جامعة بيروت العربية
BEIRUT ARAB UNIVERSITY

SUSTAINABLE DEVELOPMENT GOALS

SDG 11: SUSTAINABLE CITIES AND COMMUNITIES





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SDG 11 Sustainable Cities and Communities

THE Impact Rankings indicator 11.4.8 | Beirut Arab University, Lebanon

Question: Does the university build new buildings to sustainable standards, and which national or international standard or certifying body does it follow?

Assessment of the indicator

BAU documents sustainable construction commitments and a recent campus design incorporating environmental measures. However, the available evidence does not substantiate an unconditional Yes that completed new university buildings follow a named sustainable building standard. The strongest direct evidence concerns construction procurement policy, climate-resilient design requirements and the proposed Bekaa campus. A project-specific building standard, compliance assessment and certification award remain unconfirmed.

Evidence: BAU Sustainable Procurement Policy (sections 2 and 4, construction services and environmental responsibility)

Evidence: BAU Climate Action Policy (Climate Resilience and Adaptation)

Evidence: Original BAU Beqaa Campus project description (proposed masterplan, sections 3 and 8)

What the evidence establishes

Element of the question	Evidence status
Institutional sustainability requirements	Documented in published construction-related policies.
Sustainable design of new campus development	Documented for the proposed Bekaa masterplan; design phase announced in April 2026.
Named whole-building standard followed by BAU	Not established by the project and policy documents reviewed.
Certified completed new university building	No project-specific certificate, rating or award date verified.

A building certificate and a design standard are different forms of evidence. BAU may demonstrate compliance through approved project specifications and verified construction records even where certification is not claimed. If certification is claimed, the submission should identify the building, scheme, version, certifying organisation, rating and award date. Solar equipment, professional training and campus rankings cannot supply these details by themselves.

Evidence: USGBC explanation of LEED requirements and GBCI review (How LEED works)

LEED-certified green buildings are better buildings

LEED is the most widely recognized green building rating system in the world. LEED certification offers a framework for healthy, efficient, and cost-effective green buildings, providing environmental and social benefits. It serves as a globally recognized symbol of sustainability leadership, supported by a committed community of organizations and individuals driving market transformation.

LEED is designed for all building types and phases

LEED is for all project types and phases, including new construction, core and shell, interior fit-outs, operations and maintenance, neighborhoods and cities. To select a rating system, review the rating system selection guidance.



Building Design and Construction (BD+C)

For the design and construction of whole buildings, and additions to buildings, of various use types that are either new construction or undergoing major renovations.



Interior Design and Construction (ID+C)

For complete commercial interior fit-out projects that have no scope for the exterior shell of the building and/or site work.



Building Operations and Maintenance (O+M)

For existing buildings that are undergoing improvement work or little to no construction, O+M offers an opportunity to pay close attention to building operations by supporting whole buildings that have been fully operational and occupied for at least one year.



Neighborhood Development (ND)

For new land development projects or redevelopment projects containing residential uses, nonresidential uses, or a mix. Projects can be at any stage of the development process, from conceptual planning to construction.



Residential

For the design and construction of high-performance residential buildings.



Cities

For entire cities and sub-sections of a city. LEED for Cities projects can measure and manage their city's water consumption, energy use, waste, transportation and human experience.

How LEED works

LEED is holistic. As a framework, it addresses everything from energy and water use to materials selection, managing waste and indoor environmental quality through a series of credit categories tailored for each rating system. To achieve LEED certification, a project must first complete all prerequisites and then earn points by selecting and satisfying credit requirements. Projects go through a verification and review process by GBCI and are awarded points that correspond to a level of LEED certification: Certified, Silver, Gold and Platinum.



Platinum

80+ points earned



Gold

60-79 points earned



Silver

50-59 points earned



Certified

40-49 points earned

Certification process for the LEED BD+C, ID+C, and O+M rating systems

1. Determine the appropriate LEED rating system and version: LEED v5, LEED v4.1 or LEED v4. Review the minimum program requirements and prerequisites for credit categories related to your chosen rating system.
2. Depending on the selected version, register the project in Arc (LEED v5) or LEED Online (LEED v4.1 and LEED v4).
3. Choose the credits that align with your project's goals and build your LEED project scorecard. Learn more about the credits in the LEED credit library.
4. Manage the implementation of your sustainability strategies with your project team. Assign credits to team members and document the achievement of prerequisites and credits.
5. Submit documentation for review in Arc or LEED Online.

LEED project tools and resources

LEED is powered by comprehensive education offerings designed to equip professionals with the knowledge and skills needed to design, build, and operate sustainable buildings. Through events, courses, credentialing programs, and continuing education, professionals can lead the way in creating a healthier, more resilient built environment. Learn more.

Understanding LEED and getting started

- **Minimum program requirements** Project teams that are new to LEED use the minimum program requirements (MPRs) to determine whether their building type is eligible to achieve a LEED rating. While most are eligible, the MPRs define the types of buildings that LEED was designed to evaluate.
- **Rating system selection guidance:** This information helps project teams identify the most appropriate LEED rating system for their project. View the rating system selection guidance.
- **LEED credit library:** This is the central resource for understanding LEED credit requirements. It provides details on compliance paths and points earned. Explore the credit library.
- **Guide to Certification:** This resource outlines the overall process of pursuing LEED certification, including key steps, policies, pricing and deadlines for each rating system. This is the roadmap to getting certified. Read the guide.
- **LEED reference guides:** Comprehensive guides that provide in-depth explanations of each credit and prerequisite within a specific rating system. You can think of these as detailed instruction manuals. View LEED v5 guides and LEED v4 guides.

