Techniques for Converting Universities Into Green Environmental Universities and Its Impact on the Design of Various Spaces

Rehab Abdelfatah Sherif

Assistant Professor at Faculty of Applied Arts, October 6 University, Giza, Egypt

Submit Date: 2023-01-17 20:11:42 | Revise Date: 2023-03-17 20: 58: 52 | Accept Date: 2023-05-23 20:43:35

DOI:10.21608/jdsaa.2023.188071.1249

KEYWORDS:
Technology, Green universities, Sustainability, Design

ABSTRACT:

The University is the pinnacle of raising the intellectual, cultural and scientific level in the era of knowledge and informatics. Universities have the responsibility of leadership to achieve a sustainable future with the knowledge and technologies they provide that enable the University to provide all the requirements of sustainability for the entire environment. From this standpoint, several strategies and programs have been launched, including: The Global Conservation Strategy in 1980 By IUCN (International Union for Conservation of Nature and Natural Resources), United Nations Environment Program (UNEP) and World Wildlife Fund (WWF)

From this point of view, it was necessary to conduct several studies that we will discuss in this study, as it was found that we, as interior designers, must start applying new standards for designing the internal and external spaces, including, for example, taking into account advanced basics for studying the elements of internal and external design (floors , walls, ..., lighting, ventilation) and defining environmental standards that will affect all beneficiaries of the University (leaders, faculty members, administrators, students, ..., labor market). And because architecture is a mirror that reflects the culture of society and expresses the identity and personality of the designer, the designer sought in his designs for the internal and external spaces to apply the features of green buildings on the University, and to activate this, the difference between sustainability and sustainable development will first be clarified and their connection to the internal and external design of the University, and then clarify the classification axes Green Universities and their importance to all beneficiaries (University administration, faculty members, supporting staff members, workers, students, graduates, parents, labor market, ...) This is followed by an analytical study of an Egyptian University that achieves distinct environmental standards in its University and finally An applied study on another University that is on its way to achieving the standards of green universities in a distinct way

1- Introduction

UNEP includes “green” University networks that are being formed in Africa and other developing regions. It aims to improve the sustainability of Universities by integrating strategies to develop resilience, low carbon and aspects of sustainability in education (training, University infrastructure, improvement of the educational, recreational and educational environment for students). inside and outside universities.

The UNEP Networks will also help universities mainstream the UNEP Green University Interior and Exterior Design Toolkit into their day-to-day functions through green University developments and practices, curriculum development, and community and student engagement.

There is a lot of assistance that the United Nations is doing to support universities that are seeking to be a green University, including the development of national and regional "green" University networks for Kenya, Morocco, Uganda and West Africa, with the help of the Environmental Education and Training Unit of the United Nations Environment Program, through the leading global University partnership. On the environment and sustainability, including but not limited to:

-Launching the Green League Network initiative for Arab countries

Launch of the Kenya Green University Network, or KGUN, a functional network of 67 higher education institutions in Kenya and a strategic platform for collaborative efforts to integrate environmental and sustainability aspects into education, training and University management operations.

The research problem is to answer these questions:

- How can all University activities, whether academic, community or research, be transformed into activities that support the environmental assessment of the University?
- Is it possible to make some formative and functional modifications to the current University spaces to convert them into green spaces?

In order to find a solution to these problems, the study aimed to:

- Highlighting the impact of transforming the design of universities into green universities on the future of interior design and architecture, socially, environmentally and culturally.
- Emphasizing the importance of reconsidering and thinking for all categories of the University (leaders, faculty members, students, designer and architect, ...) in new and advanced methodologies for designing various spaces suitable for the green University

2-Sustainability and sustainable development

The UN program not only referred to the concept of sustainable development but also the term "sustainable" in relation to human use of the biosphere. The Wildlife Conservation Society (WCS) has stressed that development requires the timely conservation of the living resource base on which it depends. In the long run, development will not be able to happen unless we conserve our living resources. Likewise, conservation will not occur unless at least the minimum development criteria are met, that is, the basic needs for food, shelter, and clean water. Therefore, the difference between sustainability and sustainable development must be clarified first, and this is what the following figure will show:

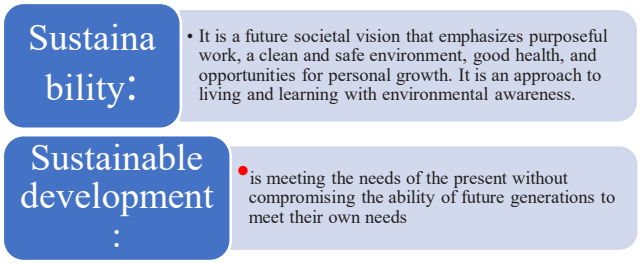


Figure (1) Sustainability and sustainable development https://www.unicef.org/sdgs

In this sense, the green University can be defined as:

"It is the University designed in accordance with environmental sustainability standards and where activities are environmentally

sound and fair socially, culturally and economically."(Gokhan NM, Needy KL ,2006)
For a University to initiate the transition towards sustainability it must necessarily reflect the social, cultural, economic and environmental conditions of the nation and the surrounding area in which that University is located.
The Green **University** Program is an "international environmental education program that provides the opportunity for the University to adopt environmental issues, innovation and research from academic departments and apply them to the daily running of the University. The Green **University** Program is operated by the Foundation for Environmental Education (FEE) Foundation for Economic Education
It is worth noting that any sustainability program takes into account the changing roles, experiences and expectations of three distinct groups in any University, who can be a starting point to contribute to transforming the University into a sustainable University. The following figure shows them:

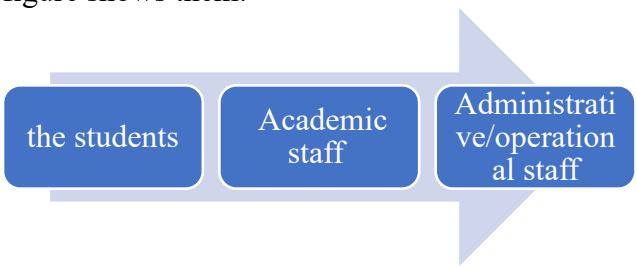


Figure (٢) the three distinct groups in any University

Figure 3[(1)]: sustainable development goals

2-1-The sustainable development goals are:

1. No poverty
2. Zero hunger
3. Good health and well-being
4. Quality education
5. Gender equality
6. Clean water and sanitation
7. Affordable and clean energy
8. Decent work and economic growth
9. Industry, innovation and infrastructure
10. Reduced inequalities
11. Sustainable cities and communities
12. Responsible consumption and production
13. Climate action
14. Life below water
15. Life on land
16. Peace, justice and strong institutions
17. Partnerships for the goals

- The Sustainable Development Goals are a global call to action to end poverty, protect the environment and the climate, and ensure that people everywhere enjoy peace and prosperity.
- The sustainable development goals are interrelated, although each of them has its own specific small goals, representing a total of 169 goals. (Scown, Murray W. ,November 2020).
- The sustainable development goals cover a wide range of social and economic development issues, hence the importance of entrepreneurship in general and environmental ones in particular

3-A historical perspective

- The first Intervarsity BioBlitz Program, held in May 2014, saw 5 Universities compete with online training and support from the National Biodiversity Data Center, partners with Green-University on the program

- Volunteers were equipped with the information needed to implement BioBlitz on their University. Records are uploaded in real time, providing an exciting and engaging level of competition between universities The Green League Network for Arab States will be launched next July, and the Kenya Green University Network, or KGUN, will be launched next month.
- In 2000, the USGBC created the LEED Green Building Certification Program as a way to define and measure green buildings. LEED is an internationally recognized green building certification program that provides third-party verification that measures how well a building or community is performing across the most important metrics (land impact - energy savings - water efficiency - emissions reduction - improvement of indoor environmental quality - stewardship of resources). (Indunil D. Batuwangala ,2018)
- LEED provides building owners and operators with a brief framework for defining and implementing practical and measurable design, construction, operation, and maintenance solutions for green buildings. It was developed through a broad consensus process that included nonprofit organizations, government agencies, architects, engineers, developers, builders, product manufacturers, and other industry leaders. LEED has grown from a single rating system to a new one
- A set of classification systems that address the full life cycle of buildings have been established.
- It is worth noting that any University can join the Green-University program according to the availability of the instructions contained in the program booklet, while the Green Flag award will be awarded to universities that complete all the basic elements of the Green-University program.
- In order to build any model of a sustainable University, a vision for sustainability must first be developed, then a mission, then a sustainability committee should be formed to set policies and goals and follow up on what is being achieved in terms of publishing the principles of sustainability in the following main areas:
- **Education:** Involvement of sustainability topics to involve students in positive attitudes to deal with the environment
- **Scientific research:** addressing sustainability issues and developing solutions to them
- **Community Service:** Pioneering awareness of sustainable development and its importance
- **University activities:** practicing activities to reduce their environmental impacts
- The number of University students in Egypt is large, so the benefit to them and their community will be great. The following table shows these numbers:

No	تصنيف الجامعة	**Business Management**
1	University ranking	**العدد**
2	public universities	٢٧
3	private universities	٢٤
4	Al Azhar University	١
5	international University	٣)+٧ future universities(
6	Ahlia University	٧)+٧ future universities(
7	technology universities	٤)+٦ future universities(
8	Government higher institutes	١٧٣
9	High tech institutes	٤٦
The total number of students is 4.2 million students, and the number is expected to reach 6.6 million students		

Table (1) : number of University students in Egypt

4-The objectives of transforming the design of universities into green universities are divided into four axes:

a- Socially:

To provide the opportunity for administration, academic staff, and students to meet and engage in environmental issues to create a more balanced University community.

Provide a role model in the community and provide guidance and engagement to local stakeholders.
- Link to Taisce's other International Environmental Collaboration Unit programs Clean Coasts, Green Home, Green Schools, National Spring Clean and other national environmental initiatives such as Tidy Towns.

b- Environmentally:

Access to a wider network of environmental support agencies.
- Improving the management of environmental aspects (Conservation of natural resources, Reduce environmental pollution, waste, resources, ...)

c- Economically:

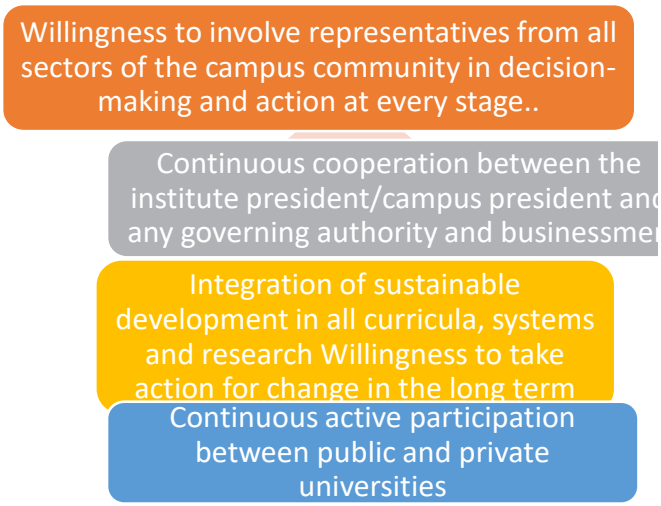
- Reduces associated costs (Reduce energy costs,..)

