



Sustainable KTU

SUSTAINABILITY REPORT 2024

7 AFFORDABLE AND
CLEAN ENERGY



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Sustainable development is not only a global vision, but also a shared responsibility that our country bears towards future generations. In this sense, the Sustainable Development Goals (SDGs) set by the United Nations, Turkey's 11th and 12th Development Plans, the Green Deal Action Plan, and the Higher Education Council's sustainability vision form a roadmap for higher education institutions.

As Karadeniz Technical University, we consider it our primary duty to contribute to these goals in line with our mission of education, research, and community service. Our university produces science-based knowledge, develops policies, and implements projects in interaction with the community across a wide range of areas, from quality education to climate action, from poverty reduction to the construction of innovative and sustainable cities.

In line with our country's national policies, our university leads regional development and assumes global responsibility through international collaborations, while also aiming to educate our students to become conscious individuals for a sustainable future. The report prepared in this context reflects not only the activities carried out but also our university's determination on its sustainability journey.

Our belief in the future is strengthened by the guidance of science and the dynamism of our youth. Karadeniz Technical University will continue to contribute to sustainable development goals and support our country's vision in this area.

Prof. Dr. Hamdullah ÇUVALCI
Rector, Karadeniz Technical University



7 AFFORDABLE AND CLEAN ENERGY



Universal access to clean, reliable, and affordable energy is of critical importance for the sustainability of modern life. Accordingly, the United Nations has established SDG-7: Affordable and Clean Energy, which aims to ensure access to safe, sustainable, and modern energy for all by 2030. This goal necessitates strategies that include expanding renewable energy sources, improving energy efficiency, and supporting investments in energy infrastructure.

Higher education institutions play a key role in achieving SDG-7 as knowledge producers and societal change agents in the fields of energy technologies and energy efficiency. Universities support the transition to low-carbon energy systems through scientific research and technology development in areas such as renewable energy generation, energy storage, and energy management. Additionally, they take responsibility for enhancing energy literacy through curricula and community-based educational initiatives that raise awareness about energy.

Karadeniz Technical University (KTU), as a public university embracing a sustainable development vision, carries out comprehensive initiatives in line with SDG-7. These include strengthening energy infrastructure, promoting the use of renewable energy sources, and developing energy efficiency practices. Notable activities include campus energy management systems, academic research projects, awareness-raising events, and multi-stakeholder collaborations.

This report aims to document KTU's policies, practices, and impacts throughout 2024 in relation to SDG-7, highlighting the university's institutional contributions to sustainable energy transformation. At the same time, it seeks to promote the sharing of best practices for raising public energy awareness and supporting the transition to clean energy.



Institutional Structure

KTU has developed a multi-stakeholder, multi-level institutional structure to support the Affordable and Clean Energy (SDG-7) goal. This structure is based on systematic task allocation and coordination aimed at improving energy efficiency across the campus, promoting the use of renewable energy, and enhancing societal awareness.

Units such as the Environmental Issues Application and Research Center, Office of International Relations, Energy Systems Engineering, Electrical and Electronics Engineering, Physics, Architecture, Maritime Transportation and Management Engineering, and Urban and Regional Planning contribute to increasing the university's scientific production capacity in energy technologies through interdisciplinary education, research activities, and sectoral collaborations.

Additionally, student clubs (e.g., the KTU Energy Club) organize activities to raise energy literacy and enhance student awareness, completing the voluntary component of the institutional structure.

The Construction and Technical Affairs Directorate manages LED conversion projects for campus lighting systems, natural gas transition projects, and maintenance of energy infrastructure. Monitoring systems such as electricity consumption, heating systems, generators, and UPS units contribute to the safe and efficient operation of sustainable energy infrastructure.

To support energy-focused student projects, a Technology Competitions Coordination Office was established, with its directive implemented in 2024. This office particularly supports student teams working on sustainable mobility, electric vehicles, and clean energy solutions.

Through this institutional structure, KTU contributes systematically to the SDG-7 targets not only in the areas of infrastructure and technology but also across strategic governance, human resource development, and public awareness initiatives.





Technology Competitions Coordination

KTU enacted the "Technology Competitions Coordination Directive" on June 11, 2024, to encourage the effective and systematic participation of students and student groups in national and international technology competitions. This directive defines the duties and responsibilities of the Technology Competitions Coordination Directorate, specifically aiming to support student teams developing projects in areas such as energy, mobility, environment, and sustainability. Within the scope of this directive, energy efficiency-focused vehicle and system projects developed in line with the SDG-7 goals are supported by the relevant student groups with a stronger structure, and students are empowered to develop practical skills in areas such as competition participation, prototype production, and international representation. This institutional structure strengthens the university's student-based R&D capacity in the field of sustainable energy technologies and facilitates the implementation of innovative solutions.



