

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



جامعة بيروت العربية
BEIRUT ARAB UNIVERSITY

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.

2. Research and Innovation for Sustainable Development:

Through the ongoing refinement of our strategy and platform, we have successfully gathered data on research that supports SDG 9, as outlined below:

2.1- Research Driving Industrial Innovation

Beirut Arab University has demonstrated significant commitment to advancing SDG 9 through impactful research and practical applications during the 2024-2025 academic year.

The university's research portfolio shows strong engagement with industrial innovation, with SDG 9-related work accounting for **35%** of total publications across key faculties. The Faculty of Engineering leads this effort, contributing **60%** of all SDG 9 research output, while the Faculties Science, Business Administration, and Health Sciences provide important complementary contributions as well.

2.2- Practical Research with Direct Industry Impact

A compelling example of BAU's practical work comes from the Faculty of Health Sciences, where researchers partnered with the Ministry of Economy and Trade to conduct a market study on tomato paste adulteration. This rigorous investigation analyzed local and imported products, developed new testing methodologies, and established quality benchmarks that are now informing national food safety standards. The project exemplifies BAU's ability to translate academic research into tangible industry benefits.

2.3- Fostering Innovation Through Strategic Partnerships

The university actively cultivates innovation through programs like the LIRA Innovation Program 2025, which connects researchers with EU funding opportunities to develop solutions for Lebanon's agricultural and healthcare sectors. This initiative reflects BAU's strategic focus on bridging academic research

with market needs, with current participation from 18 faculty researchers exploring 32 potential projects.

2.4- Research Output Driving Sustainable Development

Research output reveals particular strengths in digital transformation and smart infrastructure. Engineering disciplines show especially strong alignment, with 60% of their total publications addressing SDG 9 objectives. These scholarly contributions, combined with practical industry collaborations, position BAU as a key driver of sustainable industrialization in Lebanon, effectively supporting national progress toward SDG 9's goals of resilient infrastructure, inclusive industrialization, and technological innovation.

Some Examples from our research:

Beirut Arab University has produced remarkable research that exemplifies its commitment to sustainable industrialization and innovation (SDG 9). Below are four standout projects with significant practical applications:

Faculty of Business Administration:

1. *The impact of innovation and digitalization on the international performance of SMEs*
This study directly supports SDG 9 by examining how digital transformation and innovative practices can enhance the global competitiveness of SMEs, fostering sustainable industrial growth and economic development.
2. *Exploring the Role of AI in Improving VAT Reporting Quality: Experimental Study in Emerging Markets*
This research contributes to SDG 9 by demonstrating how AI-driven solutions can optimize tax reporting systems, improving efficiency and transparency in financial infrastructure, particularly in developing economies.

Faculty of Architecture – Design & Built Environment:

1. BIM-GIS Integration - an innovative tool to enhance urban heritage management in the digital era
The integration of BIM and GIS serves SDG 9 by fostering innovation in infrastructure planning and sustainable urban development, particularly in preserving and enhancing heritage sites.
2. Reclaimed Architecture: Traditional Crafts, And Zero Waste in the Digital Era

Reclaimed Architecture serves SDG 9 by promoting sustainable industrialization, innovation, and resource efficiency through traditional crafts and zero-waste practices in the digital era

Faculty of Engineering:

1. *AI-Driven Bionic Prosthetic Arm: From Simulation to Reality*

This pioneering research bridges artificial intelligence and biomedical engineering, developing an advanced prosthetic arm that uses AI for intuitive movement control. Its transition from simulation to real-world testing marks a crucial step toward affordable, intelligent prosthetics in Lebanon's healthcare sector.

2. *Banana Fiber-Reinforced Sustainable Construction Materials*

Addressing both waste reduction and infrastructure durability, this study explores the use of banana fibers in mortar for paving blocks. The research supports SDG 9 by promoting sustainable building practices and repurposing agricultural waste into valuable engineering materials.

3. *UAV Security: Countering GPS Spoofing with AI*

By integrating AI with aviation security, the research strengthens Lebanon's capacity for resilient infrastructure, particularly in surveillance, delivery, and emergency response systems.

4. *Olive Waste Ash in Cement: Turning Agricultural Byproducts into Construction Solutions*

This innovative study investigates olive waste ash as a partial cement replacement, demonstrating its potential to improve the volume stability of cement paste. By transforming agricultural residues into construction materials, the research aligns with circular economy principles, reducing industrial carbon footprints while supporting Lebanon's infrastructure needs.

