

NAKHCHIVAN
STATE
UNIVERSITY

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SDG PROGRESS REPORT

7 AFFORDABLE AND
CLEAN ENERGY



THE GLOBAL GOALS



Introduction

Ensuring access to affordable, reliable, sustainable, and modern energy is at the heart of Sustainable Development Goal 7 (SDG 7). NSU deepened its commitment to clean energy by advancing renewable energy production, increasing campus-wide energy efficiency, and expanding student participation in energy-focused research and international collaboration.

Building on the progress of previous years, NSU has actively integrated solar and wind technologies into campus operations while promoting awareness and capacity-building through academic initiatives. The university's approach aligns with SDG 7 targets 7.1 (universal energy access), 7.2 (renewable energy integration), and 7.3 (energy efficiency improvement).

In this report, NSU presents its measurable achievements in transitioning toward a greener energy model — showcasing technical improvements, scientific contributions, and student-led innovation in the realm of sustainable energy.

Energy Infrastructure and Efficiency Improvements

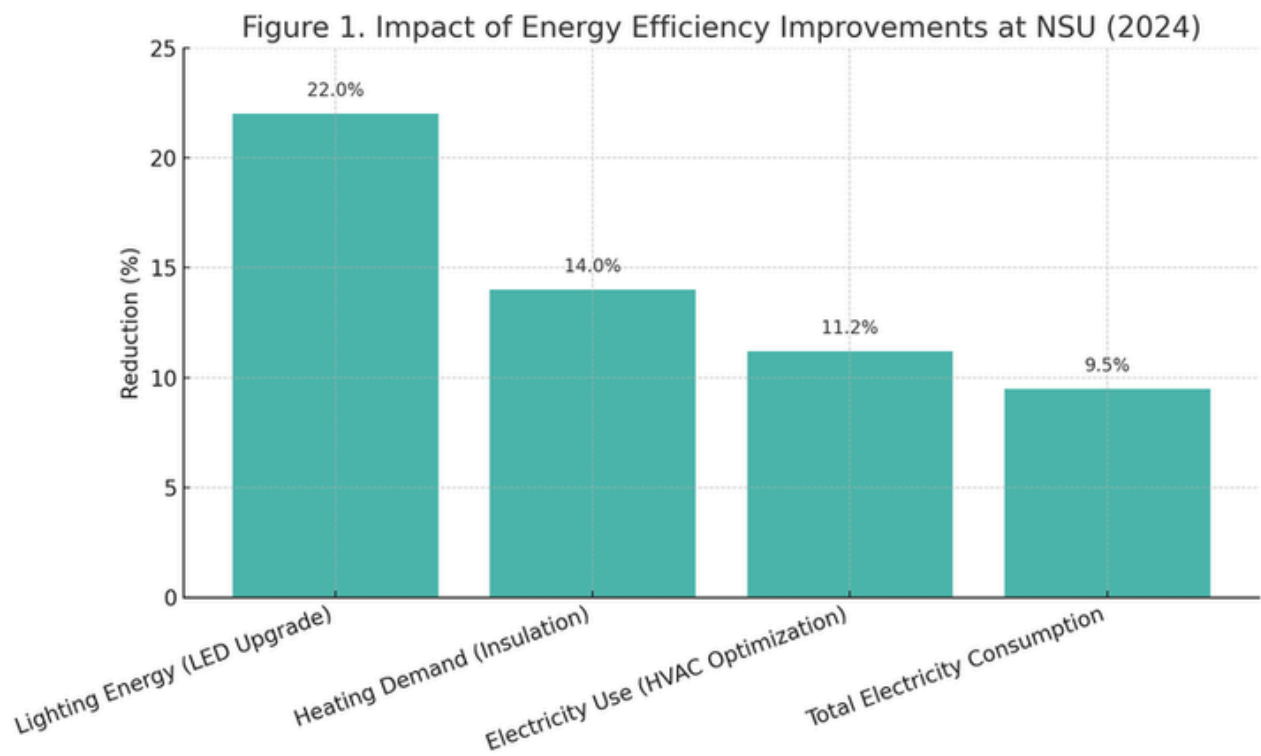
We continued to upgrade its energy infrastructure with a focus on reducing environmental impact and operational costs through smart design, energy-efficient systems, and technology integration. These initiatives were implemented across academic buildings, dormitories, and administrative offices.

Solar-powered lighting systems were installed in several outdoor areas, contributing to lower grid dependency and promoting renewable energy use on campus.

Additionally, motion-sensor LED lighting and automated HVAC controls were introduced to optimize energy consumption during non-peak hours.

