

Efforts of Universities to Transition to Green University

Üniversitelerin Yeşil Üniversiteye Geçiş Çabaları

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Abstract

Global warming and climate change are among the most important risks threatening the world. Universities are developing different policies to end or reduce these risks. Especially after 2015, with the adoption of the Development Agenda, the efforts of universities on sustainability have accelerated. The initiatives of universities on sustainability include the preparation of sustainability reports, adoption of low carbon strategies, activities carried out in sustainability centres, most effective thesis and publication awards, inclusion in international sustainability rankings, and establishing collaborations with different communities and stakeholders. The aim of the study is to examine the position of universities in the Greenmetric ranking and to present their activities related to green universities with a holistic approach. In the study, exploratory research method was used to analyse and evaluate the top ten universities in the GreenMetric ranking. For the exploratory research method, secondary sources such as books, university reports, articles, conference papers and websites were utilised. The role of green universities in sustainability is higher than non-green universities. Green universities practices are generally accepted as the first step taken by universities towards sustainability. However, it is also necessary to carry out comprehensive and multidimensional studies on sustainability in universities.

Keywords: Green University, University Ranking, Greenmetric, Sustainable Development Goals

Özet

Küresel ısınma ve iklim değişikliği dünyayı tehdit eden en önemli riskler arasında yer almaktadır. Üniversiteler bu riskleri sonlandırmak veya azaltmak için farklı politikalar geliştirmektedir. Özellikle 2015 yılından sonra Kalkınma Gündemi'nin kabul edilmesiyle birlikte üniversitelerin sürdürülebilirlik konusundaki çalışmaları hız kazanmıştır. Üniversitelerin sürdürülebilirlik konusundaki girişimleri arasında sürdürülebilirlik raporlarının hazırlanması, düşük karbon stratejilerinin benimsenmesi, sürdürülebilirlik merkezlerinde yürütülen faaliyetler, en etkili tez ve yayın ödülleri, uluslararası sürdürülebilirlik sıralamalarında yer alma, farklı topluluklar ve paydaşlarla işbirlikleri kurma yer almaktadır. Çalışmanın amacı, üniversitelerin Greenmetric sıralamasındaki yerini incelemek ve yeşil kampüs ile ilgili faaliyetlerini bütüncül bir yaklaşımla ortaya koymaktır. Çalışmada, GreenMetric sıralamasındaki ilk on üniversiteyi analiz etmek ve değerlendirmek için keşifsel araştırma yöntemi kullanılmıştır. Keşifsel araştırma yöntemi için; kitaplar, üniversite raporları, makaleler, konferans bildirileri ve web siteleri gibi ikincil kaynaklardan yararlanılmıştır. Yeşil üniversitelerin sürdürülebilirlikteki rolü, yeşil olmayan üniversitelere göre daha yüksektir. Yeşil üniversite uygulamaları genel olarak üniversitelerin sürdürülebilirlik yolunda attıkları ilk adım olarak kabul edilmektedir. Ancak üniversitelerde sürdürülebilirlik konusunda kapsamlı ve çok boyutlu çalışmaların yapılması da gerekmektedir.

Anahtar Kelimeler: Yeşil Üniversite, Üniversite Sıralaması, Greenmetric, Sürdürülebilir Kalkınma Hedefleri

In addition to educational activities in higher education, academic studies, projects and social contribution activities are carried out to solve economic, social, and environmental problems and to bring new suggestions for education policy.

Students are the most important stakeholders of higher education activities as education is the generally recognised instrument of sustainable development throughout all time. The focus of higher education policies is on strengthening students' sustainability competences and making them active in sustainable development (Faham et al., 2017).

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It is recognized by all stakeholders that universities as universities may assume a substantial role in achieving sustainability through their impact on society. The unique (educational) mission of universities in society shows that they also have a crucial role to assume in achieving sustainability. Therefore, practitioners in universities are expected to develop multidisciplinary and next-generation green practices towards achieving sustainable development (SD) (da Silva et al., 2023). Universities contribute to sustainability through their internal and external performances (Dagiliūtė et al., 2018). Therefore, universities are expected to engage with sustainability both internally and externally. Among the institutional frameworks that support a student's values, worldview, and sense of self are universities. Universities with green campus (GC) paradigms are needed to implement green initiatives in supporting sustainability gains for waste reduction, water use reduction, energy efficiency, healthy work environments and clean indoor air (Sonetti et al., 2016). Such initiatives can lead to improved quality of life for all segments of society, economic vitality and mitigated water, carbon and nitrogen footprints (Mat et al., 2011).

