 30 2012, Universidad Nacional de Colombia.
[3] Pacheco-Garzón, Andrea, 2012. Guía de aves del Jardín Botánico. Universidad Nacional de Colombia, pp. 2-3, ISBN 978-958-761-417-6, Bogotá-Colombia.

The 3rd International Workshop on UI GreenMetric
Istanbul, Turkey, 09 - 10 April 2017

NPUST Waste Handling Strategy and Program

Chang-Hsien Tai[1], Chin-Lung Chang[2], Jik Chang Leong[3*]✉
[1]*President, National Pingtung University of Science and Technology,*
[2]*Dean, Office of General Affairs, National Pingtung University of Science and Technology,* [3]*Dean, International College, National Pingtung University of Science and Technology, No. 1, Shuefu Road, Neipu, Pingtung, 91201, Taiwan.*
[a]president@mail.npust.edu.tw, [b]clchang@mail.npust.edu.tw, [c]jcleong@mail.npust.edu.tw

Abstract. The National Pingtung University of Science and Technology (NPUST) has been handling various kinds of waste for a long time. The waste handling strategy and program is not solely a matter of university staff, it also actively engages students and faculty members. In additional to Reduce, Reuse, and Recycle, the university also emphasizes on education that raises everyone's awareness so that the waste per person can be reduced.

Keywords: waste handling, education, reduce, reuse, recycle.

1. Introduction

Appropriate waste handling program is apparently an important indicator showing how dedicated a green university is obligated to promote environment sustainability. As a matter of fact, Reduce, Reuse, and Recycle are the key components to a comprehensive university waste handling program. As defined by the World Bank, municipal solid waste (MSW) also includes the non-hazardous waste generated in institutions and agricultural wastes. According to a report by Planet Aid, Inc., Austria, Germany, and Taiwan are the 2015 world leaders in recycling rate [1]. As a matter of fact, less than half of the total waste output from the top few countries on the list shown in Table 1 is actually sent to the landfill.

Tabel 1. Top recycling rates in 2015 [1].

Country	Recycling Rate
Austria	63%
Germany	62%
Taiwan	60%
Singapore	59%
Belgium	58%
South Korea	49%
United Kingdom	39%
Italy	36%
France	35%
United States	34%
Australia	30%
Canada	27%
Japan	21%

Tabel 2. Top waste producing countries in 2012 [2].

Country	Annual Waste Production (million tons)
United States	254.0*
Russia	207.4
Japan	53.4
Germany	48.8
United Kingdom	34.9
Mexico	32.2
France	32.2
Italy	29.7
Spain	26.3
Turkey	26.0

It is remarkable to point out that most of the top countries listed in Table 1 actually share a very small proportion of world population. Their effort in waste recycling does not actually have a gigantic impact on the world. In contrast, Table 2 shows the list of countries that correspond to large amounts of waste production. These figures apparently are closely dependent on the population of the countries. Although China was not on the list yet, the amount of garbage produced in China has been rising remarkably. According to the World Bank, the quantity of MSW generated in China's cities has increased fivefold

between 1980 and 2009, from 85 thousand tons to 430 thousand tons per day, and is expected to hit 1.6 million tons per day by 2030. This is attributed to economic development, urbanization, and rising standards of living in China [3]. In terms of per capita waste production, it was found that small island nations, such as Antigua and Barbuda; St. Kitts and Nevis; Sri Lanka; Barbados; St Lucia; and the Solomon Islands, are the major MSW contributors producing more than 4.3 kg of daily waste per capita. In additional to these islanders, another two small countries, Kuwait and Guyana have surprisingly produced more than 5.3 kg of daily waste per capita. On the other extreme, Ghana and Uruguay only produce roughly 0.1 kg/capita/day which is less than 10% of the worldwide average value [4].
Through recycling, the amount of waste going into a landfill can be reduced significantly. Not only so, recycling also saves energy. The energy consumed to recycle aluminum is only 5% of that required to make aluminum from bauxite ore. Recycling also saves natural resources. Products made from recycled material slow down the depletion of natural resources, such as metal ores, oil, and natural gas. Also, recycling reduces pollution. For instance, proper recycle of motor oil from just one single oil change would protect a million gallons of drinking water [5]. Recycling provides raw materials for industry. Take carpet industry for an example, carpet manufacturers turn PET plastic bottles into a fiber for their product. Clearly, waste can be both a resource and an environmental problem. Poor waste management involves considerable wastage of valuable material and can lead to environmental and health problems. NPUST considers it necessary for the volume of waste to decrease if the university is intended to manage waste sustainably. In addition, sustainable cycles can only be better maintained if a higher percentage of waste can end up in reuse and recycle. This saves both materials and energy. Not to mention that it also reduces the use of hazardous chemicals and lessens environmental problems in waste management. The purpose of this paper is to present a brief explanation of the waste management approaches in the NPUST and how the management has been successfully integrated with education.

2. Categories and Approaches

Waste appears in many different forms and may be categorized in different ways. Generally, waste could be liquid or solid. Both of them could be hazardous. Liquid and solid waste types can also be grouped as organic, re-usable, and recyclable. Examples of liquid waste in NPUST include wash water from building and animal farms, liquid chemicals, and liquid food waste. Solid waste predominantly, is any garbage, refuse or trash. These include agricultural waste, used papers, broken furniture, and even food waste. Hazardous wastes are potentially threatening to the public health or the environment because they could be inflammable, reactive, corrosive or toxic. In Taiwan, it is required by law to involve the appropriate authority to supervise the disposal of such hazardous waste. Organic waste is biodegradable and mainly comes from plants or animals sources. In a university, it includes food waste, fruit and vegetable peels, and even animal manure.
Waste management simply means the collection, transport, processing or disposal, managing and monitoring of waste materials to minimize its' consequences on humans and environment. NPUST waste basically includes general waste, hazardous waste, biodegradable waste, and recyclable waste. Most commonly encountered recyclable waste in NPUST includes paper products, plastics, aluminum bottles, batteries, electronic waste, and glass product.

2.1. To Reduce

The main purpose of waste handling strategy is to cut down negative mankind impact on the environment. The best way to manage our waste is not to produce it in the first place. This can be done through reducing the volume of throw-away products and buying only what is really needed. As a matter of fact, reducing the waste is a much better option than recycling and disposal. Many thoughts have been focused on problems and strategies about how to reduce the waste. However, we believe that this is a concept we as educators need to embed into the pubic minds.

a) Education to Promote Waste Reduction

In NPUST, several measures have been continuously carried out to educate the public about the importance of waste control and handling on our environment. To promote the awareness of resources

and waste reduction, NPUST hosts numerous on-campus events and activities. The targets are the teaching and administrative staff, the students, and also the general public. For instance, every a few years, the university would host an outdoor faculty-staff march and publicity campaign. Most of the time, this event is combined with university sport day. Every year, a publicity campaign is conducted to inform the university freshman about the importance of environment protect and how they should work together with the university in reducing and recycling our waste. This event is normally part of the orientation program for new students as shown in Figure 1. Supplementary programs are also held for kindergarteners, as shown in Figure 2. Furthermore, off-campus publicity activities are conducted on a regular basis to teach children and the general public about the importance of environmental protection and to facilitate them the mentality to reduce waste as well as to introduce them the importance of waste reusing and recycling. Not only are paper products generally easier to recycle than plastic, but also tend to biodegrade more easily than glass or aluminum can. They university encourages everyone to use paper containers instead of those made of plastic, if the containers are meant for disposal.


Figure 1. Freshman orientation


Figure 2. Education on kids


Figure 3. Off Campus Program

Action to Reduce Waste

In additional to education, NPUST also plays an active role on reducing MSW within the campus. Since there are numerous meetings conducted throughout the campus every day and a large amount of paper is consumed, the university encourages the following measure to reduce paper waste paper:

- The effective use of computers and other technology to reduce the amount of paper used,
  - The use of phone and email instead of memos and faxes for inter-office memos, announcing meetings, and targeted communications,
  - The use of electronic means to "broadcast" important messages to staff and students,
  - The use of electronic official document system to reduce the use of paper documents,
  - The use of online repair application system to replace paper applications,
  - The use of electronic communications if possible for directories, forms, bulletins, manuals, reports, and storage to reduce unwanted mail to offices; and
- The reduction of print runs whenever possible,
- The change in printing habits so that more text is put on each page,
- The use of iPad in paperless College of Engineering meetings to reduce paper reading materials,
- The use of special paper saving features in Microsoft Excel and Microsoft PowerPoint.

Although the implementation of the above paper-saving strategy is highly preferable, paper printouts are necessary in some cases. When this happens, at least the offices can try to print on used papers for unofficial purposes and to use thinner paper for printing, copying etc. In additional to paper consumption, the offices are also encouraged to practice image reduction printing and light toner copying so that the consumption of toner cartridge can be reduced. In all kinds of meeting within the university, the use of mugs (as shown in Figure 4) to replace bottle water is mandatory.

In the on-campus restaurants, non-recyclable utensils are not provided by the food stores, as shown in Figure 5. Moreover, the students are encouraged to use eco-friendly bottles. For doing this, the students actually receive a “size-up” on their purchase from some drink stores, as shown in Figure 6.

Figure 4. Use of Mugs with Officer name in meeting

Figure 5. Use of non disposable utensils in restaurants

Figure 6. Encouragement to use eco- friendly bottle

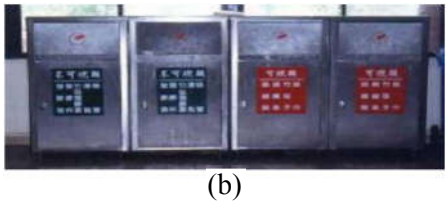
2.2. To Collect

The collection of daily NPUST MSW is mainly carried out by the Office of General Affairs (OGA) but with the help from the Office of Student Affairs occasionally. The waste is generally separated into the seven categories, as listed in Table 3. However, it is very unlikely for any university to allocate an individual bin for each kind of waste. The appropriate type of bins placed within the university depends on the main activity at the areas. The waste bins were clearly labeled, as shown in Figure 7. More details about these bins are listed in Table 4. In general, the wastes are classified into plastics, aluminum, paper, battery, reusable fabric products, reusable daily utensils, and incinerable and non-incinerable wastes. Since most food waste is generated in the cafeteria/restaurants, cuisine classrooms, and administrative offices, bins for kitchen waste are only found in those areas, as displayed in Table 5. Evaluation of waste collection from every student dormitories is also performed.

Table 3. General waste category in NPUST

Type	Common waste in NPUST
Paper	sketch papers, boxes, wrappers, advertisement papers, notebook
Plastic	food and beverage containers, disposable food service products, product wrappers
Glass	beverage containers, broken glass laboratorial containers
Metal	aluminum beverage containers, scrap metals from workshop
Food	cafeteria food waste, snacks
Wood	tree trunk and branches, broken wooden furniture
Other	Battery, leaves, fabric, mixed material (e.g. plastic and metal) products

(a)



(b)

(c)

(d)

Figure 7. Trash bins for different waste types

Table 4. Trash bins in NPUST

Type	Quantity	Locations	Waste Collection
a	605	90	plastics, aluminum, paper, incinerable, and non-incinerable wastes
b	8	2	incinerable and non-incinerable wastes
c	7	7	reusable clothing, bags, bedding, daily utensils

d	266	50	batteries

Table 5. General waste category in NPUST

	Paper	Plastic	Glass	Metal	Battery	Food	Wood	Other
Animal Farms	●	O	O		●			
Animal Hospital	●	O	O		●			●
Cafetaria and Restaurants	●	O	O		●	●		
Classroom Corridors	●	O	O		●			O
Cuisine Classrooms	●	O	O		●	●		
Dormitories	●	●	●	●	●			●
Library / Media Center	●	O	O		●			●
Offices	●	O	O		●	●		●
Workshops								
Carpentry	●	O	O	●	●		●	
Fashion Design	●	O	O		●			●
Mechanical	●	O	O	●	●			
Repair (OGA)	●	O	O	●	●		●	●

Remark: an individual trash bin is dedicated for: a specific waste type (●), and multiple waste types (**o**)

2.3. To Reuse

In additional to waste reduction, waste reuse is the second most effective ways to save natural resources, protect the environment and save money. To the non-recycler, an empty bottle is garbage. To the reuse enthusiast, that empty bottle could be a vase, a drinking glass, a water sprinkler, etc. No doubt, one man's trash is another man's treasure. In NPUST, the measures to involve the student community when dealing common reusable products are as follow:

- Collection of second hand clothing for charity from the student dormitories is carried out at the end of each semester (Figure 8),
- Student flea market is organized occasionally (Figures 9),
- Cardboard boxes are collected, stored, and reused to facilitate students who are moving, and
- Activities are organized to repair and fix up reusable items (e.g. bicycles, appliances, etc.).

Other kinds of strategy have also been implemented within the communities among the faculty members and staffs. They are constantly encouraged to place reusable and non-reusable papers in adequate paper collection bins, to reuse the papers, and to reuse second-hand envelopes whenever possible. Also, whenever there exist appliances, toner cartridges, and so on worthy of use released from an administrative office or research laboratory, an email will be sent out to the university community so that they can be transferred to those who need them. Almost all of the time, they ended up at the hands of those who needed them. Because NPUST is an agricultural university, not only do we reuse office products, but also reuse agricultural waste. For instance, tree trunks are cut into chunks and sent to the Department of Wood Science and Design for student woodwork practice. Sometimes, these tree trunks and big branches are also cut into small pieces and made into wooden souvenirs by the department students. Furthermore, seeds are also collected both inside and outside campus by the student from the Department of Forestry to make creative artwork. Snake skin peel offs collected from the snake research laboratory in the Department of Biotechnology are sterilized and then sent to the Department of Fashion Design and Management for creative design. Fish skins from the Department of Aquaculture and the Department of Food Science are sent to the Department of Biotechnology to conduct research on collagen production.

As shown in Figure 10, NPUST wastes are basically categorized into kitchen waste, reusable waste, recyclable waste, and non-recyclable waste. Since the amount of daily kitchen waste produced from the restaurants is too much for the university to decompose into organic fertilizer, majority of the kitchen waste is supplied to external company.

Figure 8. Used clothing sorting.

Figure 9. Outdoor and indoor flea markets.

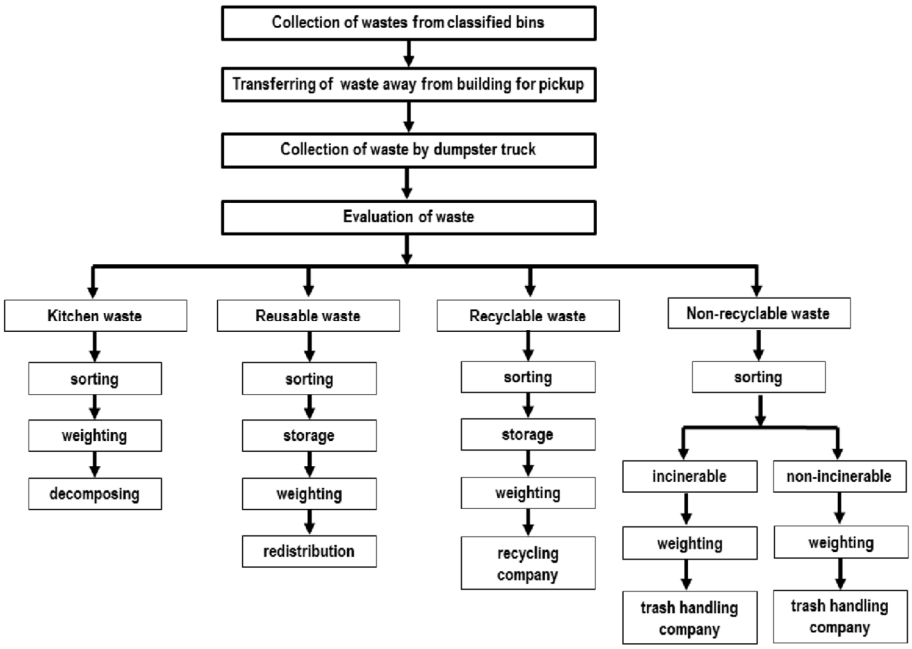


Figure 10. Treatment of various non-hazardous wastes in NPUST.

2.4. To Recycle

To ensure the success and sustainability of the NPUST recycling program, the NPUST recycling program also involves other administrators, faculty members, staff, and students. With the right team composition, it is also important for NPUST to conduct an assessment of the university waste stream by identifying the type, quantity, and/or origin of the potential recyclable materials.

NPUST understands that the recycling program in a university is a hands-on lesson that educates students about the environment, personal responsibility, community action, and MSW management. The university has been designing activities that invite students' involvement. For example, the wastes in the sorting boxes in the student dormitories, as displayed in Figure 11, are evaluated based on a regular basis. At the end of each semester, an award will be presented to the dormitory with the most successful sorting results, as shown in Figure 12. Voluntary student assistants are invited to take part in waste sorting and recycling activities, as demonstrated in Figure 13. The Center for Environment Protection, Safety and Health (CEPSH) in NPUST also welcome everyone including the outsiders to hand in their used batteries for credit points. Gift will then be awarded to these accumulated points.


Figure 11. Waste sorting boxes in student dormitory.


Figure12. Award for waste sorting competition


Figure 13. Students help with recycling

2.5. Handling of Hazardous Waste

As a comprehensive research university, NPUST deals with hazardous wastes produced in various laboratories and workshops every day. These kinds of wastes have to be given special attention. These wastes are generally categorized as:

- Heavy metal waste: iron, nickel, cobalt, zinc, copper, chromium, lead, etc.;
- Cyanide waste: cyanide-based waste or plated electrolytic waste;
- Mercury waste: inorganic mercury and organic mercury waste;
- Fluorine waste;
- Mineral acids: hydrochloric acid, sulfuric acid, nitric acid, etc.;
- Bases: sodium hydroxide, potassium hydroxide, sodium carbonate, calcium carbonate, other alkaline wastes;
- Hexavalent chromium waste: hexavalent chromium compounds;
- Fats and oils: heavy oil, lubricating oil, transformer oil, gear oil, etc.;
- Halogen-based organic solvent waste: chloroform, methylene chloride, carbon tetrachloride, chlorobenzene, etc.; and
- Non-halogen type organic solvent waste: ethers, alkanes, ketones, esters, etc.

In the beginning, the wastes have to be classified in accordance to the university standard. Then, the collection bins for these wastes are correctly and clearly labeled, as shown in Figure 14. Once the bins are full, the laboratory assistants are required to inform the staffs in OGA to schedule for a pickup service. After being picked up, the bins for laboratory waste liquids are placed in a temporary storage, as displayed in Figure 15. Every three to six months, these bins are then sent to waste handling companies accredited by the Taiwan Environmental Protection Agency, as demonstrated in Figure 16.


Figure 14. Label affixed to each laboratory waste container.

Figure 15. Storage of hazardous waste in bins


Figure 16. Bins sent off to accredited company

2.6. Handling of Waste Water

NPUST has been engaging in wastewater treatment for more than 25 years. The wastewaster can be classified into agricultural wastewater, domestic wastewater, and swimming pool wastewater. The

agricultural wastewater includes poultry manure, swine manure, dairy manure, wash water, feedlot runoff, and fish pond water. The domestic wastewater includes all sorts of sewage except the blackwater from toilets. The agricultural wastewater from livestock farms is treated before it is used for on-campus pasture watering while the agricultural wastewater from aquacultural ponds is treated by constructed wetlands. On the other hand, the domestic wastewater is collected in CEPSH for physical and biological treatment through equipments, constructed wetlands, and aquatic plants. It is then sent to various places for garden watering, restroon cleaning, and landscape architecture. The disposed swimming pool wastewater is sent to an ecological pond. For more detailed information, the readears are encouraged to refer to our previous report [6].

3. Concluding Remarks

NPUST has developed, adjusted, and upgraded our waste management program for decades. Although the program is currently implemented successfully, its strategy changes with time. To fulfill our social responsibility, it is NPUST's belief that the concept of "3Rs" must be combined with education and research. We clearly agree that our waste management plan must be appended with a monitoring program. Monitoring is essential to ensure continuous success and growth of the program. Monitoring also allows the expected impacts of the strategy to be measured against actual changes and facilitates future revisions of the management program. In the future, more elaborate regular waste audits will be scheduled at appropriate intervals within a year. The information obtained from regular audits will be collected and stored in our big data center for comprehensive analysis.

References

[1] Planet Aid, Inc. Recycling Rates around the World. Available online at http://files.www.planetaid.org/blog/recycling-rates-around-the-world/recycling_rates_around_the _world_Full_Size.jpg, accessed on 8 March, 2017

[2] Top 10 waste producing countries - Infogram, charts & infographics. Available online at https://infogr.am/top_10_waste_producing_countries, accessed on 6 March, 2017

[3] unknown, 2014, International Bank for Reconstruction and Development Project Appraisal Document on a Proposed Grant from the Global Environment Facility Trust Fund in the Amount of US$12.0 Million to the People'S Republic of China for a Municipal Solid Waste Management Project, The World Bank Report No: PAD388.

[4] Hoornweg, D., Bhada-Tata, P., 2012. WHAT A WASTE: A Global Review of Solid Waste Management. Urban Development & Local Government Unit, World Bank, Washington, DC, USA

[5] Shelton, T.B., 2003. Recycling Used Motor Oil In New Jersey. Fact sheet, FS417, Rutgers Cooperative Extension, New Jersey Agricultural Experiment Station, Rutgers, The State University of New Jersey.

[6] Chen, C.-H., Lee, H.-C., Leong, J.C., 2016. Integrated Wastewater Treatment with Landscape Architecture and Ecological Education in NPUST: A Status Report. The 2nd International Workshop on UI GreenMetric (IWGM), paper S4-3, Depok, West Java, Indonesia.

The 3rd International Workshop on UI GreenMetric
Istanbul, Turkey, 09 - 10 April 2017

Integrated Management of Solid Wastes and Hazardous Materials in a Green University Campus. The Case of the University of Ioannina

Triantafyllos A. Albanis
Department of Chemistry, University of Ioannina, Ioannina 45110, Greece
talbanis@uoi.gr

Abstract. The University of Ioannina is a medium-sized public Greek University, located at the outskirts of Ioannina city, the capital of the region of Epirus - in northwestern Greece. Ioannina is one of the most elegant and interesting cities in the country with a long history and tradition in arts, literature and commerce. The University includes 15 academic Departments in a campus of 3,350 acres and with premises of 225,620 sq.m. The University in figures has 14,988 active students, 3,113 postgraduate students, 493 members of academic and research staff, 1 temporary teaching staff, 66 members of specific technical & laboratory teaching staff, 53 technical laboratory staff and 218 administrative staff. Since 1998, the University has established a system of integrated management of solid wastes and has developed the full recycle of paper, plastics, metals, glasses, organic part and electronic materials, in collaboration with SPIDER Company. Especially for food and University restaurants, where daily 4,500 students and staff members have launch and dinner, operates a composting system in order to transform the wastes into compost for garden purposes (1,2). Finally, since 2003 the University of Ioannina has implemented the Laboratory Waste Management System. The laboratory waste is collected in laboratory space and then into temporary storage containers. A company specialized in the management of laboratory and hazardous waste with qualified staff, controls each bucket in accordance with applicable national and European standards and then receives them. This work analyzes in detail the integrate system and describes all the physicochemical and biological procedures involved in recycling and composting as well as the benefits for campus environment.