Win a prestigious award that is re-evaluated annually, and provide positive publicity for the University.

d- Academically:

-Improving learning on University by developing students' confidence and sense of citizenship through participation, research, transferable skills, and minimizing environmental risks and impacts
-Encouraging innovation and change and Provide new ideas for research topics, final year projects, and events within the institution.

In order to achieve these goals, a set of administrative and design requirements should be met, summarized in the following figure:

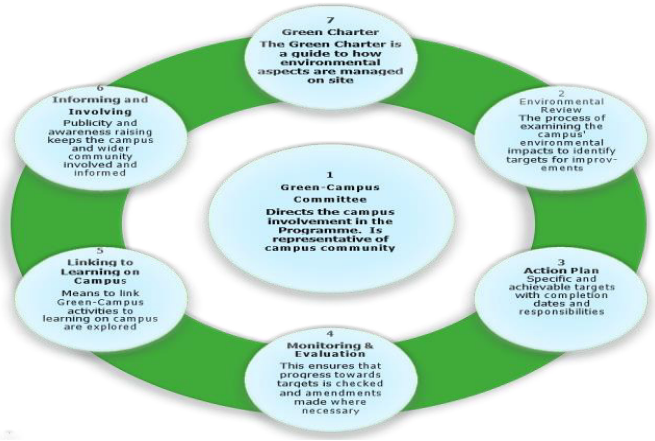


-Figure (4) set of administrative and design requirements to achieve goals

- Facing difficulties and providing a helping hand to overcome all obstacles and creating ways to obtain financial support for the environmental project.(Wang W,Zmeureanua R,Rivard H ,2005)

5- The seven steps of the green University program and their relevance to the interior design of the spaces

The seven-step process is intended to be flexible enough to accommodate any University and each step must be implemented to fit University capacity at the point of implementation. The nature of the seven steps also allows the program to be constantly updated with the changing environmental situation and the design and functional requirements of the University. We will study these points to determine their relevance to the design of the internal and external spaces.



-Figure (5) The seven steps of the green University program

5-1-The first step: Create a Green-University Committee

The Green-University Committee aims to direct and handle all phases of the Green-University Program. This step is the driving force of the program, which ensures the implementation of the other steps. Its purpose is:
- Ensuring that the opinions of all members of the University community are heard and acted upon whenever possible.
-Ensure the successful adoption and implementation of the other six steps of the program.

Emphasizing to the beneficiary parties (an external community, alumni, students, ...) to take responsibility and that their ideas are appreciated.
- Ensuring the long-term continuity of the program through integration and compatibility between interior and exterior design and between research and academic projects

5-2-The second step: environmental audit

The objective of the review is to determine the primary position on University with regard to environmental management. The environmental review includes the following:
Preparing a clear vision of the scope of University impacts.
Identifying areas where current practices are appropriate or areas where current practices are lacking.
Planning to develop a plan to prioritize the actions to be taken. The following table summarizes some of the measures in each axis (waste, energy, water, means of transportation, biological diversity, human resources)

No	Theme	Issues to Consider
1	**Litter and Waste**	- What types of waste are produced on University? To reduce or recycle waste whenever possible Is it possible to conduct garbage sorting in the area under study? To assess the impact of litter and waste on the environment and to explore practical means to prevent and reduce the amount of litter and waste produced on University. Are the correct measures taken to dispose of all hazardous waste (car waste, oils, batteries, laboratory chemicals, solvents, paints...) correctly? Does the University dispose of its used electrical appliances in the correct manner?
2	**Energy**	Are the energy sources used (eg electricity, oil, gas, solid fuels, biofuels/renewable fuels, etc.) specified? How is an audit/survey of the devices conducted based on the energy used on the University? Are all University departments aware of how to rationalize energy use?
3	**Water Conservation and Protection**	How is water metered and University consumption information. ? Is there a leak detection program? Where is the water used? And what is the high rate of users? Are there watercourses and natural resources at the site and what is the extent of environmental damage resulting from them?
4	**Travel & Transport**	How are transportation to and from the University managed? How are goods and services delivered to the University? Can links be established with local authorities to promote sustainable transport?
5	**Biodiversity**	- Is it determined if the University is located in or near a particular area? This information is available from the National Parks and Wildlife Service (NPWS). - Are land management methodologies being ascertained, especially the use of herbicides, pesticides, fertilizers, water use for irrigation, etc.?
6	**Green ICT**	Is there a department on University responsible for managing information and communication technology? Is it possible to reduce the environmental impact of information and communication technology on site? How is the procurement policy for software, ICT hardware and software determined? .

Table 2: Factors to consider when undertaking environmental reviews

5-3-The third step: action plan

Information from the environmental audit is used to identify priority areas and create an action plan.

5-4-The fourth step: monitoring and evaluation

The University monitoring and evaluation program shall:

Preparing a development plan in parallel with the work plan of the committee to be implemented by students with the college administration.

Incorporate feedback into your action plan to identify areas for adjustments and improvements to be made when and where necessary.

Increase the likelihood (or decrease the time required) to achieve the goals formulated in your action plan.

- To be made public (eg displaying graphs, charts, etc. on Green-University notice board, newsletters, social media, etc.).

5-5-Fifth step: Linking sustainable development to on-University learning

Develop links between the Green-University program and on-University learning by integrating the Green-University program through as many topics and courses as possible and using it to inform the University community and its alumni of environmental issues

5-6-Sixth step: Inform and engage the University and the wider community

Constant advertising and at least a "working day". Most universities already have Green Week. or national (such as Neat Towns, National Spring Cleaning, Energy Awareness Week, Tree Week, Bike Week, etc.).

• Placing a notice board dedicated to the Green University in a prominent position for staff, students and other visitors.

• Ensure that a green University web page is created that is easily accessible to students, staff and visitors. and create a Green-University newsletter that can be distributed to students or include Green-University articles for the University newspaper.