The importance of the study is to examine the positions of the selected universities in the Greenmetric ranking by years and to reveal the green campus activities in detail with a holistic approach. Therefore, the study has a unique value. The study is divided into five sections. In the first section, evaluations on the theoretical framework of the GC concept are made. In this context, the literature is reviewed, the historical development of the GC is examined, and evaluations in the context of economy, society and environment are discussed. In the second section, the methodology of the study is presented and the objectives, criteria, weight distribution of the criteria, the number of participating countries and universities according to years are discussed in the GreenMetric (GM) ranking. The third section is the conclusion and discussion section. In this section, the distribution of publications on GC by years, the scores of the top ten universities in different categories, and the sustainability actions reported by the top ten universities are analysed. In the fifth section, the general data of GM rankings are evaluated and interpreted.

Literature Review

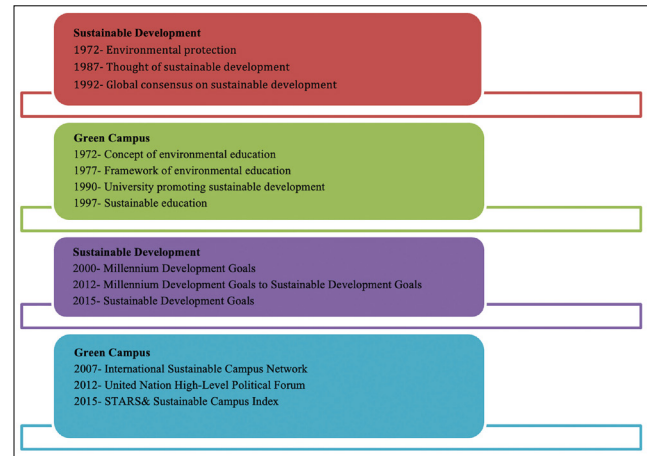
In terms of urban features and population size, universities are similar to small cities in that they engage in a variety of activities that have direct or indirect effects on the natural environment (Fissi et al., 2021). The widespread adoption of a GC approach is expected to contribute more to global sustainability performance (Dagiliūtė et al., 2018; Geng et al., 2013).

While countries continue to develop with the overall degradation of the global natural environment, SD has been agreed upon all over the world and has been accepted as

a common goal regarding the future fate of humanity and has taken its place on the agenda as a global understanding model. Sustainability, which consists of three basic elements, namely environment, economy, and society, has been constantly enhanced over time and its goals have been refined by making them clearer (Zhu et al., 2020; Tiyyarattanachai & Hollmann, 2016). When environmental protection was introduced, environmental education was elevated to the same crucial position. As a result, the former gradually evolved into a debate on SD associated with humanity's shared destiny, whereas the latter grew into the practice of constructing GCs led by global universities. The connotation of GC is therefore in line with sustainability, which includes all three dimensions of environment, economy, and society. SD and GC are concepts that develop simultaneously and support each other. The overall aim of the so-called GC approaches is to emphasize the important role of universities, which have an important place in the dynamic structure in the process of researching SD, as the basis for promotion of breakthrough concepts and recent technology experimentation, while reaching the overall SDGs. The historical development of GCs is in parallel with SD (■ Fig. 1).

■ Figure 1

Historical perspective of Sustainable Development and Green Campus



A GC is defined as a university that critically explores and incorporates sustainability into its ecosystem (Sterling & Maxey, 2013). A GC can be expressed as a desirable (future) university approach to sustainability holistically in culture, objective, values, actions, and practices. From a different perspective, a GC refers to a current or desired future university that is concerned with sustainability in a specific style and at a specific extent. Various perspectives on what a sustainable university is or should be are also recognized as a guide for the steps that need to be taken to transition to sustainability in higher education (Deleye et al., 2019). The GC also refers to a joint effort by universities around the world to ensure future mutual prosperity (Sonetti et al., 2016). As the GC efforts of universities as a learning organization



become sustainable, universities will make even more important contributions to a sustainable future (Alsharif et al., 2020).