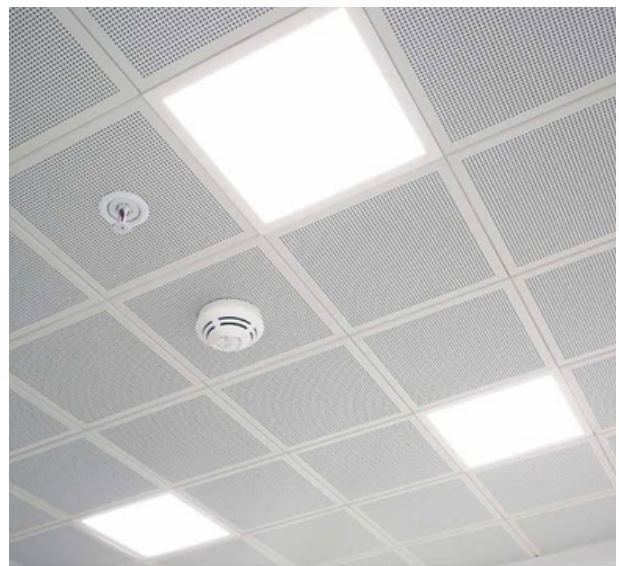
Key Achievements in Campus Energy Efficiency

- Full replacement of indoor lighting systems with LED units across 100% of classrooms and libraries
- Retrofitting of two major faculty buildings with thermal insulation, leading to a 14% decrease in winter heating demand
- Deployment of automatic lighting sensors in corridors, restrooms, and low-traffic areas across 6 buildings
- HVAC (heating, ventilation, air conditioning) optimization in central administrative block — energy use reduced by 11.2%



Energy Monitoring and Management:

- Real-time electricity monitoring dashboards were installed in 3 pilot buildings, allowing facility managers to track peak loads and adjust systems accordingly
- A smart scheduling system was introduced to reduce unnecessary lighting during off-hours



Renewable Energy Initiatives

We expanded our use of renewable energy technologies, contributing to a cleaner campus environment and reducing its dependence on fossil fuels. These efforts involved solar panel installations, wind energy integration, and pilot-scale hybrid systems — all of which supported NSU's transition to a more sustainable energy model.

Renewable Energy Initiatives

In 2024, We expanded our use of renewable energy technologies, contributing to a cleaner campus environment and reducing its dependence on fossil fuels. These efforts involved solar panel installations, wind energy integration, and pilot-scale hybrid systems — all of which supported NSU's transition to a more sustainable energy model.

Solar Energy Projects:

- NSU increased its solar panel capacity by 20 kW, bringing the total installed capacity to 85 kW across 4 faculty buildings
- Newly installed rooftop panels now supply over 17% of daytime electricity demand in administrative and academic buildings
- Maintenance teams were trained to operate and monitor photovoltaic performance via digital dashboards



Wind Energy Integration:

- The existing 5 kW wind turbine near the Engineering Faculty continued to operate effectively, powering lighting and lab equipment
- Wind production covered an average of 2.3% of monthly electricity needs in 2024 — particularly efficient during winter months

Hybrid Microgrid Experiment:

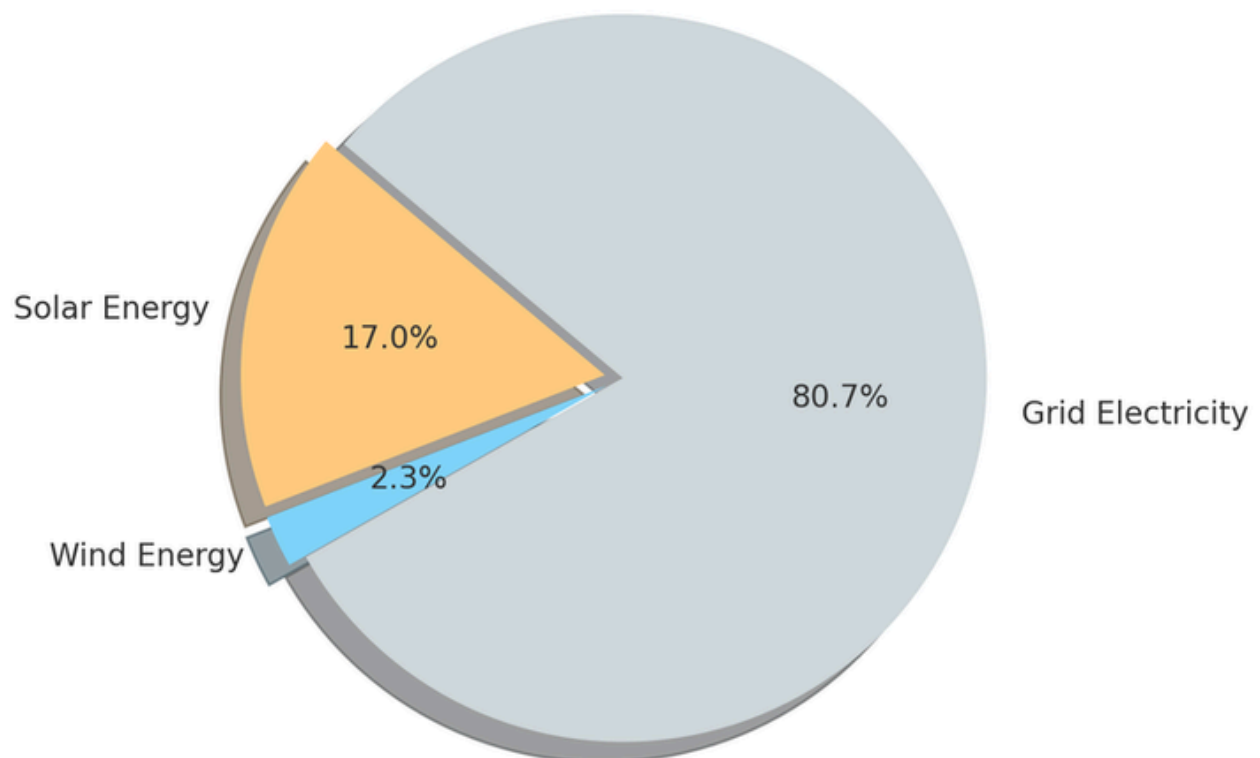
- A pilot hybrid energy system (solar + wind + storage) was launched for one dormitory block
- System included 10 kWh battery storage, reducing evening load on the central grid by 12%
- The project involved 12 students and 3 faculty advisors as part of a living-lab setup

