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Development to be a sustainable university by GreenMetric Ranking: a case of Rajamangala University of Technology Thanyaburi, Pathum Thani, Thailand

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Accomplishing the goals of an eco-university, Rajamangala University of Technology Thanyaburi (RMUTT), a suburban university in Thailand was initiated to practice an active role using the green university policy since 2016. There are two campus sites, which consist of Klong Hok Campus and Rangsit Center that located at Pathum Thani Province, Thailand. This paper was aimed to introduce the development of RMUTT to be a green campus and evaluate their results related to environment and sustainability by using UI GreenMetric ranking system during in 2017 - 2018. Six main criteria (i.e. setting and infrastructure, energy and climate change, waste, water, transportation and education and research) were probably evaluated by an effective procedure, which referred to the questionable performance on campus in each year. In 2017, it was the first time to join this ranking that produced the total based-score (about 4,095 of 10,000 maximum scores) of ranking in both national and international outputs, respectively. Various efforts of implementation at RMUTT were also detailed, such as the preparation of green and smart buildings, the application of light-emitting diode (LED) tubes and smart meters for monitoring the electrical usage on campus. Many projects have been performed for saving energy, waste-water recycling, promotion of green education and research to increase environmental awareness and sustainability. Until the year 2018, such an effort was better resulted, when compared to the last year, depending on the total based-score (about 4,825 of 10,000 maximum scores).

Keywords: Smart Building, Energy saving, Green Campus, Sustainability, Rajamangala University of Technology Thanyaburi

1. Introduction

Rajamangala University of Technology Thanyaburi (RMUTT) is now a well-established comprehensive university, offering a diverse range of programs to serve a variety of education and research. On September 15, 1988, His Majesty King Bhumibol Adulyadej (King Rama IX) bestowed the name "Rajamangala Institute of Technology" meaning the technological institute of the royal grace. Later, Rajamangala Institute of Technology has been changed the status to be Rajamangala University of Technology and then highly recognized as university of technology and innovation having a commitment on producing "hands-on graduates" to serve the nearby communities and society. Nowadays, not only almost universities worldwide devoted themselves to academic and research outcomes, but they are also mentioned to awareness on activities involved in environment and sustainability. This challenging issue has officially ranked by the Universitas Indonesia (UI) GreenMetric World University Rankings in 2010. To make the global university rankings on sustainability in each part and appreciation of universities' sustainable behavior and development¹⁾, it was suitably progressed through an online

and open access system. Main six categories are used to indicate that the percentage of total points (%) (Table 1.), which are consist of setting and infrastructure (SI), energy and climate change (EC), waste (WS), water (WR), Transportation (TR) and Education and Research (ED), respectively^{7) 8)}. RMUTT has been first participated to joint in the UI GreenMetric World University Rankings in 2017. Thereby allowing the administration of the president, Associate Professor Dr. Prasert Pinpathomrat and the executives who were initiated the official green policy that dedicated to environmental awareness and sustainability on campus. Since year 2017, each faculty and college within RMUTT act to encourage the activities related in the environment management and sustainability. Moreover, the rationale of sustainability courses was greater increased (from 2.32% to 2.59%) during in 2017 – 2018^{7) 8)}.

Regarding to the continuous development of the university for two years ago, in 2017, RMUTT was ranked 382nd in the world out of all 619 participants or the 22th ranking out of 27 universities from Thailand⁹⁾. Whilst, the world university rankings on sustainability of RMUTT in 2018 was well being ranked to 333rd in the world and then also raised it up to the 17th ranking in Thailand¹⁰⁾. This paper was aimed to report the annually performance and presentation in framework of UI GreenMetric criteria and indicators during in year 2017 – 2018. To develop the RMUTT to be a sustainable campus of higher education in Thailand. According to the RMUTT policy has been driven to mention as a good model for the societies and

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communities around the university, as well as to maintain the well-being conditions, environment and sustainability on campus. It is hereby announced to the university staffs, personnel and students.

2. Methodology

Universitas Indonesia (UI) initiated world university rankings in 2010, later known as UI GreenMetric World University Rankings for measuring green campus and sustainability efforts⁶⁾. It was intended to create an online survey to portray sustainability policies programs and in universities around the world. This global university ranking has been served as a tool for evaluation the universities to deal with sustainability challenges^{3) 4)}. Universities worldwide can be network and work together to improve their indicators and reduce negative environmental impacts⁵⁾. UI GreenMetric is a nonprofit institution; therefore, many universities can participate for free^{9) 10)}. Six main criteria of UI GreenMetric World University Ranking were investigated to score by numeric data and statistic processing that shown in Table 1 and Table 2.

Table 1 The six categories used for calculation in the ranking and their point weighting¹⁰⁾.

No.	Category	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
	Total	100

Table 2 Indicators suggested for use in the 2018 ranking¹⁰⁾.