Faculty of Science

1. *Structural, Optical, and Magnetic Characteristics of Nanocomposite Synthesized by Ball-Milling Assisted Co-precipitation*

The research pioneers a novel synthesis method for multifunctional nanocomposites with tailored electromagnetic properties for next-generation industrial applications.

2. *Palladium-Catalyzed Transfer Hydrogenation of Saturated Compound Using Formic Acid as the Hydrogen Source*

3. *Optimizing airline services: leveraging data-driven strategies for enhanced customer satisfaction and engagement*

This chemistry breakthrough offers a sustainable catalytic process for industrial hydrogenation reactions using safer, more efficient methodologies.

Faculty of Health Sciences

1. *Exploring AI governance in the Middle East and North Africa (MENA) region: gaps, efforts, and initiatives*
This research supports SDG 9 by analyzing frameworks for responsible AI adoption, which is crucial for building sustainable digital infrastructure and fostering technological innovation in the MENA region.
2. *Reduced graphene oxide-based electrochemical aptasensor for the multiplexed detection of imidacloprid, thiamethoxam, and clothianidin in food samples*
The development of this advanced biosensor aligns with SDG 9 by introducing an innovative, rapid food safety testing technology that can enhance quality control in agricultural and food industries.
3. *Optimized Extraction of Polyphenols from Kiwifruit Peels and Their Biological Activities*
This study contributes to SDG 9 by transforming agricultural waste (kiwifruit peels) into high-value bioactive compounds, promoting sustainable industrial applications in nutraceuticals and waste valorization.

These projects highlight BAU's role in merging academic research with real-world industrial challenges, driving progress in sustainable technology, infrastructure resilience, and smart innovation. Each exemplifies how targeted scientific inquiry can yield tangible benefits for Lebanon's economy and environment.

- BAU hosted the IEEE National Student Competition (LNSC2025) on May 31, 2025, at the faculty of engineering, Debbieh campus. This type of competition aims to prepare the student sector across Lebanon and the region to the development of the electrical and computer engineering sector by creating a young generation equipped with the requirements of the era. IEEE competitions encourage students to develop innovative engineering solutions using cutting-edge technologies (IoT, AI, robotics, embedded systems....), which directly align with SDG 9's core.

- A team of students from the Faculty of Architecture won the second prize at 19th Annual International Biodiversity Day (IBDAA 2025) at AUB in the Product Development category. The project focused on developing a modular 3D brick unit that can be assembled without mortar, offering a flexible, scalable infrastructure solution for refugees.

-As part of the three-year funded project "Urban Acupuncture: A Strategy of Catalytic Interventions" funded by DAAD - Ta'ziz Science Cooperations, one of the key recent activities was a Design-Build Workshop held in Kassel, Germany. This immersive and hands-on experience was designed to equip undergraduate and postgraduate students with the skills and knowledge necessary to transform urban spaces.

- Many IEEE projects in the ECE sector involve **smart cities, energy-efficient systems, renewable energy management, or digital infrastructure**, all of which are pillars of sustainable development and smart industrial infrastructure.
- Participation in IEEE aligned FYP competitions fosters **applied research** and practical engineering skills. These projects often propose new prototypes or systems that improve industrial efficiency, automation, or communication infrastructure.
- BAU Will host the Eighth IEEE International Conference on Advances in Biomedical Engineering (ICABME2025) in October 2025 at the Faculty of Engineering Debbieh Campus.
- The conference fosters collaboration among researchers, industry professionals, and academics in biomedical engineering. This synergy promotes the development of innovative medical technologies and solutions, enhancing healthcare infrastructure and aligning with SDG 9's emphasis on fostering innovation.
- By hosting and organizing such international conferences, BAU enhances its research capabilities and provides a platform for knowledge exchange. This contributes to building resilient infrastructure and promoting inclusive industrialization

3. Industry-Academia Collaboration:

BAU forms partnerships with industries and businesses to promote knowledge exchange, facilitate technology transfer, and engage in collaborative research. This approach fosters innovation and supports sustainable industrial practices.

