Times Higher Education Sustainability Impact Ratings

University: Al-Mustaqbal University

Country: Iraq

SDG 7.2: University measures towards affordable and clean energy

7.2.5 Does your university as a body undergo energy reviews to identify areas where energy wastage is highest?

Yes, Al-Mustaqbal University, conduct energy reviews to identify areas of significant energy wastage.

The findings describe the monitored buildings, highlighting their key features and the fluctuations in energy use during this period. Data collected is used to evaluate the impacts of the lockdown and to analyze the cost benefits of various measures implemented to reduce energy consumption within the university's facilities. By conducting these reviews, the university can effectively target inefficiencies and promote a more sustainable campus environment.

1- Energy Consumption Calculation

Fig.1 illustrates the percentage of energy consumption in Al-Mustaqbal University Buildings for the year 2025, represented in a pie chart format. It highlights various buildings and facilities within the university complex, with the student restaurant for the largest share at 26%. Close behind is the medical building lab, which consumes 22% of the total energy. The sport building follows at 17%, while the pathological lab of 9%. Additional facilities include the Admin Building at 5%, the energy research center at 4%.

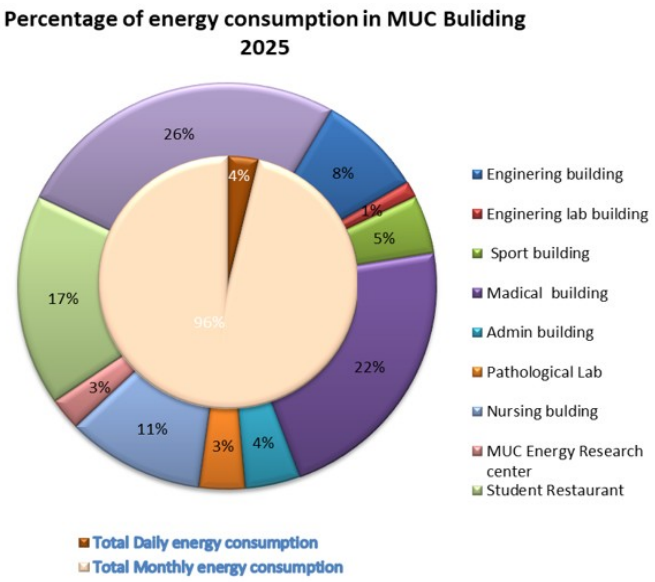


Fig.1 Annual energy usage in the main Building of Al-Mustaqbal University in 2025

2- Electricity USAGE PER YEAR (IN KILOWATT-HOUR):

The chart presents an interesting comparison of electricity usage and generator consumption from 2021 to 2025, and it's fascinating to observe the trends in energy consumption over these years.

In Fig. 2, starting with electricity usage, we see a clear upward trajectory. In 2021, the consumption was relatively low at around 172,288 kWh. However, by 2022, there's a significant jump to nearly 278,000 kWh, which suggests an increased demand, possibly due to expanded operations or additional facilities coming online. This upward trend continues, reaching approximately 416,654 kWh by 2025. On the other hand, the generator consumption presents a different story. It starts at about 68,915 kWh in 2021 and shows a noticeable increase in 2022, coinciding with the spike in electricity usage. However, after 2022, the generator consumption experiences fluctuations, peaking at around 235,500 kWh in 2024 but then dropping to about 208,237 kWh by 2025. This decline suggests that the facility may be relying less on its generator as time goes on, perhaps due to improved access to grid electricity or efficiency measures being implemented.

What's particularly striking is the growing gap between electricity usage and generator consumption. This indicates a shift towards greater dependence on external electricity sources, which can have significant implications for energy management and cost considerations. The stabilization of generator usage suggests that while the facility is still prepared for backup power, there's a clear movement toward more sustainable practices by utilizing grid electricity more effectively.

Overall, the trends captured in this chart highlight not just the changing dynamics of energy consumption but also the strategic decisions being made regarding energy sourcing and management within the facility. It raises important questions about future energy strategies and sustainability efforts, as the balance between grid reliance and generator use continues to evolve.