Impact:

- NSU's total clean energy generation (solar + wind) covered approximately 19.3% of annual electricity needs in 2024
- Reduction in CO₂ emissions estimated at ~32 tons per year
- Strengthened research capacity and student engagement in renewable energy systems

Figure 2. NSU Clean Energy Production Mix (2024)

This pie chart illustrates the proportional share of electricity generated by solar, wind, and grid sources at NSU during 2024.



Wind Energy Integration

The NSU's 5 kW wind generator, situated at the territory of the Faculty of Engineering, also continued to operate effectively throughout 2024 generating electricity for lighting and laboratory purposes. The university's needs for electricity were met by wind energy, on average, by around 2.3% per month, with the highest average in a month in winter.

Hybrid Microgrid Experiment

In 2024 NSU piloted a hybrid energy system with solar and wind supplemented with battery storage on one the dormitory blocks. This "living lab" concept comprised a 10 kWh storage unit, which, together with an energy management system, decreased the building's evening energy load from the grid by 12%. The project included 12 students and 3 faculty mentors and focused on practical and applied learning in clean energy systems and applied sustainability.

Impact

These efforts resulted in a significant change to the NSU energy profile:

The stand-alone solar plant and combined solar and wind have provided about 19.3% of the university's overall electricity for the year so far.

An estimated 32 tonnes of CO₂ emissions were saved directly at the point of relief.

The projects also helped build a research capacity and encouraged students to get involved in the planning and execution of renewable energy technologies.

Training Program and Public Awareness on Energy

Concurrently with the infrastructure improvements, NSU prioritised clean energy education and community engagement in 2024 – ensuring future professionals are prepared and ready to take the lead in sustainability.

Academic Highlights:

A third-year optional Climate and Energy module was established for students of engineering and natural sciences, and focused on such concepts as: renewable technologies; energy economy; and climate politics.

There were 54 students registered in the spring semester.

A 5-part series of guest lectures balanced graduated seminars presented by experts from the Azerbaijan Energy Regulatory Agency and regional power companies.

Sessions covered subjects ranging from grid integration and solar architecture to energy transition policies, exposing students to practical applications and opportunities in the clean energy field.



Monitoring and Conclusion

In 2024, NSU implemented an integrated energy monitoring strategy to track real-time consumption, identify inefficiencies, and ensure accountability in sustainable energy practices. This system enabled evidence-based decision-making and reinforced NSU’s commitment to long-term carbon reduction.

Monitoring Highlights:

- 3 campus buildings were equipped with smart meters that transmitted daily energy usage reports to the facilities team
- Monthly energy performance reviews were conducted to evaluate system efficiency and occupant behavior
- Energy audits revealed a 9.5% year-on-year reduction in electricity consumption, as visualized in Figure 1

Key Achievements Summary (2024)

Area	Progress Highlights
Energy Efficiency	22% reduction via LED upgrades
Renewable Energy	19.3% of energy needs met by solar and wind
Research & Education	7 student projects, 54 students in new course
Awareness Campaigns	Reached 12,000+ via digital engagement
CO ₂ Emissions	~32 tons reduced

Future Directions:

- Expand rooftop solar systems to cover additional 3 buildings
- Introduce AI-based load balancing and predictive maintenance tools
- Develop a Green Energy Certificate Program for students and faculty
- Host an International Sustainable Campus Energy Forum (2025) at NSU

Final Statement

By investing in clean energy infrastructure, advancing renewable integration, and empowering students through education, Nakhchivan State University is making tangible progress toward SDG 7. As the university moves forward, it remains committed to becoming a regional model for sustainable energy leadership in higher education.