Project development and documentation

- **Sample forms:** Access required documentation templates and examples to demonstrate compliance with LEED credits. View sample forms.
- **Addenda:** A repository of clarification, corrections, and interpretations of the LEED rating systems to ensure consistent application. Search the database.
- **Regional priority credits:** Identify LEED credits that address specific environmental priorities in your project's geographic location, potentially earning extra points. Search regional priority credits in the database.
- **Pilot credits:** Explore and utilize new, innovative credits that are being tested for potential inclusion in future LEED rating systems. Access pilot credits or register to pursue a pilot credit.

Institutional requirements and the Bekaa development

Construction procurement and environmental criteria

BAU's Sustainable Procurement Policy applies to works across the university and explicitly includes construction and facility services. It prioritises products and services carrying Energy Star, EcoLabel, FSC or equivalent certifications, favours recycled or lower-impact goods and considers lifecycle costs. The policy also provides for sustainability criteria in contract and vendor evaluation. These are relevant institutional purchasing requirements; the labels named in this procurement context do not establish certification of an entire BAU building.

Evidence: BAU Sustainable Procurement Policy (sections 2, 4, 5 and 6)

Beirut Arab University (BAU) – Sustainable Procurement Policy

1. Purpose

This Sustainable Procurement Policy establishes guidelines for responsible purchasing practices at Beirut Arab University (BAU) that prioritize environmental, social, and ethical considerations throughout the procurement process. The policy is designed to support BAU's commitment to environmental stewardship, social responsibility, and the advancement of the United Nations Sustainable Development Goals (SDGs).

2. Scope

This policy applies to all goods, services, and works procured by BAU across all faculties, departments, research units, and administrative offices. It includes:

- Supplies and equipment
- Construction and facility services
- Technology and digital services
- Food and catering services
- Vendor selection and partnerships

3. Policy Objectives

BAU's sustainable procurement efforts are guided by the following objectives:

- Reduce the environmental impact of purchasing decisions
- Support ethical sourcing and fair labor practices
- Minimize waste and promote circular economy principles
- Engage with suppliers who share the university's sustainability values
- Encourage the use of local, eco-friendly, and socially responsible suppliers

4. Guiding Principles

a. Environmental Responsibility

- Prioritize products and services with certifications such as Energy Star, EcoLabel, FSC, or equivalents.
- Avoid single-use plastics and non-recyclable packaging.

- Favor goods with low carbon footprints, made from recycled or biodegradable materials.
- Consider the lifecycle cost (acquisition, use, maintenance, and disposal) instead of lowest upfront price alone.

b. Social Equity and Ethical Practices

- Engage suppliers who uphold human rights, fair wages, and safe working conditions.
- Support vendors that promote gender equity, diversity, and inclusivity in their workforce.
- Prioritize local and regional businesses, especially small and minority-owned enterprises.

c. Economic and Operational Efficiency

- Implement value-for-money practices while balancing sustainability goals.
- Reduce over-ordering and ensure efficient inventory management to prevent waste.
- Encourage long-term contracts that include sustainability performance criteria.

5. Supplier Code of Conduct

BAU suppliers and contractors are expected to adhere to a Sustainable Supplier Code of Conduct that outlines:

- Compliance with labor laws and anti-corruption policies
- Environmentally responsible production and transport
- Openness to sustainability audits and performance monitoring
- Non-compliant vendors may be subject to review, suspension, or termination of contract.

6. Implementation and Oversight

Sustainability & Procurement Committee (SPC):

A joint committee will oversee the implementation and periodic evaluation of sustainable procurement efforts.

Departmental Procurement Officers:

Will receive training on sustainable purchasing practices and will be responsible for applying these principles in daily operations.

Vendor Evaluation Metrics:

All tender and procurement evaluations will include sustainability scoring (e.g., 20–30% of evaluation weight).

7. Monitoring and Reporting

Procurement reports will include sustainability indicators such as:

1. % of eco-friendly products purchased

2. % of contracts with local or sustainable vendors

3. Waste reduction or resource-saving outcomes

An annual Sustainable Procurement Summary Report will be prepared and submitted to the Sustainability Office and University Council.

Climate considerations in new construction

The Climate Action Policy calls for climate-resilient design principles in new construction and campus development. Its wider programme includes energy audits, efficient lighting, HVAC and insulation, renewable energy, water efficiency and rainwater harvesting. This gives environmental objectives a place in university facilities planning. The policy does not specify a mandatory LEED, BREEAM or ARZ rating for all new buildings, or identify a completed project assessment against one of those schemes.

Evidence: BAU Climate Action Policy (Energy Efficiency and Renewable Energy; Water Conservation; Climate Resilience and Adaptation)

Climate Action Plan for Beirut Arab University

Introduction:

Beirut Arab University recognizes the urgent need to address climate change and its impacts on Lebanon and the global community. As a responsible institution committed to sustainability and environmental stewardship, BAU is dedicated to implementing a comprehensive Climate Action Plan (CAP) aligned with the university's rules and regulations and in harmony with Lebanon's environmental priorities. This plan outlines the key strategies and initiatives that BAU will undertake to mitigate greenhouse gas emissions, adapt to climate change, and promote sustainability across its campuses and operations.

