

## Improving Green Metric ranking by implementation of effective actions, the practical solution towards sustainable universities (Case study: University of Guilan, Iran)

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### ABSTRACT

Universities are recognized as the main centres for innovation and environmental education, hence have a very important responsibility to increase awareness, knowledge, technologies, and necessary tools to create a sustainable future. A green campus is an important aspect of a green university and a way to promote sustainable development. Green Metric ranking has been considered as a standard framework and guide for green universities. The University of Guilan scores and ranking in 2017 at Green Metric index was used as basic information. Then, the weaknesses and threats were determined and the solution based on actions of four top universities in Green Metric ranking were obtained and implemented at this university. Eventually, the results of effective actions were evaluated by the Green Metric score results in 2018 and 2019. The results showed that the plans to improve sustainability and reach to green university were efficient from 2017 to 2019 at the University of Guilan. The University of Guilan international ranking on the Green Metric index from 2017 to 2019 has been increased by 326, 262, and 198 respectively. In addition, at the national level, its score has been improved from 8 in 2017 to 4 in 2018 and 3 in 2019. Overall, it is expected that, due to the university's green approach and providing new solutions, the position of the university in this ranking could be increase significantly in the next few years. Therefore, the continued implementation of such a program requires the attention of the university officials to sustainable development subject.

**Key words.** Green Metric, Sustainability, Green universities, Effective actions, University of Guilan.

**Article type:** Research Article.

### INTRODUCTION

Higher education institutions (universities) have high potential to participate in environmental activities. The aim of institutes is the change of society's environment behaviour and find better solutions to critical environmental conditions (Johnstone *et al.* 1998). Universities are recognized as the main centres for innovation and environmental education, which represents a valuable opportunity to create behavioural changes for the next generation to achieve better attitudes in everyday life (Tukker *et al.* 2009; Jackson 2009). Universities can be considered as complex campuses in waste production, transportation, water, energy and electricity consumption, as well as scientific, social, and educational activities. Also, university activities should increase students' intellectual, emotional, and political commitment to sustainability and stimulate the process of collaboration among students to create a sustainable education (Jones *et al.* 2010). Therefore, universities have a very important responsibility to increase awareness, knowledge, technologies, and necessary tools to create a sustainable future from an environmental perspective (Calder & Clugston 2003). A green campus is an important aspect of a green university and is a way to promote sustainable development (Wang *et al.* 2014). The subject of sustainability in higher education came back to the late 1970s with an emphasis on environmental education (Sauvé *et al.* 2007).