Keywords: Waste management, hazardous materials, University of Ioannina, green Campus

1. Introduction

1.1 Laboratory wastes

The laboratory wastes is an important category of high risk waste, as in most cases include chemicals with high toxicity: individual utilized organic solvents (e.g. acetone, dichloromethane), mixtures of organic solvents (e.g. n-hexane-ethyl acetate), aqueous solutions (acids, bases, inorganic salts), aqueous mixtures (e.g. acetonitrile-water), solid wastes, broken glassware, plates, chromatographic materials (silica gel), dehydrating salts (sodium sulfate, calcium chloride) and blemished solid chemicals.

1.2 Waste management Policy

In the last few years, the EU environmental policy has formed a modern approach to the management of any kind of wastes that says: “their disposal will be possible only where they can meet safety conditions for public health and the environment”. The main objectives of this policy are the quantitative reduction of their production and minimizing the use of hazardous substances.

1.3 Waste management regulations

The management regulations for solid waste management makes distinction between organic and inorganic reagents and collects them in separate containers. The management of liquid waste includes the identification of reagents and their categorization (acids, bases, etc.), the distinction of chemical waste of high toxicity, the disposal of inappropriate to use chemical reagents following the prescribed requirements, the separation of chemicals based on their potential risk (e.g. flammable separately from oxidants), acids separate from bases, annual inventory of chemical waste, chemical compatibility and assessment of compatibility of the waste prior to mixing.

2. Waste management policy in UoI

The integrated management of laboratory wastes in the University of Ioannina began in May 2002.
The main axis is:

- The safe collection of laboratory waste in properly labeled containers,
- Their transfer to cache,
- Their disposal either in incinerators abroad by issuing a certificate of destruction or on waste treatment plants.

In the University of Ioannina dangerous wastes are produced: chemicals, biological wastes, radioactives and glassware. The management of the biological and radioactive wastes takes place under the responsibility of each laboratory because of their special removal and destruction regulation provided by legislation. The destruction of glassware is made in glass crusher and they should be fully free from the presence of organic solvents or other toxic substances.

2.1 Collection of waste mixtures

The collection takes place in suitable containers after the distinction of the wastes. This distinction of some groups of wastes is done having in mind that acids dissolve some metals, solvents dissolve some plastics. Also, it is prohibited the mixing of radioactive chemical wastes and collection of mercury must be in special bottles.

2.2 Basic Principles of Waste Management Policy in UoI

The waste management policy has some main principles: The characterization of laboratories in waste collection centers, the positioning within the laboratory units labeled specific receptacles with specifications and of capacity for the temporary storage of laboratory wastes produced and the formation of special area in the Department of Chemistry for the temporary storage of laboratory waste to be collected for removal regularly from the university campus.
The study of the species and the laboratory waste quantities produced, can be classified they into six categories according to:

- The compatibility of the co-storage of the chemical compounds
- The “life cycle” of each compound (reuse, recycling, thermo-destruction).

Table 1. Laboratory waste categories

Category I	Halogenated hydrocarbons	dichloromethane, chloroform etc.
Category II	Non-halogenated hydrocarbons	BTEX, n-hexane, ethyl acetate / ether etc.
Category III	Aqueous acids	nitrate, sulfate, acetate etc.
Category IV	Aqueous bases	sodium hydroxide, potassium
Category V	Expert solvents	acetonitrile, DMF, TFA
Category VI	Solid wastes	silica gel, salts of rare earth metals

The *containers* must be close to the waste collection point under the control of those who produce the waste, have a label which contents waste listed (e.g. organic solvents), be in good condition, compatible with the waste, kept closed and treated so as to avoid any breakage or leakage of the contain.

Figure 1. Container

2.3 Waste transport

The *transport* of containers from the laboratory to the cache takes place with the use of wheelchair with metal safety barrier to avoid accidents.

Figure 2. Waste transport

2.4 Temporary storage

The *temporary storage* takes place in containers 1 m^3 HDPE, approved to UN, metal barrels 200 l UN and plastic barrels UN open type of various capacities.

Figure 3. Temporary storage containers

Figure 4. Temporary storage

2.5 The transfusion procedure

The transfusion procedure includes individual protective measures (gloves, goggles, gowns, and masks), grounding, good ventilation, absorbents and retention tanks.

Figure 5. Transfusion procedure

2.6 The cashes

The *cashes* include extinguishing systems (automatic and manual), cabinet with personal protective equipment (goggles, helmets, face masks, gloves, overalls, etc.) and the set of accident response equipment (chemical absorbent towels, dams, roll, polyethylene bags, etc.), marking and labelling area, work floors for retention of any leaks and grounding of metal parts to prevent static electricity.

2.7 Emergencies

The emergencies can refer to a cold incident in which the leakage is retained by paletes- containers and absorbents used for retaining the liquid. A heat incident can be faced using six (6) powder extinguishers that are installed in prominent locations in cache as well as four (4) automatic dry powder extinguishers.

Figure 6. Emergencies

2.8 Accident response equipment

An *accident response equipment* includes dry powder fire extinguishers, goggles, nitrile gloves, and masks with organic vapor filter and dust, Tyvek disposable overalls, overalls of Chemists, safety helmets, Emergency instructions, absorbent towels suitable for chemicals, absorbent booms chemicals, absorbent roll for chemicals and polyethylene bags.

2.9 The collection procedure

The *collection procedure* requires, marking, packaging container for road transport and transport by ADR truck under security conditions.

Figure 7. Collection procedure

3. Concluding Remarks

It is a common belief of the scientific and research community in the University of Ioannina that "the waste producer has to try constantly to minimize the waste". So the above described procedures became our responsibility. More information is available on the website: http://users.uoi.gr/deapi .

References

[1] T. Albanis, A system of integrate management proposed for solid wastes in Ioannina city, symposium for Sustainable management of solid wastes disposal, Kozani, 5 May 2009.

[2] T. Albanis (2014), Green chemistry and technologies, 4th Pan-Hellenic Conference of Green chemistry and sustainable development, Ioannina, 30 October-1 November, 2014.

The 3rd International Workshop on UI GreenMetric
Istanbul, Turkey, 09 - 10 April 2017

The Road Map of Jordan University of Science and Technology Towards Sustainability

Jamal Abu-Ashour
Director of Queen Rania Center for Environmental Sciences and Technology, Jordan Univesity of Science and Technology, Irbid, Jordan
jamals@just.edu.jo

Abstract. In its pursuit of distinction as a green campus and as part of its endeavor as a world-class university, Jordan University of Science and Technology (JUST) has been working on sustainability of its campus life and operations through developing relevant policies and action plans. In order to achieve this goal a sustainability policy was prepared and approved by the Dean's Council to manage and plan all components identified as pillars of sustainable campus life and operations. The policy establishes goals in eight areas of sustainable practices, namely, Water Management, Solid Waste Management, Energy Management and Carbon Emissions, Biodiversity, Teaching and Research, Sustainable Construction, Sustainable Procurement, and Sustainable Transportation. On the road to the full implementation of this policy, JUST has already have several initiatives on the ground with action plans being developed to achieve targets sought in its sustainability policy. This paper describes the progress made and presents the steps forward to achieve sustainability of JUST campus life and operations.

Keywords: university, sustainability, policy, environment, energy

1. Introduction

Jordan University of Science and Technology (JUST) is a comprehensive, state-supported university located in northern Jordan. JUST was established in 1986. Since then JUST has grown and advanced to be one of the region's leading universities in teaching and research. The number of students has increased significantly since the university's establishment. Today JUST has more than 800 full-time faculty members, with 25,000 students. About 20% of JUST students are international from 60 nationalities, rendering it the most cultural-diverse university in Jordan [1].

The university provides a wide range of advanced degree programs at the undergraduate and graduate levels. It comprises 12 faculties (Medicine, Engineering, Science & Arts, Pharmacy, Dentistry, Agriculture, Veterinary Medicine, Architecture, Information Technology, Applied Sciences, Nursing and Graduate Studies) and 55 departments offering 42 undergraduate programs and 95 postgraduate programs [1].

JUST has been working on sustainability of its campus life and operations through developing relevant policies and action plans. In order to achieve this goal a sustainability policy was prepared and approved by the Dean's Council. The policy establishes goals in eight areas of sustainable practices, namely, Water Management, Solid Waste Management, Energy Management and Carbon Emissions, Biodiversity, Teaching and Research, Sustainable Construction, Sustainable Procurement, and Sustainable Transportation [2]. On the road to the full implementation of this policy, JUST has already have several initiatives on the ground with action plans being developed to achieve targets sought in its sustainability policy. This paper describes the progress made and presents the steps forward to achieve sustainability of JUST campus life and operations. The main areas investigated are water consumption, reclaimed water use for irrigation, solid waste management, and energy.

2. Environmental Sustainability

Environmental sustainability is one of three pillars to achieve sustainability of any institution. Together with social and economic sustainability must be met for continuous successful operation of all activities within the institution.

In order to achieve environmental sustainability, the following criteria for resources use and waste generation must be implemented:

- The rate of use renewable resources should not exceed the rate of regeneration
- The rate of depletion of non-renewable resources must be associated with comparable development of renewable substitute; and
- The rate of waste generation should not exceed the environmental capacity for degradation.

JUST recognizes that limitations of the resources that Jordan as a country is facing. The country is the second poorest nation in the per capita water share. It also depends on imported oil which burdens the country's budget. Therefore, the operations and activities of JUST must coincide and abide by the country's strategies for use and management of these resources.

2.1 Water Management

JUST lies in an area where the annual rainfall is less than 350 mm, therefore rainwater harvesting and storage as surface water will not secure significant quantities for use on campus. The campus has an earth dam that temporarily holds water in extreme rainfall events. The water is the released to an artificial lake lined with a membrane. Stored water in this lake is subject to high evaporation which makes rainwater harvesting and storage as surface water not a viable option to secure sufficient quantities of water.

JUST water is abstracted from groundwater wells. In 2016, the total fresh water quantity used in JUST was 540,000 m^3 out of which 85,400 m^3 were used for irrigation. The bulk quantity of this water which is 454,000 m^3 when divided by the number of students and staff on campus yields around 16.5 m^3 per person per year. This number when divided by 240 days which is average number of work days yields around 70 L/d per person. This number is similar to the per capita water share for the nearby city of Irbid [3]. However, since life on campus is mainly for 8 hours per day, 70 L/d per person is higher than the national average

The environmental sustainability policy aims to reduce water consumption by 20% by 2020. This will be achieved by the implanting the following action plan:

- Monitor water consumption data to assist in identifying areas of potential savings
- Inspect network for potential leakages and renovate when necessary
- Install water saving devices for taps (replacing and renovating fittings).
- Implement water efficiency awareness programs to encourage students and staff to save water
- Buildings under construction should all have rainwater harvesting tanks installed to capture roof water.

2.2 Irrigation Water

JUST campus extends over a large area which planted by trees and has many green yards planted by lawn. In addition, the campus has an agricultural research station which grows trees and crops for research purposes. Water used for irrigation on campus depend mainly on treated wastewater stored in the artificial lake. In 2016, 434,000 m^3 of reclaimed water were pumped out of the lake for irrigation. Treated wastewater effluent from JUST treatment plant stored in the lake constitutes 63% of this quantity. The remaining quantity is pumped to the lake from nearby Wadi Hassan Treatment plant. In addition to the treated wastewater, about 85,400 m^3 of fresh water were used for irrigation in 2016. The per donum quantity of water used for irrigation is approximately 15 m^3 per year.

The environmental sustainability policy aims to reduce the fresh water use for irrigation by implementing water use efficiency measures in irrigation and crop selection. In addition, it targets increasing the green areas on campus by use of efficient irrigation systems using treated wastewater pumped from the lake.

2.3 Solid Waste Management

Solid waste from the university campus and King Abdullah Hospital is collected and dumped in Al Ekaider Landfill about 40 km north east of JUST. In 2016, the quantity of solid waste generated on campus was 1700 tons and from the hospital 1600 tons. An estimated 50% of these quantities is food waste from the cafeterias and restaurants.

Paper waste is also an important component of the generated solid waste. The university uses 50 tons of paper every year which has been reduced from a much higher number due to the implementation of electronic archiving, conducting more online exams, use of electronic requests for supplies and services, and use of electronic mail for communication within the academic departments.

Solid water separation at source is being experimented through students initiatives administered by Queen Rania Al-Abdullah Center for Environmental Science and Technology in the university. There are plans to expand the solid waste separation to cover the whole campus as a part of an integrated solid waste management plan.

Food waste if separated from generated solid waste can be managed on campus reducing significant transportation and disposal costs at the landfill. Queen Rania Al-Abdullah Center for Environmental Sciences and Technology is exploring the design and construction of a composting plant for the food waste generated on campus.

The environmental sustainability policy calls for the reduction of the generated solid waste and increasing recycling. The action plan will follow the solid waste management hierarchy giving priority to the reduction of the solid waste generation followed by reuse then recycle before transformation and/or landfilling.

2.4 Energy Use

Jordan is not an oil producing country and depends heavily on imported oil to satisfy its needs. The country's ministry of energy encouraged use of renewable energy to reduce burden on the budget due to rising oil prices. JUST follows the country's strategy for implementing energy use efficiency measures and decreasing the dependency on conventional energy sources when possible.

In 2016, the university used 376 m^3 of fuel for vehicles and around 900 m^3 diesel for boilers. It also consumed 33.5 million KWh of electricity. JUST has already constructed a 5-MWatt solar system which generates 8 million KWh. Another 20 MWatt solar system is being designed and will be in operation in two years. The two solar systems will collectively generate 40 million KWh which will bring the university electricity bill to zero and satisfy increasing demand.

The environmental sustainability policy calls for the reduction of carbon emissions on campus from the use of conventional oil sources. It also encourages use of green building codes in new buildings.

3. Summary

JUST has made significant steps towards achieving sustainability of it campus life and operations. The university administration approved and environmental sustainability policy targeting key areas that are essential to sustain successful life and operation on campus. Action plans and procedures were recommended to better manage water and energy use on campus. Also an integrated solid waste management system is being developed.

References

[1] JUST website 2017, available online at http://www.just.edu.jo, accessed on 27th of February, 2017.

[2] JUST Environmental Sustainability Policy, 2016, available online at http://www.just.edu.jo, accessed on 27th of February, 2017.

[3] Abu-Ashour, J. and M. Al-Sharif. 2010. An Investigation of the Linkage between Minimum Household Water Requirement and Health in the Greater Irbid Area. *Jordan Journal of Civil Engineering*, Vol. 4(1), 40-46.

Parallel Session 2
Implementing Policy into Action: Regional Experience

The 3rd International Workshop on UI GreenMetric
Istanbul, Turkey, 09 - 10 April 2017

AgriTech Hub - Center of Innovations in Sustainable Campus Development

Tlektes Yespolov
Kazakh National Agrarian University, 8 Abay avenue, 050010 Almaty, Kazakhstan
rector@kaznau.kz

Abstract. Today agriculture has to pass with extensive to an intensive method of the organization of work. At the same time, the intensification of process is impossible without modernization of the sector. It, in turn, demands attraction of investments and implementation of a transfer of new technologies on what work of the AgriTech Hub is concentrated. The AgriTech Hub of Kazakh National Agrarian University is the platform providing interaction of agrarian science, education and production. Besides, in cooperation with the best foreign partners, Agrohub will provide a transfer of new technologies and knowledge in the shortest possible time, thereby increasing competitiveness of agrarian sector of the country in general.
There are 80 experimental platforms in various regions of the country for approbation of scientific research and technology in Kazakh National Agrarian University. Also, for the effective analysis of forecasting of productivity there is 100% access to statistical data of agriculture. The main objective of system of dissemination of knowledge in the sphere of agrarian and industrial complex is introduction of the best international and domestic experience in production through specialized educational programs. For transfer of this knowledge and skills that leads to professional development, we have created school of farmers and the extension-program which covers more than 12 thousand farmers. Creation of an agro technological hub has allowed us to cooperate with the leading foreign higher education institutions and scientific centers closely. The AgriTech Hub is being a core of university, using tools of public-private partnership, in the shortest possible time will transform the innovative ideas, technologies and new knowledge to agrobusiness, thereby increasing competitiveness of agrarian sector of the country in general.

Keywords: Agrotechnological hub, sustainable campus development.

1. Introduction

Kazakhstan is one of the largest counties of the world, and takes 9th place by the territory, has a great potential for the development of agriculture. The country has 217 mln hectares of rural areas, accounting for 4% of the world's resources.
Currently about 191 thousand agro formations produce agricultural products in the country. 95% from them are peasant farms.
The country has great opportunities to increase the production of organic food based on the development of organic agricultural productions.
Grain, flour and meat already became the business card of the Kazakhstan brand of our country. It is recognizable around the world - Kazakhstani aport (apples), meat and dairy (kumys-horse milk, shubat-camel milk) products etc. (Figure 1).
In the Address to the people, the President of Kazakhstan Nursultan Nazarbayev has defined the new driver of growth is agro-industrial sector as the most priority segment of economy [1].
Kazakhstan is faced by a task – agriculture has to become the driver of development of economy therefore in high gear to develop those branches which give multiplicative effect.
The new State program of development of agrarian and industrial complex for 2017-2021 is approved; the new Laws "About Agricultural Cooperatives" and "About Pastures" take root [2, 3].
Special attention is paid to creation of large-scale commodity enterprises on the basis of cooperation. It is planned to unite in cooperatives more than 500 thousand personal subsidiary farms. New measures of the state support for development of agricultural cooperatives, in particular, financing of family dairy commodity farms, feedlots, the service and procuring centers take root.

Figure 1. Productions of Kazakhstani brand.

Today agriculture has to pass with extensive to an intensive method of the organization of work. At the same time, the intensification of process is impossible without modernization of the sector. It, in turn, demands attraction of investments and implementation of a transfer of new technologies on what work of the Agro technological Hub is concentrated (further – AgriTech Hub).

2. AgriTech Hub - center of innovations in sustainable campus development

The AgriTech Hub of Kazakh National Agrarian University is the platform providing interaction of agrarian science, education and production. Besides, in cooperation with the best foreign partners, Agrohub will provide a transfer of new technologies and knowledge in the shortest possible time, thereby increasing competitiveness of agrarian sector of the country in general.
AgriTech Hub consists of four structural components:

1) Fund-investments activity of scientific projects.
2) Start-up incubator "Catapult" - development and adaptation of new technologies for agricultural sector.
3) Science technology Park - new technologies.
4) Research centers and Laboratories - testing, the analysis and certification of production (Figure 2).

The Kazakh national agrarian university has powerful scientific and technological potential. Now the university realizes educational programs for 39 specialties of a bachelor degree, 2 – the higher education, 39 – magistracies and 16 – PhD doctoral studies.
More than 10 thousand PhD, undergraduates and students are studying. Preparation is more than 800 faculty staff.
Besides, in Kazakh National Agrarian University there are 80 experimental platforms in various regions of the country for approbation of scientific research and technology. Also, for the effective analysis of forecasting of productivity there is 100% access to statistical data of agriculture.
The main objective of system of dissemination of knowledge in the sphere of agrarian and industrial complex is introduction of the best international and domestic experience in production through specialized educational programs. For transfer of this knowledge and skills that leads to professional development, we have created school of farmers and the extension-program which covers more than 12 thousand farmers.
For increase in speed of transformation of agriculture of Kazakhstan has been studied experience of various agrarian countries - the USA, Canada, France, Southern Africa, China and so on. Optimum model for the country is the Brazilian model which is called “a grain basket” of the world.
For example, to the middle 60’s years Brazil received food as a humanitarian aid. And twenty years later, thanks to work of an agro technological hub of EMBRAPA, this country was in the top three world agrarian powers [4].

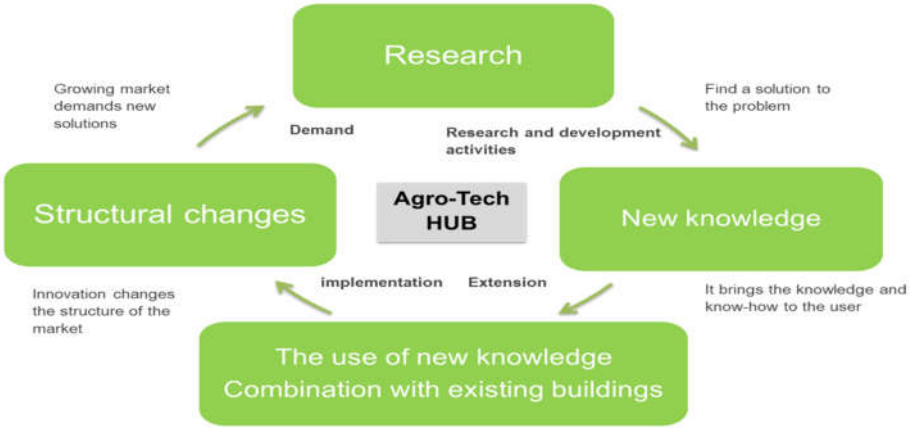


Figure 2. Structural components of AgriTech Hub.

The AgriTech Hub carries out the organization of direct introduction of technologies in production. Our partners in scientific cooperation are:

1) USDA – projects: “the development of a monitoring and control system for the Asian or migratory locust”, “Implementation of a geospatial monitoring system”, “Creation of an innovative nursery of virus-free apple seedlings”.
2) Cornell University–scientific project on Creation of innovative nursery of virus-free saplings of an apple-tree.
3) Michigan State University – projects on modernization of agriculture of Kazakhstan.
4) Columbia University - project on restoration of the Kazakhstan fund of apples.
5) NASA – project on improvement of productivity of grain crops.
6) Wageningen university– organized of greenhouse facility and sustainable development of ecosystems.
7) University Putra Malaysia – halal production.
8) University of Eastern Finland – on food safety.

AgriTech Hub's experts work in consortium with the Dutch group of companies "STAAY FOOD GROUP" and "Phillips" in the project over creation of an innovative hothouse complex in Kazakhstan with use of LED technologies.