[KTU Technology Competitions Coordination](#)





Department of Construction and Technical Affairs

The KTU Department of Construction and Technical Services is responsible for the planning, design, construction, maintenance, and operation of all building, facility, and infrastructure projects on the university campus. In this context, the department ensures the implementation of highly energy-efficient building designs and the adoption of sustainable technologies in heating, cooling, lighting, and ventilation systems. It also conducts technical improvements aimed at reducing energy consumption in new and existing buildings. It also encourages the integration of renewable resources such as solar energy into the university's energy infrastructure and facilitates the installation of energy automation systems to monitor and control energy management. With all these activities, the Department of Construction and Technical Services serves as one of KTU's core institutional units supporting clean, accessible, and sustainable energy use in line with SDG-7.

As part of its energy efficiency policies, KTU has initiated a campus-wide transformation of its lighting infrastructure by 2024. Material procurement processes are being planned for the transition to energy-saving LED lighting systems, coordinated by the University Department of Construction and Technical Services. This initiative is a key component of the university's holistic strategy to reduce energy consumption in campus buildings. The transition to LED systems aims to both reduce electricity consumption from lighting and support environmental sustainability.





Department of Construction and Technical Affairs

Karadeniz Technical University (KTU) has initiated a transition to clean energy in its heating infrastructure to reduce fossil fuel-based carbon emissions and increase energy efficiency. Within this scope, the heating system of Maçka Vocational School was converted to natural gas in 2024, thereby moving away from higher carbon-emitting fuel types. Additionally, high-efficiency wall-mounted condensing boilers have been increasingly deployed across university campuses. Compared to traditional systems, these boilers provide higher thermal efficiency and significantly reduce greenhouse gas emissions. This transformation in KTU's heating infrastructure aligns fully with SDG 7, which promotes clean, reliable, and sustainable energy use, contributing to the reduction of environmental impacts and improvement of energy performance across the campus.

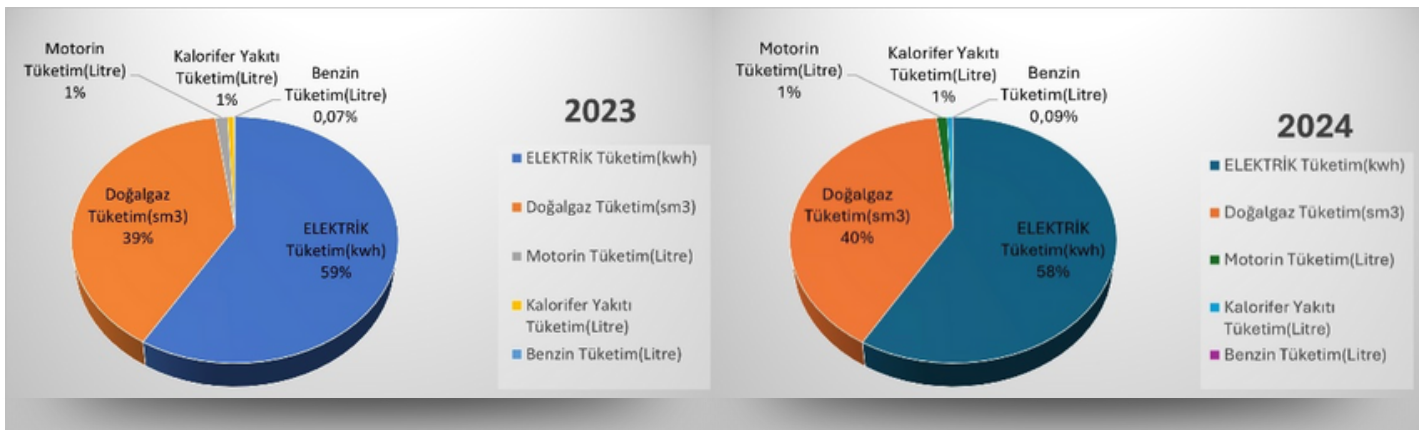
To ensure the reliable, uninterrupted, and efficient operation of energy systems, KTU centralized its maintenance processes as of 2024. Under the coordination of the Directorate of Construction and Technical Affairs, annual maintenance contracts were signed in January 2024 for generators, uninterruptible power supplies (UPS), transformers, compensation panels, fire alarm systems, elevators, and fuel- or natural gas-fired burners throughout the university. The periodic maintenance and inspection activities carried out within this framework have helped prevent potential energy outages throughout the year, minimized energy losses, and supported continuous and efficient energy use on campus. KTU's practices in this area directly align with SDG 7 by enhancing the resilience of energy infrastructure and ensuring sustainable service delivery through the prevention of system failures.