The importance of this issue is so clear, while the United Nations named the decade of education for sustainable development from 2005 to 2014 in order to integrate the principles, values, and practices of sustainable development into all aspects of education and learning. This educational effort caused a sustainable future through changes in behaviours regarding environmental integrity, economic life, and society for current and future generations (UNESCO 2018). It also caused a large number of universities to have sustainable development programs in the last two decades (Lozano *et al.* 2013). The goal of the green university is to implement the strategy of sustainable development through sharing the concept of sustainable development, conducting scientific research and related technical services, green education, and cultivating talents with green awareness and behavioural patterns (Liu *et al.* 2013). Therefore, it is desirable that relevant officials pay more attention to sustainable development in higher education institutions (Disterheft *et al.* 2015). Sustainability is the boundary of societies that allows us to meet the needs of our future generation by meeting our current needs. Meanwhile, the concept of sustainability is historically based on a triple theory, i.e., the three spheres of social, economic, and environment have similar importance and are strongly connected. Development should consider the integration between economy, society, and environment for sustainability and provide a balance between them, in which case a similar model is used for sustainable universities. University sustainability has become a global concern for policymakers and university planners due to the awareness of the impact of university activities on the environment (Lukman *et al.* 2010; Massimo *et al.* 2016). In the last two decades, the university green rankings have become a global phenomenon, while most of these ranking methods focus on research and scientific credibility, and less attention have attracted to environmental issues (Alshuwaikhat & Abubakar 2008). The Green League in 2007, the Environmental and Social Responsibility Index in 2009, and the Global Green Metric Ranking in 2010 are examples of environmental impact rating systems resulting from academic activities (Grindsted 2011). Green Metric ranking can be considered as a standard framework and guide for building a green university and build on all their activities (Suwartha & Sari 2013). Green Metric indicators are based on the Berlin principles that measure urban morphology, sustainability policies (energy, transportation, waste, water), and academic scientific programs (Marrone *et al.* 2018). This ranking is one of the initiatives in promoting sustainability in universities and the participation of stakeholders in any kind of effort to create a sustainable environment. In 2010, 95 universities from 35 countries participated in this ranking, while in 2017, 619 universities from 76 countries. The ever-increasing shows that the Green Metric is the first and only system ranking of the world's universities in the field of sustainability. Due to the high consumption of energy, transportation, generated waste, consumption of materials, and the development of buildings, a university can affect the environment negatively. Therefore, it is necessary to evaluate the performance of the university (Amrina *et al.* 2015). In this regard, to promote sustainability, higher education institutions have launched several initiatives from international declarations on sustainability to the creation of sustainability networks and its evaluation (Washington-Ottombre *et al.* 2018). The university of Guilan, one of the largest universities in North Iran, participated in the Green Metric ranking from 2017. In this study, we tried to improve the status of the University of Guilan in Green Metric ranking. So, the score of Green Metric in 2017 was examined; then we tried to find the related problems and challenges, thus the improvement action based on effective national and international studies was performed to increase its Green Metric score. Indeed, the results of the implementation of relevant solutions and actions were measured based on the Green Metric score in 2018 and 2019.

## **MATERIALS AND METHODS**

University of Guilan has 10 faculties, one campus unit and two research institutes with over 600 faculty members, over 18 thousand students and as the largest higher education centers in the northern region of Iran. It has educational and research activities and annually accept 4500 students in 544 majors in bachelor's, master's and doctoral degrees.

### **Methodology**

The research is a conceptual model to increase ecological and environmental efficiency, and achieve a sustainable university based on the Green Metric index. The University of Guilan information and data for the Green Metric index have been performed. Also, to get the best results, the effective actions of the four top universities in the world Green Metric ranking were collected and used in the improvement its ranking. The University of Guilan scores and ranking in 2017 at Green Metric index was used as basic information. Then, the weaknesses and threats

were determined and the solution based on actions of four top universities in Green Metric ranking extracted and implemented at university. Eventually, the results of effective actions were evaluated by the Green Metric score results in 2018 and 2019.

### The international ranking system of the world's green universities

Since 2016, the Green Metric index has been organized under six main categories, including infrastructure, energy and climate change, waste management, water and wastewater consumption, transportation, and education. Each of the six main categories is defined by several indicators, which allow to describe specific issues in terms of sustainability (Marrone *et al.* 2018). Table 1 shows the introduction of six Green Metric indicators (UI Green Metric guideline 2019).