Cooperation with this Dutch company which has wide distribution network on model of contact farming will allow entering in foreign markets of sale: China, Russia, India, Pakistan, etc.

On base the startup incubator at the moment is implemented several projects.

The Flyworx Company is engaged in remote sensing of farmlands with use of drones, GreenPoint Marketing - analytics and market researches, UrbanGreen - innovative greenhouses of city type, DragonFly - training of use of drones and their designing. Start-ups are also created: fast veterinary help, aquacultures, ecoprobiotics and others (Figures 3).

As a part of the AgriTech Hub: Kazakhstan-Japanese innovative center, Water innovative center, Center of Agro engineering problems and energy saving, Kazakhstan-Korean innovative center, innovative greenhouse, Center of steady agriculture, Center of technology and quality of foodstuff, Kazakhstan-Belarusian agro engineering innovative center, educational-experimental farm of Kazakh national agrarian university.

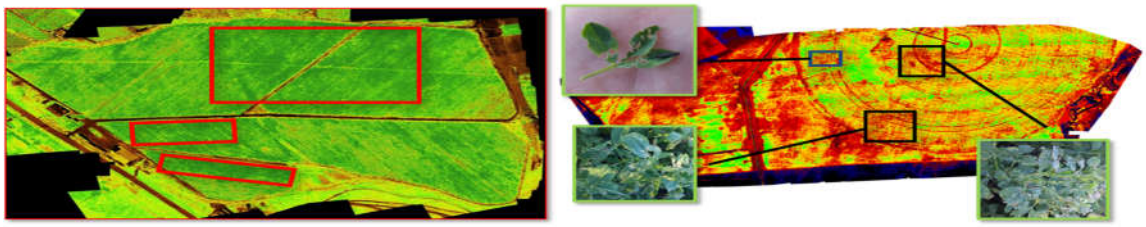


Figure 3. Examples of rural areas with using of drones

The center of steady agriculture carries out sounding of farmlands by pilotless devices - drones. Use of drones in practice allows rural businessmen to make timely and correct decisions on processing of the soil, crops and protection of plants.
The university has started training of the practical-focused experts-auditors and experts owning skills of carrying out difficult laboratory physical and chemical, phytoexamination and analytical researches of tests regarding lack of toxic and dangerous substances for the domestic agrarian market.
Work on development of domestic bioorganic agriculture is directed to creation of "a national competitive brand with emphasis on environmental friendliness".
The AgriTech Hub is engaged in purposeful search, attraction, a transfer and development of new technologies in agriculture. It becomes a link between the theory and practice of agricultural science. On the basis of all innovative centers the training centers for training of rural businessmen and experts work.
Creation of an agro technological hub has allowed us to cooperate with the leading foreign higher education institutions and scientific centers closely.
In December, 2016 was passed for the first time in Kazakhstan the Central Asian Agro technological Summit. Heads of public authorities, foreign experts, rural businessmen, scientists, teachers, students of higher education institutions have taken part in work of the Summit.
The summit became the platform on which scientists, heads of agroformations and producers have gathered. For the first time rural businessmen have told a wide range of participants including the scientist, about the business.

3. Summary

AgriTech Hub is being a core of institution, using tools of public-private partnership, in the shortest possible time will transform the innovative ideas, technologies and new knowledge to agrobusiness, thereby increasing competitiveness of agrarian sector of the country in general.

References

[1] Address of President of the Republic of Kazakhstan. Available online at http://www.akorda.kz /ru/addresses/addresses_of_president/poslanie-prezidenta-respubliki-kazahstan-nnazarbaeva-narodu-kazahstana-31-yanvarya-2017-g, accessed on 31, January, 2017
[2] Law "About Agricultural Cooperatives". Available online at http://online.zakon.kz/ Document/?doc_id=32656089, accessed on 29, October 2015
[3] Law "About Pastures". Available online at https://www.zakon.kz/4842018-zakon-o-pastbishhakh-prinjat.html, accessed on 1, February, 2017
[4] EMBRAPA Program. Available at https://www.embrapa.br/, accessed on 1, January, 2017

The 3rd International Workshop on UI GreenMetric
Istanbul, Turkey, 09 - 10 April 2017

University of Sao Paulo Environmental Policies: Challenges and Achievements

Patrícia Faga Iglecias Lemos[1]; Roberta C. Kronka Mülfarth[2]
[1, 2]*University of Sao Paulo, Brazil (USP)*
[1,2]*Superintendence of Environmental Management – SGA*
[1]patricia.iglecias@usp.br; [2]rkronka@usp.br

Abstract: The University of Sao Paulo (USP) is the largest and one of the most prestigious universities in South America with an academic population of nearly 150,000 people (127,000 students, 17,000 staff members and 6,000 teachers). The USP has 14 campuses around the state of Sao Paulo and an annual budget of US$ 1.4 billion, totally funded by the State of Sao Paulo, Brazil. Almost twenty years ago, USP started to take action in the area of sustainability and in the reduction of its environmental impacts. Due to its immense size and the presence of diverse properties in rural and urban areas, it was necessary to define environmental policies for all campuses prior to decision-making and the establishment of indicators and targets. Since 2014, USP initiated a comprehensive Sustainability Management Plan. Coordinated by the Superintendence of Environmental Management of the university (SGA), this plan was designed with the following phases:

2) Definition of Sustainability Issues Policy for the university (November 2015)
3) Definition of Sustainability Issues and Plans (June 2016)
4) Sustainability Masterplans with 11 thematic chapters for each campus (July2017)
5) Specific Sustainability Programs of each Faculty or Departments (December 2017)

All these actions are ongoing and the deadline for their completion is December 2017. It is an ambitious plan, with almost 1,000 people involved and working in the process. This work intends to present the methodologies developed to achieve the sustainability goals of the University of Sao Paulo and the results already achieved.

Keywords: campus sustainability, policies, sustainability plan, sustainability diagnosis

1. Introduction

As the fifth largest country in the world based on geographical area, Brazil has made great efforts in minimizing environmental damage by prescribing relevant legislation.

In 2010, given the increasingly visible environmental predicament, Brazilians regulators enacted the national policy for solid waste (NPSW) under the Law 12.305/2010. The Law 12.305 / 2010 introduced in Brazilian law to post-consumption responsibility and reverse logistics, establishing a number of obligations for the supply chain (manufacturers, importers, distributors and dealers). Compliance with the environmental protection principles, the production chain has the autonomy to implement and operate systems that may be convenient (Lemos, 2012).

The NPSW established guidelines for National, State, Regional and Municipal Solid Waste Plans. The specific goals of the Law include: providing incentives for recycling industries to help in the use of recycled raw materials; encouraging the use of clean technology in order to minimize environmental impacts; promoting a management hierarchy of reduce, reuse, recycle and ensuring that solid waste disposal is completed in an ecologically and environmentally responsible way; prioritizing green government procurement; and integrating reusable and recyclable materials in actions that involve liability life cycles (PNRS, 2010).

Because of this new regulatory policy, USP organized in 2012, a Working Group (WG) in order to adapt to the demands of NPSW. Although this process is not finalized, the structure of the USP solid waste policy followed the guidelines presented in NPSW:

- 1st phase: Definition of sustainability policies (in this phase the following should be defined: subject and applications, settings, principles, guidelines, preliminary provisions, management tools, administrative and financial tools, responsibilities and prohibition);

- 2nd phase: Definition of the Policy Management Plan (in this phase the goals and indicators should be defined);
- 3rd phase: Definition of actions (in this phase it should be defined actions by national legal entity registration - NLER)

Along with the tasks of the Solid and Waste Work Group, the University of São Paulo created in 2012 the Superintendence of Environmental Management (SGA Superintendencia de Gestao Ambiental). The main purpose of SGA is to plan, deploy, maintain, and promote environmental sustainability on the 14 campuses and research areas of the University of São Paulo and also to incorporate the environmental dimension of sustainability across the board in all policies, plans and activities, in the areas of teaching, research, extension and management. Although environmental and sustainable actions at USP started in the 90s, it was only with the creation of SGA that many actions related to sustainability became part of an official program for the entire University. Up until this point, sustainability actions had been compartmentalized, occurring separately at some of the USP's campuses (ROMERO and MÜLFARTH, 2017).).

From these assumptions, the SGA began to develop these actions based on three goals: 1) Towards Zero Carbon Emissions: 2) Our campuses as a lab for our cities and 3) Sustainable actions.

As a result of these actions, the first task of SGA, on its second mandate (2014) was to create "Environmental USP" based on the structure of Solid and Waste Policy of USP, guided by NPSW.

USP's Sustainability Policy

Based on the background described previously, USP, being aware of the established importance of its Environmental Policy, decided to set up "Environmental USP", based on the structure proposed for the national policy for solid waste (NPSW).

USP decided to adopt the same structure and principles adopted in the NPSW. Consequently, the construction of Environmental USP was defined in four phases:

Phase 01 – Definition of Sustainable Policies
Phase 02 – Definition of Sustainability Issues Plans
Phase 03 – Sustainability Masterplans with 11 Thematic Chapters
Phase 04 – Sustainability Program of each school or department

2. Phase 01 – Definition of Sustainable Policies

Thus, Environmental USP was divided in 11 + 01 sections, 11 thematic policies and 01 management policy of thematic policies, as following: Administration; Greenhouse Gas Emissions; Energy; Water; Solid Waste; Mobility; Fauna; Green Areas; Sustainable Buildings; Environmental Education; Land use and Sustainability Policy.

The last point, "Sustainability Policy", organizes the sustainability issues from an administration perspective in terms of USP administrative structure.

From this, subdivisions were established consisting of 12 working groups (WG) involving about 300 people, including faculties and technical staff who produced 12 documents with the following structure: Subject and Applications; Preliminary Provisions; Principles; Guidelines; Goals; Management tools; Administrative and financial tools; Responsibilities and Prohibitions.

This phase was concluded in November 2015, and established the following policies at USP:

Administration Policy

The administration WG was created in order to reduce the environmental impacts of the administrative activities of the University, establishing definitions, criteria and goals that guide the work of the Coordination of General Administration (CODAGE) and all administrative bodies in order to match the commitments of the University of São Paulo with the environmental agenda. The WG works for rationalization of goods and services consumption, expanding the use of clean technologies and reuse in order to save natural and economic resources.

Greenhouse Emissions Policy
The WG reduction of GHG emissions was created in view of the need for the University to adapt legislation, such as the National Policy on Climate Change, and develop policies for the prevention and mitigation of greenhouse gas emissions. The WG works in order to harmonize the activities of the University with the protection of the climate and environmental systems and public health.

Energy Policy
The Energy WG was established to promote the study of energy use at USP, given that it is vital that its management must prioritize conservation and rational use, in addition to meeting the legal requirements, as provided in the National Energy Policy in National Policy for Energy Efficiency and the relevant rules issued by the competent bodies.The WG looked to promote the welfare of the population, through the adoption of sustainable standards, increasing public awareness, or by the development of programs that improve production processes and energy use.

Water Policy
The Water WG was created in recognition of water scarcity issues and the consequent need for rationalization of its use, as well as preservation of water bodies. In addition, the University of São Paulo has a moral responsibility to exceed current legislation and public policies. The WG works in order to ensure water quality and adequate quantity standards, to improve the quality of effluent produced and make use of the best available technologies in order to reduce the environmental impact of the University.

Solid Waste Policy
The Solid Waste WG was created due to the requirement for a solid waste management group in accordance with the National Policy on Solid Waste (NPSW), in order to reduce the environmental impacts of the assets disposed of through human activities, including hazardous waste. The WG works in order to ensure that solid waste management prioritizes non-generation, reduction, reuse, recycling and disposal of environmentally solid waste.

Mobility Policy
The Mobility WG was created by the perceived need to improve mobility inside campuses and among the campuses so that they can carry out the mission of the university and its regular activities. The WG works in order to develop mobility policies that improve the lives of campus users, are a model for society, and comply with policies and legislation.

Fauna Policy
The Fauna WG was created based on the realization that, as the campuses are home to wildlife species, which interact with humans, there is a need for a policy that guides the administration's actions. To minimize human-wildlife interaction risks, it is vital that there is a behavioral change in the management of the University and wildlife management. The WG works in order to conserve wild and native wildlife, controlling the risks of human-wildlife interaction and combating invasive species.

Green Areas Policy
The Green Areas WG was created in view of the responsibility of the University for the protection of its ecological heritage. In addition, the USP is committed to institutional leadership and proactivity, as well as to enforcement. The preservation of green areas promotes conservation of water resources and biodiversity, improves air quality and climate control, among many other benefits.

Sustainable Buildings Policy
The Sustainable Buildings WG was created in view of the urgent need to adopt actions for the sustainability of the buildings of the University, saving natural resources such as water and energy, and financial resources. This rationalization should be adopted in the maintenance, renovation, restoration

or expansion of existing buildings, as well as in new builds. The WG works in order to promote architectural designs using natural local conditions in order to reduce energy demand and water

Environmental Education Policy
The Environmental Education WG was created considering the Law of the National Environmental Education Policy, which prescribes that environmental education should be present at all levels of formal education, as well as its value noted in other legal documents, including the Federal Constitution. In addition, the University of São Paulo is committed to social and environmental issues and should be a role model for society and help to form critical citizens capable of facing the global environmental crisis.

Land Use Policy
The Land Use WG was created in view of the need to comply with legislation and to promote proper land management on campus in order to safeguard natural areas. The WG works in order to standardize the land situation of the University and guide management of the USP territory in an efficient, socially and environmentally responsible, and financially sustainable way. Moreover, it is essential to prevent, mitigate and restore environmental damage caused by land use changes on campus.

3. Phase 02 – Definition of Sustainability Issues Plans

With the completion of the first phase and the 12 documents, Sustainability Issues Plans for each Policy that contains the details of the actions, targets, goals and their objectives are being developed.
Schedule Phase 02 – July 2016.

4. Phase 03 – Sustainability Masterplans with 11 Thematic Chapters

These masterplans consider the ecological and urban diversity of each locality and will be related to urban master plans for each campus.
Schedule Phase 03 – July 2017.

5. Phase 04 – Sustainability Program of each faculty or department

From the definition of Sustainable Policies, definitions of Sustainability Issues Plans, definitions of Sustainability Masterplans with 11 Thematic Chapters and definitions of Sustainability Programs, it will be possible to identify actions for each school or department.
Schedule Phase 04 – July 2017.

6. Conclusions

Almost twenty years ago, USP started its actions in the area of sustainability in order to reduce its environmental impacts. Due to its immense size, and the presence of rural and urban fields with diversity of ecosystems, it was necessary to define environmental policies for all campuses prior to decision-making and the establishment of indicators and targets. The USP Sustainability Policy organized the existing actions, the future actions and united a huge contingent of faculties and employees around the environmental cause. With the completion of the first phase it was possible to observe that: greater cohesion n is taking place among faculty and staff regarding sustainability issues; faculty and staff now have greater responsibility in their actions related to sustainability; after the creation of USP's sustainability policies, a clearer definition occurred, not only of the university's sustainability issues, but also in defining clear goals, targets and deadlines.
With the completion of the Environmental USP, the University of São Paulo hopes to achieve all goals by its centenary in 2034.

References

[1] Lemos, Patrícia FAGA IGLECIAS (2012), Resíduos Sólidos e Responsabilidade Civil Pós-Consumo – Thonson Reuters, 2nd Edition.
[2] PNRS Política Nacional dos Resíduos Sólidos (2010), República Federativa do Brasil. Retrieved from http://www.planalto.gov.br/ccivil_03/_ato2007-2010/2010/lei/l12305.htm

[3] A. Romero, Marcelo ; Kronka Mülfarth, Roberta C. . University of São Paulo: Sustainability Masterplan for Policies, Plans, Goals and Actions. World Sustainability Series. 01ed. Berlin: Springer International Publishing, 2017, v. 04, p. 509-530.
[4] SGA Superintendência de Gestão Ambiental (2016). Retrieved from http://www.sga.usp.br
[5] USP Universidade de São Paulo (2015), Statistical Yearbook. Retrieved from https://uspdigital.usp.br/anuario/AnuarioControle

The 3rd International Workshop on UI GreenMetric
Istanbul, Turkey, 09 - 10 April 2017

Sustainability of the University - Environmental Responsibility of the Students: Experience of the RUDN-University

Margarita Redina* [1, a], Aleksandr Khaustov[2, b]
The Peoples' Friendship University of Russia - RUDN-University
Miklukho-Maklaya street, 6, 117198, Moscow, Russia
aredina_mm@rudn.university, bkhaustov_ap@rudn.university

Abstract. In the article presented the experience of the Peoples Friendship University of Russia (RUDN University) on the development of the student project on the environmental monitoring of campus. The project is aimed on the informational maintenance of the green policy of the RUDN University. Implementation of the project and analyses of the environmental data allows us to solve different practical problems, to make the study more efficient and to develop the environmental responsibility of students.

Keywords: environmental responsibility, environmental culture, monitoring, green campus

1. Introduction

The environmental higher education in Russia is relative new direction. But during the period of its development from the teaching of some selected environmental sections in some educational programs in Russian universities, we have switched to training of the specialists in a new range of specialties: environmental engineers, natural scientists, environmental managers, and related directions. Ecology, environmental sciences, environmental protection and management are the obligatory part of virtually all the programs of higher education now. The main purpose of this activity is not only to transfer some volume of knowledge, but also do develop the environmental culture of the future specialists.

In connection with this, the important step for the RUDN-University was the decision to take part in the ranking of green universities. This will mobilize us to take a fresh look at not just teaching, but also how our colleagues, partners and students see our university.

RUDN started successful in 2016, taking 115th place in the ranking. However, we believe that some of the indicators can be improved by us. It is especially important that students take part in maintaining the "green status" of the university. Modern universities are not centers of education and research only. The ideas of sustainable development can be developed and implemented most actively and effectively in universities. Environmental performance and resource-saving require innovative approaches, which should first of all be formed in educational centers.

Among the Russian universities, the PFUR is one of the few universities with a campus infrastructure. The university's territory is the place of compact residence of thousands of students from more than 150 countries of the world, the place of work of hundreds of employees. Therefore, the analysis of the environmental state of the campus is an important practical and scientific task.

It is very important for us to disseminate experience in developing countries. Many of them are located in unique natural conditions, and our students can further conduct the environmental education activities in the universities of their countries.

PFUR has a unique territory with a large area of greenery. However, the increasing man-made load worsens the ecological situation. The current system of environmental monitoring in Moscow does not allow to identify these changes. In this regard, the university launched a project on student environmental monitoring of campus.

2. Project of student environmental monitoring

The project on campus territory monitoring is implemented by the initiative group of students of the Ecological Faculty in the framework of maintaining the status of the RUDN University as the leading "green university" in Russia. The project is aimed at solving the problem of the control of the

environment quality on the unique campus of the university. The advisers and consultants are teachers of the Ecological Faculty (departments of Applied Ecology and Geoecology).
The main goal of the project is to collect and to analyze the information on the state of the environment in the campus: an assessment of the pollution level of air and other media, the geochemical status of soils, noise pressure, levels of electromagnetic fields, vegetation state. Studies are conducted year-round. This allows us to establish the existing technogenic pressure on the campus area, to develop recommendations for maintaining the green zone in a comfortable state. At the same time, students apply the obtained theoretical knowledge in practice. At the time the calculations of the impact of vehicle emissions based on 24-hour observations on the campus have already begun. This is the main source of pollution.
Students of the University should not just study. They must also successfully adapt to the conditions of life in Russia. This is facilitated by a favorable atmosphere in the territory of the university, the state of which is carefully supported by the university staff. The territory is landscaped, the favorable state of vegetation is maintained by the greenery service. However, there are risks of deterioration of the situation due to the intensification of transport flows, the development of the infrastructure (in particular, several gas stations, active residential development). Urban monitoring services do not allow us to obtain sufficiently detailed information about stress level on the university's territory. In this regard, it is necessary to obtain information about the environmental conditions of the territory as the basis for decisions to maintain its prosperous condition.
The monitoring points was defined on the campus area. For each of point a special monitoring program is developed. Some of points are the "background" (the territory is far enough from the highways, this is a green zone). The other part of the points is in the zone of intensive pressure. The results of measurements are visualized as schemes of technogenic pressure (maps of pollution, noise loads, etc.). A database on observations is being created, which will later become the first “brick” of the information system "Green University" (assessment of resource consumption, pollution, map of zones of "ecological comfort" etc.). Within the framework of the program, an imitation model "impact-result" will be created that allows to realize the environmental management of RUDN campus using a system of environmental standards.
Thus, by the initiative group of students with the support of the teachers of the Ecological Faculty, a permanent environmental monitoring system is created for the campus area.
The project started now by students - ecologists. However, in future it is possible to expand the group and to attract students of other specialties. So, our students took part in the competition of ecological design projects. They presented a project for the development of ecological design of networking as an integral part of the environmental monitoring infrastructure.
Currently, the scheme and programs of monitoring of the campus area are being worked out; the priority points and control zones are justified. The observation points will not be only divided into "background" and "technogenic pressured", but also will be specialized in monitoring programs (priorities for snow surveys, soil control, phytomonitoring, control of acoustic loads, electromagnetic fields, background radiation).
The instrumental support of monitoring is the most important component of the work. A list of the best means of environmental control is being formed; the preference is given to modern instruments that allow the implementation of standard (official) measurement procedures. In the future, it is planned to expand the instrument base. So, for monitoring the quality of the atmosphere, the continuous monitoring is extremely important. Therefore, various versions of stationary air quality control stations are being considered. They should not only measure the quality of the atmosphere and meteorological parameters, but also successfully integrate into the design of the territory, and, if possible, also have an autonomous power supply.
The project includes interaction with local authorities and self-government, business structures: information exchange, in particular about the transport pressure (the Moscow Traffic Management Center, etc .); search for sponsorship funds, preferential terms of cooperation with the university).

The processing of monitoring data should be carried out by modern means. To do this, databases are now being formed based of the measurement results. In the future, they should be the basis for an information system for managing the quality of the environment of the campus area. Monitoring data will be visualized using modern GIS-programs. This will identify the zones of "ecological comfort" and "environmental risk" on the campus. In the future - the creation of a series of projects on green design, creating recommendations for gardening.

Also of interest is the modeling of resource flows within the university. Such projects are currently being implemented for various organizations. One of examples is the study of German universities (the GEMIS system for enterprises of various orientations, etc.) [2]. However, for Russian universities this is a new direction despite the high activity of many collegies and universities in the world [1]. Its development contributes to a better understanding of the consumption of resources within the university, as well as the approximation of educational organizations to the perception of the standards of green building. One of the most important effects of the project is that students get the practical experience in participating in environmental projects. This allows us to solve a common problem for all students, and in the further practical activities also saves the employer's expenses for "teaching" the young specialist. In the home, students seldom apply the knowledge gained in the learning process, for example, resource and energy savings. The goal of our actions is to actively introduce green technologies and a healthy lifestyle not only in production, but also in the daily life of students.

