



UNIVERSITAS  
INDONESIA

*Veritas, Probitas, Iustitia*



**UI** Green  
Metric

**World University Ranking**

"Guideline of  
UI GreenMetric World  
University Ranking 2016"

**From Policy to Action**

## **1. What is UI GreenMetric World University Ranking?**

Universitas Indonesia (UI) initiated a world university ranking in 2010, later known as UI GreenMetric World University Ranking, to measure campus sustainability efforts. It was intended to create an online survey to portray sustainability programs and policies in universities around the world.

We based the ranking broadly on the conceptual framework of Environment, Economy, and Equity. The ranking indicators and criteria are intended to be relevant to all. We have designed the indicators and weightings to be as free of bias as possible. The work of collecting and submitting data is relatively straightforward and does not make unreasonable demands on staff time.

Ninety five universities from 35 countries took part in the 2010 version of Green Metric: 18 from the Americas, 35 from Europe, 40 from Asia and 2 from Australasia. In 2015, the ranking has ranked 407 universities from 65 countries around the world. This shows that UI GreenMetric has been recognized as the first and only world university ranking on sustainability.

Our theme this year is ‘from policy into action’. We would like to focus on universities effort to implement policy into action. We look into detail universities’ actions to improve campus sustainability.

## **2. What are the objectives?**

The ranking aims to:

- Contribute to academic discourses on sustainability in education and the greening of campuses;
- Promote university-led social change with regard to sustainability goals.
- Be a tool for self-assessment on campus sustainability for higher education institutions (HEIs) around the globe.
- Inform governments, international and local environmental agencies, and society about sustainability programs on campus.

## **3. Who can participate?**

All universities in the world which have strong commitments for sustainability issues can participate in annual UI GreenMetric World University Ranking.

## **4. What are the benefits?**

Universities which participate in GreenMetric by submitting their data to be included in the ranking can expect to enjoy a number of benefits.

### **a. Internationalization and recognition**

Participation in GreenMetric can help the university’s efforts at internationalization and recognition by getting its sustainability efforts on the map. Participation in GreenMetric is accompanied by increased hits to the university website, more mentions of the institution connected with the issue of sustainability on web pages, and an increase in correspondence with institutions which are interested in your organization.

## **b. Awareness raising of sustainability issues**

Participation can help to raise awareness in the university and beyond about the importance of sustainability issues. The world faces unprecedented civilizational challenges such as population trends, global warming, over exploitation of natural resources, oil-dependent energy, water and food shortages and sustainability. We realize that higher education has a crucial role to play in addressing these challenges. GreenMetric leverages the crucial role that HEIs can play in raising awareness by helping assess and compare efforts at education for sustainable development, sustainability research, campus greening, and social outreach.

## **c. Social change and action**

GreenMetric is primarily about awareness raising, but in future it will be adapted to encourage real change. Understanding needs to shift to action if we are to address emerging global challenges.

## **d. Networking**

All participants of UI GreenMetric can automatically be a member of UIGWURN (UI GreenMetric World University Ranking Network). In the network, participant can share best practices on their sustainability program as well as networking with other participants worldwide by attending annual UI GreenMetric's International Workshop and regional / national workshops hosted by approved host universities. Participants can arrange technical workshop on UI GreenMetric at their respective universities.

As a platform to make sustainability issues into action, the network is managed by UI GreenMetric as secretariat. Programs and directions are proposed and decided by steering committee comprises of UI GreenMetric secretariat, regional, and national coordinators.

Currently the network comprises of 407 participating universities located on the dynamic and diverse Asia, Europe, Africa, Australia, America and Oceania, 1.266.718 faculty members, 12.502.719 students, with more than US\$ 29.380.515.655 total research fund on environment and sustainability.

## **5. How can universities participate?**

To participate in the ranking is simple. Sustainability director or other person in charge can visit [www.greenmetric.ui.ac.id](http://www.greenmetric.ui.ac.id) to learn about the ranking and if interested can e-mail UI GreenMetric secretariat ([greenmetric@ui.ac.id](mailto:greenmetric@ui.ac.id)) to get invitation letter and access to the system. Other participants in our database will be notified to participate.

## **6. How is UI GreenMetric World University Ranking developed?**

The decision to establish GreenMetric was influenced by a number of factors:

### **a. Idealism**

Future challenges to civilization include population pressure, climate change, energy security, environmental degradation, water and food security and sustainable development. Despite much scientific research and public discussion, governments around the world have yet to commit to a sustainable agenda. Concerned people at Universitas Indonesia see that universities have a privileged position to help develop a consensus on key areas for action. This includes such concepts

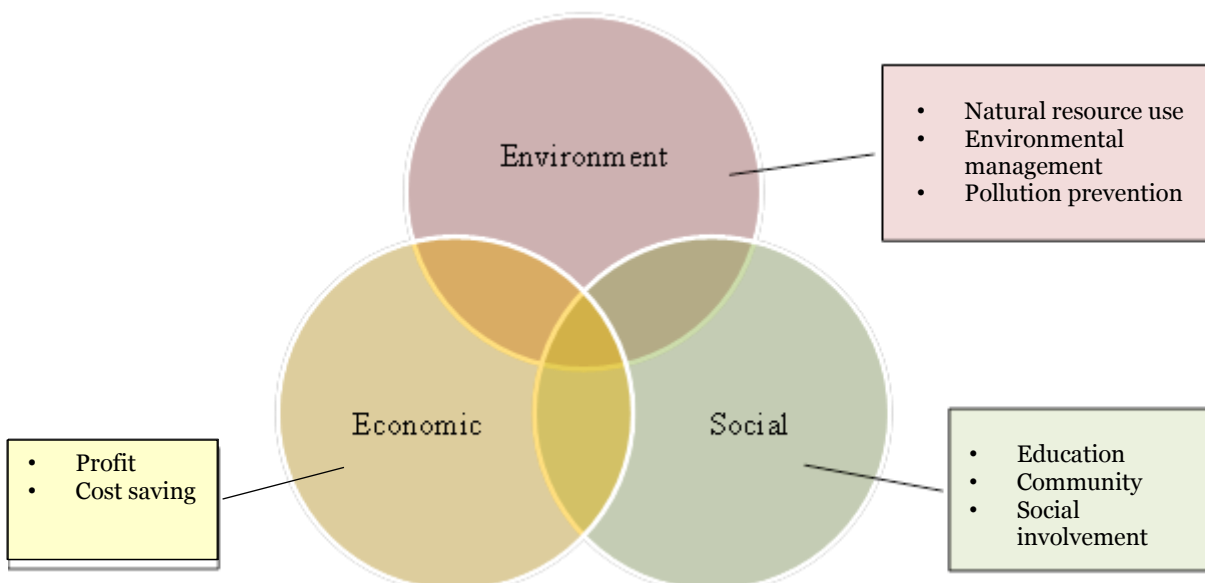
as the Triple Bottom Line, the 3 Es: Equity, Economy, Environment, Green Building, and Education for Sustainable Development (ESD).