**Table 1.** indicators and categories implemented in the 2019 ranking.

Code	Indicator	Score	Weights
1	<b>Setting &amp; Infrastructure (SI)</b>		15%
SI 1	The ratio of open space area to total area	300	
SI 2	Total area on campus covered in forest vegetation	200	
SI 3	Total area on campus covered in planted vegetation	300	
SI 4	Total area on campus for water absorption besides the forest and planted vegetation	200	
SI 5	The total open space area divided by total campus population	300	
SI 6	Percentage of university budget for sustainability efforts	200	
	Total	1500	
2	<b>Energy and climate change (EC)</b>		21%
EC 1	Energy efficient appliances usage	200	
EC 2	Smart building implementation	300	
EC 3	Number of renewable energy sources on campus	300	
EC 4	Total electricity usage divided by total campus' population (kWh per person)	300	
EC 5	The ratio of renewable energy production divided by total energy usage per year	200	
EC 6	Elements of green building implementation as reflected in all construction and renovation policies	300	
EC 7	Greenhouse gas emission reduction program	200	
EC 8	Total carbon footprint divided by total campus' population (metric tons per person)	300	
	Total	2100	
3	<b>Waste (WS)</b>		18%
WS 1	Recycling program for university waste	300	
WS 2	Program to reduce the use of paper and plastic on campus	300	
WS 3	Organic waste treatment	300	
WS 4	Inorganic waste treatment	300	
WS 5	Toxic waste treatment	300	
WS 6	sewage disposal	300	
	Total	1800	
4	<b>Water (WR)</b>		10%
WR 1	Water conservation program & implementation	300	
WR 2	Water recycling program implementation	300	
WR 3	Water efficient appliances usage	200	
WR 4	Consumption of treated water	200	
	Total	1000	
5	<b>Transportation (TR)</b>		18%
TR 1	The total number of vehicles (cars and motorcycles) divided by total campus' population	200	
TR 2	Shuttle services	300	
TR 3	Zero Emission Vehicles (ZEV) policy on campus	200	
TR 4	The total number of Zero Emission Vehicles (ZEV) divided by total campus population	200	
TR 5	The ratio of the parking area to total campus area	200	
TR 6	Transportation program designed to limit or decrease the parking area on campus for the last 3 years (from 2016 to 2018)	200	
TR 7	Number of transportation initiatives to decrease private vehicles on campus	200	
TR 8	Pedestrian path policy on campus	300	
	Total	1800	
6	<b>Education (ED)</b>		18%
ED 1	The ratio of sustainability courses to total courses/modules	300	
ED 2	The ratio of sustainability research funding towards total research funding	300	
ED 3	Number of scholarly publications on sustainability	300	

ED 4	Number of events related to sustainability	300
ED 5	Number of student organizations related to sustainability	300
ED 6	University-run sustainability website	200
ED 7	Sustainability report	100
	total	1800
Total		10000

## RESULTS

### The status of University of Guilan in Green Metric ranking in 2017

Table 2 shows the obtained score by University of Guilan in 2017 Green Metric ranking.

**Table 2.** University of Guilan, Green Metric scores in 2017.

Indicator	Indicator score	Obtained score	Rate (%)
<b>Infrastructure policy</b>	1500	856	57.7
<b>Energy and climate change</b>	2100	1032	49.14
<b>Waste</b>	1800	897	49.83
<b>Water</b>	1000	695	69.5
<b>Transportation</b>	1800	711	39.5
<b>Education</b>	1800	193	10.72

According to Table 2, the highest obtained score in 2017 in the Green Metric ranking was in the energy indicator, while the lowest in the education.

### Investigation on effective actions of the top universities to increase the environmental efficiency

To improve University of Guilan ranking and indicators scores, effective actions was obtained from top 4 green universities of the world in Green Metric ranking including Wageningen (score = 7552), Nottingham (7464), California Davis (7365) and Oxford (7199). In the Green Metric ranking, the most attention and importance is given to issues related to climate change and energy. Therefore, several indicators are defined for this sector, including the use of energy-efficient appliances, renewable energy consumption policy, total electricity consumption, energy conservation plan, green building, climate change adaptation and reduction plan, as well as greenhouse gas reduction policy. The action plans taken by top universities in the energy sector are given in Table 3.

**Table 3.** Implemented actions by world universities at energy indicator.

University	Implemented improvement energy indicator action
Wageningen	Using LED lamps, insulation of buildings contract to achieve energy efficiency up to 30% (in the period of 2005-2030), employing thermal storage system by supplying about 2% of the university's energy, geothermal heating system in buildings for heating and cooling, energy production about 65 million kilowatt hours by wind turbines, 79% reduction in carbon dioxide emissions.
Nottingham	Employing LED lamps, Using solar panels to generate electricity, double-glazed windows, geothermal heat pumps in five campus buildings, solar water heaters in two campus buildings, heat production from biomass, heat pumps with air source in two buildings.
California Davis	Using LED lamps, solar panels to generate electricity, lamps with motion sensors in buildings, online energy consumption investigation for each building.
Oxford	Employing LED lamps, solar panels with electricity generation of about 50 kilowatts. University energy consumption report to the environment agency. Displaying the amount of energy consumption in each building so that people can see the amount of consumption and the ranking of the university, using heat pumps for heating and cooling the building.