Nowadays, the GC plays an active role in spreading sustainable ideas and education due to its high social impact (Marrone et al., 2018). There are over 13,000 universities in the world. As this number grows, particularly in poorer nations where environmental difficulties are larger, the environmental impact and resource efficiency of universities is an essential issue that should not be ignored (Beringer & Adomßent, 2008). By taking steps to understand and mitigate the environmental consequences of their actions, universities can learn and teach environmental principles and environmental impact management and demonstrate exemplary practice to society (Molano-Sanabria et al., 2016). With a diverse set of stakeholders, universities can offer a detailed greening strategy to audiences that lack experience in institutional change, transformation or the latest environmentally friendly technologies (Creighton, 1998). Universities are at the forefront of the solutions needed to advance the SDGs, which underscore the essential role of education in creating healthy and inclusive societies as envisioned in the 2030 Agenda (Zhu et al., 2020). Education is widely recognized as a critical driver of the 2030 Agenda. Around the world, higher education institutions are preparing future professionals, undertaking relevant research, and collaborating with communities and stakeholders to address local, regional, national, and international concerns (Tudorie et al., 2020). The debate about the education we need for the future depends on the complexities we face, the various conflicting crises and emergencies around us. In this sense, universities are well placed to consider such challenges and how they can be addressed (Yuan et al., 2013).

A comprehensive approach to university sustainability recognises that the university's activities should be environmentally sound, socially and culturally equitable and economically viable. How the university's transition to sustainability is articulated should always reflect the social, cultural, economic, and environmental aspects of the country and region in which it is located. However, there are well-defined core principles that characterize university sustainability, although they may be expressed in different ways (Dave et al., 2014).

The ultimate goal of the ecologically sustainable campus is to serve as a learning organization and living labs for the implementation and growth of environmental sustainability. The breadth and sustainability of organizational change needed for this can only be realized by uncovering and reforming the underlying character of the university organization (Sharp, 2002).

A strong coordination and leadership the organization needs to be established at the university level to smooth campus development leading to energy and resource efficiency. Good high-level design is also necessary for the creation and maintenance of an energy-efficient campus. Because an energy and resource efficient campus is built on energy conservation, making the development and functioning of campus infrastructure energy efficient is the key to energy and resource efficiency (Tan et al., 2014).

Universities, as forums for discussion and change agents in society, are critical venues of transition. GCs are acknowledged as a low-cost solution to reduce emissions while also supporting the development of clean energy and, in some cases, the local economy (Finlay & Massey, 2012).

Materials and Methods

There are many reasons why the GreenMetric ranking was chosen for the study. The first reason is that the indicators in the GreenMetric ranking intersect perfectly with the entire Sustainable Development Goal. Also recognised globally as the only simple and accessible sustainability ranking, GreenMetric serves as a reference point, especially for universities in developing countries, to help create sustainability, promote research and development technology, and accelerate development in all research areas through various technological improvements (Suwartha & Sari, 2013).

The study was conducted through exploratory research is a phenomenological methodology that can be preferred to identify situations, examples, and scenarios that will allow for the investigation of the phenomena of university positioning in the innovation and sustainability ecosystem (Valentine et al., 2018; Goertzen, 2017). Within the scope of the study, a literature review was conducted through secondary sources such as books, university reports, published articles, conference proceedings, and university website. In addition, this methodology allows for categorizing all universities by their contribution to sustainability, identifying probable essential variables for long-term viability of universities and directing institutional policies towards those that require urgent attention. In this context, the universities to be analysed were identified first. Qualitative data were collected only from the ten identified universities. Therefore, the study's conclusions cannot be applied to institutions in other nations.

In the indexes created for universities, the sustainability efforts of universities are scored and shared under different categories. UI GM, Green Universities, STARS, QS World University Ranking (WUR), Top 50 Green Colleges, Greenest Universities, Green University Networks, Green Power Partnership Top 30 and LEED share rankings on the sustainability efforts of universities. Among these indexes, GM is one of the most institutionalized, globally participatory and generally accepted indexes. Universities

with high sustainability scores in the GM ranking are characterised by practices such as reducing carbon emissions, using renewable energy sources, reducing waste, green buildings and promoting biodiversity and healthy habits on campuses.

GM is a University of Indonesia initiative that began in 2010. The goal of this endeavor is to present the results of an online poll on the current state of GC and Sustainability policies in universities throughout the world. It is anticipated to draw the attention of university administrators and stakeholders to the importance of combatting global climate change, conserving energy and water, recycling garbage, and using green transportation. Those activities would necessitate behavioural changes as well as increasing attention to environmental sustainability and related economic and social challenges.

Organized by the University of Indonesia, the GM is the first attempt to produce a global ranking of universities' sustainable behavioural (Grindsted, 2011). The Berlin Principles are aligned with most of the indicators in UIGM. The GM ranking allows you to assess the university's strengths and weaknesses in terms of fostering GC and sustainable growth (Suwartha & Sari, 2013). Since its inception, the GM ranking is usually recognized as the first of its kind to address sustainability issues on university campuses (Ali & Anufriev, 2020).