No.	Categories/Indicators	Points	Weighting
1	Setting and Infrastructure (SI)		15%
SI 1	The ratio of open space area towards total area	300	
SI 2	Area on campus covered in forest	300	
SI 3	Area on campus covered in planted vegetation	300	
SI 4	Area on campus for water absorbance	200	
SI 5	The ratio of open space area divided campus population	200	

SI 6	University budget for sustainability effort	200	
	Total	1500	
2	Energy and Climate Change (EC)		21%
EC1	Energy efficient appliances usage	200	
EC2	Smart building program implementation	300	
EC3	Number of renewable energy source in campus population	300	
EC4	The total electricity usage divided by total campus population	300	
EC5	The ratio of renewable energy production towards total energy usage per year	200	
EC6	Element of green building implementation	300	
EC7	Greenhouse gas emission reduction program	200	
EC8	The ratio of total carbon footprint divided campus population	300	
	Total	2100	
3	Waste (WS)		18%
WS1	Recycling program for university waste	300	
WS2	Program to reduce the use of paper and plastic in campus	300	
WS3	Organic waste treatment	300	
WS4	Inorganic waste treatment	300	
WS5	Toxic waste treatment	300	
WS6	Sewerage disposal	300	
	Total	1800	
4	Water (WR)		10%
WR1	Water conservation program implementation	300	
WR2	Water recycling program implementation	300	
WR3	The use of water efficient appliances	200	
WR4	Treated water consumed	200	
	Total	1000	
5	Transportation (TR)		18%

TR1	The ratio of total vehicles (cars and motorcycles) divided by total campus population	200	
TR2	Shuttle services	200	
TR3	Zero Emission Vehicles (ZEV) policy on campus	200	
TR4	The ratio of Zero Emission Vehicles (ZEV) divided by total campus population	200	
TR5	Ratio of parking area to total campus area	200	
TR6	Transportation program designed to limit or decrease the parking area on campus for the last 3 years (from 2015 to 2017)	200	
TR7	Number of transportation initiatives to decrease private vehicles on campus	300	
TR8	Pedestrian policy on campus	300	
	Total	1800	
6	Education and Research (ED)		18%
ED1	The ratio of sustainability courses towards total courses/subjects	300	
ED2	The ratio of sustainability research funding towards total research funding	300	
ED3	Sustainability publications	300	
ED4	Sustainability events	300	
ED5	Sustainability student organizations	300	
ED6	Sustainability website	200	
ED7	Sustainability report	100	
	Total	1800	

3. Results and discussion

Rajamangala University of Technology Thanyaburi (RMUTT) was continuously performed and carried out sustainable activities by following the criteria and considerable indicators of UI GreenMetric World University Ranking System. The data in each part and the categories were measured by counting together with smart tools and visual observations around the university, which were monitored and then collected that all of related data during in the fiscal year 2016 to 2019.

3.1 Campus setting and infrastructure

RMUTT consists of Klong Hok Campus and Rangsit Center, which are located in Pathum Thani Province, Thailand (Fig. 1).

- Total main campus (Klong Hok Campus) area: $1.12 \text{ km}^2 = 1,120,000 \text{ square meters (m}^2\text{)}$.
- Total main campus distance: $4.29 \text{ km (2.67 mi)} = 4,290 \text{ meters (m)}$.
- Total forest area is approximately $282,313.19 \text{ in square meters (m}^2\text{)}$.

Because of main campus areas of RMUTT were found to be the rice fields in the past, thereby covering with both native and introduced plant species in many sites, such as the roads, gardens and buildings. Additionally, the implementation of the buildings and site administration within the university were taken by the proportion of green areas at least 60% of the total campus area.



Fig. 1 Showing the two campus sites of RMUTT in Pathum Thani Province, Thailand.

3.2 Energy saving and smart buildings

The executives of RMUTT have been performed to construct the prototype of smart buildings and green buildings on campus. Moreover, the green university policy and planning are also promoted the use of renewable energy within the university, for example; bio-diesel, biomass, biogas, solar panels, etc. Regarding to the comparison of the electrical usage between the year 2017 and 2018, which could be decrease to 9.32% that showed in the Fig. 2. At the same time, the executives, governments and employees of RMUTT have been performed to

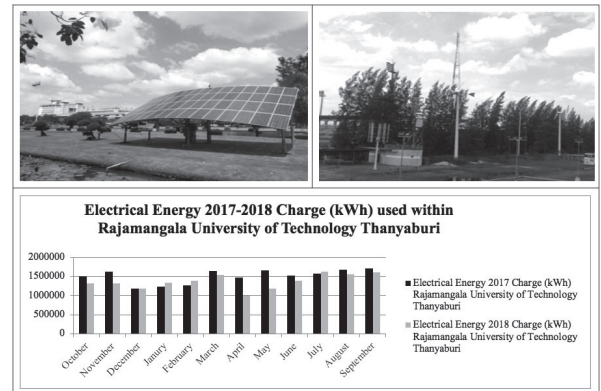


Fig. 2 The use of renewable energy and electrical usage on campus during in year 2017 – 2018.

reduce greenhouse gas emission and the amount of carbon footprint on campus, especially 15,344 metric ton per year.