Waste management is one of the main factors in creating sustainable environment. The effective actions taken in the waste indicator are presented in Table 4. In the transportation indicator, using vehicles without producing pollution is very important for reducing the amount of carbon dioxide. All four top universities in this section have used plans such as creating the necessary infrastructure for cycling and improving video conferences to reduce transportation (Table 5). In the case of water indicator at University of Wageningen, the water consumption

decreased from 234,503 m<sup>3</sup> in 2005 to 186,372 m<sup>3</sup> in 2017. This university controls its water consumption monthly and also has a wastewater treatment system.

**Table 4.** Implemented actions by world universities at waste indicator.

University	Implemented improvement waste indicator action
Wageningen	Recycling waste from the source, waste management hierarchical approach includes avoiding waste generation, reuse, recycling, conversion to energy, incineration and burial, respectively. Using the burial method in special cases such as the presence of asbestos. Establishing the goal of non-toxic waste disposal to zero percent. Using compost and anaerobic digestion for garden waste. Recycling of electrical waste, white products (electric household appliances) and brown products (TV, radio and camera).
Nottingham	Placing trash cans for recyclable waste in different parts of the university. Designing an online portal to share university supplies and equipment to the departments that need it. Food waste compost. Compost about 500 tons of garden waste every year and use it to improve the soil of the university. Using reusable water bottles and cups instead of disposable containers. Stations for donating old equipment of students and employees and sending to underprivileged areas.
California Davis	Using special trash cans for composting waste. The plan to reach zero percent academic waste by 2020, Creating university goods sharing system, organic material compost.
Oxford	Separation of waste from the source. Recycling about 60% of the waste, Using the university equipment sharing system. Donating old computer equipment to underprivileged areas for reuse

**Table 5.** Implemented actions by world universities at transportation indicator.

University	Implemented improvement transportation indicator action
Wageningen	Stations for charging electric cars, electric scooters and electric bicycles in the university, Creation of bicycle paths and bicycle parking; 57% of employees use bicycles. Only one third of the employees use a personal car daily, Using high-quality public transportation. Using video conferencing to reduce business trips
Nottingham	Implementation of the car sharing plan to reduce pollution. Implementation of the bike placement plan for employees and students. Improving video conference facilities to reduce business trips. Placing free electric vehicles for transportation in different parts, Investing in creating cycling infrastructure. Special discounts for students and staff to travel by bus
California Davis	Employing electric cars, employing around 30% of pollution-free vehicles for employees and faculty members. Creating the necessary infrastructure for cycling. About 40% using bicycles per day by university visitors
Oxford	Increasing parking spaces for bicycles. Implementation of the car sharing plan to reduce pollution. Interest-free bicycle purchase loans for employees. Intermediate and advanced cycling training for employees and students. Special discount plan for bus travel for employees and students. Improved video conferencing. Bike sharing scheme

To reduce water consumption, the university uses smart valves to prevent water wastage. At the University of Nottingham, the rainwater is directed to the river by creating a collection system. At the University of Oxford, the water consumption per person in 2010 was equal to 13.2%, which reached 12.9% in 2016, resulted in 16% total water saving. The effective actions include a sewage water treatment system, creating a system for collecting rainwater, which collected water is used for irrigation of plants and flush tanks, as well as employing smart valve. In the case of education indicator, University of Wageningen promote sustainability by creating a green office, including the Green Teacher Award, meat-free Mondays in the university restaurant, and holding green competitions related to sustainability. A person named "Green Man" regularly teaches students about sustainability with his presence on the university campus. Also, this university supports ideas and initiatives in the field of university sustainability. University of Nottingham has taken a big step in educating students about saving electricity by holding competitions among students to turn off electrical appliances. This university supports projects related to the environment and sustainability by creating an environmental innovation fund. Another measure includes creating a suitable place for agricultural markets where students can sell their products. Also, there are sustainability training courses to familiarize students with the concept of sustainability. University of California Davis was trying to increase students' knowledge about the environment by creating an environment centre. This university supports ideas and proposals related to the environment. In this university, a store has been provided for students to sell second-hand supplies and handicrafts.