GM was developed with a variety of sustainability evaluation systems and academic institution rankings in mind, although not being based on any already established rating systems. The Holcim Sustainability Awards and GREENSHIP, a grading system based on the Leadership in Energy and Environmental Design (LEED) system recently created and utilized by the Indonesian Green Building Council, are two sustainability systems that were mentioned during the design process of GM.

The task for UN Environment in the 2030 Agenda is to generate integrated strategies to SD. These approaches also focus on the social and economic benefits of improving environmental health. UN Environment action aimed at lowering environmental hazards and boosting societal and environmental resilience leads to socio-economic development by promoting the environmental dimension of SD (UNEP). These 17 aspects of the SDGs are addressed in the GM criteria and indicators.

All universities in the world that demonstrate a sound commitment to sustainability concerns are eligible to participate in the annual GM. Due to the wide range of university participation opportunities, the universities to be analysed in this study were selected from among the universities included in the GM. The GM is largely based on the conceptual framework of environment, economy and equity. The ranking metrics and categories are intended to be generalizable. Its indicators and weightings are designed to be as unbiased as possible. According to the 2010 version of GM,

95 universities from 35 countries (18 from the US, 35 from Europe, 40 from Asia and 2 from Australia) participated in the rankings, while in 2023, 1,183 universities from 84 countries worldwide participated. This data confirms that GM is the world's first university ranking on sustainability (■ Table 1).

■ **Table 1**

Number of Countries and Universities Participating in GreenMetric Ranking (Greenmetric, 2023).

Year	Number of Universities	Number of Nations
2010	95	35
2011	178	42
2012	215	49
2013	301	61
2014	360	62
2015	407	65
2016	515	75
2017	619	76
2018	719	81
2019	780	85
2020	911	83
2021	956	79
2022	1050	85
2023	1183	84

University selection is based on the GM in 2023. The top 10 universities in the index are Wageningen University & Research, Nottingham Trent University (NTU), Umwelt-Campus Birkenfeld, University of Groningen, University of California, Davis, University of Nottingham, Universidade de Sao Paulo USP, University College Cork, University of Connecticut, and Universitat Bremen.

Participation in GM rankings can help raise awareness about the prominence of sustainability issues at universities. The globe is confronted with unprecedented global difficulties, such as global warming, population trends, oil-dependent energy, over-exploitation of natural resources, water and food scarcity, and other issues of sustainability. Higher education is widely acknowledged to have a critical role in addressing these difficulties. The GM Sustainability survey harnesses the important role universities can assume in raising awareness by assessing and benchmarking efforts for campus greening and outreach.

The GM assesses the university's policy and performance based on six categories. These are setting and infrastructure, energy and climate change, waste, water, transportation, education and, research. Each category has a score weighting. The category with the most weighted score out of the total scores is energy and climate.



The compatibility of GM criteria and indicators with the institutional structure of universities is sought in education, research, campus operations, social sensitivity, evaluation and reporting processes. The activities carried out under these criteria within the institutional structure of universities are included in the methodology in determining their position in the ranking. The existence of these criteria and the activities carried out under these criteria in the universities examined within the scope of the study were examined.

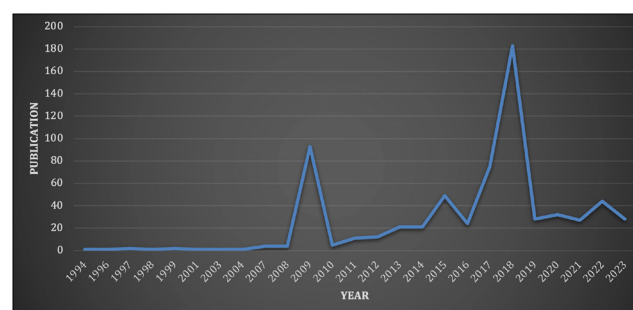
Findings

The study, which used the exploratory research method, involved a literature review of secondary sources such as books, published articles, university reports, conference proceedings and website documents. A total of 671 publications were found in the Web of Science (WoS) database with the keyword “Green Campus” on November 16, 2023 (■ Fig. 2). While no publication was recorded before 1994, one article was published each in 1994, 1996. In the period between 1994- 2023, 2018 was the year with the highest number of publications with 183 publications (Web of Science, 2023).