Goals and Objectives:

- Reduce Greenhouse Gas Emissions: Implement measures to reduce BAU's carbon footprint and transition towards a low-carbon campus.
- Enhance Climate Resilience: Strengthen BAU's resilience to climate change impacts, including extreme weather events and sea-level rise.
- Promote Sustainable Practices: Encourage sustainable behaviors among students, faculty, and staff members, and integrate sustainability principles into all aspects of university operations.
- Engage the Community: Foster partnerships with local communities, government agencies, and non-profit organizations to address climate change collectively.
- Lead by Example: Serve as a model for sustainable practices and climate action within Lebanon's higher education sector.

Strategies and Initiatives:

Energy Efficiency and Renewable Energy:

- Conduct energy audits to identify opportunities for energy efficiency improvements.
- Retrofit buildings with energy-efficient lighting, HVAC systems, and insulation.
- Install solar panels and other renewable energy systems to generate clean electricity on campus.

Sustainable Transportation:

- Encourage the use of public transportation, carpooling, cycling, and walking among students and staff.

- Provide incentives for electric and hybrid vehicle owners, such as preferred parking spots and charging stations.
- Promote telecommuting and flexible work schedules to reduce commuting-related emissions.

Waste Reduction and Recycling:

- Implement a campus-wide waste reduction and recycling program, including segregation at source and proper disposal of recyclable materials.
- Minimize single-use plastics and promote reusable alternatives, such as water bottles and coffee cups.
- Compost organic waste generated on campus and use compost in landscaping and agriculture.

Water Conservation:

- Install water-efficient fixtures and appliances in buildings, such as low-flow toilets and faucets.
- Implement rainwater harvesting systems to collect and store rainwater for irrigation and non-potable uses.
- Raise awareness about the importance of water conservation through educational campaigns and outreach activities.

Climate Resilience and Adaptation:

- Conduct vulnerability assessments to identify climate risks and develop adaptation strategies for infrastructure and facilities.
- Enhance green spaces and urban forests on campus to mitigate heat island effects and improve air quality.
- Incorporate climate-resilient design principles into new construction projects and campus development plans.

Environmental design of the proposed Bekaa campus

The architect's masterplan describes north–south building orientation for solar control and passive heating, with patios, courtyards and voids intended to support natural ventilation and respond to seasonal winds. It favours durable exposed concrete with limited finishes, and integrates the existing building and landscape into the development. These are specified design strategies, rather than independently measured energy savings or a verified embodied-carbon assessment.

Evidence: AKL Architects BAU Beqaa Campus masterplan (sections 1, 3 and 8)

BEIRUT ARAB UNIVERSITY BEQAA CAMPUS









BEIRUT ARAB UNIVERSITY BEQAA CAMPUS

Category Name -

Gallery

Project summary

“The campus arrival sequence is conceived as a gradual transition from academic life to institutional representation. Visitors are first welcomed by the Health Sciences faculty, expressing the university’s human-centered values, before arriving at the main administrative building articulated around a central piazza and drop-off. This sequence reinforces openness, orientation clarity, and social interaction while anchoring the administrative core as a visible yet non-dominant institutional landmark.”

1. Campus Identity: Human, Nature, and Continuity Between Existing and New

The campus identity is defined through a strong relationship between human activity, landscape, and spatial continuity, extending beyond the limits of the new plot.

A main pedestrian pathway — conceived as a colonne vertébrale — structures the entire campus and physically and symbolically links the new development to the existing Beqaa campus located on the adjacent plot.

This spine:

- connects all academic buildings, services, and exterior spaces
- crosses the existing road in a controlled and safe manner
- extends seamlessly into the garden of the existing L-shaped building

Through this gesture, the existing building is fully integrated into the new campus masterplan, allowing both plots to function as a single academic entity.

A strategic inversion of the existing building’s entrance transforms an underused rear courtyard into a new entrance piazza, aligned with the spine.

This smart intervention:

- upgrades the existing building without heavy structural alteration
- redefines its orientation and hierarchy
- reactivates its outdoor spaces as a social and welcoming interface

The existing campus is therefore not treated as a leftover or secondary element, but as an active and requalified component of the new academic landscape.

2. A Free-From-Car Campus Strategy

To preserve the agricultural character of the site and prioritize pedestrian experience, the campus is conceived as a car-free environment.

The plot is divided into two complementary zones:

- A vehicular access zone aligned with the Boundary Road, extending its linear logic and accommodating parking, drop-offs, and service access.
- A green landscaped academic zone, entirely dedicated to buildings, outdoor spaces, and student life.

This clear separation enhances safety, comfort, and calmness, reinforcing the campus as a walkable, human-scaled environment.

3. Sustainability, Climate, and Environmental Intelligence

Environmental performance is a fundamental design driver.

All buildings are oriented north–south to:

- optimize solar control
- reduce heat gain in summer
- allow passive heating in winter

A system of patios, courtyards, and voids is strategically introduced within the buildings, responding to dominant wind patterns

- promoting natural ventilation during summer
- offering protection and controlled air movement in winter

This passive climatic strategy reduces energy consumption while enhancing indoor comfort and reinforcing the connection between interior spaces and the surrounding landscape.

4. The Central Void: Well-Being and Collective Life

At the heart of the campus, a large open area is deliberately preserved, hosting the sports facilities and main football field.

This central void:

- keeps the core of the site open and breathable
- acts as a catalyst for collective life and informal interaction
- reinforces a human-centric approach focused on student well-being and experience

The empty space becomes an active academic ground, where physical activity, social encounters, and campus events naturally converge.