### **The implemented solutions and executive actions at University of Guilan**

Compared to the top universities, effective actions were designed and implemented at the university of Guilan, so that it can raise itself to a high level at national and international level. Based on this, we implemented some effective actions at university of Guilan as described in Table 6.

**Table 6.** Effective actions at University of Guilan in Green Metric ranking.

Indicators	effective solutions and executive actions
Infrastructure policy	<p>About 925,000 m<sup>2</sup> of the university is under forest cover. About 40 hectares are agricultural lands. In addition, the 800-m long green wall has been performed to increase the per capita green space and comply with the principles of sustainability. Therefore, some actions were carried out in two years (2017-2018), which include: planting 45 trees between the central library and the Faculty of Architecture and Art, planting 17 trees in the green space of Mirza Kochuk Khan dormitory, planting 14 Ginkgo and Cedrus trees in the Faculty of Physical Education and Sport Sciences, planting 140 Plane trees between the main square and Faculty of Agricultural Sciences, planting 6 Maple trees in the green space of the Faculty of Modern Technology with 700 m<sup>2</sup>, planting 500 Plane trees in the university around the Mosque area, the Counseling Center, Natural Resources, Humanities, Architecture And Engineering faculties, planting 313 fruit tree, planting 2187 native trees including Oak, European ash and Maple.</p>
Energy and climate change	<p>We tried to provide the necessary platform for proper energy management in several different areas, including creating double-walled doors in Architectural buildings, Faculty of Mechanics, Faculty of Agriculture, and Classroom buildings, as well as replacing ordinary lamps with LED lamps. Using elastomeric insulation in the engine house.</p> <p>In the renewable energy, the university had been created a photovoltaic power plant with a production capacity of 30 kilowatts. Also, the university has installed solar lighting system on bus stops and traffic lights.</p>
Waste	<p>The studies about the comprehensive waste plan at the University of Guilan showed that organic materials have the largest contribution to the production of solid waste in the university, which is about 57.33% of the total generated waste. Paper constitutes about 61 kg of university waste, and each person produce about 14.47 g averagely. Plastic waste includes 19.5%, about 94.23 kg per day of the university waste. Most of the plastic wastes include disposable containers and cups. Glass accounts 7.83% equal to 37.83 kg per day averagely. The amount of metal waste is 1.83%, which is equal to 8.84 kg per day (Mahmoudi 2015).</p> <p>The planned approach at University of Guilan is to reduce the amount of waste, separation of glass waste, organic waste and paper from the source of production. Some actions include implementation of the comprehensive waste plan, dry waste separation plan by placing special bins, recycling of organic waste, proposal to start a compost unit to convert waste into fertilizer, sending the remaining food untouched to the asylum and prison, collecting the door soft drinks for recycling, carrying out educational actions for students to reduce energy and paper costs and save 500,000 papers, preparing electronic documents by students which reduced 80%, conducting online courses and tests, training to reduce paper consumption, defining semi-press food for students who consume less food, eliminating the printed version of theses which saved 120,000 sheets of paper.</p>
Water	<p>University of Guilan has a wastewater treatment plant with an 800-m<sup>3</sup> treatment system which is of aerobic type. The major weakness of the university is the lack of an irrigation system for the green space, especially in the summer season. Some of the actions of the university in the case of water indicator include the renovation and repair of the sewage treatment plant in the Faculty of Sport Education, the improvement of the water piping system to the new system, and the replacement of water taps and flush tanks as well as monitoring of water consumption in different departments.</p>
Transportation	<p>The diurnal fuel consumption for each bus, minibus and cabs are 100, 30 and 20-30 liters respectively. The implemented transport system prevents the significant traffic of personal vehicles to the university and has a very positive effect on carbon stabilization. During the last few years, the university was trying to have a plan to implement a bicycle system and create a dedicated parking, but due to the distance (and the dangers) between the city and the university along the Rasht-Qazvin Highway, the plan was performed only in the university campus.</p>
Education	<p>The first environment center in the University of Guilan was established in 2008 and the second in 2015 at the Faculty of Natural Resources. The center has carried out activities to educate students about the environment. The Environment Association of the university was also established in 1998.</p>

