Azerbaijan TECHNICAL University

UI GreenMetric World University Rankings

AZERBAIJAN TECHNICAL UNIVERSITY

UI GREENMETRIC REPORT

REPORT ON ENERGY AND CLIMATE CHANGE

2024

Introduction

In response to the growing global demand for sustainable energy solutions and environmentally responsible technologies, Azerbaijan Technical University (AzTU) established the Department of Energy Efficiency and Green Energy Technologies in 2020. This strategic move was initiated by the Scientific Council through the consolidation of the Departments of “Hydraulics and Heat Engineering” and “Electric Power and Power Supply Systems.” The aim was to create a modern academic and research hub focused on addressing national and international energy and climate challenges.

The department offers a wide range of academic programs, including bachelor's, master's, and doctoral specializations, designed to prepare professionals in the fields of energy engineering, electric power, thermal systems, and renewable energy. With a strong emphasis on applied science and innovation, the department plays a key role in shaping the next generation of energy engineers and sustainability experts.

Supported by state-of-the-art laboratories—such as the Renewable Energy Sources Lab, High Voltage Technique Lab, and Thermo-Physical Properties Lab—the department provides hands-on training and research opportunities. These facilities are equipped with solar panels, wind turbines, and advanced measurement systems, allowing students and researchers to engage with real-world energy systems and green technologies.

In line with Azerbaijan’s national sustainable development strategy and international frameworks such as COP29 and the UN Sustainable Development Goals, AzTU has committed to reducing its carbon footprint, increasing renewable energy usage, and promoting smart building practices. The university has implemented various infrastructure upgrades and research projects that demonstrate its role as a national leader in green innovation and climate action.

References

UI GreenMetric

National Information Portal on Sustainable Development

AzTU Sustainability

Objectives

- **Develop Skilled Energy Professionals:**

Provide academic programs at bachelor’s, master’s, and doctoral levels to prepare highly qualified specialists in energy efficiency and renewable energy technologies.

- **Advance Scientific Research:**

Conduct innovative research in fields such as solar, wind, thermal, and small hydropower technologies to contribute to national and global energy solutions.

- **Promote Renewable Energy on Campus:**

Expand the use of solar panels, wind turbines, and biogas systems to demonstrate and implement renewable energy applications within the university infrastructure.

- **Support National Sustainability Goals:**

Align departmental strategies with Azerbaijan's 2030 development priorities and climate action commitments, including participation in COP29 initiatives.

- **Implement Smart Building Solutions:**

Integrate energy-efficient systems such as geothermal heating, solar heat storage, and smart lighting into campus buildings.

- **Reduce Carbon Footprint:**

Monitor and minimize the university's greenhouse gas emissions by improving energy consumption, reducing natural gas use, and optimizing heating systems.

- **Foster Student Involvement:**

Engage students in energy conservation campaigns, laboratory research, and sustainability projects for practical, hands-on experience.

- **Expand Industry Collaboration:**

Partner with national and international organizations for applied projects, including innovation in waste-to-energy and smart grid systems.

- **Enhance Laboratory Capabilities:**

Maintain and upgrade laboratories for renewable energy research, including facilities for high-voltage systems, thermophysical analysis, and reactive power compensation.

- **Promote Sustainability Awareness:**

Organize seminars, workshops, and educational activities to raise awareness about climate change, energy conservation, and sustainable technologies among students and faculty.

Keywords

KEYWORDS Energy and Climate Change				
Renewable energy	**Energy efficiency**	**Solar panels**	**Wind generator**	**Biogas plant**
Asynchronous generator	**Small hydropower**	**Reactive power compensation**	**Smart building**	**Thermal engineering**
Refrigeration equipment	**Thermophysical properties**	**Energy audit**	**Carbon footprint**	**Energy quality indicators**
Climate resilience	**Scientific research**	**Environmental safety**	**Digital technologies**	**COP29**
Green energy	**Innovations in energy**	**Energy-saving lamps**	**Electric scooters**	**Emission-free heating**
Geothermal heating	**Heat capacity of air**	**Pressure sensors**	**Student projects**	**Laboratory research**
Electric power industry	**Thermal power engineering**	**Air losses**	**Energy monitoring system**	**Education in sustainable development**

Current Situation

In 2020, Azerbaijan Technical University merged two departments to form the “Energy Efficiency and Green Energy Technologies” department, offering bachelor’s, master’s, and doctoral programs. The department focuses on education and research in renewable energy, supported by laboratories with solar panels, wind turbines, and modern energy equipment.