The idea that universities play a critical role in sustainability has been the focus of the fast-growing body of academic writing on the subject. Nonetheless, the precise nature of this function and the type of university required is frequently left unstated (Deleay, 2022). The importance of greening off-campus areas to minimise negative environmental and health impacts and as a step towards sustainability (Momani

et al., 2020), the adoption of green initiatives in universities worldwide is discussed, including measures such as pollution reduction, recycling and increasing green spaces. Overall, the articles in the literature emphasize the importance of implementing green technologies and initiatives in universities to ensure sustainability and contribute to the well-being of students and faculty (Ragazzi & Ghidini, 2017). The necessity of a comprehensive approach to sustainability by focusing on “learning for sustainability” in all aspects of university activities, the aspects of renewable energy and energy efficiency in universities that contribute to both cost savings and sustainable development, and the integration of sustainability principles into research and teaching activities can be achieved through integrative approaches to the implementation of sustainable development in higher education. It is of great importance that universities take a proactive role in promoting sustainability and integrate sustainable practices into their institutional structures (Filho et al., 2015).

■ **Figure 2**
Trend of Publication 1994- 2023 (Web of Science, 2023)



■ **Table 2**
Overall Rankings 2023 (Greenmetric, 2023b)

No	University	Country	Total Score	Setting & Infrastructure	Energy & Climate Change	Waste	Water	Transportation	Education & Research
1.	Wageningen University & Research	Netherland	9500	1350	1825	1800	1000	1750	1775
2.	Nottingham Trent University	UK	9475	1375	1850	1800	950	1700	1800
3.	Umwelt-Campus Birkenfeld	Germany	9450	1275	1925	1800	1000	1700	1750
4.	University of Groningen	Netherland	9425	1325	1775	1800	1000	1800	1750
5.	University of California, Davis	USA	9425	1400	1900	1800	1000	1575	1750
6.	University College Cork	Ireland	9425	1250	1875	1800	1000	1700	1800
7.	University of Nottingham	UK	9425	1375	1825	1800	1000	1750	1675
8.	Universidade de Sao Paulo USP	Brazil	9425	1450	1775	1800	950	1700	1750
9.	University of Connecticut	USA	9400	1375	1775	1725	1000	1750	1775
10.	Universitat Bremen	Germany	9375	1325	1775	1725	1000	1750	1800

It is seen that the universities in the top 10 of GM have adapted sustainability-related activities to their institutional structures, adopted sustainability principles, and adopted sustainability principles through their scores in all criteria (■ Table2).

When the data of selected universities for the year 2023 are analysed, it is seen that universities are differentiated in the water category. Considering that universities that are subjected to scoring in the criteria of water saving program and implementation, water recycling program implementation, use of water saving devices, consumption of treated water, water pollution control in the campus area can get a maximum of 1000 points under this heading, it is seen that NTU and Universidade de Sao Paulo scored less than other universities. It is understood that these universities should continue their work in these areas. When the rankings of the universities ranked in the top 10 in the GM (2023) in 2022, 2021, 2020, 2019, 2018, and 2017 are analysed, it is seen that the universities ranked in the top seven are also in the top ten in these years. Universitat Bremen, on the other hand, has seen a remarkable improvement in its ranking (■ Table 3).

GM utilizes six indicators to rank the sustainability of universities. These are energy and climate change, waste, water, environment and infrastructure, transportation, and education. The studies carried out by the universities in the

top 10 of the GM within the scope of the GC were examined within the scope of actions and activities, initiatives in which they participate, sustainable campus studies, responsible unit for sustainability within their institutional structures and sustainability reporting. The aim here is to reveal the appearance of the six indicators identified by GM to rank the sustainability of universities in the institutional structure.

Wageningen University (WUR) in the Netherlands has been ranked first among 780 universities worldwide in the GM (2023) as the most sustainable and greenest campus for the sixth consecutive year. Wageningen University fulfils all seven indicators set by GM to rank the sustainability of universities. However, transportation, the environment, and infrastructure received the lowest or weakest ratings. Even though WUR has pledged to achieving 30% energy efficiency by 2022 and has recently decreased CO2 emissions for electricity by 79% with three 26-turbine wind farms and a geothermal system, energy and climate change did not obtain full points. WUR is a member of the Nature-Positive Universities Alliance. Within the scope of GC efforts, the 80% climate neutral campus target has been set in accordance with the ISO 14064-1 norm based on carbon footprint and Greenhouse Gas (GHG) Protocol. Sustainable water use, thermal energy storage, flora and fauna policy on campus, sustainably produced food in canteens, reduction of food waste and greener travel with an innovative, regional