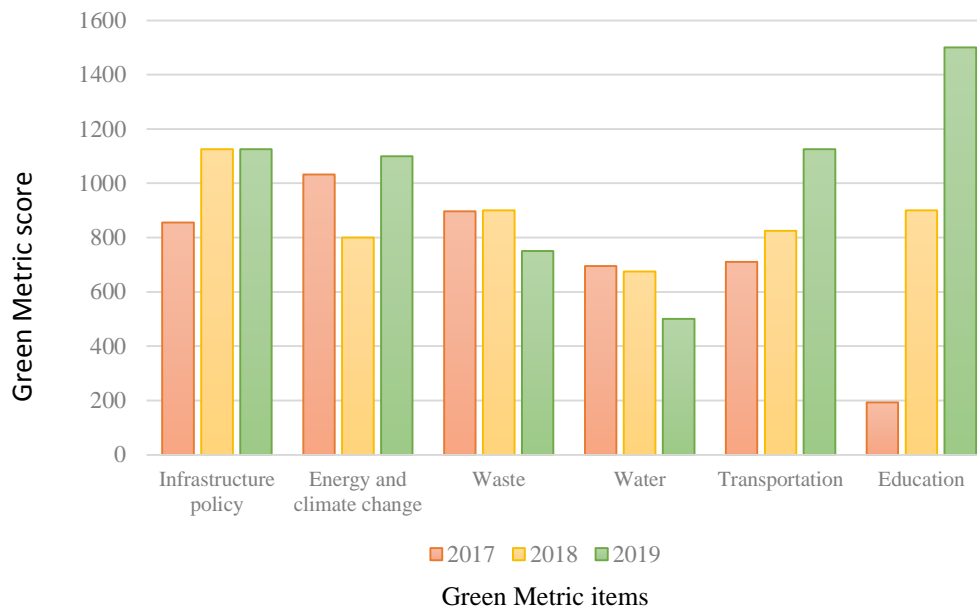
### Analysis of the status of University of Guilan in Green Metric ranking from 2017 to 2019 based on effective actions

Table 7 shows the University of Guilan score in Green Metric ranking from 2017-2019 exhibiting improvement of the university's position and score from 2017 to 2018 and 2019.

**Table 7.** The obtained scores of University of Guilan in Green Metric ranking from 2017-2019.

Indicator	Indicator score	Obtained Score			Obtained score (%)		
		2017	2018	2019	2017	2018	2019
Infrastructure policy	1500	856	1125	1125	57.7	75	75
Energy and climate change	2100	1032	800	1100	49.14	38.1	52.38
Waste	1800	897	900	750	49.83	50	41.67
Water	1000	695	675	500	69.5	67.5	50
Transportation	1800	711	825	1125	39.5	45.83	62.5
Education	1800	193	900	1500	10.72	50	83.33

According to Fig. 2, the University of Guilan score in Green Metric indicators, has grown in infrastructure, energy, transportation and education over the past three years. In the case of water and waste indicators, it has gone through a decreasing trend.