The campus has implemented sustainable energy projects, including solar and wind power systems, energy-efficient lighting, and electric scooters. In 2023, AzTU consumed 4,700 kWh of electricity over 67,000 m² and reduced heating and natural gas expenses significantly.

AzTU integrates green building technologies and follows climate action policies aligned with international agreements, aiming for carbon neutrality by 2030. The

university actively promotes energy efficiency and climate awareness through research, projects, and participation in national and global initiatives.

- **Establishment of the Energy Efficiency and Green Energy Technologies Department**

In 2020, Azerbaijan Technical University (AzTU) undertook a strategic restructuring by merging the previously separate departments of “Hydraulics and Heat Engineering” and “Electric Power and Power Supply Systems.” This merger led to the creation of a new, interdisciplinary department titled Energy Efficiency and Green Energy Technologies. The goal of this department is to integrate teaching and research efforts to better address the evolving challenges of sustainable energy and climate-friendly technologies. This formation reflects AzTU’s commitment to contributing to the sustainable development of Azerbaijan by training specialists who are equipped to work in energy efficiency and renewable energy fields.

- **Educational Programs and Degree Specializations**

The newly formed department offers a comprehensive educational portfolio across different levels of higher education. At the undergraduate level, students can enroll in a bachelor’s program specializing in Energy Engineering (code 050608). At the graduate level, three master’s programs are available, focusing on Electric Power Engineering (060608), Thermal Power Engineering (060609), and Energy Mechanical Engineering (060610). The department also offers three doctoral specializations, including research areas such as Theoretical Foundations of Heating Technology (3343.01), Deformable Solid Mechanics (2002.01), and studies related to specialists in power plants (electrical part) and electric power systems (3341.01). This educational structure ensures a full cycle of training from foundational knowledge to advanced research capabilities in energy technologies.

050608 - Energy engineering	**Bachelor**
060608 - Electric power engineering	Master
060609 - Thermal power engineering	Master
060610 - Energy mechanical engineering	Master
3343.01 - Theoretical foundations of heating technology	Doctoral
2002.01 - Deformable solid mechanics	Doctoral
3341.01 – Specialists in the specialties of power plants (electrical part) and electric power systems	Doctoral

- **Research Facilities and Laboratory Infrastructure**

The department supports its teaching and research activities through several well-equipped laboratories. The flagship facility is the Renewable Energy Sources

Wind turbines (Azerbaijan Technical University, Baku, Azerbaijan)

laboratory, which houses two wind turbines (each with a capacity of 2 kW) and four solar panels (each with 250 W capacity), installed directly on the university campus to facilitate hands-on training and experimental research. Additional laboratories include those focused on High Voltage Technique, Heat Technique, Cold Technique, Thermo-

Physical Properties of Substances, and Air Conditioning. These labs provide practical support for core subjects within the department and help students and researchers gain real-world experience in analyzing and developing energy-efficient technologies. Specialized equipment includes solar energy devices, reactive power compensation stands, measuring instruments for electrical quality indicators, devices for determining air polytropic indices, and apparatus for studying vapor pressure and heat capacities.