- Partnership with IRALEB: Beirut Arab University has strengthened its ties with IRALEB (formerly LIRA: Lebanese Industrial Research Achievements), a leading Private Non-Governmental Organization established in 1997. IRALEB is dedicated to creating career pathways for researchers, mitigating brain drain, and driving progress in Lebanon's industrial sector. The organization collaborates with 13 Lebanese universities and key local industries, fostering a robust ecosystem for innovation.
- Workshops on the Innovation Program 2025: BAU hosted IRALEB's Executive Board, including Engineer Ziad Chammas and Executive Director Mrs. Fabienne Balaa, for workshops at its Beirut and Debbieh campuses. These sessions introduced the LIRA Innovation Program 2025, an initiative designed to support early-stage applied research in critical sectors such as agrifood, healthcare, pharmaceuticals, ICT, and creative industries. The program empowers researchers and students to develop solutions aligned with Lebanon's labor market needs.
- EU-Funded Initiative Under "Lebanon Innovate": Funded by the European Union and implemented under the "Lebanon Innovate" framework, this

program enhances BAU's role in bridging academia and industry. By participating, the university reinforces its commitment to SDG 9, promoting sustainable industrialization, innovation, and infrastructure development through actionable research.

- In 2025, BAU participated in the Innovation Program 2025, and three projects at BAU (2 projects from the faculty of engineering and one from the faculty of sciences) are granted and received funding for the development of these projects.
- IEEE competitions such as LNSC 2025, often involve industry mentors, sponsors, or real-world challenges. This helps bridge the gap between academic learning and industrial application, strengthening innovation ecosystems.
- The IEEE conference at BAU (ICABME2025) encourages the application of sustainable practices in biomedical industries. Discussions and workshops focus on integrating sustainability into medical device manufacturing and healthcare services, supporting SDG 9's goal of sustainable industrialization.
- ICABME 2025 serves as a bridge between academia and industry, fostering partnerships that can lead to the commercialization of research findings. Such collaborations are vital for developing quality, reliable, sustainable, and resilient infrastructure.

Impact and Strategic Alignment: Through this collaboration, BAU researchers gain opportunities to transform ideas into market-ready solutions, supported by both local and European partners. The partnership with IRALEB underscores BAU's dedication to entrepreneurship, industrial competitiveness, and knowledge transfer, contributing to Lebanon's economic resilience and technological advancement.

4. Entrepreneurship and Start-up Support:

Incubation Support: BAU provides resources, mentorship, and incubation assistance for student and faculty startups focused on sustainable development and industrial innovation. This initiative cultivates a dynamic culture of entrepreneurship within the university community.

Organizing FYP competitions such as LNSC2025 inspire students to convert their projects into startups or contribute to local industry, contributing to **technological upgrading and innovation diffusion** in developing economies.

5. Curriculum Integration:

SDG Integration at BAU

Curricular Integration of Sustainability and SDGs:

Beirut Arab University (BAU) actively embeds sustainability and the United Nations Sustainable Development Goals (SDGs) throughout its academic curriculum. This strategic integration ensures that students are equipped with the essential knowledge, competencies, and innovative mindset required to tackle modern global challenges and contribute to sustainable development.

AI and SDG9-Aligned Research and Conferences:

In alignment with **SDG 9: Industry, Innovation, and Infrastructure**, BAU is incorporating artificial intelligence (AI) into its educational and research initiatives to serve both the community and industry. The university has hosted multiple conferences focused on AI, including the notable event titled "**Impact of Artificial Intelligence on Education and Research**." These efforts aim to foster dialogue, innovation, and collaboration in emerging technological fields.

Promoting Awareness and Alignment with SDGs:

BAU is committed to raising awareness about the SDGs across its academic and research community. To reinforce this commitment, the university has updated its **Publication Submission Form** to include a section where researchers specify the SDGs relevant to their work. Furthermore, BAU is revising its research subthemes to ensure they align with the SDGs, thereby reinforcing a culture of sustainability and academic excellence throughout its research endeavors.

As for postgraduate students, their project topics and thesis subjects are now systematically aligned with the SDGs. Each research includes a clear statement describing how the selected SDG, along with its relevant targets and key indicators, will be addressed throughout the research. This approach ensures that academic inquiry contributes meaningfully to global development priorities and fosters a deeper understanding of sustainability challenges within the context of advanced education.

6. Integration of Artificial Intelligence (AI):

AI-Focused Initiatives at BAU

Advancing AI Through Conferences and Collaboration:

Beirut Arab University (BAU) actively organizes conferences and initiatives focused on artificial intelligence (AI), creating a platform for dialogue, collaboration, and innovation in AI education, research, and practical

applications. These efforts reflect BAU's commitment to staying at the forefront of technological advancements.