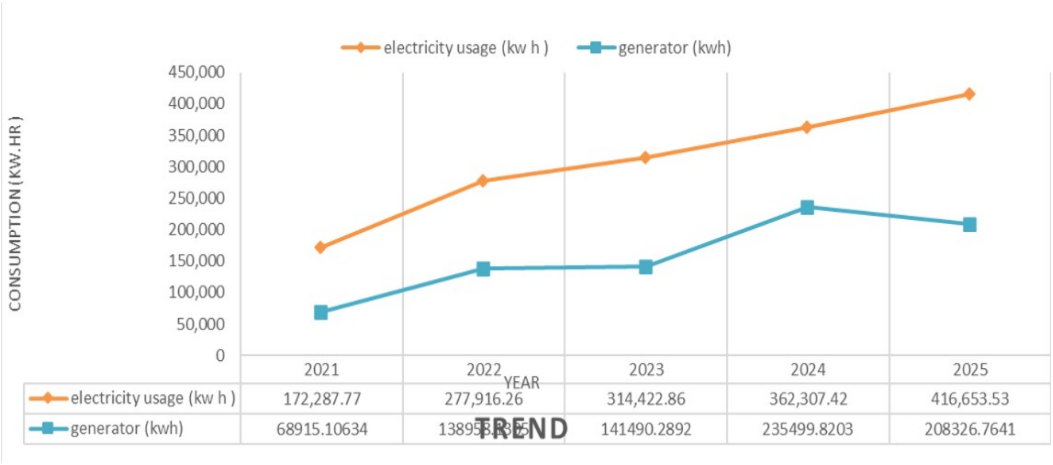


Figure 2 The trend evolution of electricity demand from (2021 to 2025)

Fig. 3 illustrates the monthly fluctuations in electricity and generator usage for the year 2024, providing a captivating look at how energy consumption varies throughout the year. In January, both electricity and generator usage start relatively low, which is common for the winter months when energy demand is typically less intense. As we move into March, there is a noticeable increase in electricity usage, peaking around March. This rise might suggest a shift towards more activity or operational needs as the weather begins to warm, prompting more energy-consuming activities.

April sees a slight dip in electricity usage, while generator consumption experiences a peculiar spike. This could indicate that perhaps there were reliability issues with the grid at that time, leading to increased reliance on backup power sources. As transition into May and June, electricity consumption rises again, reaching peak levels in June, which could align with seasonal operational demands, such as cooling systems during warmer months in Iraq

Interestingly, July presents a sharp increase in generator usage, almost mirroring the peak in electricity consumption. This simultaneous rise reflect particularly high energy demands, possibly due to extreme weather or operational peaks that necessitate additional power sources. August shows a significant decline in both electricity and generator usage, marking a break from the previous highs. This reflect a seasonal break for the students in Iraqi universities and maintenance activities that were implemented during this month, leading to reduced operational demands. As we move into September, electricity usage experiences a slight rebound, while generator usage remains low. This recovery indicates a ramp-up in activities post breaking holiday, but with a clear intention to rely more on grid electricity rather than generators.