- **Campus Renewable Energy Initiatives**

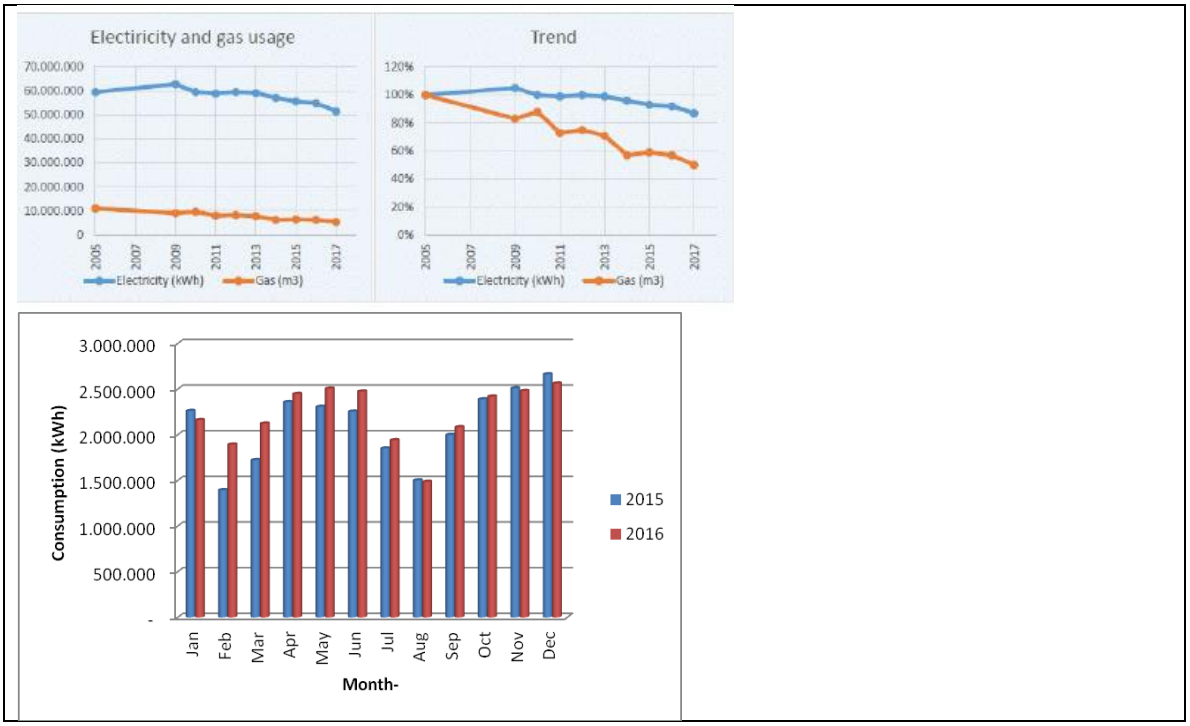
AzTU has actively integrated renewable energy sources into its campus infrastructure as a demonstration and educational platform. The university installed a 2 kW solar power plant composed of four modern solar panels (500 W each) in the campus yard, along with two 2 kW wind turbines and four additional 250 W solar panels. These installations serve dual purposes: they reduce the university's carbon footprint and provide students with the opportunity to observe and understand the operational principles of renewable energy systems. This hands-on learning is vital for preparing future engineers and researchers in the field of green energy.


Solar Panels (Azerbaijan Technical University, Baku, Azerbaijan)

- **Energy Consumption Patterns and Expense Monitoring**

In 2023, AzTU's electricity consumption averaged around 4700 kWh per year over a campus area of approximately 67,000 m². The university's energy consumption supports various needs such as lighting, cooling, heating, and laboratory equipment operation. Remarkably, AzTU reported zero heating expenses for the year 2023, highlighting effective energy management and use of sustainable alternatives. Detailed monitoring of expenses reveals careful budgeting to minimize environmental impact, with breakdowns including ratios for office supplies (0.88%), gasoline and oil (0.06%), printing items (0.11%), electricity use (0.36%), natural gas utility expenses (0.07%), heating expenses (0.43%), and travel (local: 0.01%, foreign: 0.21%). This granular attention to expense management reflects a deliberate strategy to optimize energy use and reduce carbon emissions.

Total Electricity and Gas Usage (All Locations) in 2021-2023 (Azerbaijan Technical University, Baku, Azerbaijan)



- **Implementation of Green Building Technologies**

Sustainability at AzTU extends beyond energy generation to the architectural and engineering design of its buildings. The university incorporates various green building elements to enhance energy efficiency. These include adsorption cooling plants to provide cooling, geothermal heat exchangers that pre-warm outside air to reduce heating demand, solar heat transmitters equipped with heat storage capacities, and solar thermal collectors that serve as heat sources for compression heat pumps. Additionally, ventilation systems are fitted with high-performance waste-heat extractors to recycle energy within buildings. Such technologies collectively contribute to reducing energy consumption, lowering greenhouse gas emissions, and improving indoor environmental quality on campus.

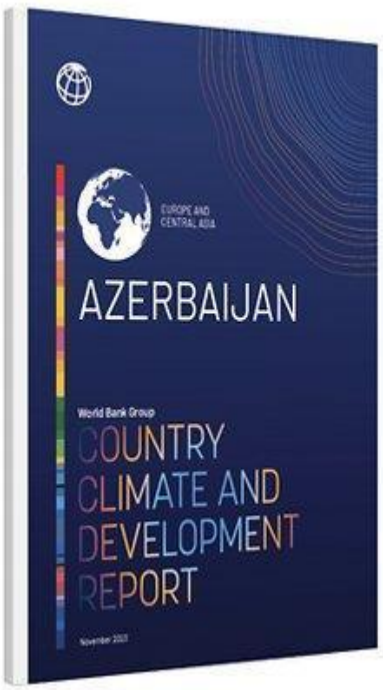
Green Building Implementation – Climate Action Plan (Azerbaijan Technical University, Baku, Azerbaijan)

- **Carbon Footprint Reduction and Climate Change Commitments**

AzTU has demonstrated a strong commitment to reducing its carbon footprint in alignment with national and global climate objectives. The university has developed a Climate Action Policy grounded in international frameworks such as the United Nations Framework Convention on Climate Change (UNFCCC) and Azerbaijan's national socio-economic development strategies. Key goals include eliminating activities that contribute to environmental pollution and greenhouse gas emissions. Through active participation in events like COP29 and collaboration with national ministries, AzTU pursues ambitious plans to achieve carbon neutrality by 2030. Its initiatives encompass reducing fossil fuel dependency, optimizing energy consumption, and promoting renewable energy integration across all campus operations.