Emission-Based Analysis of Energy Consumption

Karadeniz Technical University (KTU) has taken a significant step toward systematically assessing the environmental impacts of energy consumption and grounding its sustainability policies on a scientific basis through institutional carbon footprint measurements covering the 2023–2024 period. The calculations include a detailed comparison of Scope 1 (direct emissions) and Scope 2 (indirect emissions from electricity use). Within this framework, the university’s energy source transition trends were evaluated alongside their potential for greenhouse gas reduction.



The total CO₂e emissions reached approximately 18,500 tons in 2023 and decreased to around 17,300 tons by 2024. This reduction is directly associated with the decreased consumption of natural gas and heating fuel. The observed decline in Scope 1 emissions is a direct result of the university’s transformations in its heating infrastructure, such as the adoption of condensing boilers, the transition to natural gas, and the use of energy-efficient equipment.





Clean Energy Initiative from KTU Students

In 2024, KTU student clubs made significant contributions to SDG 7 by achieving notable results in national competitions focused on energy technologies and efficiency. The KTU Energy Technologies Club secured second place in Turkey at the Efficiency Challenge Electric Vehicle Competition organized by TÜBİTAK. This achievement highlights the university's capacity to develop energy efficiency-based technologies and the active contributions of students toward sustainable transportation.

Additionally, the Nuclear Space Team achieved second place in Turkey at the Nuclear Energy Technologies Design Competition. The project presented an approach for designing nuclear energy systems that are safe, environmentally friendly, and highly efficient, reflecting the young researchers' competencies in developing clean energy solutions.

During the preparation and participation phases, these teams received sponsorship and logistical support from MEKAP and the Trabzon Metropolitan Municipality. These supports, within the framework of university-industry-public collaboration, enhanced the development and feasibility of student-led energy projects and strengthened the university's contribution to the clean energy transition in cooperation with societal stakeholders.





Clean Energy Initiative from KTU Students

The KTU Energy Technologies Team participated in the Shell Eco-Marathon Europe & Africa 2024, one of Europe's most prestigious electric vehicle competitions, held in France from May 19 to 24, 2024. Competing in the Urban Concept Battery Electric category with their vehicle "SPECTRON II," the team achieved 6th place in Europe, marking a significant international accomplishment.

KTU was among the limited number of university teams from Turkey eligible to participate and was the only team representing the Black Sea Region. The vehicle was designed with an approach prioritizing energy efficiency and environmental sustainability in electric mobility technologies, demonstrating both the university's engineering capacity and the students' competence in developing innovative, clean energy-based solutions.

This achievement highlights KTU's support for research activities that contribute to sustainable transportation systems and clean energy technologies in line with SDG 7.





K-TECH TEAM

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Clean Energy Initiative from KTU Students

The KTU Energy Technologies Club participated in national events such as TEKNOFEST with volunteer student teams, winning over 350,000TRY in total prizes. These earnings were directly reinvested into the teams' new technology development projects. Adopting a volunteer-based, from-scratch production model, this process provided students with hands-on experience and motivation in clean mobility and energy efficiency. This approach serves as a strong example of KTU's active and sustainable role in advancing SDG 7 through youth engagement and promoting societal contributions to renewable energy.

Trainings for Clean Energy Awareness

Throughout 2024, various technical activities were carried out to increase students' practical knowledge and awareness of renewable energy technologies. The Energy Systems Engineering Department organized a technical trip to the Gürsü-Arca Hydroelectric Power Plant, owned by Gürsü Clean Energy Production Inc., as part of the Renewable Energy Resources course.



This field visit provided students with the opportunity to observe the energy production processes of hydroelectric power plants firsthand and gain firsthand knowledge of the technological infrastructure involved. Located on the Solaklı Stream, the plant was examined, including its dam structure, turbine-generator system, control room, and energy transmission equipment. Students received comprehensive information on energy production, system efficiency, water management, and environmental sustainability. This activity aligns directly with the SDG-7 goal, one of KTU's strategic steps to strengthen renewable energy awareness.