UI GreenMetric World University Ranking serves as a tool for universities to deal with sustainability challenges our world is facing. Universities can work together to reduce negative environmental impacts. It is for non-profit. Universities can participate for free.

### **b. UI GreenMetric World University Ranking model**

GreenMetric was not based on any one existing ranking system. It was however developed with awareness of a number of existing sustainability assessment systems and academic university rankings. Sustainability systems that were referred to during the design phase of GreenMetric included: The Holcim Sustainability Awards, GREENSHIP (the rating system recently developed by the Green Building Council of Indonesia which itself was based on the Leadership in Energy and Environmental Design (LEED) system used in the U.S. and elsewhere), The Sustainability, Tracking, Assessment and Rating System (STARS) and The College Sustainability Report Card (also known as the Green Report Card).

In general, the instrument adopts environmental sustainability concept that has three elements, i.e. environmental, economic, and social (Figure 1). Environmental aspect includes natural resource use, environmental management, and pollution prevention, whereas economic aspect includes profit and cost saving. Social aspect includes education, community, and social involvement. These three aspects are captured in the UI GreenMetric criteria.



Meanwhile, university academic ranking systems that were studied during the design phase of GreenMetric included: the *Times Higher Education World University Rankings* (THE) sponsored by Thompson Reuters, the *QS World University Rankings*, the *Academic Ranking of World Universities* (ARWU) published by Shanghai Jiao Tong University (SJTU), and the *Webometrics Ranking of World Universities* (Webometrics), published by Cybermetrics Lab, CINDOC-CSIC in Spain. UI has been one of the members of International Ranking Expert Group (IREG) Observatory since 2011.

During the early stages of the design of GreenMetric we sought assistance on the issues from experts in both ranking and in sustainability. These included the holding of a conference on university ranking and video conferences and expert meetings on sustainability and green building. The latest workshop on UI GreenMetric was held on April 21<sup>st</sup> 2016, in which rectors and representatives from the following universities share their experiences, i.e University of Nottingham, Università Ca' Foscari Venezia, University of Melbourne, Mahidol University, Universitat fur Bodenkultur Wien, Universidad Autónoma de Nuevo Leon, Kasetsart University, King Mongkut's University of Technology Thonburi, Da Yeh University, Universiti Teknologi Malaysia.

In 2010, 23 indicators were used within the five criteria 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 criteria including education criteria. One change being considered is the formation of a new criterion for sustainability education and research. In 2015 the theme was carbon footprint. We add two questions related this issue in the energy and climate change section. We also improve our methodology by adding a few sub-indicators that related to water and transportation in 2015 ranking.

**c. Realities and challenges**

The goal of creating a world university sustainability ranking was done with an understanding that the diversity of types of universities, their missions and their contexts would pose problems for the methodology. In particular, we were aware that universities differ with regard to levels of awareness and commitment to sustainability, to their budgets, the amount of green cover on their campuses and many other dimensions. These issues are complex but GreenMetric is committed to continually improving the ranking so that it will be both useful and fair to all.

**7. Who are the team?**

UI GreenMetric World University Ranking is run by a team under the Rector of Universitas Indonesia. The team members come from different academic backgrounds and experiences, such as ecology, sustainability, anthropology, engineering, architecture and urban design, statistics, and cultural studies.

**8. What is the methodology?**

**a. The criteria**

This year's criteria and weighting of points are shown as follows.

Table 1 Criteria used in the ranking and their weighting

No	Criteria	Percentage of Total Points (%)
1	Setting and Infrastructure (SI)	15
2	Energy and Climate Change (EC)	21
3	Waste (WS)	18
4	Water (WR)	10

5	Transportation (TR)	18
6	Education (ED)	18
<b>TOTAL</b>		<b>100</b>

The specific indicators and their points awarded are shown in

Table 2. Each indicator has been uniquely identified by a criteria code and a number (e.g. SI 5).

Table 2 Indicators and criteria suggested for use in the 2016 ranking

No	Criteria and Indicators	Points	Weighting
<b>1</b>	<b>Setting and Infrastructure (SI)</b>		<b>15%</b>
SI 1	The ratio of open space area towards total area	300	
SI 2	The ratio of open space area towards campus population	300	
SI 3	Area on campus covered in forested vegetation	200	
SI 4	Area on campus covered in planted vegetation	200	
SI 5	Area on campus for water absorbance	300	
SI 6	University budget for sustainable effort	200	
	Total	1500	
	<b>Energy and Climate Change (EC)</b>		<b>21%</b>
EC 1	Energy efficient appliances usage	200	
EC 2	Smart building implementation	300	
EC 3	Renewable energy usage	300	
EC 4	The ratio of total electricity usage towards campus population	300	
EC 5	The ratio of renewable energy produce towards energy usage	200	
EC 6	Element of green building implementation	300	
EC 7	Greenhouse gas emission reduction program	200	
EC 8	The ratio of total carbon footprint towards campus population	300	
	Total	2100	
	<b>Waste (WS)</b>		<b>18%</b>
WS 1	Program to reduce the use of paper and plastic in campus	300	
WS 2	Recycling program for university waste	300	
WS 3	Toxic waste handled	300	
WS 4	Organic waste treatment	300	
WS 5	Inorganic waste treatment	300	
WS 6	Sewerage disposal	300	

No	Criteria and Indicators	Points	Weighting
	Total	1800	
	<b>Water (WR)</b>		<b>10%</b>
WR 1	Water conservation program	300	
WR 2	Water recycling program	300	
WR 3	The use of water efficient appliances	200	
WR 4	Treated water consumed	200	
	Total	1000	
	<b>Transportation (TR)</b>		<b>18%</b>
TR 1	The ratio of vehicles (cars and motorcycles) towards campus population	200	
TR 2	The ratio of campus bus services towards campus population	200	
TR 3	The ratio of bicycles found towards campus population	200	
TR 4	Parking area type	200	
TR 5	Initiatives to decrease private vehicles on campus	200	
TR 6	Parking area reduction for private vehicles within 3 years (from 2013 to 2015)	200	
TR 7	Campus bus services	300	
TR 8	Bicycle and pedestrian policy on campus	300	
	Total	1800	
<b>6</b>	<b>Education (ED)</b>		<b>18%</b>
ED 1	The ratio of sustainability courses towards total courses	300	
ED 2	The ratio of sustainability research funding towards total research funding	300	
ED 3	Sustainability publications	300	
ED 4	Sustainability events	300	
ED 5	Sustainability student organizations	300	
ED 6	Sustainability website	300	
	Total	1800	
	<b>TOTAL</b>	<b>10000</b>	