Participation can be enhanced by:

• Use a full-University workday or long-term community project to raise green University awareness on and off University.

5-7-Seventh step: The Green Charter

The Green Charter is the guide for how to manage the environment on the University University, after the availability of all environmental data and information on the University, including waste, energy, and other environmental issues.

7-Developing universities and turning them into internationally green ones in terms of designing the internal and external space:

Africa is lagging behind in the "green" University movement - only five institutions on the continent are among the more than 400 participants in world University rankings that practice green policies to help combat climate change. However, national and regional "green" University networks are now being developed on the continent, and one of the most important classifications that Egyptian universities have become involved in is the "Green Metric" classification.

Green Metric World University Ranking:

It is a classification closely related to the main indicators of sustainability and the carbon footprint, and it began in 2015 and was issued by Universitas Indonesia. It has six axes as follows:

١. Environmental setting and infrastructure (15%)
٢. Energy and Climate Change (21%)
٣. Waste management (18%),
٤. Water Management (10%)
٥. Transportation. environmentally friendly (18%)
٦. Education (18%).

The University of Nottingham in the UK is ranked as the best 'green' University in the world, followed by the University of Connecticut in the US and the University of California, Davis. Of the six African universities included in the sustainability ranking, three are from Egypt, one from Morocco and two from South Africa.

We will discuss the analytical study of the steps of the American University in Cairo to design a green University because it ranks first in Africa, ranking 134 out of 1050 in 2022 Then, we will discuss the analytical and applied study of the Cairo to transform it into a green University, as it ranks 328 in 2022.

8-Analytical study of the interior design of the American University and the extent to which all of the above are applied to it as a green University:

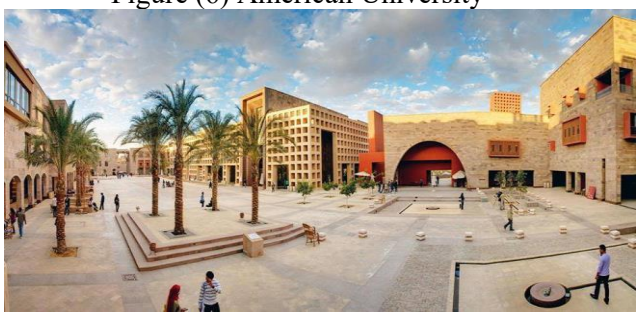
The American University as a guiding model

From AY ١٢and AY ٢٠, AUC's carbon footprint decreased by ٨,١٤٥metric tons CO٢-eq (from ٤٢,٥٣٦tons CO٢-eq to ٣٤,٣٩١million tons CO٢-eq) or by ١٩% Approximately. The reductions and increases for each major class of emissions from AY ١٢and AY ٢٠are as follows:

Increase discounts

1- HVAC (-٪٣١)
2- Transportation (+٪٣)
3- Electricity (other than HVAC) (-٪٢٩)
4- Paper (-٪٤٠)
5- Water (-٪٢٢)
6- Solid Waste Disposal (-٪٤٢)
7- Fertilizer (-٪٤٤)
8- Refrigerant (-٪٥١)

-Figure (6) American University



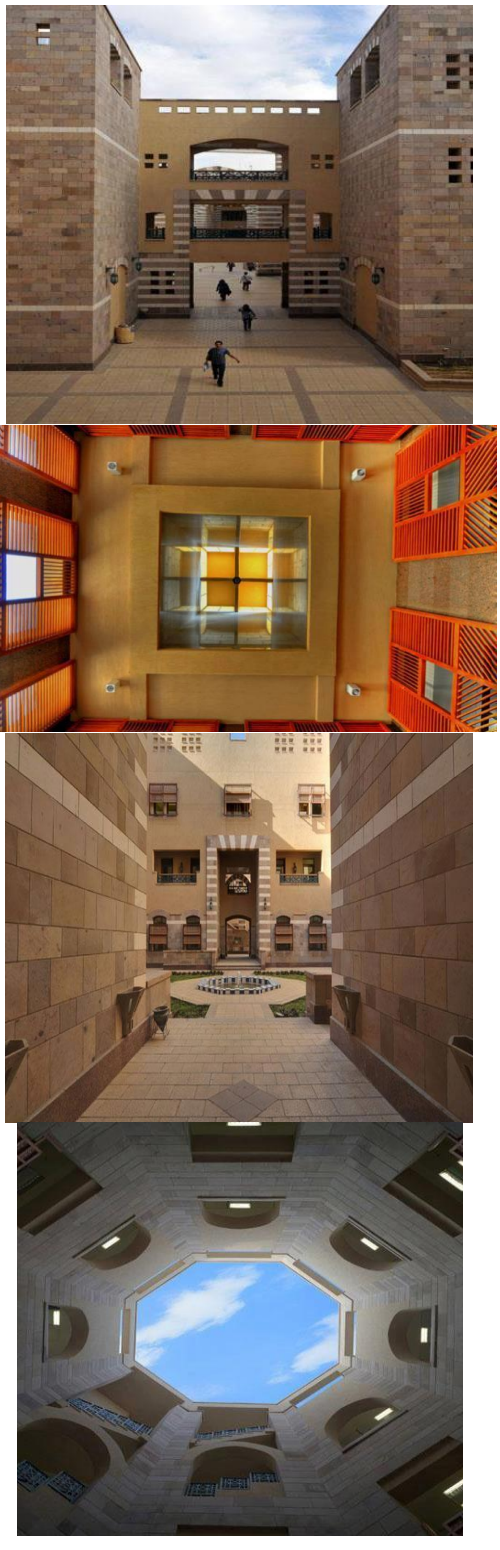


Figure (7) clearly uses the concepts of pressure difference to pass hot air to cool and create an air current in a way that simulates the traditional and is based on scientific foundations and contemporary models