The effects of implementation of project are:

- environmental effect: obtaining a basis for recommendations on the increase of environmental performance and maintaining the prosperous condition of the territory; optimization of material flows;
- social: providing a comfortable environment for the "population" of the campus - students and university staff; Development of social activity of students - for the first time the project is carried out by the initiative group of students and the results will be open for all stakeholders, - educational: implementation of theoretical knowledge by students; development of practical monitoring skills; development of a set of tasks to assess the performance of nature management in the educational organization, the implementation of meta-subjective environmental approaches, combining narrowly professional directions; formation of professional ethics and corporate responsibility among students who are implementing the project;
- informational: informing the university administration and the green services about negative environmental phenomena on the campus, displaying continuous information about the state of atmospheric air on the university's electronic display, reflecting the results of environmental monitoring in the university's periodicals, specialized reports at the Academic Councils and meetings on environmental safety and life safety for the students and employees of the RUDN.

The most important result of the project should be the formation of an ecological culture of both students and employees of the university. If for the environmental students the project allows to implement their theoretical knowledge in practice, feel themselves professionals, then for representatives of other specialties the project results are a new field of knowledge. This allows us to lay down the ideas about the need to save resources, respect for nature, about how the anthropogenic activities change the natural complexes.

Also the most important practical result will be the development of the concept of "green" development of the university, based on obtaining and processing the most diverse data on the present situation of the university's economic structure and the state of the environment.

3. Conclusion

As a national coordinator of the program of green universities, RUDN is planning to actively disseminate sustainability ideas in Russian universities. Not all the universities have such an infrastructure as the ours. However, the presence of greenery territory is only a part of the conditions for the recognition of an environmental performance of a university. In this regard, we plan to create an information system on the integration of sustainability factors and the visualization of the results of the assessment of universities. This will allow to develop recommendations on “greening” for other universities, in

particular - to bring them closer to the use of standards for assessing buildings and territories in terms of green building.

The proposals of RUDN university:

- To create under the international auspices of green universities a network publishing center to exchange information on the activities of green universities in the field of ecology and resource conservation,
- To organize a workshop on the basis of the RUDN university to demonstrate the results of the project on the environmental monitoring for campus areas,
- To organize an exchange of initiative student groups to disseminate knowledge and experience on green monitoring of campuses,
- To apply to UNESCO about the support for the green initiative of universities participating in Green Metrics programs.

References

[1] Finlay J., Massey J. Eco-campus: applying the ecocity model to develop green university and college campuses // International Journal of Sustainability in Higher Education. 2012. Vol. 13(2). Pp. 150-165.

[2] Fritsche U. R., Schmidt K. Global Emission Model of Integrated Systems (GEMIS) Manual // Darmstadt–Germany: Öko–Institut eV (Institute for Applied Ecology). 2008.

The 3rd International Workshop on UI GreenMetric
Istanbul, Turkey, 09 - 10 April 2017

The UNAM Environmental Badge: an Environmental Performance Assessment Tool

Mireya Imaz *[1, a], Luis Gutiérrez [1, b], Daniel Peñalosa[1, c], Jorge Pérez [1, c]
[1]*Av. Universidad Nº 3000, Universidad Nacional Autónoma de México, C.U., Ciudad de México, México*
[a] mimaz@unam.mx, [b]luisgutierrez@puma.unam.mx, [c]dpmartinell@puma.unam.mx

Abstract. The role of universities in developing strategies to improve environmental performance has proved to be crucial. Their participation has a direct impact on the population. With this in mind, we aimed to obtain objective and accurate information on the current environmental performance of the UNAM buildings. As a result, an audit tool was designed and it culminated in the creation of the UNAM Environmental Badge (UNAM-EB). This tool analyzes the environmental performance of buildings in 4 main categories: energy consumption, water use, waste disposal and the acquisition of high consumption office materials (responsible consumption). The results obtained applying the UNAM-EB periodically to an institution that belongs to the UNAM display an average improvement on all 4 areas of 17.4% between the first and second evaluation, demonstrating the effectiveness of the recommendations issued. The objective of obtaining accurate information and continuously monitor the environmental performance of the UNAM buildings was achieved. In addition, it has been observed a greater participation from the faculties and institutes in the practices that lead the institutions to a better environmental performance, facilitated by the implementation of the recommendations of the UNAM-EB.

Keywords: Sustainability, Environmental performance of buildings, Sustainable development, Software audit tool.

1. Introduction

The role of universities in developing strategies to improve environmental performance has proven to be crucial [1, 2]. In addition to generating knowledge and methods that identify key points and policies that can work for the society in which they are implemented, they also prepare the professionals of the future. Young professionals that know and care for sustainability and the environmental culture, in order to forge generations aware of the high environmental impact of anthropogenic activities around the globe [3, 4].

One of the three pillars of sustainability and a key aspect of the environmental culture is the environment, which is impacted by building's operation and organization's management. The environmental performance is understood as the "measurable results of an organization's management of its environmental aspects" [5] and is one of the most promising ways of guiding productive activities towards a sustainable route.

The first step in involving society and improving environmental performance is to consult and take into account the opinion of the nation's universities, colleges and investigation institutions, and to relay on their experience, professionals and infrastructure to improve the application of policies that affect the use of common resources such as water or energy, as recommended by the agenda 21 in relation to sustainable development [6].

The National Autonomous University of Mexico (UNAM) is Mexico's most densely populated university and one of the biggest in Latin America, with more than 345,000 students, 39,500 academics and researchers, and more than 29,000 individuals as support staff, who carry out administrative and other functions within the university's facilities [7].

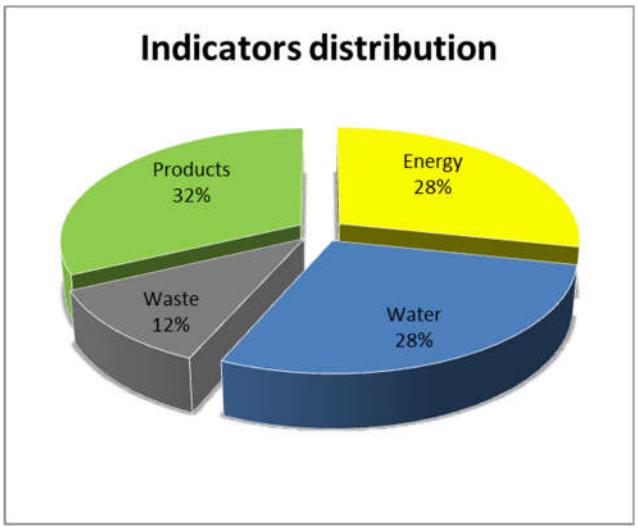
Despite the importance and size of the UNAM, knowledge about the environmental performance of its buildings was very limited and outdated. Because the consumption of resources by the built buildings can reach enormous amounts throughout their life time [8, 9], the University Program of Strategies for

Sustainability (PUES) was given the task of designing a methodology that fulfilled the following objectives:
1) Evaluate the environmental performance of each of the UNAM buildings in an objective, accurate and continuous manner and 2) make recommendations that help improve this environmental performance through the creation of the UNAM Environmental Badge (UNAM-EB).

2. Development of an audit tool and performance evaluation

The UNAM- EB has been designed to collect objective, detailed and precise information about the environmental performance of operating buildings. The components of the UNAM-EB are described in this section and follow the next logic: (1) Credit design, (2) Indicators development, (3) Digitalization of the indicators, (4) Catalogs, (5) Data collection, and (6) Digitalization of the data.

1) Credit design: The credits measure the entity's environmental performance. Credits are developed based on other distinctions, mainly LEED (in its chapter once called existing construction, now known as operation and maintenance), STARS and other criteria developed by UNAM. The indicators used were evaluated by UNAM experts and, if necessary, eliminated or adjusted to meet the realities of Mexico. Credits number distribution is depicted in Graphic 1. Although the number of credits vary, the importance of each category remains equally important due to a system of distinction levels.
2) Indicators development: indicators are tools designed to measure analytically the status of each credit. The indicators are placed in tabs similar to the example in figure 1, where they the units of measure of each indicator and the analytical tool used to obtain the value of environmental performance of each credit are showed.



Graphic 1. Distribution of the credits on the environmental performance audit tool

3) Digitalization of the indicators: Once the indicators necessary for the evaluation of the credits were studied and designed, the calculations were written in computational algorithms.
4) Catalogs: The catalogs contain a large amount of furniture and equipment previously evaluated and, therefore, their environmental performance is known. The catalogs identify, through an alphanumeric code, the equipment that is recurrent at the facilities. This way, those responsible for data collection only have to identify the equipment model, find it in the catalog, and write down its code in the data collection table.
5) Data collection: trained technicians are sent to collect the data to assure the information homogeneity and quality. The data is registered in previously designed tables and the building blueprints.
6) Digitalization of the data: First, the data is uploaded on a mobile application under strict standards to maintain consistency in the data collected.

EL1. Monthly energy consumption for lightning
Units: kW-h/month
EL1= SUM [number of lightbulbs x * lightbulb power * average time of use of lightbulb x (hr/day) x (day/month)]
Where:
EL1: Monthly energy consumption for lightning
Lightbulb x: Model or brand of the lightbulb
Lightbulb power: Obtained from the catalogue of the

Figure 11. example of the construction of a credit, used to measure the indicators.

Then the data is sent from the mobile device to the PUES server, where the calculation algorithms that generate the results of the UNAM-EB are executed. As a result, a web report and other evaluation products are generated.

3. Results

Although data collection is in its first stage, some entities have already been evaluated twice, which allows comparisons of the state before and after the application of the UNAM-EB. To exemplify some of the results obtained after the tool application and to show the improvement capacity that the monitoring of the recommendations issued by the UNAM-EB presents, the case of the Institute of Renewable Energies will be presented.

Case of study: Institute of renewable energies:

Results obtained in the two different evaluations for each of the categories, as well as the mean performance for each evaluation and the improvement that has been observed following the implementation of the given recommendations appear in table 3.

Table 1. Comparative of the percentage of compliance from the first evaluation and the second one, after the recommendations were followed.

Category	2013	2017	Improvement
Energy	68.20%	76.33%	8.13%
Water	67.47%	75.00%	7.53%
Waste	33.33%	83.33%	50.00%
Responsible Consumption	64.71%	68.66%	3.95%
Mean	58.43%	75.83%	17.40%

All categories have presented progress. The category “responsible consumption” was the one with the lowest improvement range with a 3.95%. This category also is the one with the poorest performance percentage in the latest evaluation with a difference of 14.67%. The categories of energy and water present a more expected improvement between 5 and 10%. The biggest improvement is observed in the waste category, where a progress of 50% was obtained between the first and the second evaluation. In average, the institute of renewable energies has improved its environmental performance in 17.4% since the implementation of the UNAM-EB.

In addition to the general results observed in Table 3, more specific details have been obtained for each of the categories. Because the full extent of the recommendations issued is about 40 pages, we opted to exemplify this point showing an indicator of each category (Table 2).

Table 2. Comparison of one example of indicator for each category with its respective recommendations for each of the evaluations made on the Institute of renewable energy.

		2013		2017	
Category	**Indicator**	**%**	**Recomendation**	**%**	**Recomendation**
Energy	The engines are less than 10 years old	36	Implement a preemptive maintenance program and analyze the efficiency of 61 equipment that use engines 10 years old or older	47	Implement a preemptive maintenance program and analyze the efficiency of 60 equipment that use engines 10 years old or older
Water	It has tap adapters that reduce water waste	32	Adapt 63 caudal reducers or water aerators in kitchen faucets, dining rooms and laboratories	41	Adapt 69 caudal reducers or water aerators in kitchen faucets, dining rooms and laboratories
Waste	It has the separation system for Urban Solid Waste (organic/ paper, cardboard/ glass bottles and cans/ plastic bottles) established by UNAM	0	Implement an efficient waste separation and management system	100	
Responsible Consumption	It meets the criteria of purchasing liquid detergents that are biodegradable, phosphate-free and non-corrosive	100		98	Replace 15 liters of detergents for biodegradable and phosphate-free products

As we can see in Table 3, in the category “energy” the percentage of compliance of the credit is improved from 36% to 47%. In the “water” category, there is also an improvement in the percentage of compliance of the indicator from 32% to 41%, however the number of adapters to implement increases from 63 to 69, due to the total number of keys in the building increased. For this reason, percentages of compliance are used to measure the progress of the institution and not total numbers.
In the category “waste”, there is a 100% improvement, so no recommendations were issued for this indicator on year 2017.
In the category “responsible consumption”, the percentage of 100% credit compliance in 2013 is reduced to 98% in 2017, which indicates that once the recommendations have been made or the credit has been fulfilled, it is necessary for the institution to continue monitoring the performance of each indicator in order to avoid reducing the percentage of compliance. In the ”waste” category example, we can see that there are no recommendations when the 100% credit compliance is met, however there is a recommendation for the second evaluation, due to the aforementioned decrease.
The recommendations procedure for each evaluation is similar to that depictured in Table 3 throughout the 53 credits of the UNAM-EB, proposing specific and detailed activities to improve environmental performance.

4. Conclusions

The application of the UNAM-EB has allowed to obtain unprecedented information on infrastructure and operating practices that have an impact on the environmental performance of the University's buildings in a relatively short time and at low cost, given the dimensions and diversity of the UNAM's buildings.

The UNAM-EB provided each evaluated entity with a route for continuous improvement of its environmental performance, based on recommendations custom-made to each building. The fact that the evaluated entities are carrying out these recommendations places the University as a whole on a path towards a better environmental performance in the med-term.

The information obtained has allowed us to evaluate the effectiveness of the University's policies in terms of environmental performance; it also has allowed us to create new institutional policies to solve the deficiencies found. An example of this is the evaluation of the "waste" category, the results of which led to the redesign of the University's waste management system and has gradually been adopted by two-thirds of the central campus. It is important to note that poor waste management in the UNAM reflected its mismanagement throughout the entire country. Thus, the UNAM-EB is also allowing defining a new policy on waste management applicable in other buildings outside the UNAM, such as the Mexican Chamber of Deputies, which in 2016 adopted the UNAM's System for waste management. The description and results of this project will be the subject of another text.

Currently the UNAM is part of a consortium of ten universities across the world that will use the UNAM-EB as the base protocol to build an environmental performance assessment tool with global application. The UNAM-EB has proven to be adaptable enough to evaluate buildings with diverse uses and its precision has generated enough confidence as denoted by the evaluation of the headquarters building of the Mexican Ministry of the Environment and 9 other Mexican Ministries, as well as the Mexican Chamber of Deputies. More than 1.8 million built square meters have been evaluated in total, which makes it the main referent of environmental performance evaluation in the country.

References

[1] Hart, D., Bell K. P., Lindenfeld L. A., Jain S., Johnson T. R., Ranco D., and McGill B.., 2015. Strengthening the role of universities in addressing sustainability challenges: the Mitchell Center for Sustainability Solutions as an institutional experiment. *Ecology and Society, Volume* 20 (2:4).

[2] Waas, T., Verbruggen, A., Wright, T., 2010. University research for sustainable development: definition and characteristics explored. *Journal of Cleaner Production,* Volume 18, pp. 629–636.

[3] Bates, C., Silverblatt, R., & Kleban, J., 2009. Creating a new green management course. *The Business Review, Cambridge*, Volume 12 (1), pp. 60-66.

[4] Chiappetta,C., 2010. Greening of business schools: a systemic view, International Journal of Sustainability in Higher Education, Vol. 11 (1), pp. 49–60.

[5] ISO 14031:2013(es), ISO manual for sustainable development available online at https://www.iso.org/obp/ui#iso:std:iso:14031:ed-2:v1:es

[6] United Nations Conference on Environment and Development. 1992. *Agenda 21, Rio Declaration, chapter 35:* Science For Sustainable Development. New York: United Nations.

[7] University statistics webpage, UNAM course 2015-2016. March 1, 2017 available online at www.estadistica.unam.mx

[8] Roodman, D., Lenssen, N., 1995. A building revolution: How ecology and health concerns are transforming construction. *Washington: Worldwatch Institute.* 67p.

[9] Lopez V.M., 2008. Sustentabilidad y desarrollo sustentable: origen, precisiones conceptuales y metodología operativa, Trillas: IPN, pp.76 - 96

Panel Session 5
Issues and Innovation in Managing Education

The 3rd International Workshop on UI GreenMetric
Istanbul, Turkey, 09 - 10 April 2017

Developing Partnership in Integrating Green and Sustainability with Education, Research, Community Aids and Student Orientation Activities

Ravik Karsidi[1)], Okid Parama Astirin[2)], Winny Astuti[3)]
[1)] *Rector Universitas Sebelas Maret, Campus UNS Kentingan, Surakarta, Indonesia*
[2)]*Department of Biology, Faculty of Mathematics and Natural Science UNS, Coordinator of Green Campus Team UNS*
[3)]*Study Program of Urban and Regional Planning, Faculty of Engineering UNS, Chairman of Green Campus Team UNS*

Abstract. Green Campus has become commitment of several universities in the world to create more livable and sustanable living on campus. In Universitas SebelasMaret, the commitment of implementation of Green Campus has been expressed in formulation of independent team by Rector called Green Campus Team in 7nd of August 2012. Several efforts and partnerships with other institutions have been initiated related to Green and Sustainability. Basically, managing education is purposed for character building of civitas academica toward "Green Attitude and Environment". Partnership in managing education has been expressed through some innovations: integration with Student Orientation Activities focused on Green and Sustainability through "One Student Five Trees"; development of Research Laboratory of Renewable Energy in developing National Electric Car ; Integration to Community Aids activities and character building of civitas academica. These Efforts have been successfully implemented through several partnerships with other institutions, such as the Ministry of Environment and Forestry, the Ministry of Research and Technology through development of Research ; the Ministry of Public Works and Spatial Planning and some Government Units and Institutions in the local levels. Universitas Sebelas Maret kindly invites more other global institutions for Green and Sustainability efforts.

Keywords: Sustainability, green campus, Sustainable development, environment.

1. Introduction

Universitas Sebelas Maret (UNS) is the biggest university in Surakarta Central Java Indonesia, which was established on March 11th, 1976 through Presidential Decree No. 10 of 1976. At that time, UNS has 10 faculties, namely the Faculty of Teacher Training and Education (FKIP); Faculty of Cultural Science (FIB); Faculty of Art and Design (FSRD),Faculty of Social and Political Science (Fisipol), Faculty of Economics and Bussiness (FIB), Faculty of Law (FH), Faculty of Economics (FE), Faculty of Medicine (FK), Faculty of Agriculture (FP), Faculty of Engineering (FT) and Postgraduate Programs. The commitment of implementation of Green Campus has been expressed in formulation of independent team by Rector of UNS called Green Campus Team in 7th of August 2012. This was followed by achiement of UI Green Metric of UNS by number of 134th (2013), number 156 th (2014); number 97th (2015). In 2016, UNS has reached the achiement by the rank of 5th (Indonesia) and 76th (world). Several efforts and innovations in managing education have been innitiated and conducted through several partnerships with other institutions in national level as well as in local level. Global partnership in International level has always encouraged in the future.

2. Partnership in Integration of Green and Sustainability with Student Orientation Program through One Student Five Trees Program

Several activities related to Student Orientation Program have been created in order to support the green and sustainablity efforts. The activities purpose for enhancing new students' awareness toward Green Campus, which have to be implemented and actualized in their behaviour and attitude during their study in UNS. Integration of green and sustainability to support Green Campus has been expressed in Student Orientation Program through Program called " One Student Five Trees Program". The Program has been implemented since 2015, as a part of commitment of UNS with the Ministry of Environment and

Forestry. New students obligate to plant 5 trees for each student, to water and to take care of its as pre requisite of the graduation requirement. As the limitation of land on campus, they also can plant trees in the neighborhood areas surrounding campus. The program also supports the Arboretum Program in UNS, which is designed to increase the variety of plantation for the purpose of education and function. Program of One Student Five Trees is supported by Government Unit of Forestry of Surakarta and the Board of Riverbank Area and Forest Conservation (BPDAS HL) Surakarta, in spite of The Indonesian Army, Program of One Student Five Trees also supports the Surakarta Government's commitment in Green City, where UNS has declared as Campus Forest of Surakarta City.

Figure . 1.A and B. Program of" Rector plants trees with the Students, 2016; 1C. Indonesian Army supported the Program of Clean Campus, 2016 (Sources: Team of Green Campus UNS, 2016)

3. Partnership in Integration of Green and Sustainability with Education, Research and Community Aids

3.1 Partnership in Managing Education based on Green and Sustainability

Integration of green and sustainability in Education Program aims for enhancing green attitude and behaviour toward environment. Universitas Sebelas Maret developed Post Graduate Program specialized in Environment Studies , which is based on multidiciplinary field of study. The Environment Studies Department has been the destination for studying the students in several field of studies from the Government Unit as well as from other universities in Indonesia. Apart from that, UNS developed Center of Study specialized in environmental issues, namely Research Center for Environmental Studies under the Center of Research and Community Aids (PPLH LPPM UNS). The center of study has been developing partnership with Government Units of Environment in the Regencies or Cities in overall Indonesia through the preparation of Environmental Impact Assestment Document (AMDAL). Several Short Course Programs on Environmental Management has also been regularly conducted with the participants from the Government Units related to Environment and Forestry in National, Provincial or Local Level in Indonesia. The Program of short course in PPLH LPPM UNS has been awarded highest degree of Certification from the Ministry of Environment and Forestry.

In internal operation of education, the percentage of coursework related to green and sustainability is about 10 %. This been conducted in several study programs, such as Ecology Studies, Environmental Science, Natural Resources and Environment, Green Application in Architecture, etc. Some courseworks are conducted in outdoor environment areas outside campus involving thelocal communities. Whereas number of publication concerning green and sustainability is 149 articles in 2016 (Green Campus Team, 2016).

3.2 Partnership in Character Building of Civitas Academica

Enhanching the Green Character is one the UNS concern for building Green Attitude for all civitas academica, through Zero Waste Attitude, Free Smoking Areas on Campus. One of the effort in limiting unorganic waste production is Tumblerization, where civitas academica is encouraged to use Tumbler for drinking rather than buying mineral water, which has implication on producing plastic garbage. This is supported by construction of Water Drinking Instalation Unit (SPAM) in partnership with the Ministry of Public Works and Spatial Planning 2015. The SPAM has been facilitated by 150 spots of Drinking Water Tap distributed in almost every building in Campus.