## b. 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. Details of the scoring can be found at Appendix 1.

## c. The weighting of criteria

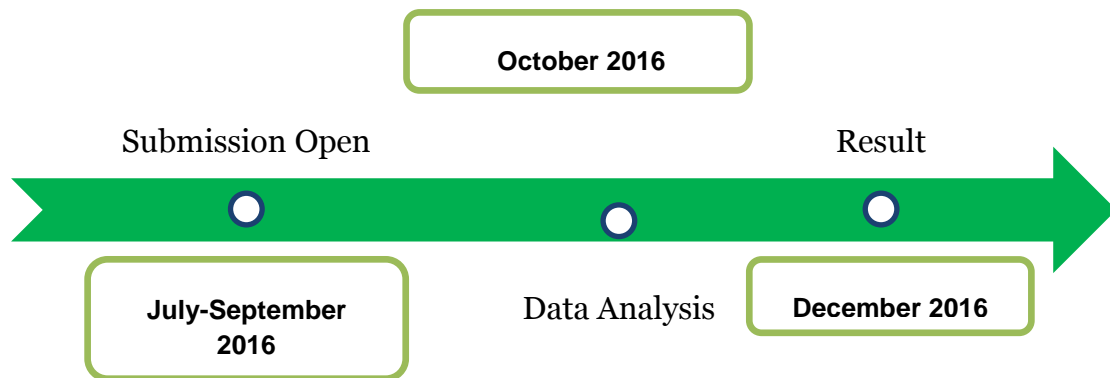
Each of the criteria will be categorized in a general class of information and when we process the results, the raw scores will be weighted to give a final calculation.

**d. 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.

**e. Data collection**

Data will be collected through online system between July – 31 October 2016 from the universities we have contacted and who are willing to provide information.



**f. Result**

The preliminary result of the metrics is expected to be collected in October 2016, and final complete result will be released in December 2016.





The basic ranking results and the detailed scores can both be found online

<http://greenmetric.ui.ac.id/ranking/year/2015>

## **9. Who are our networks?**

This idealism surrounding awareness of sustainability issues is now generating a network of likeminded organizations. UI is a member of the International Ranking Experts Group (IREG) and a signatory to UN Commitments such as that on Sustainable Practices of Higher Education Institutions for the Rio 2012 Conference on Sustainable Development. We have also presented our progress at the International Sustainable Campus Network (ISCN) – GULF-WEF Symposium 2012, together with other Data Monitoring and Evaluation of Sustainability in Higher Education Report such as the College Sustainability Green Report Card and GRI. UI GreenMetric also has been presented at the Quality Education Conference in Universidad Autónoma de Nuevo Leon, Mexico, on October 2013 and the Sustainability, University Ranking Conference at the Università Ca' Foscari Venezia, Italy, November 2013. Various articles, magazines, Journal papers, university and institution webpages cited and referred UI GreenMetric evaluation and result. In 2014, III Asian Universities Forum organized by Al-Farabi Kazakh National University, in Astana & Almaty, endorsed UI GreenMetric to be used as a tool to evaluate university sustainability achievement.

On September and October 2016, three UI GreenMetric technical workshops will be conducted to encourage full participations of Russian, Jordanian and Turkish Universities. These workshops are organized in collaboration between UI GreenMetric Team and Host Universities, i.e. People's Friendly University Russia (RUDN University) in Moscow, Bulent Ecevit University in Zonguldak Turkey, and Jordan University of Science and Technology (JUST) in Irbid Jordan, in order to promote UI GreenMetric participations and providing platforms for universities to share there experiences in creating green and sustainable campuses.

Eighteen Universities in Russia will Join the Techical Workshop at the RUDN University in Moscow, which is one of leading university in Moscow that is in position to reveal back their historical status as the center of education for many overseas leaders.

The technical workshop in Zonguldak, near the Black Sea will be an opportunity to prepare for the annual International Workshop on UI GreenMetric (IWGM) 3 which will be conducted in Turkey on March 2017 next year. More than 15 Turkish University will participate.

Two days after the workhop in Turkey, consecutively the technical workshop for university in Jordan will be organized in Irbid on the 5th of October 2016. These workshops will be a working model of collaboration between universities to combat the misuse of ranking and go further beyond competition.

We encourage universities in the near by region to participate in these workshops in which 2 representatives from UI GreenMetric will help to answer your questions. We hope that this workshop will ensure that requested information can be submitted by October 31st 2016.

## **10. What are the future plans?**

A new version of GreenMetric should be developed to take into consideration how better to achieve its own goals, how to learn from constructive criticism about rankings and the advancement of ESD, and how to learn from the diverse experience of participants with their

different goals and in different settings. Among the ideas under consideration for possible future innovations in the ranking are:

- Better university profiling: universities create a profile based on their unique mission, objectives, typological features and context.
- Criteria focused results: scores are provided not just as a single aggregate but separately for the main ranking criteria and indicators.

#### **11. How to contact us?**

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## **Questionnaire (Criteria and Indicator)**

There are six main criteria in the questionnaire which consist of setting and infrastructure (SI), energy and climate change (EC), waste (WS), transportation (WR) and education (ED). These criteria are divided in several sections and the detail questions' explanations are as follow:

### **1. Setting and Infrastructure (SI)**

The campus setting and infrastructure information will give the basic information of the university consideration towards green environment. This indicator also shows whether the campus deserve to be called Green Campus. The aim is to trigger the participating university to provide more space for greenery and in safeguarding environment, as well as the development of sustainable energy.

#### **1.1. Type of higher education institution**

Please select one of the following options:

- [1] Comprehensive
- [2] Specialized higher education institution

#### **1.2. Climate**

Please select one of the following options that clearly describe the climate on you region:

- [1] Tropical wet
- [2] Tropical wet and dry
- [3] Semiarid
- [4] Arid
- [5] Mediterranean
- [6] Humid subtropical
- [7] Marine west coast
- [8] Humid continental
- [9] Subarctic

#### **1.3. Number of campus sites**

Please state the number of separate locations in which your university has buildings for academic purposes. For example if your university has some campuses in different districts, towns or cities which are separated from the main campus, please state the total number of your university locations.

#### **1.4. Main Campus Setting**

Please select one of the following options:

- [1] Rural
- [2] Suburban

[3] Urban

[4] In city center

[5] High rise building area

Note: if you have more than one campus site, please select an option that describe your main campus condition.

1.5. Total main campus area (meter square)

Please state the total areas of your campuses (in square meter). It is expected that the total area counted are only those in which academic activities are being conducted. Forest and fields and other areas can only be counted if it is being used for academic purposes. If you have separate location for university forest, please do not count this as your campus area.

1.6. Total main campus first floor area of buildings (meter square)

The green area of your university will be calculated from the percentage of green area of your university. Please provide the information of the area occupied by buildings , by providing the total area of the first floor part of your university buildings.