8-1-The analytical study of the seven axes will be covered in the following table:

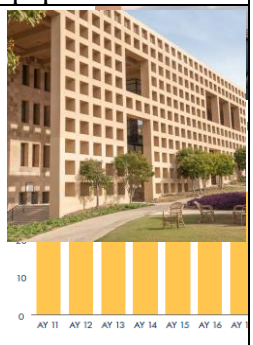
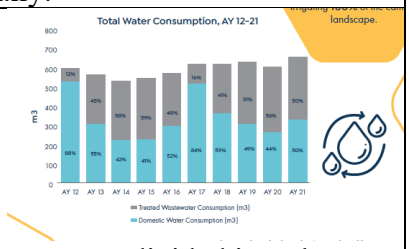
Theme	Issues to Consider
Litter And Waste	- Installing 30 small sorting stations for plastic, cans and garbage. - 4 container stations (plastic, cans, food and other waste). - Building a compression station on University to compress plastic, cans and separate paper.
Energy	- Improving the management of  the HVAC system and increasing renewable energy sources to meet the energy requirements of the American University in Cairo (solar energy project) and reduce carbon emissions by about 77 tons annually.
Water Conservation and Protection	 Water uses are divided into three categories: air conditioning cooling towers, green space irrigation, and building use Installing low flow shower heads in the dorms Effective management of the HVAC system Treating wastewater to irrigate green spaces on University.  Upgrade drinking water stations on University by installing water dispensers that provide filtered, chilled drinking water to students, faculty, staff, and visitors to fill in their own reusable bottles
Travel & Transport	The University provides sustainable options for University personnel to get to and from University, including: Multiple buses daily to and from University along 13 routes serving Greater Cairo, and students can use them for a reasonable subscription fee.
Biodiversity	It studies the diversity of plant and animal life associated with Universities and finds ways to promote and protect biodiversity. Investigate land management methodologies, especially the use of herbicides, pesticides, fertilizers, water use for irrigation, etc.
Green ICT	AUC's curricula and departments address various sustainability issues through innovation The three pillars of sustainability have been applied throughout the curriculum for many courses at AUC, with specific schools and departments focusing more on each of the thematic areas: environment, economy and society. - Organizing a range of courses and programs to strengthen students' understanding of sustainability in a local and global context.-

Table (3) The analytical study of the seven axes

8-2-University plans for the future

With the advent of the next academic year 2023-2024, the University will be as follows: Green roofs throughout the University - Solar energy is exploited in all spaces - Energy-saving doors and windows - Motion sensors are available - The distribution of landscapes full of low-impact local plants will increase

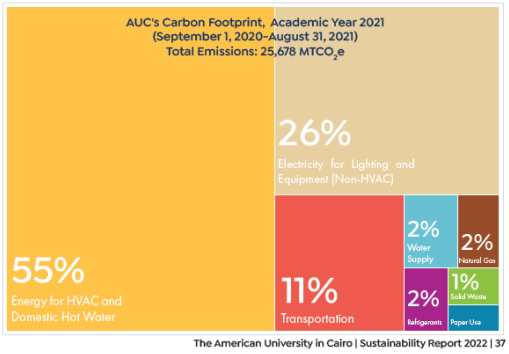


Figure (8) AUC carbon footprint

9-An analytical study of the interior design of the October 6 University and the extent to which all of the above are applied to it as a green University :

October 6 University occupies, in the result of the international Green Metric classification of environmentally friendly universities for the year 2022, and for the third year in a row, the first place among the private Egyptian universities that participated in the classification, and the result was as follows: -

1- Locally, October 6 University ranked seventh out of 16 Egyptian universities that participated in this classification this year.

2- Africa, October 6 University ranked seventh among the African universities that participated in the ranking.

3- Internationally, October 6 University ranked No. 328 out of 1,050 universities from 85 countries that participated in this ranking this year.

It is worth noting that the University is ahead of 43 Russian universities, 27 Brazilian universities, 8 American universities, 3 Greek universities, 15 Italian universities, 5 Jordanian universities, 13 Spanish universities, etc., which allows October 6 University the possibility of forming partnerships with universities that are ahead of them in different rankings. .

The following table shows the result of October 6 University in the current year 2022 compared to previous years: - Table (4)

	Global Ranking	October 6 University	National Ranking	Total Score	Setting and Infrastructure	Energy and Climate	Waste	Water	Transportation	Education
		Rank (private universities)		Weight	1500	2100	1800	1000	1800	1800
					15%	21%	18%	10%	18%	18%
2020	519	1	6	4950	475	775	975	375	1075	1275
2021	429	1	6	5850	675	950	900	550	1375	1400
2022	328	1	7	6850	840	1335	1050	700	1325	1600

It is clear from the previous table: -

October 6 University is the first in this classification for three consecutive years, compared to Egyptian private universities.

- Upgrading the University's international ranking from year to year, and this is commensurate with the effort made in this regard.

Universities applying for this classification compete with each other in their ability to be sustainable in facilities and equipment, energy and climate, safe disposal of waste, water conservation, transportation, and education, which are the six criteria on which this classification is based.