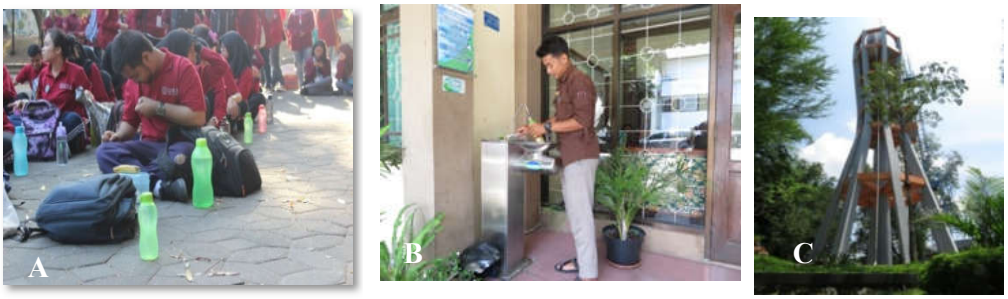


Figure 2.A. Program of Tumblerization for Students in the Student Orientation Activities, 2015; 2.B. A student is filling a tumbler with fresh water from drinking water tap; 2.C. Water Drinking Instalation Unit (SPAM) UNS (sources : Team of Green Campus UNS)

3.3 Partnership in Developing Research Laboratory of MOLINA

Concerning the Research Development, UNS has developed Master Plan of Research Development 2012 – 2025, which the researches are mostly dedicated for green and sustainability issues, such as : Renewable Energy; Climate Change; Food Security; Biodiversity and Resillience. In 2016, percentage of research related to Green and Sustainability has reached by 33, 20% of overall researches conducted in UNS (http://greencampus.uns.ac.id).

Development of Center for Development of National Electric Car (MOLINA) in Engineering Faculty expressed awareness of UNS toward Renewable Energy. In spite of National Electric Car, this center developed electric motorcycle in partnership with the Ministry of Research and Technology. Apart from that, Engineering Faculty developed Laboratory of Biofuel for developing bateries and power to be used for National Electric car.

Figure 3.A. Center for Development of National Electric Car in Enginnering Faculty; 3.B. UNS Electric Car; 3.C. UNS Rector ride an Electric motorcycle of UNS
(Sources: Team of Green Campus UNS, http://uns.ac.id, http://greencampus.uns.ac.id)

3.4 Partnership in Integration of Green and Sustainability with Community Aids

Commitment of UNS toward community in the area surrounding campus related to green and sustainability has been expressed in solving the problem of Liquid Domestic Waste. By partnership with the Ministry of Public Works and Spatial Planning, UNS constructed Integrated Liquid Domestic Waste Treatment (IPAL terpadu) in 2016, which manages integration of Liquid Domestic Waste from surrounding residential areas in Jebres District and from internal Campus into the Instalation of Integrated Liquid Domestic Waste Treatment located in Campus.

Figure 4.A. Integrated Liquid Domestic Waste Treatment, which manages liquid domestic waste from campus and surrounding areas in Jebres Distric *(*sources: Ministry of Public Works and Spatial Planning, 2017*)*

References

[1] Team of Green Campus UNS. 2013. Strategic Planning og Green Campus UNS 2013-2010
[2] Profil of Universitas Sebelas Maret. 2016. http://uns.ac.id
[3] http://greenmetric.ui.ac.id/overall-ranking-2016
[4] Universitas Sebelas Maret. 2012. Master Plan of Research Development Universitas Sebelas Maret 2012-2025
[5] Ministry of Public Works and Spatial Planning. 2017. Matery of Presentation of Socialization of SOP Integrated Liquid Domestic Waste Treatment UNS

The 3rd International Workshop on UI GreenMetric
Istanbul, Turkey, 09 - 10 April 2017

Raising Awareness and Good Conducts to Build a Conservation University with International Reputation

Fathur Rokhman, Amin Retnoningsih, Hendi Pratama
Universitas Negeri Semarang, Indonesia
fathurrokhman@yahoo.co.id, aminretnoningsih2013@gmail.com, hendi.edu@gmail.com

Abstract. Higher education should have four strategies to contribute to sustainable future: (1) by improving environmental and sustainability literacy, (2) by creating curriculum incorporating environmentally sustainable design on campuses, (3) by creating curriculum involving improvement in local communities and (4) by expanding and improving architectural education [1]. These steps have been adopted and maintained by Universitas Negeri Semarang to build a conservation university. First of all, the university does not only focus on physical environment but also on characters development and cultures. It means that the university has put an emphasis on educating the students and faculty members on the conservation values. Currently. UNNES has developed modules of the eight values of conservation: (1) inspiration, humanitarian, awareness, innovation, sportiveness, creativity, honesty and fairness. This paper will elaborate the university efforts in immersing those eight values into curriculum and conservation.

Keywords: conservation, higher education, sustainability,

1. Introduction

Universitas Negeri Semarang has been declared as a conservation university in 2010 by the Minister of National Education. This declaration was based on the understanding that UNNES has full awareness that university should think about sustainability for future. Along the way, the university has expanded this understanding into a more subtle combination of concepts. The university thinks that conservation in terms physical environment needs to be accompanied by the conservation of values and arts. This concept is more comprehensive, so that in 2014 the university dictated three pillars which become the main attention of conservation.

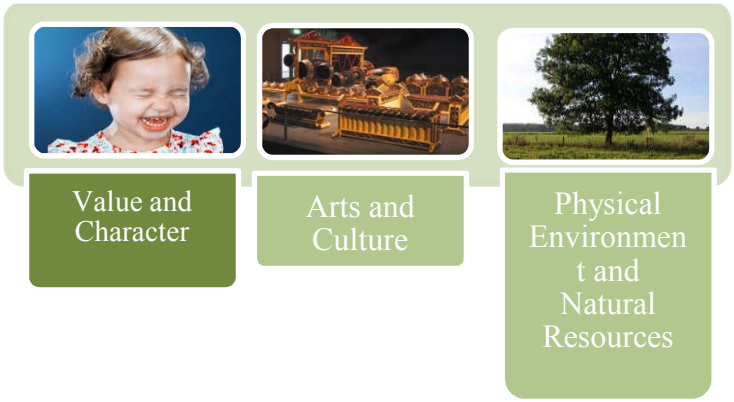


Figure 1. Three Pillars of Conservation at UNNES

With the combination of three pillars, the university then deemed that conservation university as an identity is no longer accurate. The university then calls itself as a conservation-minded university. A conservation-minded university is more complex and it has a full connection to the humans behind the conservation. Ironically, when humans are crucial factors of biodiversity loss [3], humans might be the only hope slow down the process of destruction [3]. This is the starting point where UNNES believes that humans (mentality) shall be the focus of change and reconstruction.

2. Reconstruction of Human Mindset

At this point we must agree that education (especially higher education) shall be a tool for conservation [4]. This is the way how we change human mindset. The following is the complete view on how humans interact with nature.

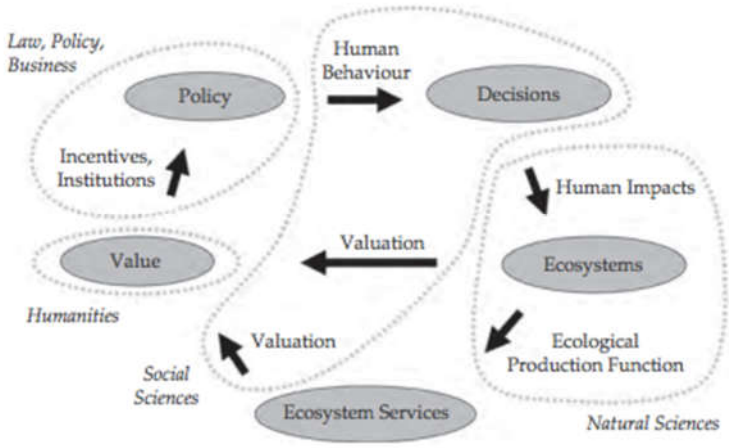


Figure 2. Interconnection between humans and ecosystem

Shown at the picture above, we can see the humans are important parts of the ecosystem. Not only that humans are inevitable parts of ecosystem, the derivatives of human knowledge are also parts of the ecosystem services. It starts with values held by a number of individuals or society. These values will lead to the construction of policy. In turn, law, policy and business can affect humans' behaviour when they make decisions. Their decisions will create impacts to ecosystem. Meaning that the first pillar of UNNES conservation has been grounded by this mechanism.

Values are not the only factors affecting human behaviour towards ecosystem. Culture, politics and economics also affect human behaviors [5]. The following excerpt from [5] would give us a better picture on how culture can affect human behaviour towards nature.

Culture is a dynamic system of collectively shared symbols, meanings, and norms – the nongenetic information possessed by a society. People are born into cultural settings, which help shape their perceptions of the world around them. For example, societies that believe guardian spirits reside in forests will often take measures to protect those forests; likewise societies that believe that ecosystems are naturally held in balance might do little to actively conserve their resources (Claus et al., 2010).

Now, we start to see the complexity of the case and now we can relate UNNES' second pillar to the force created by culture to drive human behaviour. And that's why at UNNES why try to cultivate eight values of conversation.

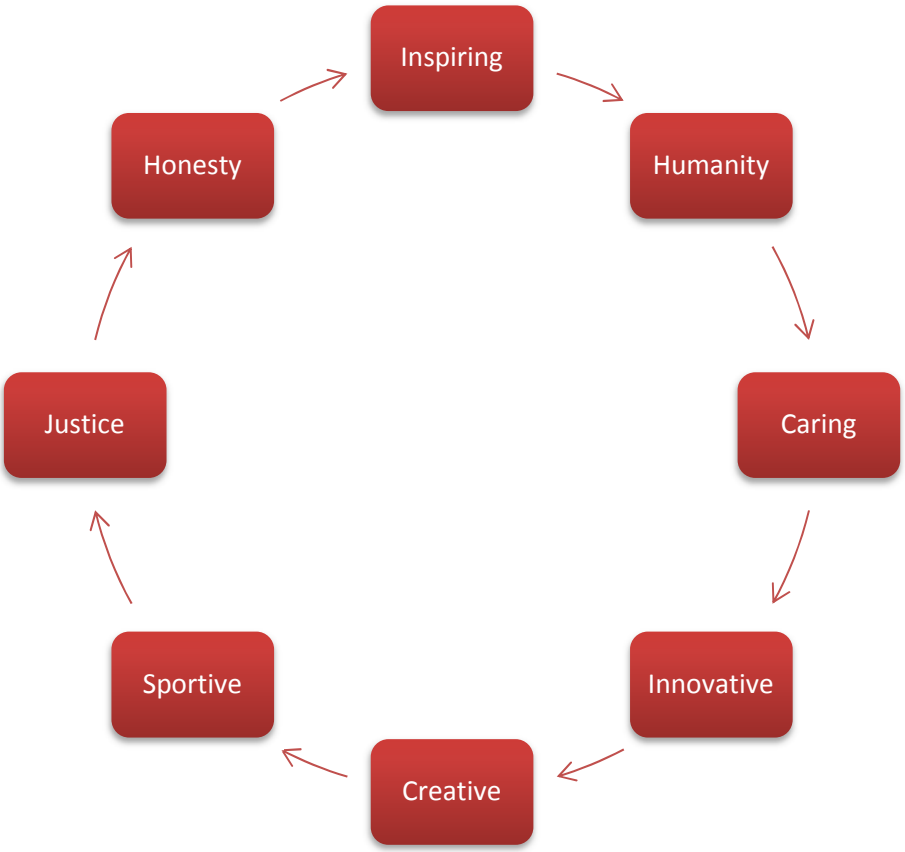


Figure 3. Eight Values of Conservation at UNNES

Our understanding that values have driven human behaviours to protect of destroy their environments has led UNNES to develop those eight values to be immersed in the teaching and learning process.

3. Conclusion and Recommendation

Our proposition is quite clear that we need to invest to the humans as an addition to any mitigation we have so far to prevent further planet destruction. At the level of university, UNNES has tried to fill its roles to invest of human values and characters. To focus on some values UNNES cultivate eight values of conservation.

References

[1] Cortese, A. D. (2003). The critical role of higher education in creating a sustainable future. Planning for higher education, 31(3), 15-22.
[2] Forester, D. J., & Machlist, G. E. (1996). Modeling human factors that affect the loss of biodiversity. Conservation Biology, 10(4), 1253-1263.
[3] Raga, J. T. Role of Peoples and Nations in Protecting the Natural Environment. The Global Quest for Tranquillitas Ordinis, 142.
[4] Howe, C. (2009). The role of education as a tool for environmental conservation and sustainable development. Imperial College London.
[5] Claus, C. A., Chan, K. M., & Satterfield, T. (2010). The roles of people in conservation. Conservation biology for all, 1, 262-283.

The 3rd International Workshop on UI GreenMetric
Istanbul, Turkey, 09 - 10 April 2017

UMS EcoCampus: Transforming Ideas into Reality

Mohd Harun Abdullah[1, a] and Siew-Eng How[*2, b]
[1]*Chancellery Department, Universiti Malaysia Sabah, Jalan UMS, 88400, Kota Kinabalu, Sabah, Malaysia*
[2]*UMS EcoCampus Management Centre, Universiti Malaysia Sabah, Jalan UMS, 88400, Kota Kinabalu, Sabah, Malaysia*
[a]harunabd@ums.edu.my, [b]sehow@ums.edu.my

Abstract. Universiti Malaysia Sabah (UMS) has moved up by 129 placings to 44 th ranking in the UI-GreenMetric World University ranking 2016 compared to 173 th in 2015, due to our sustainability commitment under the EcoCampus agenda. In line with the global call for the "The Future We Want" made at the Rio+20 Earth Summit, UMS recognizes that fundamental changes need to be made in the way society thinks and acts towards sustainable development. We believe that this can only be achieved through the education and transformation of our values and lifestyles. Thus the idea of the EcoCampus was born with a vision to become a leading model of the "new flagship EcoCampus" of the 21 st century. UMS is committed to be a university of excellence in teaching and research, and an EcoCampus that incorporates due environmental considerations in it planning and activities by being innovative, relevant and sustainable. The environmental stewardship towards sustainable development will address local, national and global environment challenges in collaboration with stakeholders. With its strategic location and a growing population of more than 18000 students and 2855 staff, UMS recognizes that its decisions and actions can have a significant impact on the environmental, economic and social dimensions of the region, at present and in future. The UMS EcoCampus Management Centre was established in February 2013 to redefine and "green" our policies and practices in an ecologically-friendly context by setting new standards in campus management and ensuring the realization of EcoCampus transformation plan based on five core values that integrated into the six key elements of EcoCampus. The implementation of the action plan and stakeholders engagement are based on a seven steps approach. It is our wish that the UMS staff and students could be proud ambassadors of "the practice of what they preach" on campus.

Keywords: EcoCampus; transformation; environmental stewardship; engagement; sustainability.

1. Introduction

Universiti Malaysia Sabah (UMS), the Malaysia's ninth public university was established in 1994 to amidst calls for the creation of a world-class university in Sabah to cater for the needs of the country. UMS has been categorised as a comprehensive university and started out to embrace the precepts of sustainable growth in the campus since its establishment. UMS has strong academic and research strengths in the environment related filed, besides having a beautiful campus and recognizes that it has a responsibility to the environment, and building upon these strengths, is committed to become a leading green university (eco-campus) in the region. The UMS strategic plan 2013-2017 [1] outlines seven strategic priorities or key result areas (UMS-KRAs) which emphasizes our roadmap and commitment to excellence. The UMS-KRA 7 clearly expresses the commitment of UMS striving to cultivate environmental citizenship among the students and staff through university activities, practices and operation, besides contributing towards the sustainability of the local and global environment. In line with the global call for the "The Future We Want" made at the Rio+20 Earth Summit, UMS recognizes that fundamental changes need to be made in the way society thinks and acts towards sustainable development [2]. We believe that this can only be achieved through the education and transformation of our values and lifestyles. Thus the idea of the EcoCampus was born with a vision to become a leading model of the "new flagship EcoCampus" of the 21 st century. In 2016, UMS moved up by 129 placings to 44 th ranking in the UI-GreenMetric World University ranking (2016) compared to 173 th in 2015 [4], due to our sustainability commitment under the EcoCampus agenda [5-6].

2. EcoCampus: A UMS Agenda

2.1 EcoCampus

Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs [4]. EcoCampus is a point of reference to act as a steward of the environment, contributing to global efforts towards sustainability by introducing environmental excellence in teaching and learning, research, infrastructure development, management and operational practices, and campus experience. EcoCampus allows the institution to systematically identify, evaluate, manage and improve its environmental performance and practices. The main aims is to promote environmental education and care, and moving towards environmental sustainability through good planning, and operational and management practices that will influence curriculum, teaching and research, and campus experience through leadership of the university [5-6].

2.2 EcoCampus Management Centre

UMS is committed to be a university of excellence in teaching and research, and an EcoCampus that incorporates due environmental considerations in it planning and activities by being innovative, relevant and sustainable. With its strategic location and a growing population of more than 18000 students and 2855 staff, UMS recognizes that its decisions and actions can have a significant impact on the environmental, economic and social dimensions of the region, at present and in future. The UMS EcoCampus Management Centre (EMC) was established in February 2013 to redefine and ”green” our policies and practices in an ecologically-friendly context by setting new standards in campus management and ensuring the realization of EcoCampus transformation plan based on five core values [5,6] which are sustainable development, ecological protection, environmental compatibility, resources conservation and environmental stewardship that integrated into the six key elements of EcoCampus namely mindset change, infrastructure development, teaching and learning, research themes, management and operational practices. EMC serves to enlighten and empower the campus community to make the difference through their environmental awareness, knowledge, skills and values [7].

2.3 Engaging The stakeholders

At an international level, an early commitment to sustainability in higher education was made in 1990, which is known as the Talloires Declaration [8]. It is a ten-point action plan for incorporating sustainability and environmental literacy in teaching, research, operations and outreach at colleges and universities. On the other hand, the Sapporo Sustainability Declaration [9] outlines the responsibility of universities to contribute toward the attainment of sustainability, and the specific actions they must undertake to fulfil that responsibility. It recognizes 8 principles concerning the role of universities in global efforts to attain sustainability.

The doctrine of sustainability cuts across every aspects of our activities, thus we shoulder the responsibility in educating all our stakeholders on responsible environmental stewardship. The UMS EcoCampus Blueprint form the basis to drive a mindset change (Figure 1) in all the stakeholders include students, staff, alumni, parents, community, industry and government.

“The crisis we face is first and foremost one of the mind, perception and values; hence it is a challenge to those institutions presuming to shape the minds, perceptions and values” [10]. It is thus a challenge for the UMS campus community to be transformed into one that is fully informed and conscious about the sustainability concept and motivated to implement the initiatives towards environmental sustainability. Mutually-reinforcing and interconnected through effective communication aimed at inculcating attitudes and behaviors leading to sustainability, such sensitivities and efforts need to start as a collective contribution of top-down and bottom-up commitments through university policies and planning being largely implemented.

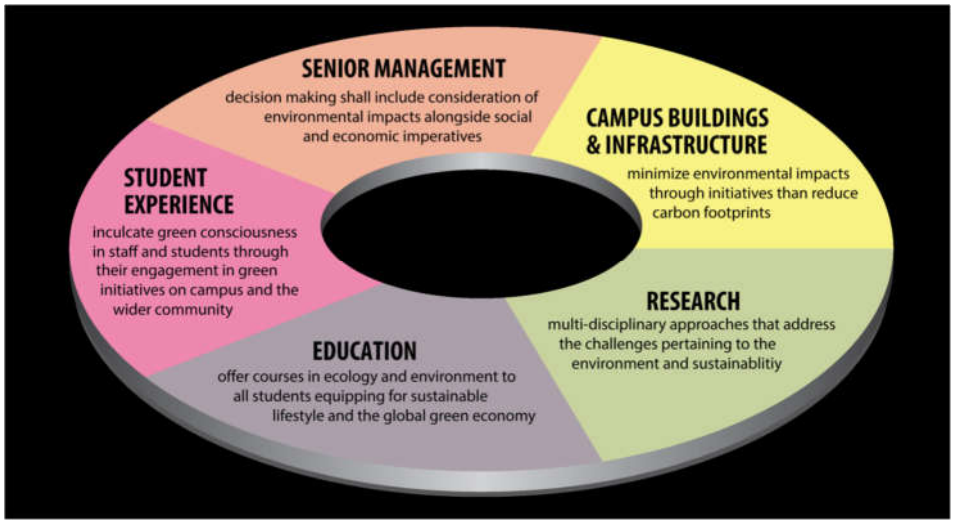


Figure 1. Shift in the mindset of the stakeholders involed in the university administration, teaching and research

2.4 Seven Steps Approach

Following the adoption of the UMS EcoCampus Blueprint in 2013, UMS has taken seven steps to implement the action plan by engaging various stakeholders.

Step 1: Establish an EcoCampus Management Centre supported by various Green Committees

This is the heart of the UMS EcoCampus. The EMC is supported by eight committees. The centre and committee members consist of academic and non-academic staff who are responsible for making recommendations to relevant decision-makers, organizing, directing and coordinating activities on campus as well as outreach programs outside the campus.

Step 2: Adopt an Environmental Vision Statement

All faculty, institute, department and administrative section are required to determine and implement their key initiatives based on the University key performance indicators stated in the UMS strategic plan. To enhance the ownership, each of the faculty, institute, department and administrative section of the university is also encourage to make a greening pledge by adopting its own vision statement and setting its own key performance indicators.

Step 3: Conduct an Environmental Audit

To identify priorities for action, each faculty, institute, department and administrative section of the university work closely with EMC and UMS Development and Maintenance Department to conduct a review of their section's environmental impact audit.

Step 4: Create and review the EcoCampus Action Plan

The results of the environmental audit are used to identify priorities of the key areas where each faculty, institute, department and administrative section is committed to make changes by creating a realistic and achievable action plan and reviewing it from time to time to ensure tangible accomplishments in the short term and long-term impacts.

Step 5: Monitor and Evaluate Progress

The EMC and green committees assist with monitoring and evaluating progress on the priorities in the action plan. This involves conducting an annual environmental audit to monitor the levels of waste, recycling, energy use, purchases of environmentally-friendly products, and financial savings or costs. Positive outcomes and improvements can act as huge motivators for the campus community to continue with the greening efforts.

Step 6: Integrate Greening Principles into the Curriculum and Co-curriculum
Greening concepts and environmental principles are encouraged to be integrated into existing curricula in science, art, humanities, math, language arts, or other disciplines currently offered at UMS. Furthermore, there is a proposal to offer environmental sustainability course as a compulsory subject to all UMS students. Where environmental education is not part of the regular curriculum, recommendations are made by the Green Committee as to how these themes can be incorporated.