- **Innovative Programs and Campus Sustainability Initiatives**

AzTU actively pursues innovation in energy and climate change mitigation through several campus-wide programs. The university has upgraded lighting systems by retrofitting buildings with daylight-saving and energy-efficient bulbs and installed energy-efficient appliances to optimize overall consumption. HVAC systems have been modernized to increase performance and reduce waste. Transportation within the campus has been made more sustainable by introducing electric scooters for service needs, reducing reliance on fossil-fuel-powered vehicles. Landscaping choices favor drought-resistant evergreen trees that require minimal watering, contributing to water conservation efforts.



-Policy-Paper.pdf

İnnovative programs (Azerbaijan Technical University, Baku, Azerbaijan)

İnnovative programs (Azerbaijan Technical University, Baku, Azerbaijan)

- **Academic Engagement and Broader Climate Change Efforts**

In addition to technical and operational measures, AzTU prioritizes education and community involvement to address climate change. The university participates in the Azerbaijan Country Climate and Development Report program, aligning academic activities with national development goals. It hosts seminars, workshops, and research projects on energy efficiency and renewable energy technologies, engaging students, faculty, and external stakeholders. These activities emphasize knowledge dissemination, awareness building, and practical training. AzTU's Climate Action Policy supports these initiatives by promoting behavior change, sustainability awareness, and expanding research projects related to clean energy and environmental protection.

Future goals

- **Expansion of Renewable Energy Capacity**

Goal: By 2030, generate at least 30% of the university's total energy demand from renewable sources.

Actions: Increase the number of solar panels and wind turbines on campus.

Implement biogas systems and explore geothermal energy options.

Continue developing the Renewable Energy Sources Laboratory.

- **Full Implementation of Green Building Principles**

Goal: Ensure that all existing and new campus buildings meet green building standards by 2025.

Actions: Use energy-efficient window systems and daylight-maximizing designs. Install ventilation systems with heat recovery units.Expand the use of solar thermal collectors and adsorption cooling systems.

- **Transition to Carbon Neutrality**

Goal: Achieve full carbon neutrality by 2030.
Actions: Reduce electricity and heating emissions through efficiency measures.Promote clean transportation (e.g., electric scooters, cycling paths).Monitor and reduce greenhouse gas emissions annually.

- **Expansion of Academic and Research Programs**

Goal: Introduce new master's and doctoral programs in energy and climate-related fields.
Actions: Launch courses on energy transition, green economy, and climate policy. Encourage interdisciplinary research involving students and faculty. Collaborate with international partners on sustainability projects.

- **Optimization of Sustainability Budget and Expenses**

Goal: Reduce the share of non-sustainable expenditures by 20% by 2025.
Actions: Digitize administrative processes to reduce paper and printing. Promote online meetings to reduce travel-related emissions and expenses. Monitor utility use (electricity, heating, gas) and set reduction targets.

- **Awareness and Behavior Change for Sustainability**

Goal: Implement energy-saving and climate action training for 100% of students and staff by 2026.
Actions: Organize awareness campaigns through student clubs and events.
Offer "Green Leadership" certification for students.
Host an annual "Green Campus Week" with workshops, exhibitions, and competitions.

Conclusion

Azerbaijan Technical University (AzTU) has taken meaningful steps toward building a sustainable, energy-efficient, and environmentally responsible campus. Through the establishment of the "Energy Efficiency and Green Energy Technologies" department, implementation of renewable energy sources, integration of green building principles, and development of climate-conscious policies, AzTU demonstrates a strong institutional commitment to supporting the Sustainable Development Goals (SDGs).

The university's efforts to reduce its carbon footprint, promote research and innovation, and raise awareness among students and staff reflect a forward-thinking approach aligned with global climate action priorities. With its clear goals to expand renewable energy use, achieve carbon neutrality by 2030, and integrate sustainability across all operations, AzTU is positioning itself as a national leader in higher education for sustainable development.

Continued investment, monitoring, and engagement will ensure that these initiatives translate into long-term impact — making AzTU not only a center of academic excellence but also a model of environmental stewardship in the region.