9-1- The following table shows the result of October 6 University in 2022 compared to other Egyptian universities: Table (5)

World Ranking 2022	University	Country	Total Score	Setting and Infrastructure	Energy and Climate Change	Waste	Water	Transportation	Education	
134	American University in Cairo	Egypt	7965	940	1425	1575	950	1400	1675	1
270	Cairo University	Egypt	7150	1075	1275	1200	650	1300	1650	2
275	Benha University	Egypt	7085	835	1775	1050	700	1175	1550	3
276	Kafrelsheikh University	Egypt	7085	735	1625	1275	850	1175	1425	4
283	Alexandria University	Egypt	7045	870	1525	1125	900	1275	1350	5
316	Ain Shams University	Egypt	6910	765	1510	1275	550	1160	1650	6
328	**October 6 University**	**Egypt**	**6850**	**840**	**1335**	**1050**	**700**	**1325**	**1600**	7
355	Sohag University	Egypt	6745	1150	1360	1050	550	1235	1400	8
374	Beni-Suef University	Egypt	6675	815	1625	1275	700	1010	1250	9
397	Misr University for Science and Technolo	Egypt	6555	835	1485	1125	550	1110	1450	10
433	Damietta University	Egypt	6360	790	1210	1200	600	1060	1500	11
554	Minia University	Egypt	5715	825	1190	600	500	1325	1275	12
618	Al-Azhar University	Egypt	5305	740	1190	600	250	1100	1425	13
643	University of Sadat City	Egypt	5205	535	885	900	650	885	1350	14
865	South Valley University	Egypt	3875	965	950	525	250	435	750	15
935	Egyptian Russian University	Egypt	3255	495	710	750	400	435	465	16

a-Heating, Ventilation, Air Conditioning (HVAC) and Domestic Hot Water

In line with the Sustainable Development Goals No : Goal 3: Good health and well-being - Goal 7: Affordable and clean energy - Goal 9: Industry, Innovation and Infrastructure - Goal 11: Sustainable cities and communities - Goal 13: Climate action

University-wide recommendations:

• Conducting an assessment of material changes after occupancy and their impact on the internal and external design of the University.

• Manage cooling on and off on specific days throughout the year with favorable indoor and outdoor temperatures
Recommendations at the level of the internal space:
• Ongoing maintenance of windows to reduce leaks and control of the HVAC system to improve comfort
• Design of umbrellas for self-regulation of heating and cooling

b- Means of transportation

In line with the Sustainable Development Goals No : Goal 3: Good health and well-being - Goal 7: Affordable and clean energy - Goal 9: Industry, Innovation and Infrastructure - Goal 11: Sustainable cities and communities - Goal 12: Responsible consumption and production- Goal 13: Climate action

University-wide recommendations:
Expanding available bus times and routes to stimulate bus travel.
Converting the University's means of transportation from diesel and gasoline to clean energy.
Allocating charging stations for electric and hybrid cars from renewable sources.

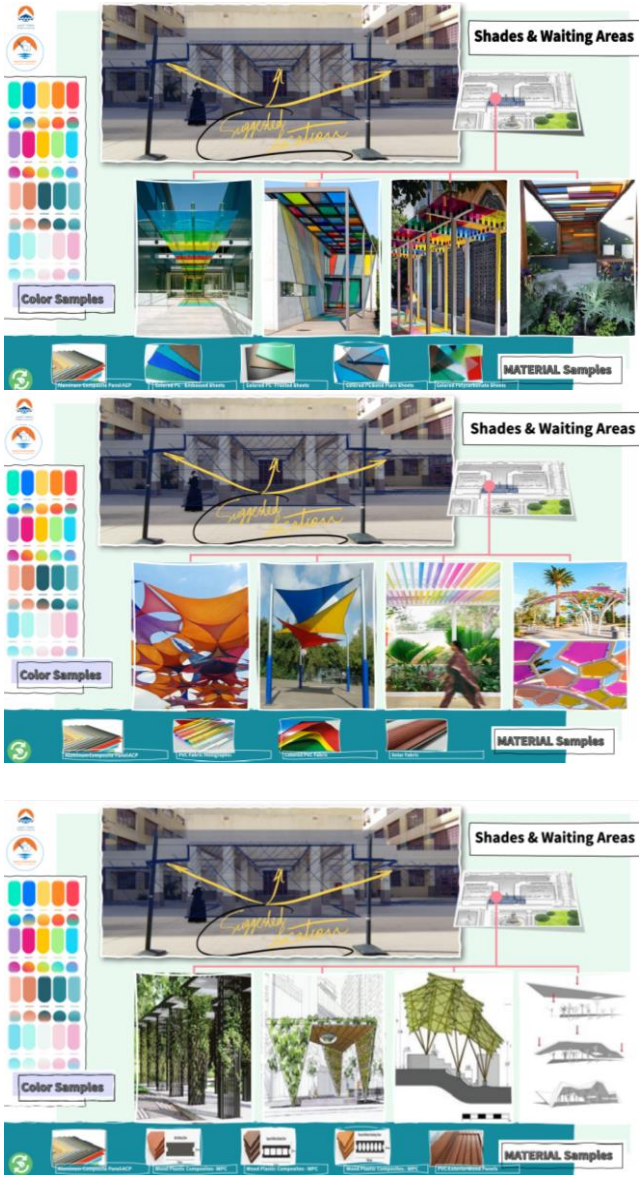
Neighborhood recommendations:
- Integration of the bicycle sharing system with the neighborhood area
Allocating places for pedestrians and bicycles to walk through the surrounding areas

c- Electricity (lighting and other equipment (other than HVAC):

In line with the Sustainable Development Goals No Goal 4: Quality education

- Goal 7: Affordable and clean energy - Goal 11: Sustainable cities and communities - Goal 12: Responsible consumption and production- Goal 13: Climate action- Goal 16: Peace, justice and strong institutions- Goal 17: Partnership for the goals

University-wide recommendations:
• Installing solar panels in parking lots and existing buildings
• Expanding the use of motion sensors in all corridors.
• Installation of occupancy sensors in individual offices.
• Created Eco-Rep to monitor electricity usage in student residences and University buildings.
• Develop an incentive system that rewards buildings or departments that use the least amount of electricity.
• Develop a policy in coordination with the University for the promotion or forced closure of unused office equipment and lights.
• Replace all non-energy-saving lamps with energy-saving ones, including carbon-efficient ones.