Step 7: Inform, Involve, and Celebrate Greening Achievements
The university must not only be seen to practice green activities but also celebrate their success. Honoring, celebrating, and communicating achievements are critical components of a Green University. Greening programs often help to unify the whole campus community and strengthen inter-departmental relations. Communication, publicity and collaboration programs keep the university and the community informed.

3. Summary
The university community plays a meaningful role in improving the acceptance of sustainable solutions. The changes in mindset among the university communities will be evident from their actions. Mindset change allows the UMS community as a whole to become the agent for change towards a sustainable future. It is our wish that the UMS staff and students could be proud ambassadors of "the practice of what they preach" on campus.

References
[1] Universiti Malaysia Sabah, 2013. *Universiti Malaysia Sabah Strategic Plan 2013-2017: Sustaining Excellence Towards International Prominance*. Kota Kinabalu, Universiti Malaysia Sabah.
[2] Mohd Harun Abdullah, 2014. *Ecocampus UMS:Menjunjung Ilmu Melestari Alam*. Kota Kinabalu, Universiti Malaysia Sabah.
[3] UI GreenMetric World University Ranking (2016). Overall ranking 2016. Available online at http://greenmetric.ui.ac.id/overall-ranking-2016/. Acessed on 17 March 2017.
[4] United Nation Commission on Environment and Development (1987). Our Common Future, Report of the World Commission on Environment and Development (Brundtland Report). Available online at http://www.un-documents.net/our-common-future.pdf. Acessed on 17 March 2017.
[5] Universiti Malaysia Sabah, 2013. *UMS EcoCampus Blueprint: Transforming Ideas into Reality*. Kota Kinabalu, Universiti Malaysia Sabah.
[6] Universiti Malaysia Sabah, 2016. *UMS Ecocampus Plan 2015-2020: Transforming Ideas Into Reality*. Kota Kinabalu, Universiti Malaysia Sabah.
[7] Rosazman Hussin and Velan Kunjuraman, 2015. Exploring strategies for sustainable 'ecocampus': the experience of Universiti Malaysia Sabah. *Geografia: Malaysian Journal of Society and Space*, 11 (3). pp. 84-96.
[8] Talloires Declaration, 1990 Available online at http://ulsf.org/talloires-declaration/. Acessed on 17 March 2017.
[9] Sapporo Sustainability Declaration 2008. Available online at http://www.engagement.illinois.edu/globalsummit2012/PDFs/All_Declarations.pdf. Acessed on 17 March 2017.
[10] Orr, D. W. 2004. Earth in Mind: On Education, Environment, and the Human Prospect, 2 nd edition. Island Press: Washington

The 3rd International Workshop on UI GreenMetric
Istanbul, Turkey, 09 - 10 April 2017

On the Road to Green Campus-Experience of Da-Yeh University

Jerry J. R. Ou[a], Yi-Ching Chen*[b]
Da-Yeh University, No.168, University Rd., Dacun, Changhua 51591, Taiwan(R.O.C.)
[a] president@mail.dyu.edu.tw, [b] yiching@mail.dyu.edu.tw

Abstract. DYU has done to shape a multiple environmental quality aspects with good mountains, good water, and good life. Following the concepts of green university, DYU develop its own blueprint of sustainable management strategies for school development. The trilogy, such as green ecological construction, green life management, and green courses and experience is the major category for long-term developing. DYU has done a series reduction operation to achieve electricity and water conservation, as well as transportation management, for a large campus of more than 12,000 members, however, without lowering down quality of campus life. Also, the certifications of ISO14001 environmental management system and ISO50001 energy management system can prove the well performance of this green campus. DYU recognizes that creating a sustainable campus can actually strengthen its core research and teaching mission as the result of reaching the road of green.

Keywords: DYU (Da-Yeh University), green university, electricity and water conservation, ISO14001, ISO50001, sustainable campus

1. Introduction

For Da-Yeh University (DYU), the green concept was initiated by the facts that reducing the massive resources used, such as electricity, water, oil and others during the operation. However, those green operation can also reduce the adverse effects on the campus environments. The concepts of sustainable development as well as environmental protection then were assimilated into the university's education. The development of green campus can actually enhance the environmental awareness of all students and staffs in University.

The Talloires Declaration [1] shows that the key role and urgency of the institutions of higher education for environmental protection and sustainable development. The university has to play an important role to pursuit a sustainable environment in the past, present and future. *"Universities have a major role in the education, research, policy formation, and information exchange necessary to make these goals possible. Thus, university leaders must initiate and support mobilization of internal and external resources so that their institutions respond to this urgent challenge."*
It is grateful that the GreenMetric World University Ranking[2] can recognize DYU as 48th place in the world and the 2nd place in Taiwan in 2016. The reason is that DYU has a unique green campus environment with 82.7% green coverage area (shown as Figure 1), and the environmental education and sustainable development are promoted with long-term investment by all staffs and students.

2. The Sustainable Management Strategy

2.1 Trilogy of Green Thinking Blueprint

While the university is in operation more than 27 years with 12,350 students and staffs now, it cannot be avoided that massive resources are used and large amounts of waste are produced. These substances will eventually become environmental problems for the campus and neighboring communities. Therefore, DYU has to solve these environmental problems and reduce the impacts. In fact, those are the most basic problems happened for all green universities to solve at the early stage. The environmental actions therefore appear in demand.[3]
Following the concepts of green university, DYU develop its own blueprint of sustainable management strategies for school development. The trilogy (shown as Figure 2), such as green ecological construction, green life management, and green courses and experience is the major category for long-term developing.

Figure 1. The 82.7% green coverage area of campus in DYU

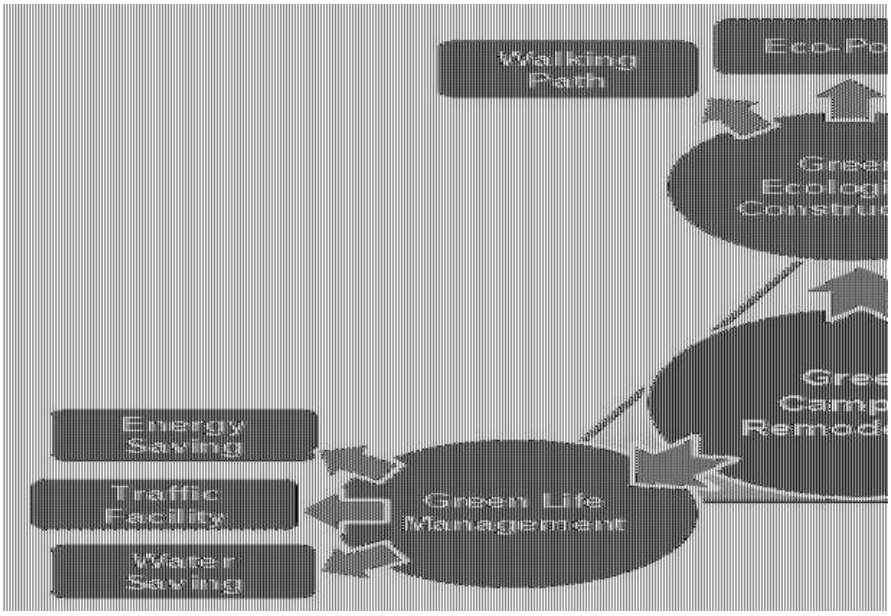


Figure 2. Blueprint of green campus in DYU

(1) Highlight the healthy campus with ecological environment
- Ecological mountain trail in campus
- Landscape ecological pool
- Environmental interpretation system in campus
- Sustainable environmental education

(2) Promote the campus energy saving and carbon reduction system
- A sustainable environment system
- A sustainable environmental management
- Green procurement
- Waste management

(3) Create a friendly and barrier-free campus
- Comfortable and convenient six-vehicle traffic network
- Build a barrier-free campus environment

(4) Sustainable and security campus network
- Promoting the campus environment to enhance safety and health
- Strengthen the waste management operations in laboratories

2.2 Prospects for Sustainable School Development

In 1996, Australian scholar Dyer, C. argued that schools should develop specialized disciplines of environmental education and embody a comprehensive concept of environmental sustainability into all courses and campus lives [4]. These views emphasize the relationship and importance of education and environmental protection. In general, the development of green universities began with a variety of management strategies to protect the environment, and later gradually extended to the development of environmental education to enhance the environmental awareness of all people, the concept of sustainable development and environmental protection into the university. It should be the basic functions of higher education. In addition, universities should constantly examine their own internal management and external environment and develop improvement strategies and action programs. Ultimately school can reduce the impacts to the campus environment and the advantages can feedback to the community and society.

Bekessy *et al.* (2003) [5] also emphasized that schools often create decision-makers, managers and teachers in many societies in future and schools have an unavoidable influence on the overall direction of social development. Therefore, when human beings face major environmental problems, implementation of environmental education in university is more important.

The school, DYU, has its own long-term framework (shown as Figure 3) for sustainable school development by committee of sustainable development directed by president and well-literacy members. Also, the certifications of ISO14001 environmental management system and ISO50001 energy management system can prove the well performance of this framework.

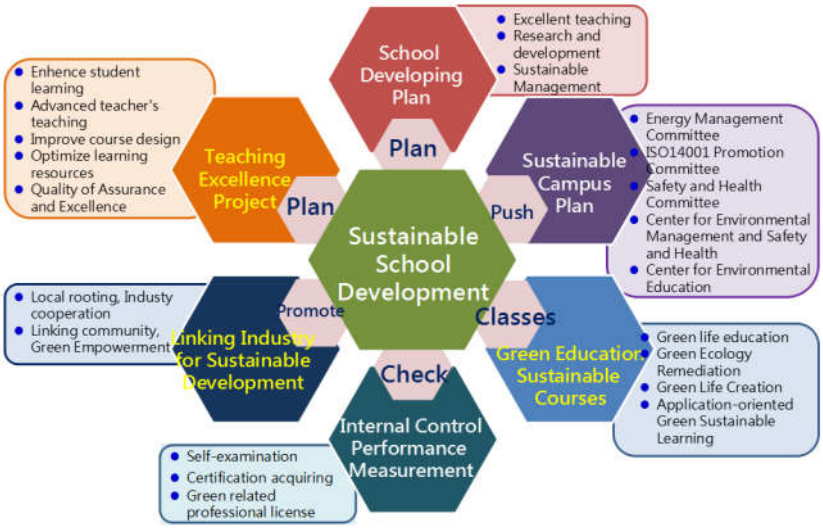
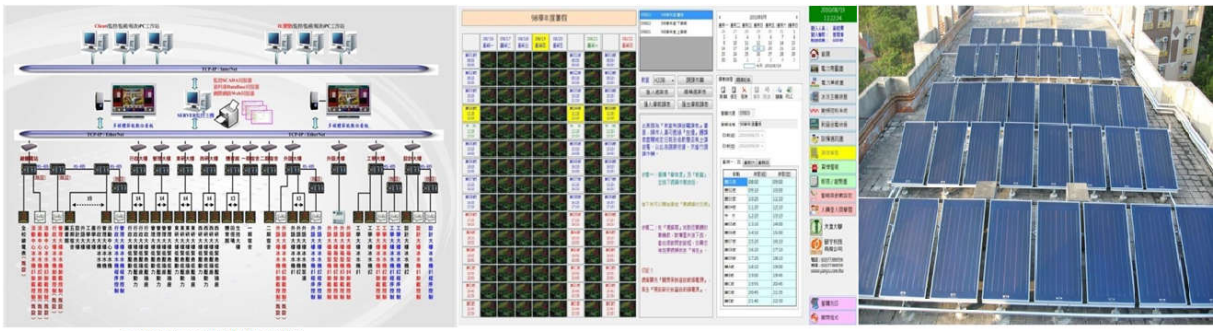


Figure 3. The framework of sustainable school development for DYU

3. The Achievements of Green Campus in DYU

3.1 Energy Saving Performance

The electricity and water are major consumption for a large campus with more than 12,000 members. It needs a series reduction operation to achieve, however, without lowering down quality of campus life. Several facilities have been accomplished, such as campus energy monitoring system, intelligent air conditioning management system for large building, automatic electricity scheduling system for classrooms, solar hot water system for dormitory, LED lighting replacement for public area of building, and library building energy saving (thermal buoyancy system, intelligent sensing system at book area), etc (shown as Figure 4). The accomplishment of electricity conservation is listed on Table 1within 2014~2016. The EUI performance of 74.9 is excellent compared with average of 98.2 for all universities in Taiwan. The average electricity consumption per person performance of 1,208 kW-hr is also much lower compared with average of 1,890 kW-hr in Taiwan population.



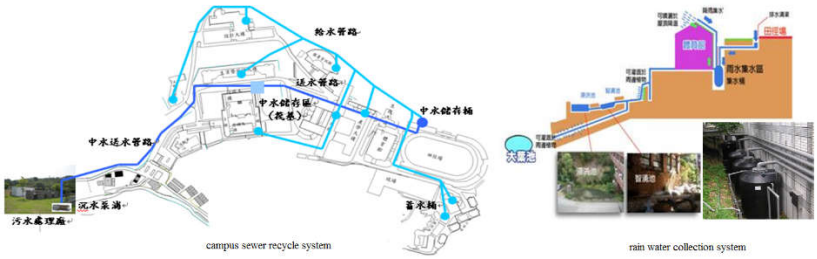
campus energy monitoring system | automatic electricity scheduling system for classrooms | solar hot water system for dormitory

Figure 4. Examples of energy saving facilities in DYU

Table 1. Accomplishment of electricity conservation in DYU, 2014-2016

Calendar year	2014	2015	2016
Total student/staff	12,211	12,474	12,351
Total floor area (m^2)	199,102	199,102	199,102
Annual Electricity Consumption (kW-hr)	14,353,600	14,773,200	14,924,351
Reduced Rate compared with 2013	3.25%	2.84%	1.02%
Electric Use Intensity (kW/m^2)	72.1	74.2	74.9
Average Electricity Consumption Per Person (kW-hr/ca)	1,176	1,184	1,208

Also, the accomplishment of water conservation has extremely performing to reach 10.5% reduction with campus water monitoring system, rain water collection system, sewer recycle system, and water saving equipments, etc. (shown as Figure 5) The average water consumption per person performance of 11.3 ton is also much lower compared with average of 39.4 ton for all universities in Taiwan. (listed on Table 2)



campus sewer recycle system | rain water collection system

Figure 5. Examples of water conservation facilities in DYU

Table 2. Accomplishment of water conservation in DYU, 2014-2016

Calendar year	2014	2015	2016
Total student/staff	12,211	12,474	12,351
Total water consumption (ton)	153,639	145,027	140,016
Rate of Conservation compared with 2013	1.8%	7.9%	10.5%
Annual average water consumption per person (ton/ca)	12.8	12.1	11.3

3.2 Waste Management Performance

Garbage produced and wastewater treatment need to be mostly concerned to reach the road green campus. The resource recycled has been done in good condition to get almost 35% accomplishment. (listed on Table 3) However, there is still a goal to reach compared with the whole average recycle rate of 55% in Taiwan.

Table 3. Accomplishment of garbage produced and recycle in DYU, 2014-2016

Calendar year	2014	2015	2016
Total student/staff	12,211	12,474	12,351
Total amount of garbage (kg)	247,220	282,810	277,130
Average amount of garbage produced per person (kg/ca)	20.25	22.67	22.44
Total amount of recycled garbage (kg)	98,871	95,324	96,763
Rate of Recycle	39.99%	33.71%	34.92%

The school installed a MBR wastewater treatment system in 2006 with the capacity of treating1,200 tons of wastewater per day. However, the waste water produce in campus is only 600 ton per day and almost 300 ton high quality recycled effluent water is used for toilet flushing and lawn watering. The effuent water, with removal rate of 94% BOD, 83% COD and 98% SS, has always fulfilled the requirements established by the Taiwan EPA criteria.

3.3 Transportation Management Performance

DYU is located at foot of Ba-Gua Mountain. The road condition is actually not good in country area. Motorcycle is most common transportation vehicle for students. The accidental events happen very often. For the sake of traffic safety and green transportation, DYU has provided students and university staff with a safe, comfortable and convenient six-vehicle transportation network system (shown as Figure 6) including shuttle bus service from Taichung High Speed Rail station, local bus service in Yuanlin area, contracted school bus system, off-campus shuttle bus network, campus shuttle bus service, and contracted taxi service. The capacity and green effect are list on Table 4.

Figure 6. Six-vehicle transportation network system in DYU

Table 4. The capacity and green effect for six-vehicle transportation network system

Calendar year	2014	2015	2016
Total user (person time)	858,568	886,365	999,530
CO_2 Reduction (kg)	525,614	542,631	611,910

3.4 Teaching Excellence Performance

The purpose of the subprogram in Teaching Excellence Project supported by Ministry of Education is to promote the green and sustainable concept of curriculum planning. DYU encourages different areas of teaching with the relevant issues to teach, design environmental issues and problem based learning. Therefore, the social context can be connected and the green life education connotation can be implemented. In the general curriculum, a large number of planning related topics, such as: energy technology and environmental sustainability, people and the environment, marine and human

sustainable development, natural ecology and life education are planned. Through the concepts of environmental sustainability are established for students, the corporate social responsibility is promoted and a responsible global citizen is expected.

4. Summary

DYU has done to shape a multiple environmental quality aspects with good mountains, good water, and good life. However, we still believe that DYU has a special role and a special responsibility to confront the challenge of climate change by reducing campus greenhouse gas emissions by the maximum practicable rate. Challenge of reducing energy and emissions remains one of the university's top priorities, and we will continue to meet this goal through best-in-class innovations in energy efficiency and energy management. DYU recognizes that creating a sustainable campus can actually strengthen its core research and teaching mission. Therefore, it is the road to green campus we have to reach without regret.

Acknowledgement

The authors would like to thank UI GreenMetric for inviting the 3rd International Workshop. DYU has participated this evaluation of Green University since 2011 and got honors for several years. We still have to make more progress in all aspects of green and we will be glad to share the experience on the road to sustainable campus.

References

[1] The Association of University Leaders for a Sustainable Future (ULSF), 2009. Talloires Declaration. http://ulsf.org/talloires-declaration/, accessed on 5, March, 2017
[2] Universitas Indonesia, 2016. UI GreenMetric. http://greenmetric.ui.ac.id/, accessed on 5, March, 2017
[3] Bartlett, P. F., Chase, G. W., 2004. Sustainability on Campus: Stories and Strategies for Change. Cambridge, Mass: MIT Press.
[4] Dyer, C. 1996. Moving from Rhetoric to Reality: An Initial Exploration of Theories and Approaches to Curriculum Greening Appropriate to the Faculty of Environmental Design and Construction, RMIT University, Melbourne.
[5] Bekessy, S., Burgman, M.., Wright, T., Filho, W., Smith, M., 2003. Universities and sustainability, Tela Papers, No. 11, Australian Conservation Foundation, Melbourne.

Appendix

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 degree in metallurgy from School of Materials, University of Sheffield, UK. Muhammad Anis has held various position 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 (2000-2007). He was Universitas Indonesia's Director of Education for the terms 2003-2007 and was appointed Vice Rector for the Term 2007-2012. In 2003, he was appointed as Interim Rector of Universitas Indonesia.

Prof. Dr. Mahmut ÖZER
Rector of Bülent Ecevit University

Dr. Mahmut Ozer graduated from Istanbul Technical University, Department of Electronics and Communication Engineering (1992). He completed his Masters and Ph.D. degrees in 1996 and 2001 respectively at Karadeniz Technical University, Institute of Science, Electronics Engineering Department. Between 1992-1994, he served as Electronic Engineer at Dalaman Airport, General Directorate of State Airports Authority. Then, between 1994-2002, he worked as an Instructor in Gazi Osmanpaşa University Tokat Vocational School Electrical Program. In July 2002, he started to work as an assistant professor in the Department of Electrical and Electronics Engineering at Zonguldak Karaelmas University Engineering Faculty. Özer, who was appointed Professor as of July 2010, has been serving as the Rector of Bülent Ecevit University since 28.11.2010. In addition, Özer, who is the Vice President of the Vocational Qualifications Authority (MYK), has so far provided consulting services to 24 master's theses
Between the dates August 1, 2015 and August 1, 2016, he was the President of the Interuniversity Council (UCU). He is the editor-in-chief of the Turkish Journal of Electrical Engineering & Computer Sciences published by the Scientific and Technical Research Council of Turkey (TUBITAK). He is currently President of the Association of Quality Assurance Agencies of the Islamic World (AQAAIW), General Assembly Membiñer of the Turkish Standards Institute (TSE), and President of the West Black Sea Development Agency (BAKKA) Development Council. Mahmut Özer is married and has 3 children.
Prof. Dr Mahmut Ozer graduated from Istanbul Technical University, Department of Electronics and Communication Engineering (1992). He completed his Masters and Ph.D. degrees in 1996 and 2001 respectively at Karadeniz Technical University, Institute of Science, Electronics Engineering Department. Between 1992-1994, he served as Electronic Engineer at Dalaman Airport, General Directorate of State Airports Authority. Then, between 1994-2002, he worked as an Instructor in Gazi Osmanpaşa University Tokat Vocational School Electrical Program. Özer, who was appointed Professor as of July 2010, has been serving as the Rector of Bülent Ecevit University since 28.11.2010. In addition, Özer is the Vice President of the Vocational Qualifications Authority (MYK). He is the editor-in-chief of the Turkish Journal of Electrical Engineering & Computer Sciences published by the Scientific and Technical Research Council of Turkey (TUBITAK). He is currently President of the Association of Quality Assurance Agencies of the Islamic World (AQAAIW), General Assembly Membiñer of the Turkish Standards Institute (TSE), and President of the West Black Sea Development Agency (BAKKA) Development Council.

Prof. Dr. Mahmut AK
Rector of Istanbul University

Prof. Dr. Mahmud AK is the Rector of Istanbul University since 2015. Previously he was the Vice Rector, Chair of History, and also serves as a member and/or chair of various commissions affiliated to the Istanbul Universty. He gained his BA in History- Istanbul University-1987, MA in History of Early Modern Period- Istanbul University-1990, and PhD in History of Early Modern Period - Istanbul University.

Dato' Professor Dr. Daing Mohd Nasir bin Daing Ibrahim
Vice-Chancellor of Universiti Malaysia Pahang, Malaysia

Dato' Professor Dr. Daing Mohd Nasir bin Daing Ibrahim, as Vice-Chancellor of Universiti Malaysia Pahang since on 16 May, 2008, graduated with a Bachelor of Business Administration from Western Michigan University in 1981 and subsequently obtained his MBA from University of Arkansas in 1983 and Doctor of Philosophy from the University of Dundee in 1992. He has a CPA (Australia), Chartered Accountant (Malaysia) and a FCPA (Australia). He received the 2010 AGBA Lifetime Achievement Award for Contribution in the advancement of Management Education and Scholarship in Accounting, recognized at the 7th at the Academy for Global Business Advancement (AGBA) World Congree, 1-3 Dec 2010, Putrajaya, Malaysia.