1.7. Total main campus buildings area (meter square)

Please provide the information of the area occupied by buildings, by providing the total area all floors of your university buildings in your main campus. This is to calculate the smart building implementation percentage

1.8. Total main campus smart building area (meter square)

Please provide the information of the total area (including ground floor and other floors) of your university smart buildings. A smart building should be equipped with energy efficient tools. Smart building achievement is a measure that deliver useful building services which make occupants productive (e.g. illumination, thermal comfort, air quality, physical security, sanitation, etc.). Smart building should be provided at the lowest cost and generate beneficial environmental impact over the building lifecycle.

1.9. Total parking area (meter square)

Please provide the information of the total parking area in your university. You can validate this using google maps.

1.10. Area on campus covered in vegetation in the form of forest

Please provide the percentage of the area on campus covered in vegetation in the form of forest (a large area covered chiefly with big-trees, a large number or dense mass of vertical, and undergrowth for conservation purposes) to the total campus area.

1.11. Area on campus covered in planted vegetation

Please provide the percentage of the area on campus covered in planted vegetation (include lawns, gardens, green roofs, internal planting; for vegetation purposes) to the total campus area.

1.12. Total area on campus for water absorption beside forest and planted vegetation

Please provide the percentage of non-retentive surfaces (eg. earth, grass, concrete block, etc.) in your campus for water absorption as percentage to the total site area. The larger water absorption area is desirable.

1.13. Number of students

1.13A Total Number of Regular Students

The total number of students (full time and part time) registered, as regular and online students, at your university. If your university has calculated the Effective Full Time Students (EFTS) number, you are welcome to submit this number.

1.13B Total Number of Online Students

The total number of students registered as online students only, at your university.

1.4. Number of academic and administrative staff

Please state the total number of lecturers and administrative staff working in your university.

1.15. University budget for sustainability effort

Please provide the percentage calculation of the environment and sustainability budget to the total university budget.

2. Energy and Climate Change (EC)

The university's attention to the use of energy and climate change issues is the indicator with the highest weighting in this ranking. In our questionnaire we define several indicators for this particular area of concern, i.e. energy efficient appliances usage, the implementation of smart building/automation building/intelligent building, renewable energy usage policy, total electricity use, energy conservation program, elements of green building, climate change adaptation and mitigation program, greenhouse gas emission reductions policy and carbon footprint. Within these indicators, university is expected to increase the effort in energy efficiency on their building and to care more about nature and energy resources.

2.1. Energy efficient appliances usage are replacing conventional appliances

Energy efficient appliances usages are replacing conventional appliances. This is also extent to the use of energy efficient appliances/lighting fixtures (e.g. the use of energy star-rating for electronic devices, LED light bulb).

Please select one of the following options:

[1] None

- [2] less than 20%
- [3] 20% - 40%
- [4] 40% - 60%
- [5] 60% - 80%
- [6] 80% - 100%

## 2.2. Smart Building program implementation

Please provide the stage of smart building implementation in your university. This is defined as the existence of formalized effort in applying the program in order to accommodate all of energy efficient appliances usage. Please select one of the following options:

- [1] None
- [2] Program in preparation (e.g. Feasibility Study or Detailed Engineering Designed phase)
- [3] Program in initial implementation (e.g. Builder already appointed)
- [4] Implemented in less than 30% of the total building area
- [5] Implemented in between 30% - 70% of the total building area
- [6] Implemented in more than 70% of the total building area

Smart Building can be defined as the use of networked technology, embedded within architecture to monitor and control elements of the architecture for exchange of information between users, systems and buildings.

## 2.3. Renewable energy usage policy

Please select one or more of the following alternative energy sources used in your campus and please provide the capacity of the energy produces in Kilo Watt:

- [1] None
- [2] Bio Diesel (provide capacity in Kilo Watt)
- [3] Clean Biomass (provide capacity in Kilo Watt)
- [4] Solar Power (provide capacity in Kilo Watt)
- [5] Geothermal (provide capacity in Kilo Watt)
- [6] Wind Power (provide capacity in Kilo Watt)
- [7] Hydropower (provide capacity in Kilo Watt)
- [8] Combine Heat and Power (provide capacity in Kilo Watt)

## 2.4. Electricity usage per year

Please provide the total energy used in the last 12 months in your entire university (in Kilo Watt Hour/KWH) used for all purposes such as lighting, heating, cooling, running university laboratories, etc.

## 2.5. Ratio of renewable energy production towards total energy usage per year

Please provide the ratio of renewable energy produce towards total energy usage per year  
Please select one of the following options:

- [1] None
- [2] less than 20%
- [3] 20% - 40%
- [4] 40% - 60%
- [5] 60% - 80%
- [6] 80% - 100%

## 2.6. Elements of green building implementation as reflected in all construction and renovation policy

Please provide information on the elements of green building implementation as reflected in the construction and renovation policy in your university. Please select one or more that apply of the following list:

- [1] None. Please select this option if there is no green building implementation in your university.
- [2] Natural Ventilation. Please select this option if natural ventilation is used in your university for air circulation purposes.
- [3] Full-Day Natural Lighting. Please select this option if natural light is encouraged to be used for daily source of lighting during the day time whenever possible.
- [4] Existence of building energy manager. Please select this option if your university has building energy manager.
- [5] Existence of Green Building. Please select this option if your university has a green building.

## 2.7. Greenhouse gas emission reductions program

Please select a condition which reflects the current condition of your university in providing formal program to reduce greenhouse gas emissions on the following options:

- [1] None
- [2] Program in preparation
- [3] Program in initial implementation
- [4] Implemented in HVAC System / Refrigerator / Laboratory Gases  
(Heat, Ventilation, Air Conditioning and Refrigeration)

## 2.8. Please provide total carbon footprint (CO<sub>2</sub> emission in the last 12 months, in metric tons)

Please provide the total carbon footprint in your university. Please exclude carbon footprint from flights and secondary carbon sources such as dishes and clothes. You can use carbon footprint calculator from [www.carbonfootprint.com](http://www.carbonfootprint.com) as the standard of carbon footprint calculation, please visit the website to see elements of carbon footprint that you can count.

For the example of how to calculate your university carbon footprint please refer to the appendix

### 3. Waste (WS)

Waste treatment and recycling activities are major factors in creating a sustainable environment. The activities of university staff and students in campus will produce a lot of waste, therefore some programs and waste treatments should be among the concern of the university, i.e. recycling program, toxic waste recycling, organic waste treatment, inorganic waste treatment, sewerage disposal, policy to reduce the use of paper and plastic in campus.