5. The Main Cluster and Institutional Representation

The main cluster of buildings is organized around the administrative core, positioned to incubate the existing mature trees and the open landscape.

The main administrative building:

- opens toward nature
- frames a large outdoor space dedicated to events, ceremonies, and graduation
- establishes a direct dialogue with the site

Rather than imposing itself, the building breathes with the landscape, connects visually with the scenery through an open urban gate.

Its unicity remains legible from afar through its location, scale, and architectural treatment, ensuring institutional visibility without domination.

6. A Clear Political and Social Message

The spatial hierarchy of the campus conveys a deliberate political and social message.

By positioning the Faculty of Health Sciences as a primary building along the main spine, the project:

- places people, care, and well-being at the forefront
- affirms the university’s commitment to society and public health
- reinforces the idea that human life and knowledge precede administration

While the administrative building maintains its symbolic role and visibility, the campus narrative clearly prioritizes people over institutions.

7. Phasing, Flexibility, and Long-Term Growth

The campus is conceived as a phased, adaptable, and scalable system, capable of evolving over time in response to academic growth and demand.

Beyond the global phasing of the campus, large-scale faculties are themselves subdivided into distinct functional zones. This internal zoning strategy allows:

- the construction of major faculties in two or more successive stages

- progressive investment without compromising academic functionality
- immediate operation of the first phase while future extensions remain structurally and spatially anticipated

Each faculty is therefore designed as a complete self-sufficient yet expandable entity, where initial construction delivers full academic autonomy, and subsequent phases can be seamlessly integrated without disrupting campus life or altering the overall architectural coherence.

This allows future expansions to be smoothly “plugged in” without disrupting campus life, ensuring architectural continuity and controlled growth aligned with demand and resources.

8. Material Strategy and Durability

Material choices are guided by durability, sustainability, and low maintenance.

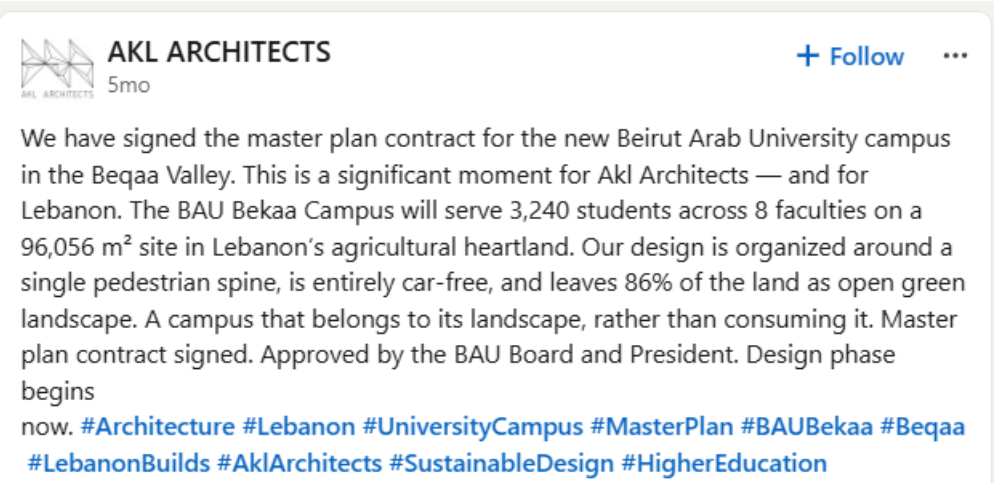
The project favors the use of exposed concrete with minimal or no added finishes, ensuring:

- long-term resistance
- reduced maintenance costs
- architectural honesty and clarity

The materiality reinforces the campus’s relationship with the land, expressing permanence, sobriety, and resilience within the agricultural context of the Beqaa Valley.

On 29 April 2026, AKL Architects announced the masterplan contract, reported approval by BAU’s Board and President and stated that design was beginning. The announcement describes a car-free layout and 86% of the site retained as open green landscape. This dated evidence establishes a recent development commitment. The source presents the design phase; it does not announce construction completion or a sustainability certificate.

Evidence: AKL Architects masterplan contract announcement (29 April 2026, date recorded in the original page metadata)





BAU

+1

Recent delivery and expertise supporting sustainable buildings

Implemented renewable energy in Beirut

The study Towards Energy Sustainability in University Campuses A Case Study of Beirut Arab University, published on 8 May 2023, documents implementation of a roof-mounted solar system at Beirut Campus, coupled with existing diesel generators. The implementation section includes photographs of the array and inverters and a controller reading from December 2022. It provides concrete evidence of a delivered energy project. It concerns existing campus energy infrastructure and supplies no whole-building sustainability certification for a new building.

Evidence: Original 2023 study in Sustainability (section 4, PDF pages 12 to 14, Figures 17 to 19)

4. Implementation

As concluded in the previous sections, an on-grid solar system coupled with diesel generators is the most feasible solution for the electricity problem in both the short and long terms. As a result, BAU implemented an on-grid solar system on its Beirut campus. An overview of the different parts of the implemented system is given in this section.

4.1. Diesel Generators

The five diesel generators present at BAU have a combined generation capacity of 4500 kVA. Figure 15 shows one of those existing generators. It should be noted that the capacity of the generators was designed to follow the 2N + 1 redundancy standard to ensure optimal reliability.



Figure 15. Main body of the larger generator.

A specialized control system is used to turn the generators on and off properly, based on both the changes in the load and the power generated by the solar system. This system, as shown in Figure 16, is placed inside a metal compartment to protect it from external factors and interference.