Professor Dr Prasart Suebka
Rector of Suranaree University of Technology, Thailand

Professor Dr Prasart Suebka received his PhD in Physics from Arizona State University, Tempe, USA, and attended the National Defense College of Thailand in 1999. For almost 12 years, he has been the Rector of Suranaree University of Technology (SUT), Nakhon Ratchasima, Thailand. His leadership at SUT earned him 'The Best Chief Executive Officer of Academic Institution for Cooperative Education in Thailand' Award in 2010 and 2011 from the Ministry of Education, and has brought 'Thailand's No. 1 in Physics' status to SUT. Outside SUT, he served the Thai education in various capacities, such as the President of Association of Universities of Asia and the Pacific (AUAP), President of the Council of University Presidents of Thailand (CUPT), President of the University Sports Board of Thailand (USBT), as well as a member of the Senate, Thailand. Currently, his other key positions are Executive Board Member of Thailand's Synchrotron Light Research Institute (SLRI) and Advisor for the National Olympic Committee, to name a few.

Prof. Bahram Maleki
Representative of Rector of University of Zanjan, Iran

Prof. Bahram Maleki is Associate professor of University of Zanjan, Iran. He graduated from Zanjan University, Iran majoring in Agronomy and plant Breeding in 1992. He continued his master's degrees in Tehran University, Iran majoring Plant Breeeding in 1995. He got PhD in Indian Agricultural Research Institute, New Delhi India majoring Agronomy and plant Breeding in 1999-2004. He had been Head of Department of Genetic and Plant Breeding, Zanjan Univ., in 1995-1999, Deputy of Research-Science Faculty 2004 - 2009. Then, Vice President of Administrative and Financial Affairs, University of Zanjan, Zanjan, Iran.

Prof. Marcelo Bregagnoli
Rector of Instituto Federal de Educação, Ciência e Tecnologia do Sul de Minas (IFSULDEMINAS), Brazil

Professor Marcelo Bregagnoli is the rector of the Federal Institute of Education, Science and Technology of the South of Minas Gerais. He is a Member of the Board of Trustees of UNIFAL (holder), Board member of FIEMG (Alternate), Councilor of CPPG - Permanent Committee of Planning and Management of the Federal Network of Professional, Scientific and Technological Education (alternate), Adviser of ANATER - National Agency for

Assistance of Technician and Rural Extension (alternate) PhD in Phytotechnology by the University of São Paulo (USP), master in Phytotechnology by the Federal Rural University of Rio de Janeiro (UFRRJ). He holds a degree in Agricultural Sciences from the Federal Rural University of Rio de Janeiro (UFRRJ). Agricultural Technician by the Federal Institute of the South of Minas - Campus Muzambinho. He is still a Coordinator of the Brazilian Agricultural Olympiad (OBAP), being the mentor at the International Earth Science Olympiad (IESO) in 2014 in Spain. He was the coordinator of the Graduate Course in Sustainable Coffee Growing at IFSULDEMINAS-Campus Muzambinho, where he has been working since 1996 and currently teaches Water and Soil Conservation in the Agronomic Engineering course. Has experience in Education, with emphasis on Vocational Education and publications on the following themes: annual crops, coffee, fertility and sustainability. Member of the CONIF Field Education Chamber.

Dr. Yuhlong Oliver Su
President, National Chi Nan University, Taiwan

Dr. Yuhlong Oliver Su graduated with a bachelor's degree in Chemistry from National Taiwan University Taiwan. He hold a master's degree in Chemistry from National Taiwan Normal University. Dr. Yuhlong Oliver Su was a Vice President at the National Chung Hsing University in 2010-2011. He completed his PhD from Ohio State University, USA. He got Research Associate from Princeton University, USA. Since 1998 until now, he is Professor in Department of Applied Chemistry, National Chi Nan University, Taiwan.

Mr. Satya Saran
Representative of President, Institute for Financial Management and Research, India

Mr. Satya Saran is a Chief, Projects and Administration of Institute for Financial Management & Research (IFMR). He had studied in Indian Institute of Management, Ahmedabad Business Administration and Management in 2013 – 2014, in Logistics Management of College of Defence Mangement, Secunderabad in 2009, and Police Duties and Security Management of Corps of Military Police Centre & School, Bangalore in 2009.

Prof. Dr. Ir. Tommy Ilyas, M.Eng.
Representative of Rector, University of Indonesia, Indonesia

Prof. Dr. Ir. Tommy Ilyas, M.Eng is a expert member in UI GreenMetric. He graduated with his bachelor's degree from Engineering of Universitas Indonesia in 1977. He received a master's degree in the field Geotechnic from Sheffield University (UK) in 1983. He completed his doctor's degree from Universitas Indonesia with Natioanl University of Singapore in 2002. He Inaugurated as Professor of Universitas Indonesia in 2006.

Jose Herney Ramirez Franco
Representative of Rector, Universidad Nacional de Colombia, Colombia

Jose Herney Ramirez Franco is Associate professor at Chemical Engineering Department, Engineering Faculty, Universidad Nacional de Colombia. His research areas are in development, preparation, characterization and application of new materials based on clays, coals zeolites and silicas, and synthesis and use of these materials in the treatment of waste water. He received his bachelor's degree in Chemical Engineering from National University of Colombia, Colombia in 1998. He continued his magister in Chemical Engineering. São Paulo University, São Paulo – Brazil in 2003. He completed his Doctoral's degree in Chemical Engineering, Oporto University. Porto – Portugal in 2008.

Dr. Amin Yousef M. Noaman,
Vice President for Development, King Abdulaziz University, Saudi Arabia

Dr. Amin Noaman holds the position of Vice President for Development at King Abdulaziz University, Saudi Arabia. He is a computer science enthusiast and an IT consultant for many companies and organizations. He's also an SAP certified consultant and a BVQI certified auditor. He has taught various courses in computer science and information system. Now he is teaching a graduate course in Advance Database Systems at King Abdulaziz University. Furthermore, he has developed curriculums of Computer Science and Information Technology for many colleges. He also has published a set of papers in journals and conferences.
Having spent so many years in academia, he has been honored five timesamong which are the Faculty of Science and Fellowship, both from the University of Manitoba; also the distinction award in Teaching from King Abdulaziz University. Along with 30 years of experience, Dr. Noaman holds a Ph.D. in Data Warehousing from the University of Manitoba in 1999.

Dr. Jamal Abu-Ashour,
Representative of Rector, Jordan University of Science & Technology, Jordan

Dr. Jamal Abu-Ashour is an Associate professor of Jordan University of Science And Technology, Jordan since 2004 until now. He graduated with a bachelor's degree from the Civil Engineering from the Yarmouk University, 1986. He got his master's degree in Civil Engineering from the Jordan University of Science And Technology, 1990. Then, He completed his Ph.D. in Civil Engineering from the University of Guelph in 1994.

Prof. Okid Parama Astirin
Representative of Rector, Universitas Sebelas Maret, Indonesia

Prof. Okid Parama Astirin is a lecturer in Biology of Universitas Sebelas Maret in 1997-now, Asesor Biology of BAN-PT in 2010 - now, and staff research of PPLH-LPPM-UNS in 2006 – now. She received his bachelor's degree in Biology from Universitas Gadjah Mada Yogyakarta in 1980-1985. She continued his magister in Biology from Universitas Gadjah Mada Yogyakarta in 1988-1991. She completed his Doctoral's degree in Biotechnology at Universitas Brawijaya, Malang in 2002-2006.

Prof. Ir. Joni Hermana, M.Sc.ES. Ph.D
Rector, Institut Teknologi Sepuluh November

Prof. Ir. Joni Hermana, M.Sc.ES. Ph.D graduated with his bachelor's degree from Environmental Engineering at the Institute of Technology Bandung (ITB) in 1986. He received Master of Science on Environmental Sanitation from the University of Ghent, Belgium in 1991. He completed his doctor's degree from the Philosophy Department on Environmental Engineering from University of Newcastle Upon Tyne, United Kingdom in 1997.

Prof. Dr. Fathur Rokhman, M.Hum
Rector, Universitas Negeri Semarang

Prof. Dr. Fathur Rokhman, M.Hum received his bachelor's degree from Education Program of the Indonesia Language of IKIP Bandung, 1990. He continued his magister in Linguistic at the University of Indonesia, in 1996, and he received a Specialist Certificate in Language Curriculum and Material Development (RELC Singapore), 1998. He completed his Doctoral's degree in Linguistic at the Universitas Gadjah Mada, Jogjakarta, in 2003.

Jenny Andrea Diaz Pulido

Representative of Rector, Universidad del Rosario, Colombia

Jenny Andrea Diaz Pulido is Senior Sustainability Specialist of **Universidad del Rosario, Colombia in** October 2011 – present**.** Experienced sustainability and corporate social responsibility lead with expertise in managing social risk and integrating environmental and social impacts for growth and profitability. Skilled in orchestrating change using systems thinking and is driven by connecting cross-functional projects and teams to create strategic sustainability initiatives and acheive broader business objectives. She received his bachelor's degree in Environmental Engineer from Universidad Central in 2007. She got Specialist in environmental impact assessment from Universidad Jorge Tadeo Lozano in 2009. She continued her magister in Environmental Management of Universidad de los Andes in 2017.

Prof. Dr. Ir. Ambariyanto, M.Sc
Representative of Rector, Universitas Diponegoro, Indonesia

Prof. Dr. Ir Ambariyanto MSc., is Vice Rector for Research and Innovation Diponegoro University and a Professor at the Faculty of Fisheries and Marine Sciences of Diponegoro University. He received his bachelor's degree from Department of Fisheries, Faculty of Animal Husbandry of Diponegoro University in 1986. His Master's degree in Ocean Sciences gained at the University of Wales in 1990. He achieved a Ph.D. in Marine Ecology at the University of Sydney, Sydney, Australia in 1996. He completed his Postdoctoral at the University of Sydney in 1997.

Dr. Yi-Ching Chen
Representative of President, Da-Yeh University, Taiwan

Dr. Yi-Ching Chen is Head of Dept. of Environmental Engineering and Director of Environmental Education Center at the Da-Yeh University. He completed his Ph.D. in Dept. of Civil & Environmental Engineering, from Clarkson, USA. He was Associate Professor, Da-Yeh University and Hydraulic Professional Engineer (Taiwan). He received the Annual Outstanding Teacher in Contribution of Environmental Protection in 2009 (EPA & Ministry of Education, Taiwan), Excellent Course Project for General Education in 2010 (Ministry of Education, Taiwan) and Annual Teaching Excellence Professor in 2011 (Da-Yeh University).

Dr. Ir. Yusli Wardiatno, M.Sc.
Representative of Rector, Bogor Agricultural University, Indonesia

Dr. Ir. Yusli Wardiatno, M.Sc. is Director of Business Development of Bogor Agricultural University, Indonesia. He works in Department of Aquatic Resources Management, Faculty of Fisheries and Marine Science of Bogor Agricultural University. His field specialization is in Benthic ecology. He got his bachelor's degree in Aquatic Resources Management at the Bogor Agricultural University in 1990. He continued his magister in Marine Science at the Aarhus University, Denmark in 1996. He completed his doctoral's degree in Marine Science at the Nagasaki University, Jepang in 2002.

Dr. Chang Hsien Tai
President, National Pingtung University of Science and Technology (NPUST), Taiwan

Dr. Chang Hsien Tai is Academic Vice President, NPUST, Taiwan, since 2006. In 2002-2006, he is the Dean at the Institute of Technology (NPUST), Taiwan. He worked on the development of CFD algorithm and its applications, Design of wind power system/ hybrid power system, and Shock interaction and its applications. He got his bachelor's degree from the Dept. of Mechanics Engineering, Chung-Cheng Institute of Technology, Taiwan in 1979. He completed his Master's degree in Dept. of Mechanics Engineering, National Taiwan University, Taiwan and in Dept. of Aerospace Engineering, University of Michigan,

USA. In 1990 he acquired a PhD at the Dept. of Aerospace Engineering, University of Michigan, USA.

Dr.Sc. Econ, Margarita Redina
Representative of Rector, Peoples' Friendship University of Russia (RUDN-University)

Dr.Sc. Econ, Margarita Redina is Dean of the Ecological Faculty of RUDN-University. She received master of ecology and nature management in ecological faculty of PFUR in 1999. She got doctor of Economics, associate Professor (dissertation for the degree of doctor of economic Sciences, specialty "Economics and management of national economy (environmental Economics) "Methodological principles of ensuring ecological and economic sustainability of oil and gas companies" in 2012. She have experience in scientific projects on geoecology, nature management, environmental economics, environmental regulation, IT for environmental safety, environmental education and Successfully partnership with companies of oil and gas sector (more than 15 projects). She is Author of more than 180 publications (incl. cited in the international citation bases), including more than 20 monographs and textbooks for higher education and certificates of authorship.

Asst. Prof. Dr. Sefa Kocabaş
Representative of Rector, Bulent Ecevit University, Turkey

Asst. Prof. Dr. Sefa Kocabaş is Assistant Professor of Bülent Ecevit University, in 2007-now. He was Specialist of Chemistry Department in Bülent Ecevit University in 1996-2007 and Head of Bülent Ecevit University Devrek Vocational School, 2011- 2015. He have experience in Carbon Footprint, Global Warming, Environmental Management, Adsorbent Characterization and Modifications, Pollution Control. He graduated with a bachelor's degree in Environmental Engineering from 19 Mayis University in 1994. He got his master's degree in Chemistry from Bülent Ecevit University in 2000. He completed his Ph.D. in Physical Chemistry at the Bülent Ecevit University in 2006.

Dr. Noor Al-Kharabsheh
Representative of Rector, Al-Balqa Applied University(BAU) Jordan

Dr. Noor Al-Kharabsheh are an Assistant Professor of Hydrogeology/Hydrogeological Engineering, Water protection and Quality, and Environment (Feb. 2016-current) and Director of the International Research Center for Water, Environment, and Energy (IRCWEE) at Al-Balqa' Applied University (Oct. 2016-current). He got his bachelor's degree in Water Resources and Department of Water Environmental Resources and Environment Management, Management, Al-Balqa' Applied (Agricultural Eng.). University, Al-Salt – Jordan in 2004-2006. He continued his magister in Water Resources and Department of Water Environmental Resources and Environment Management, Management, Al-Balqa' Applied Hydrochemistry University, Al-Salt - Jordan. (Agricultural Eng.) in 2006-2009. He completed his PhD in Engineering Department of Engineering Sciences/Hydrogeological Geology and Hydrogeology, Engineering RWTH Aachen University (LIH), in 2011-2015.

Prof. Patricia Iglecias
Representative of President, USP - University of Sao Paulo

Associate Professor, Department of Civil Law, USP Law School (2011), PhD (2007) and a Master's degree (2002) by the same institution. Advisor of the master's and doctorate courses at the Faculty of Law of USP and PROCAM Environmental Science Program of USP. Currently, she is Superintendent of Environmental Management at USP and a leading researcher at the Environmental Applied Studies Group: preventive and reparative damages (USP), registered at CNPq. Main areas of activity: sustainable consumption; reverse logistic; Solid wastes and post-consumer liability; Shared responsibility; Causal link; Contaminated

areas; Civil liability for damages to the environment; environmental compensation . Lecturer in Brazil and abroad, has several published works, highlighting the book & quot; Solid waste and post-consumer civil liability, "by Editora Revista dos Tribunais. Vice President for the Southeast Region of the Institute The Right for a Green Planet. Member of the Association of Teachers of Environmental Law of Brazil APRODAB. Member of CErSOL. Multidisciplinary Center for Studies on Solid Waste at USP. Member of the European Environmental Law Association. She was Secretary of State for the Environment of São Paulo.

Dr. How Siew Eng,
Representative of Rector, Universiti Malaysia Sabah, Malaysia

Dr. How Siew Eng is Associate Professor and Director, Centre for EcoCampus Management of Universiti Malaysia Sabah at Kota Kinabalu. She graduated with a bachelor's degree from Combinatorial Chemistry / Natural Product Chemistry of Universiti Malaysia Sabah. She got Master from University of Science, Malaysia. Then, she completed her Ph.D. in Southampton.

Prof. Dr. Ir. Riri Fitri Sari MM MSc
Chairperson of UI GreenMetric

Riri Fitri Sari is a professor of Computer Engineering at Electrical Engineering Departement, Faculty of Engineering, Universitas Indonesia (UI). She holds 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 from the Universitas Indonesia to rank universities worldwide based on their green campus and sustainability programs. Since September 2015, she has been appointed a member of Special Task Force for Improving Indonesia Universities Academic Reputation for the Ministry of Research and Higher Education.

Ms. Estelle S. Davutoğlu
Founding Coordinator
Department of International Entrepreneurship, TOBB University of Economics and Technology-Ankara, Turkey

Ms Estelle Davutoglu is a University Representative for External Relations and Internationalization, and Coordinator of Department of International Enterpreneurship, TOBB University of Economy and Technology, Ankara, Turkey . She has an MBA in Educational management from University of Leicester and is currently doing a PhD in English and American Studies, University of Paul Valery, France

Asst. Prof. Dr. Seda Cengiz
DDS, PhD, Assistan Professor, Department of Prosthodontics, Faculty of Dentistry, Bulent Ecevit University, Zonguldak, Turkey.

Assistant Professor Seda Cengiz is Head of Environmental Problems Application and Research Center, Bulent Ecevit University, Zonguldak, Turkey. She received her Degree of dental surgery in Dentistry from Ankara University in 2003. She completed her Doctorate in Department of Prosthodontics of Medical Sciences at 19 Mayıs University, Samsun in 2008. She appointed to an assistant professor in 2009. She commissioned as assistant of dean and head of education commision between 2009-2016.

Habib M. Fardoun
Director of KAU Observatory Center for Academic Standards and Excellence
Advisor of Vice-President for International Relations and University Ranking of King Abdulaziz University (KAU)
Jeddah, Saudi Arabia.

Dr. Habib M. Fardoun has a PhD in Model-Based Approach for the Development of Quality Higher Educational Environments (2011), and Master in Aptitude for Teaching (2008), and Master in Advanced Computer Technologies (2007), by the University of Castilla-La Mancha. Currently, he is occupying the position of Associate Professor at the Faculty of Computing and Information Technology, and as Advisor of the Vice-President for Development for the University International Relationships and Ranking, at the King Abdulaziz University (Jeddah, Saudi Arabia).
With several years of experience on effective solutions for the improvement of universities rankings, Habib has diversified his work along many areas that are key factors in the improvement of the overall academic and research reputation. And, gained the experience of the creation of long/short-terms strategic plans and management towards excellence.

Mr. Junaidi, M. A.
UI GreenMetric Expert Member, Universitas Indonesia, Indonesia

Junaidi is an expert member of UI GreenMetric World University Rankings, and Lecturer in Linguistics and Cultural Studies at English Department, Faculty of Humanities, Universitas Indonesia. He holds degrees from English Department, Universitas Indonesia (Sarjana Sastra/BA in English language and Literature); and Warwick University, UK (M.A in British Cultural Studies, with Distinction). As a Chevening scholar, he has academic interests in the area of British Studies, international higher education, network society, popular culture, and cultural identity. He teaches and supervises undergraduate and post-graduate students in British Studies, Cultural Studies, and Discourse Analysis at the Faculty of Humanities, Universitas Indonesia.
He has been actively involved in the internationalization of Universitas Indonesia from 2004 to 2015 with different university positions. He is UI 2011-2015 Head of International Office and Chairperson of ASEAN University Network- ASEAN Credit Transfer System (AUN-ACTS). With his extensive experience in internationalization of Universitas Indonesia, he is invited as one of the resource persons for internationalization of Indonesian universities at Ministry of Research and Higher Education, Republic of Indonesia. In this capacity he has travelled extensively to many Indonesian universities nationwide to promote internationalization of universities. Since 2015 he is an expert member of UI GreenMetric World University Ranking.

Prof. Dr. Yılmaz Yıldırım
Department of Environmental Engineering, Bulent Ecevit University, Turkey

Dr. YILDIRIM is a Professor and currently Department of Environmental Engineering at BEÜ, Turkey. He received his Diploma (M.Sc.) in Environmental Engineering, his Master's degree (M.Sc.) in Environmental Engineering and his Doctorate (Ph.D.) in Chemical Engineering, in 1989, 1992 and 1998 from Ondokuz Mayıs University (Turkey), Atatürk University (Turkey) and the University of Salford (UK), respectively. From July 2002-September 2002, he was a Postdoctoral Researcher at Department of Environmental Science, University of Hertfordshire, UK, for Air Quality Modelling. His research interests include Air Quality Monitoring, Modelling and Control, Waste Management and Membrane Processes. He has experience in scientific projects on Air Quality Monitoring and Modelling, Solid Waste Management, Environmental Impact Assessments, Environmental Regulation, Environmental Education and Recycling and Reuse of Wastewater discharges for different Industries and private sectors (more than 20 projects). He is author or co-author of more than 80 publications including cited in the international citation bases.

Dr. Hadiyanto
Universitas Diponegoro, Indonesia

Dr. Hadiyanto, MSc received his BSc of Chemical Engineering from Diponegoro University in 1998 and MSc of Bioprocess Engineering from Wageningen University, The Netherlands in 2003. While the degree of PhD has been obtained in 2007 from Wageningen University, Netherlands.
After finishing his PhD, he had opportunity to work as scientist at NIZO Food Research BV Netherlands (2007-2009), and Research Associate at Process Intensification Group at TU DELFT Netherlands (2009-2010). Besides these works, he has been invited as visiting research fellow at KU Leuven Belgium (2011), Kyoto University (2012) and DTU Denmark (2014).
On 2010, he came back to Diponegoro University as assistant professor at Chemical Engineering Department and focusing research in bioprocess engineering. He is also actively involved in Sustainable Energy and Environmental (SEE) Forum, UNDIP green metric task force and coordinating world class university program since 2016. In 2016, he was appointed as head of master program of environmental studies, school of postgraduate studies, Diponegoro University.