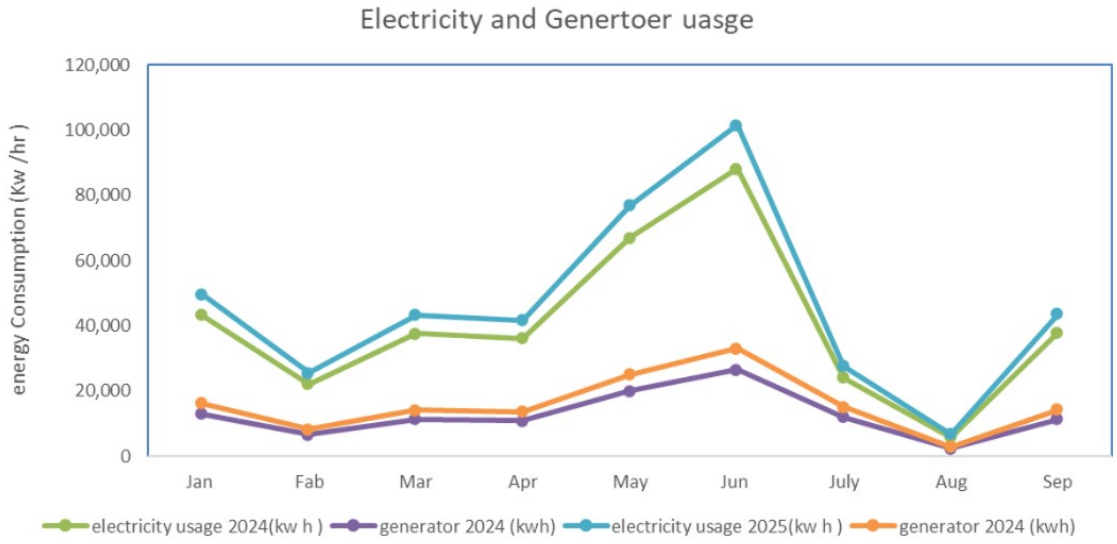


Figure 3 Comparison differences in electricity consumption between 2023and 2024

Fig. 4 compares electricity usage (in kilowatt-hours) across the years 2022, 2023, 2024, and 2025. In January, usage is low for all years, typical of winter months. A noticeable increase

occurs in March and April, peaking in June, particularly in 2023, indicating high summer demand, likely due to cooling needs. July shows a slight decline in electricity consumption, while August experiences a significant drop as summer ends and holiday for the students in Iraq. September and October see a rebound in usage, with October 2025 showing a marked increase compared to previous years. Overall, the chart highlights seasonal trends and yearly variations in energy consumption, suggesting influences from operational demands and environmental factors. This analysis can inform strategies for optimizing energy use throughout the year.

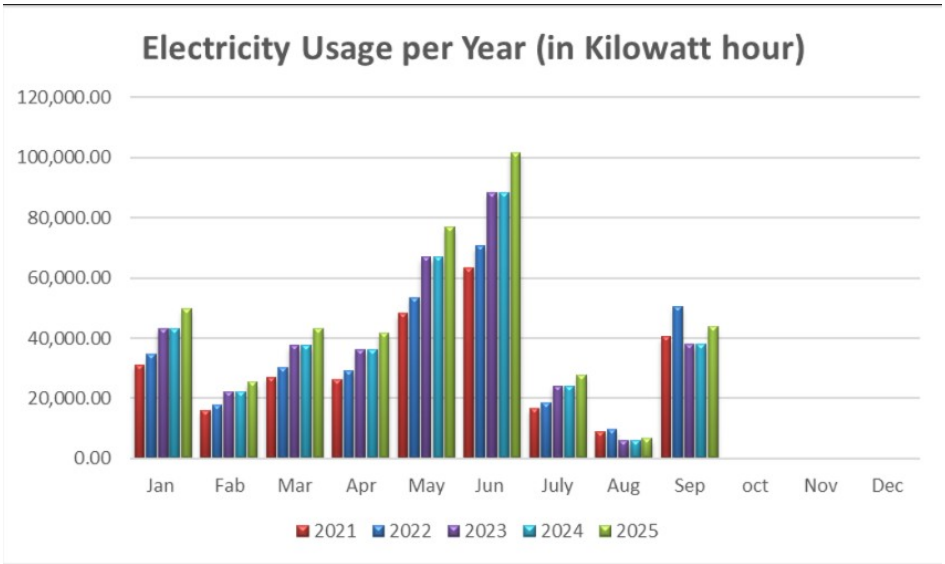


Figure 4 The total electricity and generator usage for the main building (2021-2025)

Fig. 5 illustrates daily energy consumption measured in kilowatt-hours across various time intervals. From 7:00 to 8:30, energy usage is relatively low, rising significantly from 8:30 to 10:30. This peak likely reflects increased operational activities as the day begins. Consumption remains high from 10:30 to 12:30, slightly decreasing during the lunch hour (12:30 to 2:30), before experiencing another spike from 2:30 to 4:30. In the final time slot, from 4:30 to 5:30, energy consumption drops again, indicating a decrease in activity as the day winds down. Finally, the chart highlights clear patterns of peak energy usage during mid-morning and mid-afternoon, suggesting busy operational periods during these times. This data can help in planning energy management strategies to optimize consumption.