Figure 16. Control system coupling the five generators.

4.2. PV Panels

The panels used in this system are the Trina 550 W modules with the specifications presented in Table 9.

Table 9.

Specifications of Trina solar panels.

These panels are spread all over the roofs of the facilities present at BAU at different angles to capture the most available solar radiation throughout the day (see Figure 17). This spread also helps make utmost use of the limited area available.



Figure 17. The complete solar array installed at BAU Beirut campus.

4.3. Inverters

In this system, nine 50 kW, SMA on-grid inverters are coupled together and then synchronized with the diesel generators via a DEIF controller to feed the required load throughout the day. Figure 18 shows the inverters used in the real system. It is worth mentioning that the inverters were positioned in different places all over the campus close to the PV sub-arrays to minimize losses during transmission as much as possible.

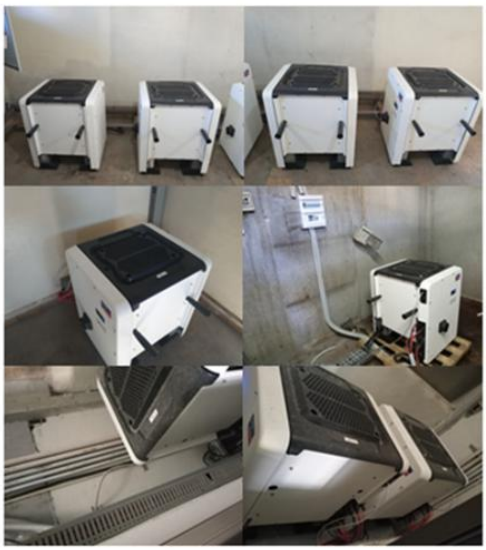


Figure 18. The installed inverters.

4.4. Functionality

This system has proven to be able to feed the load even during winter days when the sun's angle is low and the days are short. Figure 19 shows the generation details of the controller used to monitor the system at 10:30 am on 1 December 2022. We can see that, for a total load of 300 kW (representing only the main building), the solar system supplies 67% of the load at a power factor of 86%.

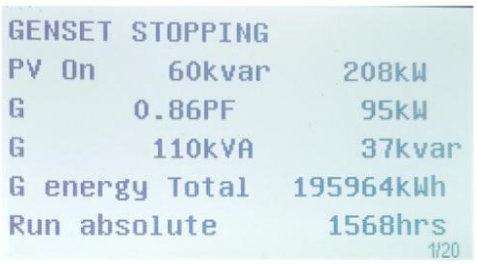


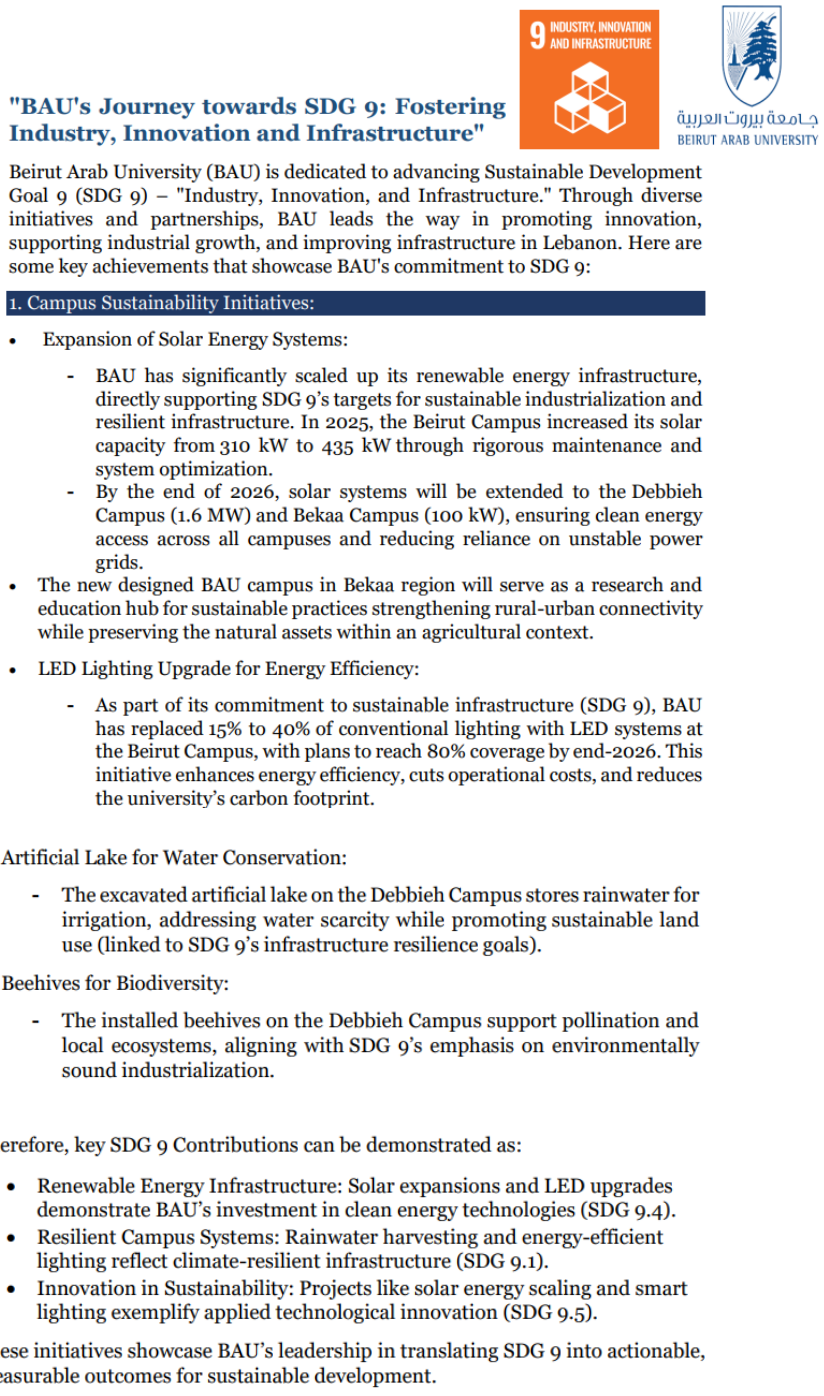
Figure 19. Controller display showing the actual generation of the on-grid solar system.