Dr. Aigerim Shilibekova
Vice Rector for Strategic Planning and International Relations
Atyrau State University in Kazakhstan

Dr. Aigerim Shilibekova is the First Vice Rector – Vice Rector for Strategic Planning and International Relations at Atyrau State University in Kazakhstan. She is a coordinator of many successful innovative projects at Atyrau State University such as the Kids University, English Only Space and the business incubator and co-working iSpace, the Science Café, and the Eco-Campus.
Dr. Shilibekova holds BA degree in Economics from Taraz State University, Kazakhstan (1999), MA in International Relations from Istanbul University, Turkey (2004) and PhD in Political Science from Eurasian National University, Kazakhstan (2009). She is an alumna of the Executive Education Program from Harvard University's Kennedy School of Government (2013). She speaks Kazakh, Russian, English, Turkish, and French and has the moderate knowledge of German and Persian.

Tlektes Yespolov
Rector, Kazakh National Agrarian University

Dr. Tlektes Isabaevich Yespolov is the Rector of Kazakh National Agrarian University and the Academician of National Academy of Sciences of the Republic of Kazakhstan. Dr Yespolov obtained his post graduate degree in Technical Sciences at Scientific Research Institute of Hydraulic Engineering in Moscow in 1982. After graduation, he worked in Kazakh Institute of Agriculture as a lecturer, associate professor and the Head of Industrial Research Laboratory of Kazakh Institute of Agriculture. In 1993 he was appointed as the Director of the Almaty Industrial College, and then as the Rector of the Almaty Industrial Pedagogical Academy. In 1997, he defended a doctorate dissertation in Economic Sciences. In 2001 was awarded the rank of Professor. Under his leadership the transition to a three-level structure of university education: bachelor - master – doctorate Ph.D was adopted and a credit education technology was introduced. Planned work to achieve a world level education institution is carrying out nowadays at the university. Kazakh National Agrarian University has entered the European educational space, has joined the Bologna Declaration, and signed agreements on cooperation with 54 foreign universities. Strategic plan for the development of the University for 2010-2015, Development Program for National Research University for 2011-2015 have been developed under the leadership of the Rector.

Participants List

No	Full Name	Position	University	Nationality	Email
1	Prof. Dr. Mahmut Özer	Rector	Bülent Ecevit University	Turkey	ozelkalem@beun.edu.tr
2	Prof. Dr. Mahmut AK	Rector	İstanbul University	Turkey	mak@istanbul.edu.tr
3	Prof. Dr. Ir. Tommy Ilyas, M.Eng.	Representative of Rector	University of Indonesia	Indonesia	tilyas10@gmail.com
4	Prof. Riri Fitri Sari	Chairperson of UI GreenMetric	University of Indonesia	Indonesia	riri@ui.ac.id
5	Junaidi S.S., M.A.	Expert Member of UI GreenMetric	University of Indonesia	Indonesia	junaidi@ui.ac.id
6	Arsy Imanda N. Raswati, S.Si	Communication and Administration of UI GreenMetric	University of Indonesia	Indonesia	arsy.imanda@ui.ac.id
7	Mr. Dincer Bicer	International Affairs Coordinator	Bülent Ecevit University	Turkey	dincer.bicer@gmail.com
8	Prof. Dr. Yılmaz Yıldırım	Department of Environmental Engineering	Bülent Ecevit University	Turkey	
9	Asst. Prof. Dr. Seda Cengiz	Head of our Environmental Problems Application and Research Center	Bulent Ecevit University	Turkey	
10	Prof. Dr. Ergun Yolcu	Adviser to the Rector, Press and Public Relations Director	Istanbul University	Turkey	eyolcu@istanbul.edu.tr
11	Lect. Esma Sancar	Press and Public Relations Office	Istanbul University	Turkey	demireresma@gmail.com
12	Res. Asst. Lale Cansu Tutar	Press and Public Relations Office	Istanbul University	Turkey	lctutar@gmail.com
13	Dr. Yuhlong Oliver Su	President	National Chi Nan University	Taiwan	yosu@ncnu.edu.tw,
14	Mr. Satya Saran	Representative of President	Institute for Financial Management and Research	India	satya.saran@ifmr.ac.in
15	Professor Dato' Dr Daing Nasir Ibrahim	Vice Chancellor	Universiti Malaysia Pahang	Malaysia	daing@ump.edu.my,
16	Prof. Dr. Prasart Suebka	Rector	Suranaree University of Technology	Thailand	sumittra@sut.ac.th
17	Prof. Bahram Maleki	Representative of President	University of Zanjan	Iran	bmalekiz@znu.ac.ir, bmalekiz@yahoo.com
18	Prof. Marcelo Bregagnoli	Rector	IFSULDEMINAS	Brazil	pamela.oliveira@ifsuldeminas.edu.br
19	Dr. Yusli Wardiatno	Representative of Rector	Bogor Agricultural University	Indonesia	wardiatno@gmail.com, yusli@ipb.ac.id
20	Jenny Andrea Diaz Pulido	Representative of Rector	Universidad del Rosario	Colombia	jenny.diazp@urosario.edu.co
21	Jose Herney Ramirez Franco	Representative of Rector	Universidad Nacional de Colombia	Colombia	jhramirezfra@unal.edu.co
22	Dr. Jamal Abu-Ashour	Representative of Rector	Jordan University of Science & Technology	Jordan	jamals@just.edu.jo

23	Dr. Amin Yousef M. Noaman	Vice President for Development	King Abdulaziz University	Saudi Arabia	hfardoun@kau.edu.sa, anoaman@kau.edu.sa
24	Prof. Dr. Ir. Ambariyanto	Representative of Rector	Universitas Diponegoro	Indonesia	ambariyanto.undip@gmail.com warek4@live.undip.ac.id
25	Prof. Ir. Joni Hermana, M.Sc.ES. Ph.D	Rector	Institut Teknologi Sepuluh November	Indonesia	sekrektor18@gmail.com
26	Prof. Okid Parama Astirin	Representative of Rector	Universitas Sebelas Maret	Indonesia	parama_astirin@yahoo.com
27	Prof. Dr. Fathur Rokhman, M.Hum	Rector	Universitas Negeri Semarang	Indonesia	hendi.edu@gmail.com
28	Dr. Yi-Ching Chen	Representative of President	Da-Yeh University	Taiwan	clwu@mail.dyu.edu.tw
29	Dr. Chang Hsien Tai	President	National Pingtung University of Science and Technology (NPUST)	Taiwan	president@mail.npust.edu.tw
30	Redina Margarita Mikhailovna	Representative of Rector	Peoples' Friendship University of Russia (RUDN-University)	Russia	redina_mm@rudn.university
31	Prof. Patricia Iglecias	Representative of President	USP - University of Sao Paulo	Brazil	sga@usp.br, rkronka@usp.br
32	Dr. Noor Al-Kharabsheh	Representative of Rector	Al-Balqa Applied University(BAU)	Jordan	noorkharabsheh@yahoo.com
33	Asst. Prof. Dr. Sefa Kocabaş	Representative of Rector	Bulent Ecevit University	Turkey	sefakocabas@gmail.com
34	Prof. Tlektes Yespolov	Rector	Kazakh National Agrarian University	Kazakhstan	rector@kaznau.kz
35	Assc. Prof. Dr. How Siew Eng	Representative of Rector	Universiti Malaysia Sabah	Malaysia	sehow@ums.edu.my
36	Prof. Khaled Ebnalwaled	Manager of Project Management Unit	South Valley University	Egypt	kh_ebnalwaled@yahoo.com
37	Hendi	Head of Public Relation	Universitas Negeri Semarang	Indonesia	hendi.edu@gmail.com
38	Prof. Amin Retnoningsih	Head of Conservation Development, Universitas Negeri Semarang	Universitas Negeri Semarang	Indonesia	aminretnoningsih2016@mail.unnes.ac.id
39	Dr. Loai Mohammad Juma'h Abu Sharour	Dean, Faculty of Nursing	Al-Zaytoonah University of Jordan	Jordan	loai.S@zuj.edu.jo
40	Prof. Akbar Tahir	Director of LPIU-Green Knowledge SALUT	Universitas Hasamuddin	Indonesia	akbar_tahir@mar-sci.unhas.ac.id
41	Dr. Hadiyanto	TaskForce Undip Ranking	Diponegoro Universtiy	Indonesia	hadiyanto@live.undip.ac.id
42	Mr. D. Ramakrishnan	Manager, Projects and Administration	Institute for Financial Management and Research	India	

43	Mr. László Gyarmati	Director	University of Szeged József Attila Study and Information Centre	Hungary	gyarmati.laszlo@tik.u-szeged.hu
44	Dr. Winny Astuti	Chairman of Green Campus	Universitas Sebelas Maret	Indonesia	winnyast64@gmail.com
45	Prof. Dr. Ir. Sari Bahagianti K, M.Sc.	Rector	UPN "Veteran" Yogyakarta	Indonesia	saribk@upnyk.ac.id
46	Mrs. Hazlina Faizal	Senior Assistant Registrar	Universiti Malaysia Pahang	Malaysia	haz@ump.edu.my
47	Dr. Eko Teguh Paripurno	Chairman of Disaster Management Department	UPN "Veteran" Yogyakarta	Indonesia	paripurno@gmail.com
48	Dr. Helmi Syaifuddin	Lecturer	UIN Maulana Malik Ibrahim Malang	Indonesia	helmi.syaifuddin@gmail.com
49	Mrs. Estelle S. Davutoğlu	Founding Coordinator, Department of International Entrepreneurship	TOBB University of Economics and Technology	Turkey	estelle.davutoglu@gmail.com
50	Dr. Alexander A. Gusev	Head of Research Institute for Environmental Science and Biotechnology	Derzhavin Tambov State University	Russian Federation	nanosecurity@mail.ru
51	Prof. Abdelaziz Yahyaoui	Professor	Cadi AYYAD University	Morocco	ayahyaoui2006@yahoo.fr or presidence@uca.ma
52	Dr. Apif Miptahul Hajji	Deputy Vice Rector	Universitas Negeri Malang (UM)	Indonesia	apif.miptahul.ft@um.ac.id
53	Prof. AH. Rofi'uddin	Rector	Universitas Negeri Malang (UM)	Indonesia	rektor@um.ac.id
54	Prof. Hariyono	Vice Rector I	Universitas Negeri Malang (UM)	Indonesia	wr1@um.ac.id
55	Dr. Aigerim Shilibekova	First Vice Rector For Strategic Development And International Cooperation	Atyrau State University	Kazakhstan	a.shilibekova@asu.edu.kz
56	Aitzhan Kulumzhanova	Director for international cooperation	Atyrau State University	Kazakhstan	a.kulumzhanova@asu.edu.kz
57	Mrs. Roberta Consentino Kronka Mülfarth	Deputy Head of Environmental Affairs	USP - University of Sao Paulo	Brazil	rkronka@usp.br
58	Mr. Murad Abd. Ghani	Director	Universiti Malaysia Pahang	Malaysia	muradghani@ump.edu.my

59	Mrs. Muhammad Hairynizam Bin Muhd Taib	Director	Universiti Malaysia Pahang	Malaysia	hairynizam@ump.edu.my
60	Dr. Jik-Chang Leong	Dean of International College	National Pingtung University of Science and Technology (NPUST)	Taiwan	tanyacheng@mail.npust.edu.tw
61	Dr. Agnes Tuti Rumiati	Secretary of Institute	Institut Teknologi Sepuluh Nopember	Indonesia	agnestuti@yahoo.com
62	Dr. Naser Waheeb Essa	Assisstant Professor in Architectural Engineering	University of Bahrain	Bahrain	nalnaser@uob.edu.bh
63	Dr. Daniya Assanova	Vice-Rector for International Relations and Investments	Kazakh National Agrarian University	Kazakhstan	daniya.asanova@gmail.com
64	Dr. Sukaina Alzyoud	Director	The Hashemite University	Jordan	sukaina-alzyoud@hu.edu.jo
65	Mr. Mücahit Şişlioğlu	Deputy Rector	Secretary General	Turkey	aince@yeditepe.edu.tr
66	Dr. Najat Mohamed Essa Es'haqi	Assistant Professor	University of Bahrain	Bahrain	neshaqi@uob.edu.bh
67	Prof. Abdellatif Miraoui	President	Cadi Ayyad University Marrakech	Marroco	f.arib@uca.ma
68	Prof. Fatima Arib	Head of sustainable development strategy	Cadi Ayyad University Marrakech	Marroco	f.arib@uca.ma
69	Mrs. Narayana de Deus Nogueira Bregagnoli	International Affairs	IFSULDEMINAS	Brazil	narayana.nogueira@ifsuldeminas.edu.br
70	Ms. Lütfiye Kozlan	Landscape architect	Yeditepe University	Turkey	lkozlan@yeditepe.edu.tr
71	Dr. Sugeng Listyo Prabowo, M.Pd.	Vice Rector II - AUPK Campus	UIN Maulana Malik Ibrahim Malang	Indonesia	sugenguinmalang100@gmail.com
72	Mohd Nurulakla Mohd Azlan	Energy Manager	Universiti Malaysia Pahang	Malaysia	nurulakla@ump.edu.my
73	Dr. Ahmed Ghassan Methkal El-Qasem	Director; Quality Assurance, Planning and Performance Management- Ass. Prof	University of Petra	Jordan	aelqasem@uop.edu.jo
74	Dr. Olga V. Zakharova	Assistant Director of Research Institute for Environmental Science and Biotechnology	Derzhavin Tambov State University	Russia	olgazakharova1@mail.ru
75	Mrs. Poppi Lestari Wahjuhardini	Secretary of IPB Woman Association	Bogor Agricultural University	Indonesia	wardiatno@gmail.com

76	Dr. Ahmad Muhtadi Ridwan	Lecturer	UIN Maulana Malik Ibrahim Malang	Indonesia	read_one_feuinmlg@yahoo.co.id
77	M. Sasmito Djati	vice rector for planning and collaboration	Brawijaya University	Indonesia	msdjati@ub.ac.id
78	Habib M. Fardoun	Director of KAU Center for Academic Standards & Excellence	King Abdulaziz University	Saudi Arabia	hfardoun@kau.edu.sa
79	Asociate Professor Dr. Sittichai Seangatith	Assistant Rectors Academic Affairs	Suranaree University	Thailand	sumittra@sut.ac.th
80	Nilay Cevher	PhD student	Hacettepe University	Turkey	nilcevher@gmail.com

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 mottos 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 Progrmme 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

THE 3rd INTERNATIONAL WORKSHOP ON UI GREENMETRIC WORLD UNIVERSITY RANKINGS "Global Campus Partnership for Sustainable Future" 9-10 April 2017 Baltalimani Social Facilities, Istanbul University, Turkey	
DAY 1: 9 APRIL 2017 - SUNDAY	
Timing	**Session**
Whole day	**Arrival of participants**
1:00 PM - 4:00 PM	**Registration of Delegates** Venue: Baltalimani Social Facilities, Istanbul University (Conference Facility entrance)
4:00 PM - 5:30 PM	**UI GWURN Committee Meeting (by invitation)** Venue: Palace Building, floor 2
7:00 PM - 9:00 PM	UI GWURN Committee Dinner (by invitation) Venue: Baltalimanı Facility Restaurant
9:00 PM - 9:15 PM	Transfer to hotel
DAY 2: 10 APRIL 2017 - MONDAY	
8:30 AM - 9:00 AM	**Registration of Delegates** Venue: Baltalimani Social Facilities, Istanbul University
9:00 AM - 9:30 AM	**Welcome Speech** Venue: Conference Facility, Floor 2 Baltalimani Social Facilities, Istanbul University • **Prof. Riri Fitri Sari**, Chairperson of UI GreenMetric World University Rankings • **Prof. Dr. Mahmut Özer**, Rector of Bülent Ecevit University • **Prof. Dr. Ir. Tommy Ilyas, M.Eng.,** Representative of Rector of University of Indonesia • **Prof. Dr. Mahmut AK.**, Rector of İstanbul University
9:30 AM - 10:15 AM	**Keynote Speeches** Keynotes: • **H.E Mehmet Özhaseki,** Minister of Environment and Urban Planning, Republic of Turkey (TBC) • **Prof. Dr. M.A. YektaSaraç**, Head of Turkish Higher Education Council
10:15 AM - 10:30 AM	Group photo
10:30 AM - 10:50 AM	Coffee Break
10:50 AM - 11:30 AM	**Panel Session 1** **Session 1: Issues and Innovation in Managing Energy** Chair : **Mrs. Estelle S. Davutoğlu** Founding Coordinator, Department of International Entrepreneurship TOBB University of Economics and Technology-Ankara, Turkey Speakers: • ***Carbon Footprint of BEU Devrek Campus: A Case Study*** Asst. Prof. Dr. Sefa Kocabaş, Representative of Rector, Bulent Ecevit University • ***Energy and Climate Management Techniques Employed by Institute for Financial Management and Research (IFMR)*** Speaker: Mr. Satya Saran, Representative of President, Institute for Financial Management and Research, India

	• ***Green NCNU in the Heart of Taiwan*** Speaker: Dr. Yuhlong Oliver Su, President, National Chi Nan University, Taiwan • ***Cultivating Green Energy at the Universitas Indonesia Towards Sustainable Campus*** Speaker: Prof. Dr. Ir. Tommy Ilyas, M.Eng., Representative of Rector, University of Indonesia, Indonesia
11:35 AM - 12:15 PM	**Panel Session 2** **Session 2 : Issues and Innovation in Managing Setting and Infrastructure** Chair : **Asst. Prof. Dr. Seda Cengiz,** Head of Environmental Problems Application and Research Center, Bulent Ecevit University, Turkey Speakers: • ***Challenges in Transformation into Green and Sustainable Campus: Ump Experience*** Professor Dato' Dr Daing Nasir, Vice Chancellor, Universiti Malaysia Pahang, Malaysia • ***SUT as a Green and Clean University*** Professor Dr. Prasart Suebka, Rector, Suranaree University of Technology, Thailand • **The Green Road of the University of Zanjan to Sustainable Development** Prof. Bahram Maleki, Representative of President, University of Zanjan, Iran • ***Multidisciplinary Actions as an Instrument of Sustainable Development*** Prof. Marcelo Bregagnoli, Rector, Instituto Federal de Educação, Ciência e Tecnologia do Sul de Minas, Brazil
12:20 PM - 12:40 PM	**Panel Session 3** **Session 3 : Issues and Innovation in Managing Transportation** Chair : **Habib M. Fardoun** Director of KAU Center for Academic Standards & Excellence King Abdul Aziz University, Saudi Arabia Speakers: • **Implementing Green Transportation in University Level: a Case Study from Bogor Agricultural University, Indonesia** Dr. Ir. Yusli Wardiatno, M.Sc., Representative of Rector, Bogor Agricultural University, Indonesia • ***Environmental Management System - Air Program*** Jenny Andrea Diaz Pulido, Representative of President, Universidad del Rosario, Colombia

<table>
<tr><td>12:45 PM – 1:25 PM</td><td colspan="2">Panel Session 4
Session 4 : Issues and Innovation in Managing Water

Chair: Mr. Junaidi, M. A.
UI GreenMetric Expert Member
University of Indonesia, Indonesia

Speakers:
• King Abdulaziz University Strategy for Water Management
Dr. Amin Yousef M. Noaman, Vice President for Development, King Abdulaziz University, Saudi Arabia

• Programs for Clean, Healthy and Convenient Diponegoro University Campus: a Green-metric Practices
Prof. Dr. Ir. Ambariyanto, M.Sc., Rector, Universitas Diponegoro, Indonesia

• Sustainable Water Management in Tropical Region Campus: Study Case of Institut Teknologi Sepuluh Nopember Indonesia
Prof. Ir. Joni Hermana, M.Sc.ES. Ph.D, Rector, Institut Teknologi Sepuluh, November, Indonesia

• Evaluation of Environmental Performance of BAU to facilitate ranking to a higher position among UI GreenMetric List
Dr. Noor Al-Kharabsheh, Representative of Rector, Al-Balqa Applied University(BAU) Jordan</td></tr>
<tr><td>1:25 PM - 2:25 PM</td><td colspan="2">Networking Lunch
Venue: Baltalimanı Restaurant</td></tr>
<tr><td>2:25 PM - 3:05 PM</td><td>Parallel Session 1
Session 5 : Issues and Innovation in Managing Waste

Chair: Prof. Dr. Yılmaz Yıldırım
Bülent Ecevit University Department of Environmental Engineering

Speakers:

• Implementation of the Environmental Management System at the Universidad Nacional de Colombia
Jose Herney Ramirez Franco, Representative of Rector, Universidad Nacional de Colombia, Colombia

• NPUST Waste Handling Strategy and Program
Dr. Chang Hsien Tai, President, National Pingtung University of Science and Technology (NPUST), Taiwan</td><td>Parallel Session 2
Session 6 : Implementing Policy into Action : Regional Experience

Chair : Dr. Hadiyanto
TaskForce Undip Ranking
Universitas Diponegoro, Indonesia

Speakers:

• AgriTech Hub - center of innovations in sustainable campus development
Tlektes Yespolov, Rector, Kazakh National Agrarian University, Kazakhstan

• University of Sao Paulo Environmental Policies: Challenges and Achievements
Prof. Patricia Iglecias, Representative of President, USP - University of Sao Paulo, Brazil</td></tr>
</table>

	• **The Road Map of Jordan University of Science and Technology Towards Sustainability** Dr. Jamal Abu-Ashour, Representative of Rector, Jordan University of Science & Technology	• **Sustainability of the University - Environmental Responsibility of the Students: Experience of the RUDN-University** Dr.Sc. Econ, Margarita Redina Representative of Rector, Peoples' Friendship University of Russia (RUDN - University)
3:15 PM - 3:55 PM	**Panel Session 5** **Session 7 : Issues and Innovation in Managing Education** Chair : **Dr. Aigerim Shilibekova** First Vice Rector for Strategic Development and International Cooperation Atyrau State University, Kazakhstan Speakers: • **Developing Partnership in Integrating Green and Sustainability with Education, Research, Community Aids and Student Orientation Activities** Prof. Okid Parama Astirin, Representative of Rector, Universitas Sebelas Maret, Indonesia • ***Raising Awareness and Good Conducts to Build a Conservation University with International Reputation*** Prof. Dr. Fathur Rokhman, M.Hum, Rector, Universitas Negeri Semarang, Indonesia • **UMS EcoCampus:Transforming Ideas Into Reality** Assc. Prof. Dr. How Siew Eng, Representative of Rector, Universiti Malaysia Sabah, Malaysia • **On the Road to Green Campus-Experience of Da-Yeh University** Dr. Yi-Ching Che, Representative of President, Da-Yeh University, Taiwan	
3:55 PM - 4:15 PM	Closing Remarks • Bulent Elcevit and Istanbul University Prof. Dr. Ir. Riri Fitri Sari, Chairperson of UI GreenMetric	
5:00 PM - 7:00 PM	Boat Tour of the Bosphorus	
7:30 PM - 9:00 PM	Dinner Venue: Baltalimanı Restaurant	
9:00 PM	Transfer to Hotel	