■ **Table 3**
University rankings and sustainability actions (Authors' own creation)

University	Actions and Activities	Rank					
		2022	2021	2020	2019	2018	2017
Wageningen University & Research (Greenmetric, 2024a)	Research and Education is Subdivided into Six Sustainable Themes: Biodiversity, Climate Change, Circular & Biobased Economy, Feeding the World and Nutrition & Health	1	1	1	1	1	1
Nottingham Trent University (Greenmetric, 2024b)	Construction, Travel and Transport, Carbon, Waste and Recycling, Ethics and Values, Food, Wildlife and Greenspaces	2	4	4	5	5	5
Umwelt-Campus Birkenfeld (Greenmetric, 2024c)	Infrastructure, Energy and Climate, Waste Management, Water, Mobility	6	2	3	4	2	2
University of Groningen (Greenmetric, 2024d)	Waste, Biodiversity, Communication, Diversity/Inclusion, Energy, Food, Human Resources, Environmental Performance Indicators, Buildings, Education, Research, Participation, Printing, Water	4	3	7	8	7	11
University of California, Davis (Greenmetric, 2024e)	Buildings, Food&Dining, Zero Waste, Climate, Labs, Diversity, Equity&Inclusion, Land Management, Transportation, Energy, Nitrogen, Water	5	5	5	3	3	3
University College Cork (Greenmetric, 2024f)	Energy, Waste, Purchasing, Resources	7	6	6	6	6	10
University of Nottingham (Greenmetric, 2024g)	Energy and Carbon; Transport; Waste and Recycling; Food and Catering	3	8	9	9	9	9
Universidade de Sao Paulo USP (Greenmetric, 2024h)	Sustainable Production, Habitat Loss, Sustainable Management of Fishes and invertebrate, Pollution Reduction, Pressures on Vulnerable Ecosystems,	10	9	11	11	10	7
University of Connecticut (Greenmetric, 2024i)	Climate, Energy and Buildings, Environmental Justice, Grounds and Outdoor Areas, Sustainable Dining, Transportation, Waste and Recycling, Water	8	16	20	46	61	71



transportation concept that includes public transportation, electric driving and (electric) bicycles, separation of waste in 15 different streams across the campus and reuse of organic waste as compost. The responsible unit for all activities has been identified in the organizational structure and is known. The University also publishes sustainability reporting (Wageningen University, 2023).

NTU, located in the UK, declares that it focuses on construction, travel and transportation, carbon, waste and recycling, ethics and values, food, wildlife, and green areas within the scope of actions and activities. The university, which does not have membership and/or participation in any initiatives, invests in net zero carbon emission, renewable energy generation and responsible carbon offset projects within the scope of sustainable campus studies. The responsible unit for all activities has been determined in the corporate structure and this unit is referred to as the University Executive Team. The University also publishes sustainability reporting. GM scores the WUR using 35 criteria in 5 different categories. Out of all the categories, energy and climate has the highest weighted score.

Table 4

Nottingham Trent University Carbon Emission Distribution by Area (Nottingham University, 2023)

Area	2018/19 emissions (tonnes CO ₂ e)	Contribution to NTU carbon emissions (%)
Supply chain	39,501	55
Commuting	15,967	22
Energy use	10,15	14
Business travel	3,682	5
Partner accommodation	3466	4
Water	44	0.065
Waste and recycling	24	0.03
Total	72,833	100

Table 4 shows the distribution of NTU's carbon emissions in seven areas. In 2018- 2019, the university emitted a total of 72 tonnes of carbon emissions. The highest share in these emissions belongs to the supply chain with 55%. The emission rate of the waste and recycling area is at the lowest level (Nottingham Trent University, 2023).

The Nottingham Trent University has chosen to base its 2021 carbon reduction targets for its UK activities on scientific principles. It has established carbon reduction goals in accordance with the Paris Agreement, using 2018- 2019 as the base year and focusing first on scope 1 and scope 2 emissions (Table 5).

Table 5

Carbon Reduction Goals (2018/2019 as the baseline year) (Nottingham Trent University, 2023)

Year	Goal
2030	63% reduction in emissions (science-based target)
2040	Net zero carbon target (with offsetting)
2050	Absolute zero carbon target (without offsetting)

University of Nottingham declares that it focuses on energy and carbon, transport, waste and recycling, food and catering services within the scope of actions and activities. The University is not a member of any initiatives. The university organizes the Biodiversity Photography Competition in the Green Awards every year. Within the scope of sustainable campus activities, the focus is on reducing carbon emissions by 83% by 2050. The unit responsible for all activities is the Sustainability Team. The university also publishes sustainability reporting.