Reported infrastructure improvements in 2025

BAU's 2025 SDG 9 report, hosted by the International Association of Universities, reports Beirut solar capacity rising from 310 kW to 435 kW through maintenance and optimisation, LED replacement progress

and an artificial lake storing rainwater for irrigation at Debbieh. It also identifies end-2026 targets for solar systems at Debbieh and Bekaa and wider LED coverage. These targets should retain their planned status until completion is documented. The report supports resource-efficient campus operations, while providing no certificate or named new-building assessment scheme.

Evidence: BAU 2025 infrastructure report hosted by IAU (PDF page 1, Campus Sustainability Initiatives)



"BAU's Journey towards SDG 9: Fostering Industry, Innovation and Infrastructure"

Beirut Arab University (BAU) is dedicated to advancing Sustainable Development Goal 9 (SDG 9) – "Industry, Innovation, and Infrastructure." Through diverse initiatives and partnerships, BAU leads the way in promoting innovation, supporting industrial growth, and improving infrastructure in Lebanon. Here are some key achievements that showcase BAU's commitment to SDG 9:

1. Campus Sustainability Initiatives:

- Expansion of Solar Energy Systems:
  - BAU has significantly scaled up its renewable energy infrastructure, directly supporting SDG 9's targets for sustainable industrialization and resilient infrastructure. In 2025, the Beirut Campus increased its solar capacity from 310 kW to 435 kW through rigorous maintenance and system optimization.
  - By the end of 2026, solar systems will be extended to the Debbieh Campus (1.6 MW) and Bekaa Campus (100 kW), ensuring clean energy access across all campuses and reducing reliance on unstable power grids.
- The new designed BAU campus in Bekaa region will serve as a research and education hub for sustainable practices strengthening rural-urban connectivity while preserving the natural assets within an agricultural context.
- LED Lighting Upgrade for Energy Efficiency:
  - As part of its commitment to sustainable infrastructure (SDG 9), BAU has replaced 15% to 40% of conventional lighting with LED systems at the Beirut Campus, with plans to reach 80% coverage by end-2026. This initiative enhances energy efficiency, cuts operational costs, and reduces the university's carbon footprint.

- Artificial Lake for Water Conservation:
  - The excavated artificial lake on the Debbieh Campus stores rainwater for irrigation, addressing water scarcity while promoting sustainable land use (linked to SDG 9's infrastructure resilience goals).
- Beehives for Biodiversity:
  - The installed beehives on the Debbieh Campus support pollination and local ecosystems, aligning with SDG 9's emphasis on environmentally sound industrialization.

Therefore, key SDG 9 Contributions can be demonstrated as:

- Renewable Energy Infrastructure: Solar expansions and LED upgrades demonstrate BAU's investment in clean energy technologies (SDG 9.4).
- Resilient Campus Systems: Rainwater harvesting and energy-efficient lighting reflect climate-resilient infrastructure (SDG 9.1).
- Innovation in Sustainability: Projects like solar energy scaling and smart lighting exemplify applied technological innovation (SDG 9.5).

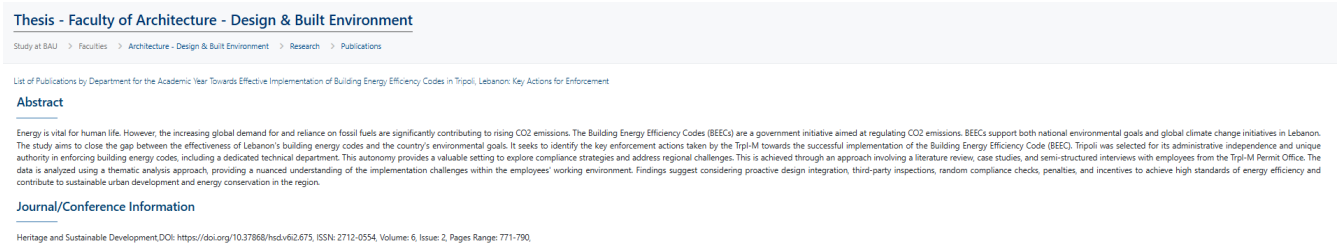
These initiatives showcase BAU's leadership in translating SDG 9 into actionable, measurable outcomes for sustainable development.

Research on building codes and LEED in 2024

BAU's 2024 to 2025 publication record includes a study of building energy code enforcement in Tripoli. It examines municipal permitting and recommends design integration, inspections and compliance checks.

This establishes research expertise in implementation of standards, without demonstrating that BAU's own new buildings passed those checks.