**Fig. 2.** The change in the score of University of Guilan from 2017 to 2019.

## DISCUSSION

University campus sustainability is a multifaceted and challenging subject. Many aspects of university operations imply a concept of sustainability, including construction, building operation and maintenance, food service, shopping, and business travel (Wright 2002). The Green Metric index is the best tool to investigate universities' sustainability programs. The indicators of Green Metrics include: (i) infrastructure, (ii) energy, (iii) water, (iv) waste, (v) transportation, and (vi) environmental education. The University of Guilan sustainability data was used in 2017 as basic information and solution based on applicable and effective actions (adopted from four top universities in Green Metric ranking) used to improve university ranking in 2018 and 2019. It can be concluded that with proper planning, the ranking of the university can be improved. The implementation of program requires the attention of university officials to sustainable development. During the last two decades, a large number of universities have implemented sustainable development. Also, due to the improvement of their sustainability strategy, many universities began to modify their research programs and adapt structure, data reporting, programs, and activities in line with sustainability (Vicente-Molina *et al.* 2013). The results showed that some activities and solutions implemented between 2017 to 2019 were successful and improved the university sustainability. In the case of the infrastructure indicator the university scores increased 269 points from 2017 to 2018, while no change was observed from 2018 to 2019. The university effective actions in improving the green spaces, creating a green wall and planting many species have improved this indicator. Nottingham University has tried to use natural light to avoid energy consumption, and also low-water plants have been planted on the university roofs to increase biodiversity. The University of California Davis has 17 gardens covering 100 hectares, which have different plant species from the five continents. In the new buildings of this university, it has been tried to use more natural light. In the Gallagher building of this university 30% of its equipment is made from recycled materials and its roofs are made of wood. In the case of energy and climate change indicators, the University of Guilan Green Metric score has increased 222 points from 2017 to 2018 and 300 points from 2018 to 2019. These results showed that the suggested and applicable improvement plans were efficient and developing renewable energy uses can elevate the energy scores. A sustainable campus is actually designed to reduce the negative effects of human-made activities on health and environment by effective use of energy and water, maintaining the health of employees, and eliminating waste, pollution, and environmental degradation (Patel *et al.* 2012). In 2004, and 2006, the University of Wageningen used wind turbines to generate electricity. Currently, this university has 26 wind turbines with an annually production capacity of 65 million kilowatts. The University of Nottingham has paid the most attention to invest for building equipment in order to reduce energy consumption. So that, by creating double-glazed windows, changing the chiller, and using LED lamps, reached its goals. The university of Guilan will also be able to significantly reduce its electricity costs using such a strategy and changing all the lamps to LED and