The University of Groningen in the Netherlands declares that its actions and activities focus on waste, biodiversity, communication, diversity, energy, food, human resources, environmental performance indicators, buildings, education, research, participation, and water. Sustainability is one of the core values of the University of Groningen. This means that the University of Groningen aims to integrate sustainable development into all aspects of the University. The University is not a member of any initiatives. The responsible body for all activities has been identified in the organizational structure and is referred to as the Green Office. The University of Groningen feels a responsibility towards future generations and a sustainable society, not only in teaching and research, but also in its business activities, and wants to make an active contribution to this goal. In addition, the university aims to set an inspiring example by transparently promoting sustainability and actively involving and facilitating students in sustainable activities. (University of Groningen, 2024). In this context, the university aims to have 95% of total waste (hazardous and non-hazardous) separated, reduce total waste by 15% compared to 2019 (per capita (staff/student) from 29 kg to 25 kg) and establish a waste cycle by the end of 2026.

The University of California, Davis, located in the USA, declares that it focuses on buildings, food and nutrition, zero waste, climate, laboratories, diversity, equity and inclusion, environmental management, transportation, energy, nitrogen, water within the scope of actions and activities. In the university, which does not have membership and/or participation in any initiatives, the responsible unit for all activities is determined in the institutional structure and this unit is referred to as campuswide sustainability. The university publishes a sustainability report. In 2021, UC Davis concluded its SDG Voluntary University Review for the whole campus. This initiative is being spearheaded by the Global Affairs, Sustainability and Diversity, and Equity and Inclusion divisions at UC Davis (Table 6).

Table 6

UC Davis Sustainability-Related Courses (University of California Davis, 2023)

Alumni	% Sustainability Related Courses
2020-2022	21
2016-2019	12
2010-2013	6

Umwelt-Campus Birkenfeld, located in Germany, declares that its actions and activities focus on energy and climate, waste management, water, and mobility. The university has the German Sustainability Award; Birkenfeld Environmental Campus Nomination and BioPD membership. Within the scope of SC studies, the university aims to reduce total waste by 15%, to make 95% of total waste separated, to reduce carbon emissions by 30% and to make all waste circular in 2026 based on the base year 2019. In 2025, another goal is to achieve zero emission logistics. The unit responsible for all activities is the Green Office (Umwelt-Campus Birkenfeld, 2024). The University regularly publishes sustainability reporting.

University College Cork, located in Ireland, declares that it focuses on energy, waste, procurement, resources within the scope of actions and activities. The University has certificates and/or memberships in ISO 50001, Green Awards, UN Environment Programme, GEMS, STARS, GUMES, LAMA, ULSF. Within the scope of sustainable campus activities, the university aims to reduce electricity use by 15% and gas use by 9%. The unit responsible for all green campus activities is the Green Office (University College Cork, 2023). The University publishes sustainability reporting (Table 7).

The University of Connecticut, located in the USA, declares that its actions and activities focus on energy, water, materials, and mobility. The University takes part in A Bee Campus USA and A Tree Campus USA initiative. The University's goals within the scope of sustainable campus efforts are to reduce its carbon footprint by meeting campus energy demands with increased renewable and clean energy such as solar, geothermal, fuel cells and wind energy; to design, construct and renovate greener buildings on campus that operate more efficiently, use less energy and water, and have reduced environmental impacts; to provide recycling, waste sorting and waste minimisation through outreach; to make improvements to multiple solid waste streams; and to increase faculty, staff and student engagement to promote

leadership. The unit responsible for all activities is the UConn Office of Sustainability in the institutional structure (University of Connecticut, 2024). Sustainability reporting is published at the university.

The Universitat Bremen in Germany declares actions and activities to include further development of environmentally compatible and safe use of hazardous substances, optimisation of paper consumption, optimisation of energy and water consumption, reduction of personal waste, further development of emergency prevention and fire protection, optimisation of traffic connections to the campus, good communication in the field of occupational safety, health and environmental protection, optimisation of environmental protection from the planning stage, wider integration of sustainability aspects in research and teaching, protection and promotion of biodiversity. Water saving techniques have been updated throughout the University. The unit responsible for all activities within the scope of sustainable campus studies at the university, which is included in the German Society for Sustainability at Universities initiative, is the Green Office in the corporate structure (Universitat Bremen, 2024). Sustainability reporting and environmental reporting studies are carried out at the university.