Evidence: BAU original record of the building energy code study (abstract and DOI 10.37868/hsd.v6i2.675)



Thesis - Faculty of Architecture - Design & Built Environment

Study at BAU > Faculties > Architecture - Design & Built Environment > Research > Publications

List of Publications by Department for the Academic Year Towards Effective Implementation of Building Energy Efficiency Codes in Tripoli, Lebanon: Key Actions for Enforcement

Abstract

Energy is vital for human life. However, the increasing global demand for and reliance on fossil fuels are significantly contributing to rising CO2 emissions. The Building Energy Efficiency Codes (BEECs) are a government initiative aimed at regulating CO2 emissions. BEECs support both national environmental goals and global climate change initiatives in Lebanon. The study aims to close the gap between the effectiveness of Lebanon's building energy codes and the country's environmental goals. It seeks to identify the key enforcement actions taken by the Trpl-M towards the successful implementation of the Building Energy Efficiency Code (BEEC). Tripoli was selected for its administrative independence and unique authority in enforcing building energy codes, including a dedicated technical department. This autonomy provides a valuable setting to explore compliance strategies and address regional challenges. This is achieved through an approach involving a literature review, case studies, and semi-structured interviews with employees from the Trpl-M Permit Office. The data is analyzed using a thematic analysis approach, providing a nuanced understanding of the implementation challenges within the employees' working environment. Findings suggest considering proactive design integration, third-party inspections, random compliance checks, penalties, and incentives to achieve high standards of energy efficiency and contribute to sustainable urban development and energy conservation in the region.

Journal/Conference Information

Heritage and Sustainable Development,DOI: https://doi.org/10.37868/hsd.v6i2.675, ISSN: 2712-0554, Volume: 6, Issue: 2, Pages Range: 771-790,

A separate 2024 BAU engineering paper develops a LEED-oriented strategy for the Lodge in the Green resort project. The case concerns a resort, and the authors' assessed points are not a GBCI certificate for a university building. Its appropriate role here is supporting evidence of technical capacity.

Evidence: BAU Journal original 2024 resort certification research (Volume 5, issue 2, article 6)

5.2. LEED Categories and Activities Selection

5.2.1. Natural systems and ecology

Communities depend on nature and ecosystem services to not only sustain life but also enhance the quality of life. Ecosystems protect and even regenerate natural systems, thereby increasing the ecosystem services they provide and creating ecologically resilient communities. Light pollution, also known as photo pollution, is a hidden pollution type that almost all people disregard. On health level, its danger affected about 80% of people worldwide; ranging from disorders to severe illness (Cao, et al., 2023). Knowing that artificial night light is one of light pollution forms, the use of full cut-off lights and side floor lights offers to help in resilience planning and light pollution (as indicated in Table 2). For illustration, (as shown as Fig. 4) non-cutoff and semi-cutoff lights have dazzling glare and part of its energy is wasted whereas the full-cutoff lights are found to serve 100% of good light with no wasted energy. However, (as shown as Fig. 3) these lights have one disadvantage; its uniformity-range of light-gets smaller. Moreover, putting more poles doesn't solve the problem. As such, the solution was found in keeping the same distance between poles as that of semi-cutoff lights but with a larger height.



Fig. 3: Efficiency illustration (Eric Vandernoot, Department of Physics, FAU.)

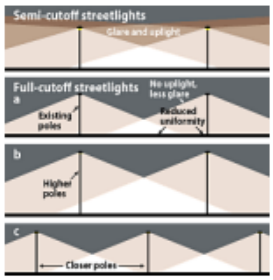


Fig. 4: Light poles' uniformity (Oberjohn, K. (2018). Park Hills Street Lighting.)

One of the most common and important pollution problem is the bad\excessive use of artificial outdoor light, having a huge negative impact both on wildlife and humans, by its contribution to increase the rate of carbon dioxide (CO_2) in the atmosphere obscuring the sky's natural light at night (Tong, et al., 2023). Furthermore, it disturbs natural rhythm done by human being causing: headache, disturb sleep, irritability, stress and anxiety by decreasing melatonin production which is a hormone produce by our brain in response to natural darkness, helps timing of our circadian rhythms and sleep, being exposed to light at night may stop or prohibit those hormone production.
In order to solve it, the test of few available alternatives was in-fact efficient. Table 3 represents the selected alternatives and its annual savings. Comparing the results of two of the best available alternatives: first alternative: use 1000 full cut-off lights on sidewalks to keep the night sky visible (35W LED) in addition to 250 side floor lights fixture (Leonlite 5W Low Voltage landscape pathway lights), second alternative: use of 1250 500W halogen flood light. (as indicated in Table 3).