Notable Events and SDG Alignment:

Among the planned events is the conference titled "Impact of Artificial Intelligence on Education and Research." which explores the evolving role of AI in academic settings. In parallel, BAU is promoting awareness of the United Nations Sustainable Development Goals (SDGs), particularly by aligning its research strategies with these global objectives to ensure responsible and impactful innovation.

Empowering Faculty with AI Tools:

To enhance teaching effectiveness and research capabilities, BAU is equipping its faculty members and researchers with the latest AI tools and technologies. This initiative is designed to enrich faculty-student engagement, streamline research processes, and open new frontiers in academic inquiry and professional development.

A series of public lectures were delivered by the faculty of Architecture- Design & Built Environment academic staff members on AI-Aided Design in several local and regional universities discussing the role of artificial intelligence in transforming the future of architecture and design.

7. Capacity Building and Technical Training:

- BAU offers training programs and workshops designed to equip students and professionals with skills and knowledge relevant to sustainable infrastructure development, industrialization, and innovation.

- Innovation HUB - SDG9:

- The Innovation Hub of Beirut Arab University was launched in mid-2023 as part of the ELEGANT project funded by the European Union.

- The hub is dedicated to empowering students by providing realistic learning opportunities, fostering pioneering mindsets, and developing transferable skills essential for their chosen career paths.

- Its mission includes reducing the gap between ICT companies' needs and students' skills, strengthening employability skills, facilitating cooperation in applied research, and fostering knowledge transfer between the university and partner enterprises. Aimed at preparing students to explore their interests confidently, the hub equips them with the necessary knowledge and skills to pursue post-graduation training and achieve success in their chosen careers.

- The goals of the Innovation Hub encompass nurturing groundbreaking talent, transforming passion into reality, cultivating visionary mindsets, and ensuring enjoyable learning experiences.

- The Sustainability Day 2025, organized by the Faculty of Architecture- Design & Built Environment, included a series of public lectures focusing on SDGs in Design. The event highlighted the application of SDGs in architectural projects and showcased recent simulation tools employed in Sustainability practices. Additionally, the Hariri Foundation contributed with a lecture by Mohamad Hariri entitled "The Blue Economy: System Boundaries and Lebanon's Agenda".

8. Community Engagement and Outreach:

- BAU engages with local communities through awareness campaigns, workshops, and collaborative projects to promote sustainable practices, infrastructure development, and innovation.

- The establishment of the Digital Fabrication Lab in March 2017 at the Faculty of Architecture – Design and Built Environment has revolutionized Digital Architecture and Fabrication. The lab, equipped with cutting-edge technology like the 6-axis robotic machine, enables the conversion of virtual models into tangible material systems, through a direct connection between the digital model and the production process known as file-to-factory. This innovative approach, explored across various research domains, aims to lead the students to discover the impact of those software tools on their production and to build new design methods, fostering inquiry and driving the development of new software tools for design.

- The Faculty of Architecture- Design & Built Environment has selected four design proposals developed by fourth-year students, addressing the rehabilitation of René Mouawad Airport in Qlayaat. The proposals include a detailed design brief and defined programmatic areas and a comprehensive set of architectural drawings. These submissions have been formally presented to Prime Minister Nawaf Salam in response to the government's expressed interest in developing a new airport on the site. Moreover, the faculty participated in the Contest entitled Rachid Karami International Fair and Rene Mouawad Air base, as part of the "Cooperation in Urban Management and Territorial Development" project, through proposals for an Onsite Civil Aviation Academy.

-The Faculty of Architecture developed a proposal for the Bab El Saray Square Urban Regeneration project, funded by the 'Mohamad Zeidan' Association. The three phases have been successfully completed including the design of the building facades and landscaping as well as execution drawings, BOQ and specifications sheets for implementation.

A team of students participated in the training and design workshop on sustainability organized by Hariri Foundation which aims to develop the 2025 urban vision titled "Touring the City (The Case of Saida)." The workshop included four modules extended over four weeks where students explored dynamic interactions between urban connectivity, green corridors, sustainable transportation and mobility, and place identity in the city of Saida.

9. Policy Influence and Advocacy:

Policy Engagement: BAU is actively involved in policy discussions and advocates for sustainable practices across institutional, local, national, and international platforms. The institution contributes to research and policy briefs related to SDG 9 and other Sustainable Development Goals. An IP Policy is put into effect and efforts to start a Technology Transfer Office are in action.

These efforts collectively highlight BAU's steadfast commitment to fostering innovation, promoting sustainable development, and advancing the objectives of SDG 9, thereby supporting Lebanon's path towards a more prosperous and sustainable future.