3.3 Waste recycling

The executives and personnel of RMUTT act on the awareness and responsibilities of waste management that authorized to all of the university staff. It was also supported about the development and improvement of the waste management on campus. Such an efficient project was to recycle the plastic waste for diesel energy and any recycled plasticware that performed by Faculty of Engineering, Rajamangala University of Technology Thanyaburi (RMUTT) (Fig. 3).



Fig. 3 The project to recycle plastic inorganic waste such as plastic water bottles and the like.

3.4 Water management

The waste water management system of the university was performed by the central waste water treatment plant that placed on campus. Waste water sent to treat into the aeration tank through sedimentation system with overflow, and then proceeded together with the filter system again before utilization, such as watering plants, gardens, fire trucks and so on (Fig. 4). Depending on biochemical oxygen demand (BOD) value of treated water consumed in campus was in range 7.8 – 7.9 mg/L.

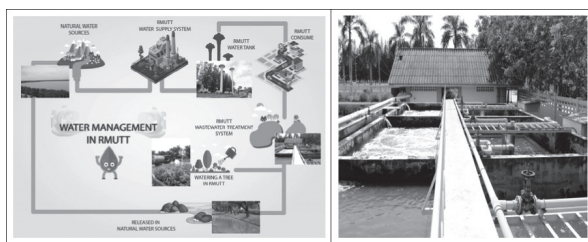


Fig. 4 Monitoring the water conservation and management that organized within RMUTT.

3.5 Transportation and zero emission vehicles (ZEV) policy

The executives, employees and students of RMUTT have been arranged to use an electric mini-bus service, which is a public transportation system inside the university in order to reduce the use of private vehicles (cars and motorcycles). Actually, this campaign resulted to decrease the accidents, which is promoted the use of sustainable energy on campus (Fig. 5).



Fig. 5 Utilization and promotion of the use of zero emission vehicles (ZEV) on campus.

3.6 Education and research dedicated to environment and sustainability

The executives and personnel of RMUTT have been promoted and act to support teaching, learning activities, research and sustainability campaigns, which were mainly foster together by the student clubs and student organizations within the university.

The example of activities related to environment and sustainability on campus that performed by student organization named “UI Green University RMUTT”, Faculty of Science and Technology (Fig. 6). However, we were created a website related to energy serving, environmental management and sustainability for disseminating information and database to the university employees, personnel and students (Available on www.greenuniversity.rmutt.ac.th). The education and research related to sustainability should also be incorporated into the overall action plan and policy of the university and then participated in various efforts²⁾.



Fig. 6 The example of activities related to environment and sustainability on campus.

4. Conclusions

Moreover, the closely collaboration of all faculties (about 11 faculties and 1 college, following by Faculty of Engineering, Faculty of Liberal Arts, Faculty of Fine and Applied Arts, Faculty of Home Economics Technology, Faculty of Business Administration, Faculty of Architecture, Faculty of Technical Education, Faculty of Science and Technology, Faculty of Mass Communication Technology, Faculty of Agricultural Technology, Faculty of Nurse and Thai Traditional Medicine College), staff

members and students and efficiently comprehensive plan and policy will be necessary for moving towards an eco-university and sustainable campus, which provided the knowledge and more resources supporting its implementation in the future.

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- Personnel Division
- Finance Division
- Public Relations Division
- Department of Student Development
- Legal Affairs Division
- International Strategy Division
- Office of Academic Promotion and Registration
- Office of Academic Resource and Information Technology
- Office of Educational Quality Assurance
- Office of Cooperative Education
- Institute of Research and Development
- University Business Incubator (RMUTT-UBI)
- Technology Licensing Office Rajamangala University of Technology (TLO)
- Office of Assets Management
- Internal Auditing Unit
- RMUTT Broadcasting Station
- The Rajamangala University of Technology Savings and Credit Co-Operative Limited
- Welfare Shop
- Office of Graduate Studies
- Faculty of Business Administration
- Faculty of Home Economics Technology
- Faculty of Technical Education
- Faculty of Mass Communication Technology

- Faculty of Science and Technology
- Faculty of Engineering
- Faculty of Liberal Arts
- Faculty of Fine and Applied Arts
- Faculty of Agricultural Technology
- Faculty of Architecture
- Faculty of Nursing
- Thai Traditional Medicine College
- Hands-On Center
- Student SERVICE Center
- Rajamangala University of Technology Thanyaburi Alumni Association “RMUTTA”
- Innovation Demonstration School
- Hotel RajaBongKod
- etc.

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