#### 3.1. Policy to reduce the use of paper and plastic in campus

Please select a condition which reflects the current condition of your university in providing formal policy to reduce the use of paper and plastic from the following options:

- [1] None
- [2] Double sided-printed policy program
- [3] The use of tumbler
- [4] The use of reusable bag
- [5] Print when necessary

#### 3.2. Recycling program for university waste

Please select a condition which reflects the current condition of your university policy led effort to encourage staff and students to recycle waste, from the following options:

- [1] None
- [2] Partial (less than 25% of waste)
- [3] Partial (25% - 50% of waste)
- [4] Extensive (more than 50% of waste)

#### 3.3. Toxic waste handled

Please select a condition which reflects the current condition on how your university handles toxic wastes. The handling process includes whether toxic wastes are dealt separately, for example by classifying and handling it over to third party or certified handling companies. Please select one of the following options:

- [1] Not managed
- [2] Partly contained and inventoried
- [3] Completely contained, inventoried and handled

#### 3.4. Organic waste treatment

The method of organic waste (e.g. garbage, discarded vegetable and plant matter) treatment in your university. Please select an option that best describe your university overall treatment of the bulk of your organic waste:



- [1] Open dumping
- [2] Partly composted
- [3] Partly composted and compost used
- [4] Fully composted, compost used
- [5] Fully composted, compost used internally and externally

### 3.5. Inorganic waste treatment

Please describe the method of inorganic waste (e.g. rubbish, trash, discarded paper, plastic, metal, etc.) treatment in your university. Please select an option that best describes your university overall treatment of the bulk of your inorganic waste:

- [1] Burned in open are
- [2] Taken off campus to a dump site
- [3] Partially recycled (less than 50%)
- [4] Fully recycled (more than 50%)

### 3.6. Sewerage disposal

Please describe the primary method of sewerage treatment in your university. Please select an option that best describes how the bulk of your sewerage is disposed of:

- [1] Disposed untreated to waterways
- [2] Treated individually in septic tank
- [3] Centralized treatment before disposal
- [4] Treatment for recycling

## 4. Water (WR)

Water use in campus is another important indicator in GreenMetric. The aim is that universities can decrease water usage, increase conservation program, and protect the habitat. Water conservation program, water recycling program, water efficient appliances usage, and treated water consumed are among the criteria.

### 4.1. Water conservation program implementation

Please select a condition which describes your current stage program, which has a systematic and formalized program that support water conservation program (e.g. for lake and lake management system, rain harvesting system, water tank) in your university, from the following options:

- [1] None
- [2] Program in preparation (e.g. Feasibility Study and promotion)
- [3] Program in initial implementation (e.g. initial measurement of potential water conserved)

[4] Implemented in Rain Harvesting System

[5] Implemented in Ground Water Tank

[6] Implemented in Lake or Pond

#### 4.2. Water recycling program implementation

Please select a condition which reflects the current condition of your university in providing formal policy for water recycling program (e.g. the use of recycled water for toilet flush, car wash, plants irrigation, etc). Please select an option that describes your program at current stage:

[1] None

[2] Program in preparation (e.g. water efficient appliances selection priority are identified)

[3] Program in initial implementation (e.g. initial measurement of potential water recycle)

[4] Recycled water is used for garden sprinkler system

[5] Recycled water is used for toilet flush

[6] Recycled water is used for cooling system

#### 4.3. Water efficient appliances usage

Water efficient appliances usages are replacing conventional appliances. This is also extent to the use of water efficient appliances (e.g. using censored/automated hand washing tap, high efficient toilet flush, etc). Please select one of the following options:

[1] None

[2] Program in preparation (e.g. water efficient appliances selection priority are identified)

[3] Water efficient appliances installed is less than 25%

[4] Water efficient appliances installed is 25%-50%

[5] Water efficient appliances installed is 50%-75%

[6] Water efficient appliances installed is more than 75%

#### 4.4. Treated water consumed

Please indicate the percentage of treated water consumed (e.g. piped water and rain water tank source) from utility or piped system compared to all water consumed sources in your university.

#### 5. Transportation (TR)

Transportation system plays an important role on the carbon emission and pollutant level in university. Transportation policy to limit the number of motor vehicles in campus, the use of campus bus and bicycle will encourage a healthier environment. The pedestrian policy will encourage students and staff to walk around campus, and avoid using private vehicle. The use of environmentally friendly public transportation will decrease carbon footprint around campus.

5.1. Number of cars owned by your university

Please provide the number of car owned by your university.

5.2. Number of cars entering the university daily

Please provide the average number of cars that enter your university daily based on balanced sample, e.g. considering term and holiday periods.

5.3. Number of motorcycles entering the university daily

Please provide the average number of motorcycles that enter your university daily based on balanced sample, e.g. considering term and holiday periods.

5.4. Number of campus shuttle operated in your university

Please provide the number of campus shuttle operated in your university. The campus shuttle can be in the form of bus, MPV car or mini van which operated inside the campus.

5.5. Average passengers of each shuttle bus

Please provide the average passengers of each shuttle in one trip.

5.6. Total trips for service each day

Please provide the total trips for service each day.

5.7. Number of bicycles that are found on campus on an average day

Please provide the average number of bicycles found around the campus daily which include both those owned by the university and privately owned bikes.

5.8. Parking area type

Please select a condition which reflects the current condition of your university on your parking area type.

[1] Open space or horizontal type

[2] Combination of open space and building

[3] Building or vertical space

[4] Parking is not permitted

5.9. Transportation policy designed to limit or decrease the parking area on campus within 3 years (from 2013 to 2015)

Please select a condition which reflects the current condition of your university on the availability of transportation policy designed to limit or decrease the parking area on campus. Please select an option that best describe your university from the following options:

- [1] None
- [2] Program in preparation
- [3] Program in initial implementation
- [4] less than 10% decrease
- [5] between 10% - 30% decrease
- [6] more than 30% decrease

5.10. Transportation initiatives to limit or decrease private vehicles on campus

Please select a condition which reflects the current condition of your university on the availability of transportation initiatives to limit or decrease the number of private vehicles on campus. Please select an option that best describe your university from the following options:

- [1] None
- [2] High charging parking fee
- [3] Car sharing
- [4] Metro/tram/bus station on campus
- [5] Metro/tram/bus services inside campus

5.11. Campus shuttle service

Please describe the condition of the availability of shuttles for journeys within the campus and whether the ride is free or charged. Please select an option from the following options:

- [1] Shuttles use not possible or practical
- [2] Shuttles service is available, but paying service
- [3] Shuttles service is available and free service

5.12. Bicycle and pedestrian policy on campus

Reflects the extent to which use of bicycle or walking is supported. Please select an option from the following list that apply to your campus:

- [1] Bicycle and pedestrian way is not available
- [2] Bicycle use not possible or practical, but pedestrian way is available

[3] Bicycle and pedestrian way are available

[4] Bicycle and pedestrian way are available, and bicycles provided freely by university

5.13. The approximate travel distance of a vehicle each day inside campus only (in kilometers)

Please provide approximate travel distance of a vehicle (e.g. bus, car, motorcycle) each day inside campus only in kilometers.