- Figure (9) suggestions for shades and waiting area

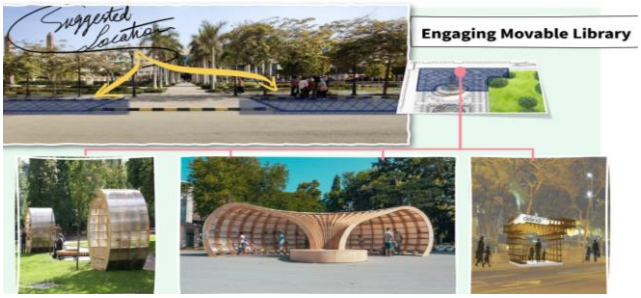
d- Refrigerants:
In line with the Sustainable Development Goals No : Goal 3: Good health and well-being - Goal 11: Sustainable cities and communities - Goal 13: Climate action
University-wide recommendations:
• Increasing the use of environmentally friendly non-chlorofluorocarbon (CFC) compatible refrigerants by phasing out conventional refrigerants and using R22 to use R407c exclusively.

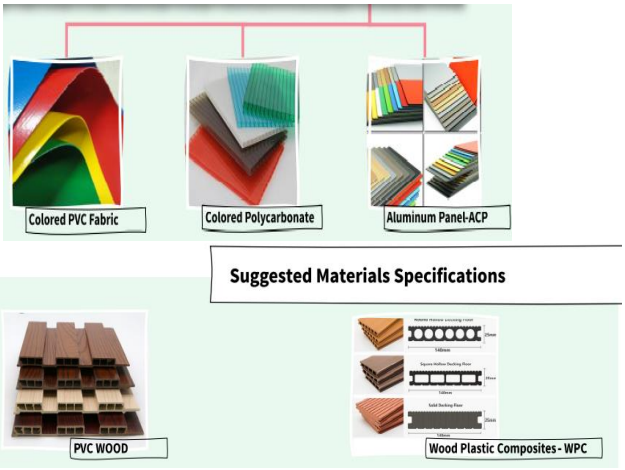
e- Use of paper:
In line with the Sustainable Development Goals No : Goal 11: Sustainable cities and communities - Goal 12: Responsible consumption and production- Goal 15: Life on land- Goal 16: Peace, justice and strong institutions- Goal 17: Partnership for the goals
University-wide recommendations
• Adopting the University's policy to make the default setting on all computers two-sided printing, promoting online media instead of print media, and establishing central printers in all offices
• Drafting an annual audit paper for all departments and establishing a committee to evaluate research papers at the University level
• Finding sources of high quality recycled paper at an affordable cost to reduce your carbon footprint

f- Water supply:
In line with the Sustainable Development Goals No : Goal 4: Quality education- Goal 9: Industry, Innovation and Infrastructure - Goal 11: Sustainable cities and communities - Goal 12: Responsible consumption and production- Goal 14: Life below water- Goal 17: Partnership for the goals
University-wide recommendations:
Low flow faucets and University level water filters
- Adoption of the University's policy regarding the cooling tower with air conditioning and the consumption of treated wastewater for air conditioning, cooling towers and buildings.
- Improving or modernizing the sewage treatment plant by adding a new high-capacity water tank and sterilization equipment.
Finding engineering solutions to capture rainwater and increasing the use of drought and salinity resistant materials, plants, shrubs and trees in landscaping on University.

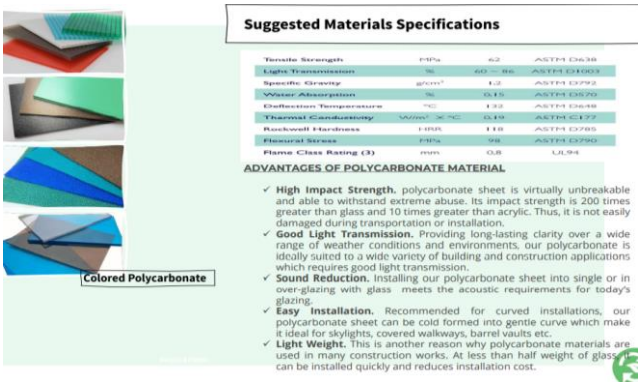
g. Carbon footprints:
A University's carbon footprint is the annual total of carbon dioxide (CO_2e) and other important greenhouse gases emitted into the atmosphere as a result of the daily activities and operations of the University.
- Publishing a periodic report on the carbon footprint showing the trends of the past years and the improvement plans for the future
The carbon footprint is a widely accepted way to measure the impact of human activity on global warming.
The main components of the carbon footprint:
1. Heating, Ventilation and Air Conditioning (HVAC) (1.4%).
2. domestic hot water (41%)
3. transportation (25%)
4. Electricity for lighting and other equipment (20%)
5. natural gas (7%)
6. Paper use (4%)
7. water supply (1.6%).

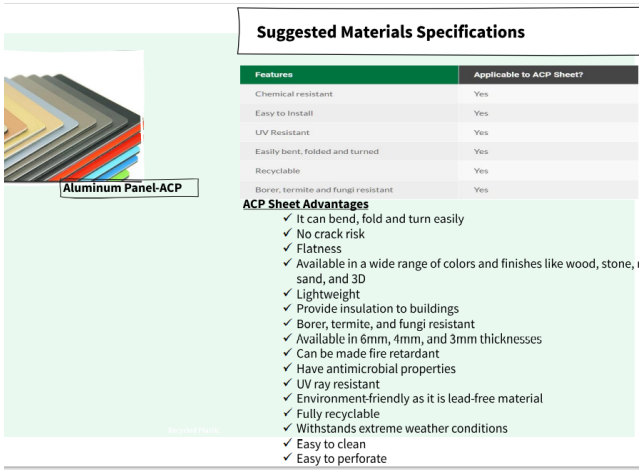
i. Sustainable selection of materials
- Searching for sustainable materials such as certified wood that has been harvested in the most sustainable way.
- Using recycled materials or made from recycled materials such as: wool insulation (made from recycled materials).
- Using sustainable woods such as bamboo, which is a very strong and fast-growing grass that can be used for flooring, furniture, and more.