double-glazing windows. The use of solar panels is performed in most of the top universities in the world to produce energy. For instance, Oxford University produces about 50 kilowatts of electricity from solar panels. The University of Ferdowsi in Iran also has a 21 kW solar power plant. Due to the fact that the University of Guilan has the capacity to produce electricity from solar panels, it is expected that more attention will be paid to these panels. University of California Davis has provided a system for online observation of the amount of energy consumption for each building, and a similar system exists at the University of Ferdowsi and the University of Oxford. In the case of water indicator, the score of University of Guilan decreased by 20 points in 2018 compared to 2017. In 2019, compared to 2018, in the case of waste indicator there was a decrease by 250 points, while in that of water indicator by 175 points. According to the studies conducted by Mahmoudi *et al.* (2015), the generated waste at the University of Guilan was 114 g per capita daily, including 57% organic waste, 19% plastic, and 19% paper. Organic waste usually constitutes the heaviest part, which requires more costs, and also has the greatest potential for greenhouse gas emissions (Diaz *et al.* 1993). One of the common methods among universities for organic waste is to produce compost. For instance, the University of Ithaca in the United States uses 5 tons of food waste to produce compost every week, which is about 13-15% of the total produced waste (REMP, 2003). Given that the most generated waste of the University of Guilan is organic, a compost centre at the university site, and preparing for the implementation of recycling policies will be among the proper solutions. A research was conducted at the University of Gadj Mada (2018) with the aim of investigating the waste management system in accordance with the concept of green development using the Green Metric ranking system. The university plans to achieve sustainable development was recycling program and waste treatment. The results showed that vermicompost can be used for food waste. Non-recyclable waste can also be incinerated to reduce landfilling (Setyowati *et al.* 2018). At the University of Indonesia, 50% to 75% of water is provided from purified water sources. In addition, this university has underground water reservoirs and artificial lakes. Water from coolers is collected and reused (University of Indonesia 2018). In the Faculty of Engineering, University of Indonesia, an artificial groundwater feeding system has been created from rainwater, which is collected into wells and finally, the water penetrates the soil. It also has a system to check and monitor the quality of ground and surface water (Kristanto *et al.* 2017). The studies conducted in Japan in connection with water bottle filling stations to achieve the sustainability of universities by preventing the use of plastic bottles and replacing them with metal or glass bottles showed that 58.82% of students have a desire to use this system. Accordingly, it saved 45,191 disposable plastic bottles and reduced 10,846 kg of carbon dioxide emissions (Uehara & Ynacay-Nye 2018). In the case of transportation indicators, the University of Guilan Green Metric score has increased by 114 points from 2017 to 2018 and 300 points from 2018 to 2019, exhibiting the efficient applicable solution. At the university of Wageningen, 57% of employees use bicycles. This university has used a high-quality public transportation system. Another activity of this university is online meeting conferences to reduce office work hours. In this university, electric charging points for electric cars, electric bicycles, and electric scooters have been installed. In the case of transportation indicators, the university Green Metric score has increased by 707 points from 2017 to 2018 and 600 points from 2018 to 2019. The 21<sup>st</sup> agenda of the United Nations, addressed the vital role of environmental sustainability in education for three important principles: changing the direction of education towards sustainable development, increasing public awareness of environmental issues, and promoting environmental education among teachers (Wright 2002). Higher education institutions have increased their sustainability efforts following the adoption of the development agenda. This agenda is seen by adopting carbon reduction strategies, embracing environmental sustainability, and working with society and stakeholders at all levels to prioritize sustainability issues (UN Environment 2018). In addition, the university environment can influence people's behaviour through education and research (Krasny & Delia 2015; Leal Filho & Brandli 2016). In China, University of Tsinghua has taken steps to achieve sustainability with the one principle and three dimensions' program. The first step is related to green education. In this dimension, there are programs such as providing green education programs, and student green internships that help students find the necessary skills in the field of environment. This university has made courses on environmental protection and sustainable development compulsory for all undergraduate students (Zhao & Zou 2015).

## CONCLUSION

In this study, we conducted and implemented some effective action plans to improve Green Metric score in University of Guilan to get sustainability. The university international ranking on the Green Metric index from



2017 to 2019 has increased by 326, 262 and 198 respectively. The score of the university at the national level has been improved from 8 in 2017 to 4 in 2018 and 3 in 2019. Overall, it is expected that, due to the university's green approach and providing new solutions, the position of the university in this ranking will increase significantly in the next years. Therefore, the continued implementation of such a program requires the attention of university officials to sustainable development. There are some other suggested solutions that help to improve this position.

1. Construction of new buildings based on the principles of sustainability.
2. Planting drought-resistant species.
3. Converting the grass area into a tree-planted area.
4. Using LED lamps: Currently, University of Guilan has succeeded in changing 30% of the lamps in the university to LED ones.
5. If possible, using natural light instead of artificial one: In places where it is possible, the employment of natural light can be useful. It causes a 3-5% reduction in energy consumption.
6. Employing solar panels
7. Separation of hazardous waste
8. Collecting organic waste and producing compost: By carrying out this plan, the university can add up to 100-200 points to the overall score, which needs more attention.
9. Promoting the use of bicycles for employees: using a bicycle that causes zero pollution and is a clean way to travel. It is expected to reduce 5-10% of the amount of carbon production. On the other hand, increasing the score of the university in transportation by 50 to 100 points.
10. Rainwater collection system.
11. Holding training courses and workshops about sustainable development and environment.

## ACKNOWLEDGMENTS

This manuscript is a part of MSc. Dissertation in field of environmental pollution at University of Guilan.

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