6. Education (ED)

6.1. Number of courses related to environment and sustainability offered

The number of courses related to environment and sustainability offered at your university. Some universities have already tracked on how many courses available for this. The definition of the extent to which a course can be stated to be related to environment, sustainability, or both, can be define according to your university situation. If a course contributes in more than a minor or passing way to increasing awareness, knowledge, or action related to Environment and Sustainability, then it counts.

6.2. Total number of courses offered

The total number of all courses provided at your university yearly. This information will be used to calculate to what extend environment and sustainability education has been defined in your university teaching and learning.

6.3. Total research funds dedicated to environmental and sustainability research (in US Dollar)

Please provide the average funding for research on environment and sustainability per annum over the last 3 years.

6.4. Total research funds (in US Dollars)

The average total research funds per annum over the last 3 years. This information will be used to calculate the percentage of environment and sustainability research funding to the overall research funding.

6.5. Number of scholarly publications on environment and sustainability published

Please provide the average number of publication on environment and sustainability published annually over the last 3 years.

6.6. Number of scholarly events related to environment and sustainability

Please provide the number of scholarly events (eg. conferences, workshops, etc.) that was **hosted or organized** by your university related to environment and sustainability (average per annum over the last 3 years).

6.7. Number of student organizations related to environment and sustainability

Please provide the total number of student organizations at faculty and university level. For example a student movement on green campus in the faculty of humanities can be considered as one organization.

6.8. Existence of a university-run sustainability website

If your university has sustainability website, please provide the address of the web. Some detailed information of a university website to educate students and staff as well as providing information of their latest involvement on green campus, environment and sustainability programs will be very beneficial. You could also email us some report such as University Sustainability Tracking, Assessment and Rating System (STARS) report, if you have one. We welcome any e-mail or hardcopy of your university sustainability evaluation and report as well as evidence on sustainability activities in your university.

## **Related Papers and Publications about UI GreenMetric**

1. UI GreenMetric Ranking of World Universities: Methodology and Evaluation by Prof. Riri Fitri Sari, Prof. Gunawan Tjahyono Published at Journal of Higher Education Evaluation and Development Volume 6, No.2 (December 2012)
2. Evaluating UI GreenMetric as a tool to Support Green Universities Development: Assessment of the Year 2011 Ranking by Dr. Nyoman Suwartha and Prof. Riri Fitri Sari. Published at Journal of Cleaner Production Volume 61, (15 December 2013)
3. Proceeding of International Workshop of UI Greenmetric 2013:
  - a) University Setting and Infrastructure achievement towards World Class Green University by Nyoman Suwartha, Riri Fitri Sari, Gunawan Tjahjono, Atmadewita in Proceeding of International Workshop of UI Greenmetric 2013
  - b) Universitas Indonesia, The Nation's Greenest Campus Nyoman Suwartha, Riri Fitri Sari, Gunawan Tjahjono, Atmadewita in Proceeding of International Workshop of UI Greenmetric 2013
4. Critical review of a global campus sustainability ranking: GreenMetric by Allan Lauder, Riri Fitri Sari, Nyoman Suwartha, Gunawan Tjahjono in Journal of Cleaner Production (March 2015)
5. UI GreenMetric World University Ranking: The Roles and Its Impact, Presentation on APAIE (3 March 2016)
6. Presentation on IREG Forum, Evaluation of UI GreenMetric 2010-2015: Chalennges and Opportunity
7. Carleton University's Integrated Vision for Sustainability in Research, Teaching, Campus Plan and Operations by Prof. Roseann O'Reilly Runte, Carleton University, presented at the 2<sup>nd</sup> International Workshop on UI GreenMetric 2016 21 April 2016
8. Development of Sustainability in University College Cork by Mr. Mark Poland and Professor John O'Halloran. University College Cork presented at the 2<sup>nd</sup> International Workshop on UI GreenMetric 2016 21 April 2016
9. Sustainability at PNU Campus by Musaad Almosaind, Princess Noura University, presented at the 2<sup>nd</sup> International Workshop on UI GreenMetric 2016 21 April 2016
10. The Future Challenge for the Implementation of Eco-Campus Programme at ITS Surabaya by Joni Hermana,<sup>a</sup> and Idaa Warmadewanthi presented at the 2<sup>nd</sup> International Workshop on UI GreenMetric 2016 21 April 2016
11. Sustainability Indicators of the University of Zanjan by Khalil Jamshidi and Esmail Karamidehkordi presented at the 2<sup>nd</sup> International Workshop on UI GreenMetric 2016 21 April 2016
12. Towards Sustainable University through Setting and Infrastructure Development at the Universitas Indonesia by Nyoman Suwartha, Riri Fitri Sari, Baiduri Widanarko, Ayomi

- Rarasati, Adi Zakaria Afiff presented at the 2<sup>nd</sup> International Workshop on UI GreenMetric 2016 21 April 2016
13. The University of Alcalá's efficient energy policies. Where are we? Where are we headed? by Carlos Báez, Amparo Andreu, Rubén Garrido, José Santiago Fernández, Jesús Cano, Fernando Galván, presented at the 2<sup>nd</sup> International Workshop on UI GreenMetric 2016 21 April 2016
  14. The University in a Green Forest – Towards Eco-Friendly Campus by Mohamed Mustafa Ishak presented at the 2<sup>nd</sup> International Workshop on UI GreenMetric 2016 21 April 2016
  15. The Development of Sustainability at BOKU University of Natural Resources and Life Sciences, Vienna Austria by Dominik Schmitz MSc, Thomas Lindenthal PhD<sup>1,b</sup>, Lisa Bohunovsky MSc presented at the 2<sup>nd</sup> International Workshop on UI GreenMetric 2016 21 April 2016
  16. The Strategic Environmental Plan of Federal University of Lavras, Brazil: Who We Are, Where We Came From, Where We Want to Go by José Roberto Soares Scolforo, Zuy Maria Magriotis, Ana Carla Marques Pinheiro, José Maria de Lima, Cibele Maria Garcia de Aguiar, Luiz Roberto Guimarães Guilherme presented at the 2<sup>nd</sup> International Workshop on UI GreenMetric 2016 21 April 2016
  17. Thammasat University Implementation on Sustainability: Natural Resources, Energy, and Environmental Conservation by Chanan Phonprapai, presented at the 2<sup>nd</sup> International Workshop on UI GreenMetric 2016 21 April 2016
  18. Reduction of water resources consumption and the student-led environmental management system of Chiba University by Sakiko Okayama, presented at the 2<sup>nd</sup> International Workshop on UI GreenMetric 2016 21 April 2016
  19. Chulalongkorn University Development: Approaches and Achievements to Sustainability Campus Korb Limsuwan, Boonchai Stitmannaitum, presented at the 2<sup>nd</sup> International Workshop on UI GreenMetric 2016 21 April 2016
  20. Developing Conservation in Semarang State University by Prof. Dr. Fathur Rokhman, M.Hum, presented at the 2<sup>nd</sup> International Workshop on UI GreenMetric 2016 21 April 2016
  21. UI GreenMetric sustainability indicators in the University of Castilla-La Mancha (Spain) by Federico Fernández-González and Miguel Ángel Collado Yurrita, presented at the 2<sup>nd</sup> International Workshop on UI GreenMetric 2016 21 April 2016
  22. Integrated Water Treatment with Landscape Architecture and Ecological Education in NPUST: A Status Report by Chin-Hui Chen, Hsiu-Chu Lee, Jik Chang Leong, presented at the 2<sup>nd</sup> International Workshop on UI GreenMetric 2016 21 April 2016
  23. Water and Wastewater Management on Jordan University of Science and Technology Campus by Prof. Majed Abu-Zreig, presented at the 2<sup>nd</sup> International Workshop on UI GreenMetric 2016 21 April 2016