- Figure (10) WPCs do not corrode and are highly resistant to mold, rot, and marine borer attack. WPCs are a sustainable material because they can be made using recycled plastics and wood industry waste products. Although these materials last the life of used and discarded materials, the added polymers and adhesives make WPC difficult to recycle again after use. However, it can be easily recycled into new WPC, like concrete. One advantage over wood is the material's ability to be shaped to meet almost any desired shape. The WPC member can be flexed so that it does not need to be painted. They are manufactured in a variety of colors, but are most widely available in gray and earth tones.





- Figure (11) PVC is more affordable and less expensive than wood. PVC is light and can be easily assembled and transported. Cabinets, drawers and shelves made of PVC are easy to maintain and cost less, and PVC is easy to clean. You don't have to worry about pests like termites with PVC fittings

There are many sustainable surface finishing options available, including bamboo flooring, cork flooring, linoleum, and more. Consider using glass or recycled paper for your countertops. Use low VOC (Volatile Organic Compound) paint to reduce indoor air pollution.

Figure (12) The sustainable spaces in October 6 University

10-Results :

- Technology and the environment, and its impact on the design of interior spaces can be summarized in the following points:
- The need to apply specific environmental standards in the design of the internal and external space when transforming green universities.
- When converting any University into a green University, the capabilities of modern technologies and information technology must be studied and future interim plans should be developed.
- The transition to green universities requires re-designing and developing the internal and external space environmentally, formally and functionally.
- The use of recycled materials or their leftovers contributes to achieving many of the seventeen goals of sustainable development

- Using less energy to obtain and process new raw materials results in less carbon emissions

11-Recommendations:

Given that the aim of the research study is to serve the University student, academics, administrators, and all beneficiaries of the University, the study recommends the following recommendations:

1- Awareness and publicity about the importance of sustainable environmental design and the importance of its application in transforming universities into green universities.

2- The need to pay attention to sustainable environmental design thinking in terms of elements, functions, configurations, and space distribution.

3 - The interior designer must be fully aware of the advanced technologies to benefit from them when transforming green universities

12-References

1. Gokhan NM, Needy KL (2006) The economic benefits of green buildings: a comprehensive case study. The Engineering Economist 51(3): 259-295.
2. Indunil D. Batuwangala (2018) “An Overview of the Green Building Concept”. Dubai. 3. Pulselli RM, Simoncini E, Pulselli FM, Bastianoni S (2007) Emergy analysis of building manufacturing, maintenance and use: building indices to evaluate housing sustainability. Energy and Buildings 39(5): 620-628.
3. Ssion, Leslie Dietz, Patrick F. Horve, David A. Coil, Mark Fretz, Jonathan A. Eisen, Kevin Van Den Wymelenberg. DOI: 10.1128/mSystems.00245-20
4. Wang W, Zmeureanua R, Rivard H (2005) “Applying multi-objective genetic algorithms in green building design optimization”. Building and Environment 40(11): 1512-1525.
5.www.smart.arch.nl[Accessed1June 2022]
6.https://www.unicef.org/sdgs
7. https://friendsoftheearth.uk/sustainable-living/7-benefits-recycling
8. http://www.dailytonic.com/blossom-
9. www.ergo-eg.com/ppt/2vrb.pdf
10.http://hipercroquis.net/2010/11/10/mitchell-joachim-dont-build-your-home-grow-it/
11.http://designreform.net/ - Exploring parametric modeling, BIM and Design Technology for new forms
12.http://www.rhinofablab.com/ - Design - Optimization - Fabrication D-O-F[Accessed 15 June 2022]
13. http://www.designalyze.com/ - the analysis of design[Accessed 15 June 2022]
14. http://designplaygrounds.blogspot.com/ - open design research platform
15. http://softrigid.com/ - soft/rigid behavior in architecture[Accessed 25 June 2022]
16. https://e3arabi.com/money-and-business/
17. https://al-ain.com/article/malaysia-helps-small-medium-industries-android [Accessed 1 August 2022]
18. https://www.ikea.com/qa/ar/this-is-ikea/sustainable-everyday/akhtyar-almwad-kwnna-shrkh-kbyrh-fin-ldyna-msuwlyat-kbyrh-pub47a5ba42[Accessed 29 June 2022]
19. Schleicher, Judith; Schaafsma, Marije; Vira, Bhaskar (2018). "Will the Sustainable Development Goals address the links between poverty and the natural environment?". Current Opinion in Environmental Sustainability. 34: 43.
20. Llanos, Andrea Ordóñez; Raven, Rob; Bexell, Magdalena; Botchwey, Brianna; Bornemann, Basil; Censoro, Jecel; Christen, Marius; Díaz, Liliana; Hickmann, Thomas (31 July 2022), Biermann, Frank; Hickmann, Thomas; Sénit, Carole-Anne (eds.), "Implementation at Multiple Levels", The Political Impact of the Sustainable Development Goals (1 ed.), Cambridge University Press, pp. 59–91,
21. Scown, Murray W. (November 2020). "The Sustainable Development Goals need geoscience". Nature Geoscience. 13 (11): 714–715. Bibcode:2020NatGe..13..714S. doi:10.1038/s41561-020-00652-6. S2CID 225071652.