Table 2 Required LEED points for each of the chosen categories and activities

Activities	points
Natural Systems and Ecology	
Ecosystem Assessment, Construction Activity Pollution Prevention and Green Spaces	required
• Use of full cut-off lights on sidewalks to keep the night sky visible	7
• Use of side floor light fixture (may be solar)	
Resilience Planning	6
Water Efficiency	
Integrated Water Management	required
Treatments ensure the quality of water	required
Activated Carbon filter improves the quality of drinking water	required
• Stormwater Treatment • Use of strategies to collect max stormwater	5
• Treatment of wastewater • Use of stormwater after being treated as a supply for the resort inner network (basins in kitchen and bathroom and in shower) • Reuse of wastewater after being treated for landscape irrigation • Reuse of basin and shower water for flushing in the W.C.. • Reuse of the 98% of water from sludge after being treated as another source of water for irrigation or flushing	5
• Smart sensored faucets to reduce the waste of water - • Smart irrigation via either: sensor or infrared self-irrigation / monitored irrigation application (ex: rainbird)	2
Energy and Greenhouse Emissions	
Power Access, Reliability and Resiliency	required
Collecting methane to be used as biogas to reduce GHG emissions	19
Use insulators in the Structure to decrease CFC from air conditioners	
• Reuse of water stated above reduces the consumption of energy as per (EERE) • Sensor lights in rooms (not glare)	4
• Use of hydroelectric energy to produce electricity (already found in Jezzine)	6
Biomass energy	
Use insulators in the Structure to decrease CFC from air conditioners	
Methane collection	
Internet of things and consumer incentives	2
Materials and Resources	
Construction and Demolition Waste Management	required
Solid waste Management: Innovative recycling strategies	required
• Organic waste infrastructure to be collected • Composting system from the organic waste	7
• HDPE used for durable pipe systems • Activated carbon filter to improve the quality of drinking water	2
• RFID (radio frequency identification) chips helps in enhancing recycling systems • Internet of things	2

Table 3 Energy and annual savings per selected light appliance

Alternative	APPLIANCES	Unit price ($)	Lifespan (years)	Number of fixtures	Env. Benefit % energy saving	saving $/year/fixture	saving $/year
1	Use of full cut-off lights on sidewalks to keep the night sky visible (35W LED)	37.18	5.7+	1000	65%	62.7	62700
	Use of side floor light fixture (LEONLITE 5W Low Voltage Landscape Pathway Lights)	5.49	5	250	57%	6.4	1600
2	Halogen Flood Lights Solar Powered with Motion Sensor and Remote Control for Parking Lot Garden Yard Garage-500w	252	6	1250	62%	180	225000

The first option involves purchasing a total of 1,250 energy-saving light units. The total purchase value for this option is 38,552.50$. However, considering the energy savings, the total cost after savings is calculated to be 64,300$. This means that with first option it effectively saves 25,747.50$, making it a promising choice. On the other hand, the second option involves buying 1,250 halogen flood light units. The total cost for this option is significantly higher, at 315,000$. Even though these are also energy-saving units, the total savings would only amount to 225,000$. Therefore, the total cost after savings would be 90,000$ more than the initial investment, making this option less desirable. Overall, the 500w halogen flood light can be a transformative element when used in small areas, where cost-effectiveness and energy savings are clearly noticeable. However, for larger scale projects, it is advisable to utilize modern technologies that minimize light wastage. This approach not only illuminates most areas effectively but also reduces the temperature emitted in the area where the light is projected, thereby contributing to the mitigation of global warming.
For instance, with the first alternative, the area under the light placement tends to maintain a mild temperature of 29°C. In contrast, with the halogen light, the temperature can reach up to 33°C. Furthermore, the first alternative is more cost-effective and energy-efficient than the second alternative, and both options have approximately the same lifespan. Therefore, the first alternative emerges as the most promising choice.

5.2.2. Water efficiency

Water is the lifeline of any community. Water demand has been constantly increasing in urban and peri-urban areas due to ascending population densities (Dawadi & Ahmad, 2013). On the contrary, this fact is stressing freshwater reserves leading to perennial shortage of water in these communities (Dawadi & Ahmad, 2013). This credit category addresses water at multiple levels – meeting demand, maintaining water quality, reducing water losses, capturing stormwater, and managing urban floods. To fulfill the prerequisite of having sustainable groundwater use, the concept of having a self-sufficient water network in the resort was predicted.

5.2.3. Greywater recycling

In line with LEED and Lebanese standards for green buildings, an effective strategy to conserve water is to implement a greywater recycling system. Greywater, which is relatively clean wastewater from basins and showers, can be collected, treated, and reused for flushing toilets in bathrooms. This not only reduces the demand for fresh water but also decreases the volume of wastewater that needs to be treated and disposed. As for the quantity and quality of water, using activated carbon filter to purify water and having a wastewater treatment plant -where its effluent is to be used for landscape irrigation- are of great benefit in maintaining a good quality of water. Not to mention, in case of high and sufficient precipitation rates, stormwater can be harvested in rainy seasons to be domestically used as a source of water on one hand and to reduce the pressure on groundwater on the other hand. By integrating these strategies, we can create a more sustainable and water-efficient community.

Sustainability design education in March 2024

The Faculty of Architecture's Sustainability Day on 6 March 2024 addressed RIBA-related design approaches, sustainable housing, green building fire safety, zero-energy houses and site selection. It demonstrates education and practical discussion. RIBA-related teaching and academic accreditation should be distinguished from environmental certification of campus construction.

Evidence: BAU original Sustainability Day event record (6 March 2024)

The Faculty of Architecture Design and Built Environment s Sustainability Day on March 6th packed a powerful punch







The Faculty of Architecture, Design and Built Environment's "Sustainability Day" on March 6th packed a powerful punch. From Dr. Mona Salem's intro to UN SDGs, along with practical methods for integrating them into projects using RIBA standards, followed by Dr. Samer Al Sayary's dive into sustainable housing. Mr. Abu Shaqra tackled green building fire safety, and Dr. Maged Youssef capped off the lectures with insights into Lord Norman Foster's sustainable strategies. The day didn't end there – an interactive discussion, a student vision board for a sustainable city, and workshops on zero-energy houses (led by Dr. Al Sayary) and eco-friendly location selection (led by Dr. Mona Salem) provided hands-on learning. Professor Dr. Abdel Salam's closing message sent students off with a powerful call to action: build a balanced and sustainable future.