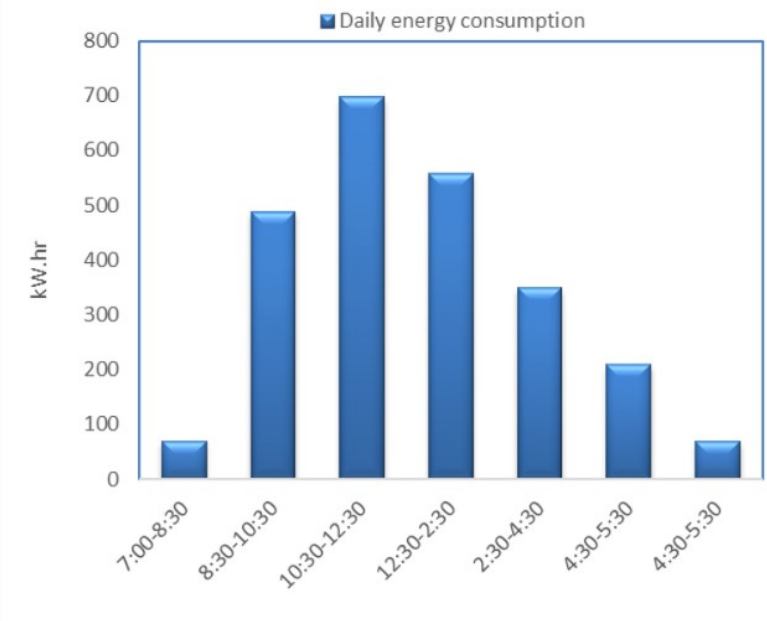


Fig. 5 Daily energy consumption of Al-Mustaqbal University

2.1 Estimation of Change in Occupancy and Operation Patterns

Alongside the energy consumption data, information regarding the behavior patterns of occupants in the Al-Mustaqbal University building has been gathered using surveys and questionnaires. This approach allows for a deeper understanding of how individuals interact with their environment and utilize energy resources. Additionally, various physical characteristics of the building have been documented. This includes details about the construction materials used, the types of lighting and appliances installed, as well as the specifications and performance metrics of the air conditioning systems.

Such comprehensive data collection not only aids in assessing energy efficiency but also provides insights into how building design and occupant behavior can influence overall energy consumption. Table 1 presents a summary of the key characteristics of the energy models pertaining to several buildings within Al-Mustaqbal University, highlighting the interplay between physical features and energy use patterns. This information is crucial for developing strategies aimed at optimizing energy performance and enhancing sustainability within the university's facilities.

Table 1: Behavior schedules specific to 2025 calibration of the energy models for of Al-Mustaqbal University building.

Building model		**Eng. building**		**Medical building**		**Administration building**		**Sport building**		**Security building**	
Typical Schedules	Hours	WD (Sat-Wed)	WEH (Thu -Fri)	WD (Sat-Wed)	WEH (Thu-Fri)	WD (Sat-Wed)	WEH (Thu-Fri)	WD (Sat-Wed)	WEH (Thu-Fri)	WD (Sat-Wed)	WEH (Thu-Fri)
Occupancy	1-8	0%	0%	0%	0%	0%	0%	0%	0%	25%	25%
	8-14	100%	0%	100%	0%	100%	0%	100%	0%	100%	50%
	14-18	50%	0%	25%	0%	0%	0%	40%	0%	75%	25%
	18-24	0%	0%	0%	0%	0%	0%	0%	0%	25%	25%
Lighting	1-8	3%		5%		1%		0%		30%	
	8-14	75 %	0%	80%	3%	100%	1%	80%	0%	100%	60%
	14-18	100%	5%	50%	3%	1%	1%	50%	0%	100%	40%
	18-24	3%		5%		1%		1%		50%	
Appliances	1-8	0%	0%	0%	0%	0%	0%	0%	0%	40%	
	8-14	80%	0%	80%	0%	100%	0%	70%	0%	100%	50%
	14-18	40%		30%		0%	0%	40%	0%	75%	50%
	18-24	0%		0%		0%		0%		50%	30%