As part of its actions and activities, the University of Sao Paulo declares sustainable production, habitat loss, sustainable management of fish and invertebrates, reduction of pollution, minimisation of pressures on sensitive ecosystems. Educational programmes on sustainability and the environment were awarded the Award of the Competition to choose the logo of the Interdisciplinary Seminar on Sustainability. The university has numerous initiatives to become a sustainable university and has more than 22 million m² of ecological reserves. The USP Environmental Policy was established in 2018 in accordance with the university principles to promote more efficient, integrated environmental management (Universite of Sao Paulo, 2023). The Superintendency of Environmental Management (SGA) aims to incorporate the environmental dimension of sustainability into all policies, plans, and activities of the university in the areas of teaching, research, extension or management (Universite of Sao Paulo, 2023a).

The Program for the Efficient Use of Water and Energy Resources (PUERHE) and the Program for the Rational Use of Energy and Alternative Resources (PUREFA) were generated to render the use and management of resources on USP campuses more efficient; PUERHE deals with

Table 7

UCC Energy Performance Statement (University College Cork, 2023)

Scope	2018/19	2019/20	%Change 18/19	2020/21	% Reduction 18/19 baseline
Electrical GWh	19.98	17.01	-15	19.50	2
Gas GWh (normalised)	21.09	19.98	-9	20.03	8



both energy and water resources, while PUREFA focuses on the application of electrical energy and renewable energy sources (Universite of Sao Paulo, 2023b). The Program for the PUREFA, the Program for the PUERHE and the Program for the PUREFA were created with the aim of making the use and management of resources on USP campuses more efficient; PUERHE deals with both energy and water resources, while PUREFA focuses on the implementation of electrical energy and renewable energy resources (Universite of Sao Paulo, 2023c). The University of São Paulo started measuring human greenhouse gas emissions on all of its campuses in 2009 (Universite de Sao Paulo, 2023d). ATLAS is a Geographic Information System developed by a multidisciplinary team of architects, urban planners, engineers, graphic designers, geographers and systems programmers, coordinated by the Laboratory of Collected Information of the Faculty of Architecture and Urbanism (Universite de Sao Paulo, 2023e).

Conclusions

Since the first task of universities is education, it should be considered as the first step towards sustainability policy. Organizing activities that will increase the level of environmental awareness of students, active participation of students in policy-making processes, adding sustainability-oriented courses to the curriculum are some initiatives to be taken in the field of education.

As a result of the research conducted through the web pages of the universities ranked in the top 10 in the GM World Ranking, it was concluded that the universities responded in detail to the indicators of total area covered with forest, cultivated vegetation, forest and cultivated vegetation in their campus areas, as well as water absorption, use of energy-saving devices, smart building application, renewable energy generation/ production collection ratio and were able to provide evidence.

Annual energy use reduction, green building practices, greenhouse gas emission reduction programme, waste policies, transportation initiatives to reduce the number of private vehicles on campus, increasing the use of ZEV are some of the green campus initiatives implemented by universities. These initiatives were accessed from the official websites of the universities. Practices for zero emission vehicles were identified in all the universities in the top ten. All universities except the University of Sao Paulo have published sustainability reports. New indicators were added to the methodology in relation to water pollution. Nottingham Trent University and Universitat Bremen should make improvements within the scope of the newly added indicators.

The current efforts of universities are ensuring that they rank high in the GM ranking. The fact that universities set examples of good practice for society and share their

sustainability efforts with their stakeholders will have a far-reaching impact on society. It is important to measure the impact of the actions taken to move universities up the sustainability rankings. It would be an incomplete goal to simply aim to stay in or move up the ranking.

Based on the increasing importance of GC practices in the sustainability policies of universities in recent years, this study shows the sustainability-related activities, good practice examples and the position of prominent universities in the Greenmetric ranking. The comprehensive assessment presented in the study is intended to provide insights for interested researchers, professionals and university administrators. Future research should focus on the elaboration of GC practices for inclusion in other indices, measuring the transformation towards a sustainable culture and its positive impact on each university community.

There are two different limitations in the study. The first limitation was applied in the selection of Greenmetric as a ranking system. The second limitation was in the selection of the universities ranked in the top ten. If future research is repeated using different limitations and university selection, different evaluations can be made.

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