24. Sustainable Initiatives to Improve Higher Education Performance by Prof. Dr. Werry Darta Taifur, presented at the 2<sup>nd</sup> International Workshop on UI GreenMetric 2016 21 April 2016
25. Paving the Way to a Green Campus: Kasetsart University by Ratchot Chompunich, Supaporn K. Leopairojna, presented at the 2<sup>nd</sup> International Workshop on UI GreenMetric 2016 21 April 2016

## Appendix 1

Details of the scoring are described as follows:

No	Criteria and Indicators	Points	Score	Weighting
<b>1</b>	<b>Setting and Infrastructure (SI)<sup>s</sup></b>			<b>15%</b>
SI 1	The ratio of open space area towards total area	300		
SI 2	The ratio of open space area towards campus population	300		
SI 3	Area on campus covered in forested vegetation	200		
SI 4	Area on campus covered in planted vegetation	200		
SI 5	Area on campus for water absorbance	300		
SI 6	University budget for sustainable effort	200		
	Total	1500		
	<b>Energy and Climate Change (EC)</b>			<b>21%</b>
EC 1	Energy efficient appliances usage	200		
	None		0	
	Less than 20%		0.15×200	
	20% - 40%		0.25×200	
	40% - 60%		0.50×200	
	60% - 80%		0.75×200	
	80% - 100%		200	
EC 2	Smart building implementation	300		
	None		0	
	Program in preparation (e.g. feasibility study or detailed engineering designed phase)		0.15×300	
	Program in initial implementation (e.g. builder already appointed)		0.25×300	
	Implemented in less than 30% of the total building area		0.50×300	
	Implemented in between 30% - 70% of the total building area		0.75×300	
	Implemented in more than 70% of the total building area		300	
EC 3	Renewable energy usage <sup>†</sup>	300		
	None		0	
	Bio diesel		1/7×300	
	Clean biomass		1/7×300	
	Solar power		1/7×300	

No	Criteria and Indicators	Points	Score	Weighting
	Geothermal		1/7×300	
	Wind power		1/7×300	
	Hydropower		1/7×300	
	Combine heat and power		1/7×300	
EC 4	The ratio of total electricity usage towards campus population <sup>§</sup>	300		
EC 5	The ratio of renewable energy produce towards energy usage	200		
	None		0	
	Less than 20%		0.15×200	
	20% - 40%		0.25×200	
	40% - 60%		0.50×200	
	60% - 80%		0.75×200	
	80% - 100%		200	
EC 6	Element of green building implementation <sup>‡</sup>	300		
	None		0	
	Natural ventilation		0.25×300	
	Full natural day-lighting		0.25×300	
	Existence of building energy manager		0.25×300	
	Existence of Green Building		0.25×300	
EC 7	Greenhouse gas emission reduction program	200		
	None		0	
	Program in preparation (e.g. feasibility study and promotion)		0.33×200	
	Program in initial implementation (e.g. initial measurement of gas emission reduction)		0.66×200	
	Implemented in HVAC System/Refrigerator/Laboratory Gases		200	
EC 8	The ratio of total carbon footprint towards campus population <sup>§</sup>	300		
	Total	2100		
	<b>Waste (WS)</b>			<b>18%</b>
WS 1	Program to reduce the use of paper and plastic in campus <sup>‡</sup>	300		
	None		0	
	Double sided-printed policy program		0.25×300	
	The use of tumbler		0.25×300	
	The use of reusable bag		0.25×300	
	Print when necessary		0.25×300	

No	Criteria and Indicators	Points	Score	Weighting
WS 2	Recycling program for university waste	300		
	None		0	
	Partial (less than 25% of waste)		0.33×300	
	Partial (25%-50% of waste)		0.66×300	
WS 3	Toxic waste handled	300		
	Not managed		0	
	Partly contained and inventoried		0.5×300	
	Completely contained, inventoried and handled		300	
WS 4	Organic waste treatment	300		
	Open dumping		0	
	Partly composted and compost dumped		0.25×300	
	Partly composted and compost used		0.5×300	
	Fully composted, compost used		0.75×300	
WS 5	Inorganic waste treatment	300		
	Burned in open area		0	
	Taken off campus to a dump site		0.33×300	
	Partially recycled (less than 50%)		0.66×300	
WS 6	Sewerage disposal	300		
	Disposed untreated to waterways		0	
	Treated individually in septic tank		0.33×300	
	Centralized treatment before disposal		0.66×300	
	Treatment for recycling		300	
	Total	1800		
	<b>Water (WR)</b>			<b>10%</b>
WR 1	Water conservation program∞	300		
	None		0	
	Program in preparation (e.g. Feasibility Study and promotion)		0.15×300	
	Program in initial implementation (e.g. initial measurement of potential water conserved)		0.25×300	
	Implemented in Rain Harvesting System		0.25×300	
WR 2	Water recycling program∞	300		
	Implemented in Ground Water Tank		0.25×300	
	Implemented in Lake or Pond		0.25×300	
	None		0	