Table 2: Behavior schedules specific to 2024 calibration of the energy models

Building model		Eng. building		Medical building		Administration building		Sport building		Security building	
Typical Schedules	Hours	WD (Sat-Wed)	WEH (Thu-Fri)	WD (Sat-Wed)	WEH (Thu-Fri)	WD (Sat-Wed)	WEH (Thu-Fri)	WD (Sat-Wed)	WEH (Thu-Fri)	WD (Sat-Wed)	WEH (Thu-Fri)
Occupancy	1-8	0%	0%	0%	0%	0%	0%	0%	0%	25%	25%
	8-14	20%	0%	30%	0%	50%	0%	10%	0%	50%	30%
	14-18	50%	0%	25%	0%	0%	0%	40%	0%	50%	25%
	18-24	0%	0%	0%	0%	0%	0%	0%	0%	25%	25%
Lighting	1-8	3%		5%		1%		0%		30%	
	8-14	25 %	0%	30%	3%	100%	1%	20%	0%	100%	60%
	14-18	5%	5%	5%	3%	1%	1%	5%	0%	100%	40%
	18-24	3%		5%		1%		1%		50%	

Appliances	1-8	0%	0%	0%	0%	0%	0%	0%	0%	40%	
	8-14	20%	0%	20%	0%	100%	0%	20%	0%	75%	50%
	14-18	0%		0%		0%	0%	0%	0%	75%	50%
	18-24	0%		0%		0%		0%		50%	30%

2.2 Energy Efficient Appliances Usage

Table 3 shows the energy efficient appliance usage by Al-Mustaqbal University in 2025. Lightening (Indoor light bulbs: replacing Halogen light bulb with LED), Heating and cooling Fan, air conditioner, fan ceiling, office equipment, and computers are some examples of the energy efficient appliance that Al-Mustaqbal University adopted in the new policy of efficient energy systems.

This Table shows that **95.94%** of the appliance available at the campus and buildings are energy efficient.

Table (3): Appliance Usage in 2024-2025.

Appliance	Total Number	Total number energy Efficient appliances	Percentage
Lighting			
Indoor light bulbs: replacing Halogen light bulb with LED	11245	11142	98.9%
Heating and cooling			
Fan	610	595	97.5%
Air conditioners	940	920	97.8%
Fan ceiling	1107	1100	99.3%
Office equipment			
Computers	1250	1225	98%
		Average Percentage	98%

3- Al - Mustaqbal University had many energy efficient appliance usages, for example:

Using energy-efficient appliances can contributes critically in cost savings, energy security, conservation, reduction of the emission. Al- Mustaqbal University aimed to find the suitable solutions committed to enhance the energy efficiency in the campus through various appliances and technologies. Some of them are described in the following:

a) **New Low-Energy Buildings**:

Implementing efficient (low-energy building) designs, including electrification and renewable energy sources such as wind turbine and solar energy, can reduce emissions and energy saving up to 80% of the annually.

b) **Inverter Air Conditioning** (IA/C):

Inverter A/C units have been installed by certified technician in lecture halls and the required rooms and space, and this significantly reduced the energy consumption while upholding comfort situation during cold and hot weather.

c) **Projects for Solar Refrigeration and Air Conditioning**:

The campus of Al-Mustaqbal University utilizes solar energy to power applications like split air conditioners and solar absorption refrigerators in order to reduce the energy consumption.

d) **Enhanced Energy Efficiency for the Building in Campus:**

Al-Mustaqbal University has replaced the energy sources of the high CO_2-emitting fuels with low-emission alternatives by adopting renewable technologies, such as solar panels and wind turbine generators.

e) **Ceiling Fans**:

Whenever the weather is good and suitable through some periods in the Iraqi climate, Al-Mustaqbal University are using ceiling fans extensively instead of using A/C systems, thereby reducing usage energy-intensive cooling systems and results in substantial energy savings.

f) **LED Lighting**:

Al-Mustaqbal University campus has extensively transitioned to use LED bulbs, which can enhance the energy efficiency 60% to 70% if compared to traditional lighting systems. This in turns significantly reduced the electricity consumption.

g) **Energy Usage Diagnostics**:

Al-Mustaqbal University built special units for regular measurement, monitoring, and analysis the energy usage of the buildings and CO_2 emissions. This helped the specialist to improve energy management systems and classify the areas for further efficiency improvements.

h) **Daylighting Strategies**:

Most of the existing buildings and the new buildings in the campus are designed with effective daylighting distribution that reduces the need for conventional lighting systems and effectively reduces the high electric demand.

i) **Smart Energy Management**:

Utilizing cost-effective methods and smart energy management systems efficiently reduced energy usage in both existing and upgraded technologies of management of the old and new buildings inside the campus.

j) **Smart Appliances**:

Al-Mustaqbal University integrated several smart appliances that managed and programmed for operation during off-peak energy hours for the building of the campus to minimize energy costs and increase the overall efficiency. For example, smart LED and a smart refrigerator that equipped with smart and programmable technology that allows monitoring processes remotely using a smartphone or other devices. It comes with a lot of benefits, such as energy monitoring, scheduling of operations, temperature managing, alerts and notifications to shut the cooling systems in case one door is left open, for an example.

k) **Community Engagement Initiatives**:

Al-Mustaqbal University has been introducing workshops and information to teach students and staff about the welfares of energy-efficient appliances and keeping encourages spreading the culture of sustainable campus.

l) **Motivations for Energy Efficiency**:

AL-Mustaqbal offers motivations for departments that achieve countable reductions in consumption of energy in order to widespread their adoption of energy-efficient practices. Additional cash and moral awards are offered by the university annually.

m) **Regular Maintenance Programs**:

Al-Mustaqbal University establishing a repetitive maintenance schedule for all appliances in the campus for ensuring they work properly at its maximum level of the efficiency. This will prolong their lifespan and maintain the energy savings.

n) Smart Power Strips:

The smart power strips are widely used in the campus appliance to cut off power to devices when working in standby mode. These strips prevented wasting energy when appliances are not actually in use.

o) Incorporating Renewable Energy Sources:

Al-Mustaqbal University paid too much attention for transition phase from conventional sources into the most recent-economically efficient. For example, Solar panels and wind turbines are used to power specific appliances. This led to further reducing reliance on grid and traditional resources of energy and enhanced sustainability.

p) Use of Water-Efficient Appliances:

Al-Mustaqbal University also invested in water-saving appliances, such as smart and low-flow dishwashers and smart washing machines. Adopting this policy not only conserved water but also reduced the energy required for heating and cooling water.

q) Engaging Students in Research Projects:

This step is one of the most important steps adopted by our university. It trying to involve students their final year projects and research to put more effort on developing innovative solutions toward efficient energy usage in and out the campus. This step fostered a hands-on learning environment and encouraged student's creativity.

r) Real-Time Feedback Displays:

As usual and as indicators about energy consumptions, our university installed real-time energy displays in special and common areas or wherever that applicable to show energy consumption for the appliances inside the campus. This really encouraged users to be more mindful of their energy use.

s) Partnerships with Local Utilities:

Collaborate with local utility companies to provide workshops, resources, and incentives for energy-efficient appliance usage and upgrades.

t) Sustainability Competitions:

In order to foster the sense of the campus community, our university organized several events involve competitions among departments of the university in order to recognize which one of

them can achieve the greatest level of energy savings through use of energy-efficient appliances.

u) Training Staff:

The university provides routine training for the management staff on the latest technology of the efficient energy management. By this training, the university assured that their staff can sustain and optimize appliance performance and that for sure led to increase energy efficiency.

4- Energy Efficient Appliances Usage:

Using efficient appliance devices in the Al-Mustaqbal University – Iraq







Installing skylights to allowing sunshine and natural light flood into the building





Novel design of vertical axis-wind turbine	Design and implementation of a water Solar pumping System



Implementation of PV panels for lighting Al-Mustaqbal Energy Research Center

Evidence:

https://uomus.edu.iq/Department/Details/81760

https://uomus.edu.iq/Department/Details/87663

https://uomus.edu.iq/Department/Details/84002

https://uomus.edu.iq/Department/Details/66985

https://uomus.edu.iq/College/Details/97919