No	Criteria and Indicators	Points	Score	Weighting
	Program in preparation (e.g. Feasibility Study and promotion)		0.15×300	
	Program in initial implementation (e.g. initial measurement of potential water conserved)		0.25×300	
	Recycled water is used for garden sprinkler system		0.25×300	
	Recycled water is used for toilet flush		0.25×300	
	Recycled water is used for cooling system		0.25×300	
WR 3	The use of water efficient appliances	200		
	None		0	
	Program in preparation (e.g. water efficient appliances selection priority are identified)		0.15×200	
	Water efficient appliances installed (less than 25%)		0.25×200	
	Water efficient appliances installed (25%-50%)		0.50×200	
	Water efficient appliances installed 50%-75%)		0.75×200	
	Water efficient appliances installed (more than 75%)		200	
WR 4	Treated water consumed <sup>§</sup>	200		
	Total	1000		
	<b>Transportation (TR)</b>			<b>18%</b>
TR 1	The ratio of vehicles (cars and motorcycles) towards campus population <sup>§</sup>	200		
TR 2	The ratio of campus bus services towards campus population <sup>§</sup>	200		
TR 3	The ratio of bicycles found towards campus population <sup>§</sup>	200		
TR 4	Parking area type	200		
	Open space or horizontal type		0.25×200	
	Combination of open space and building		0.50×200	
	Building or vertical space		0.75×200	
	Parking is not permitted		200	
TR 5	Initiatives to decrease private vehicles on campus <sup>‡</sup>	200		
	None		0	
	High charging parking fee		0.25×200	
	Car sharing		0.25×200	
	Metro/tram/bus station on campus		0.25×200	

No	Criteria and Indicators	Points	Score	Weighting
	Metro/tram/bus services inside campus		0.25×200	
TR 6	Parking area reduction for private vehicles within 3 years (from 2013 to 2015)	200		
	None		0	
	Program in preparation (e.g. feasibility study and promotion)		0.25×200	
	Less than 10% decrease		0.50×200	
	Between 10% - 30% decrease		0.75×200	
	More than 30% decrease /or parking is not permitted in campus		200	
TR 7	Campus shuttle services	300		
	Shuttles use is possible but not provided		0	
	Shuttles service is available, but paying service		0.5×300	
	Shuttles service is available and free service. Or bus use is not possible		300	
TR 8	Bicycle and pedestrian policy on campus	300		
	Bicycle and pedestrian way is not available		0	
	Bicycle use not possible or practical, but pedestrian way is available		0.33×300	
	Bicycle use not possible or practical, but pedestrian way is available		0.66×300	
	Bicycle and pedestrian way are available, and bicycles provided freely by university		300	
	Total	1800		
<b>6</b>	<b>Education (ED) §</b>			<b>18%</b>
ED 1	The ratio of sustainability courses towards total courses	300		
ED 2	The ratio of sustainability research funding towards total research funding	300		
ED 3	Sustainability publications	300		
ED 4	Sustainability events	300		
ED 5	Sustainability student organizations	300		
ED 6	Sustainability website	300		
	Total	1800		
	<b>TOTAL</b>	<b>10000</b>		

§The score of these criteria and/or indicators is based on the minimum and maximum numbers from participants. Hence, the score of these criteria and/or indicators can only be calculated after all participants have submitted their data.

‡Each response (except 'None') scores  $1/7 \times 300$ . For example, if you choose 'Bio diesel' only, your score is  $1/7 \times 300$ ; if you choose 'Bio diesel', 'Solar power', and 'Geothermal', your score is  $[(1/7)+(1/7)+(1/7)] \times 300$

‡Each response (except 'None') scores  $0.25 \times 300$  (for EC6 and WS1) or  $0.25 \times 200$  (for TR5). For example, if you choose 'Natural ventilation' only, your score is  $0.25 \times 300$ ; if you choose 'Full natural day-lighting' and 'Existence of building energy management', your score is  $(0.25+0.25) \times 300$

∞For WR1 and WR2, the score for 'None' is 0, the score for 'Program in preparation' is  $0.15 \times 300$ , the score for 'Initial implementation' is  $0.25 \times 300$ . You may select more than one option for [4], [5], and [6], and get  $0.25 \times 300$  (with additional  $0.25 \times 300$ ) for each score. For example, if you choose option [4], your score is  $[0.25+(0.25)] \times 300$ . If you choose options [4], [5], and [6], your score is  $[0.25+0.25+0.25+(0.25)] \times 300$ .

## Appendix 2

### Calculation of Carbon Footprint

The Carbon footprint calculation can be conducted based on the stage of calculation as state <http://carbonfootprint.org>, which is the sum of electricity usage per year and transportation per year.

- Carbon Footprint Per Year

Total emissions divided by open space area per total people

Notes :

Total emissions come from:

- Electricity usage per year
  - Transportation per year: Bus, Car, Motorcycle

Example of calculation :

- Open space area = total campus area – total ground floor area of building
- Total people = number of students including part- and full- time students + number of academic and administrative staff
- Electricity Usage Per Year

CO<sub>2</sub> emission from electricity

= (electricity usage per year in Kwh / 1000) x 0.84

= (1633286 Kwh/1000) x 0.84

= 1371.96 metric ton

Notes:

Electricity usage per year in UI = 1633286 Kwh

0.84 is the coefficient to convert Kwh to Metric ton (source: carbonfootprint.com)

- Transportation Per Year (Bus)

$$\begin{aligned}
&= (\text{Number of shuttle bus in your University} * \text{total trips for shuttle bus service each day} * \text{approximate travel distance of a vehicle each day inside campus only (in kilometers)} * 240/100) * 0.01 \\
&= ((15 * 150 * 5 * 240)/100) * 0.01 \\
&= 270 \text{ metric ton}
\end{aligned}$$

Notes :

240 is number of working days per year

0.01 is the coefficient (source: carbonfootprint.com) to calculate the emission in metric ton per 100 km for bus

- Transportation Per Year (Car)

$$\begin{aligned}
&= (\text{Number of cars entering your University} * 2 * \text{approximate travel distance of a vehicle each day inside campus only (in kilometers)} * 240/100) * 0.02 \\
&= ((2000 * 2 * 5 * 240)/100) * 0.02 \\
&= 960 \text{ metric ton}
\end{aligned}$$

Notes :

240 is number of working days per year

0.02 is the coefficient (source : carbonfootprint.com) to calculate the emission in metric ton per 100 km car

- Transportation Per Year (Motorcycle)

$$\begin{aligned}
&= (\text{Number of motorcycle entering your University} * 2 * \text{approximate travel distance of a vehicle each day inside campus only (in kilometers)} * 240/100) * 0.01 \\
&= ((4000 * 2 * 5 * 240)/100) * 0.01 \\
&= 960 \text{ metric ton}
\end{aligned}$$

Notes :

240 is number of working days per year

0.01 is the coefficient (source: carbonfootprint.com) to calculate the emission in metric ton per 100 km for motorcycle

- Total Emission Per Year

$$\begin{aligned}
&= \text{total emission from electricity usage} + \text{transportation (bus, car, motorcycle)} \\
&= 1371.96 + (270 + 960 + 960) \\
&= 3561.96 \text{ Metric ton}
\end{aligned}$$



**UI GreenMetric Ranking Team**

**Ver 1.15 October 14<sup>th</sup> 2016**

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