Technical Trip News

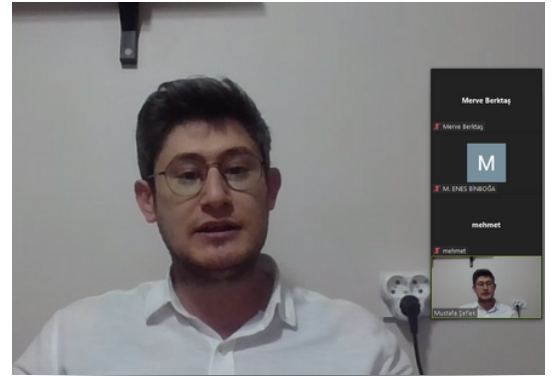




Trainings for Clean Energy Awareness

KTU conducts regular training programs and events to develop awareness and expertise in the field of clean energy. On May 16, 2024, a “Project Design Training in Photovoltaic Solar Systems” was organized for Energy Systems Engineering students to provide them with technical knowledge and practical experience in solar energy project design and to support their preparation for the renewable energy sector. This training enabled students to acquire hands-on skills and technical competence in solar energy project development.

On December 4, 2024, a technical seminar titled “Heat Pumps and Their Applications” was held at the Arsin Vocational School campus. During the seminar, an expert engineer provided a detailed explanation of the operating principles of heat pump technologies, their application areas, and their contributions to energy efficiency. The event attracted significant interest from academic and administrative staff as well as students. This activity is considered part of the university’s efforts to share knowledge and raise awareness in energy technologies and directly contributes to SDG 7’s goal of transitioning to sustainable, modern, and clean energy.



[Training on Project Design for Solar Systems](#)

[Technical Seminar on Heat Pumps and Their Applications](#)





Trainings for Clean Energy Awareness

KTU takes significant steps not only through infrastructural investments but also in developing qualified human resources to ensure the sustainable implementation of clean fuel transitions. Within this framework, a “Natural Gas-Fired Boiler Operator” course was held at Arsin Vocational School from October 22 to November 13, 2024, providing certified training to local participants. The course aimed to equip participants with the technical knowledge and practical skills necessary for the safe, efficient, and environmentally friendly operation of natural gas heating systems.

Additionally, on May 21, 2024, a technical seminar titled “The Role of Gas Fitters in Mechanical Installation Systems” was conducted. An experienced KTU alumnus participated as a speaker, sharing energy-efficient operational practices for HVAC (heating, ventilation, and air conditioning) systems with students.

These training and awareness-raising activities are strategically important for enhancing energy efficiency awareness, strengthening professional competence, and building local and societal capacity. At the same time, they align with SDG 7 objectives by equipping human resources to support the transition to clean energy.





University-Public Partnership Theme for Clean Energy

In the last quarter of 2024, the “Smart Cities and Cadastre Panel” was held on December 27, 2024, organized through a collaboration between the KTU Department of Geomatics Engineering and the Trabzon Branch of the Chamber of Survey and Cadastre Engineers. The event was attended by the Governor of Trabzon, the Mayor of Trabzon Metropolitan Municipality, Rector Prof. Dr. Hamdullah Çuvalcı, as well as representatives from public institutions, academics, and students.

In his opening remarks, Rector Çuvalcı emphasized that shaping cities through information technologies is critical for energy efficiency, transportation, and public services. The panel discussed how innovative technologies and digital cadastre systems in smart cities offer significant advantages in terms of energy and resource utilization. This event contributed to raising awareness of a sustainable city vision encompassing energy efficiency and clean energy management, while also strengthening academic-public sector collaboration.





University-Industry Partnership Theme for Clean Energy

Rector of KTU, Prof. Dr. Hamdullah Çuvalcı, along with a delegation, visited the Kalyon PV Solar Panel Manufacturing Facility to discuss potential collaborations. KTU maintains close engagement with industrial organizations in the clean energy sector. In December 2024, the delegation, led by Rector Prof. Dr. Hamdullah Çuvalcı, visited the Kalyon Solar Technologies Production Facility in Polatlı, Ankara. During the visit, opportunities for university-industry cooperation were explored, and the delegation examined advanced solar panel manufacturing processes on-site, discussing potential joint R&D projects in the field of sustainable energy.

As a result of the discussions, KTU and Kalyon PV reached a preliminary agreement to collaborate on the development of innovative photovoltaic cell technologies, student internships and project opportunities, and the establishment of joint R&D centers. Rector Çuvalcı emphasized that producing joint projects with industry would contribute to both academic and technological advancement and stated that such initiatives could create significant impact in the future energy sector. This engagement serves as a prime example of KTU's partnerships with the private sector and highlights the university's vision of playing a leading role in clean energy innovation.





UYGULAMALI FİZİK VE İLGİLİ TEKNOLOJİLER

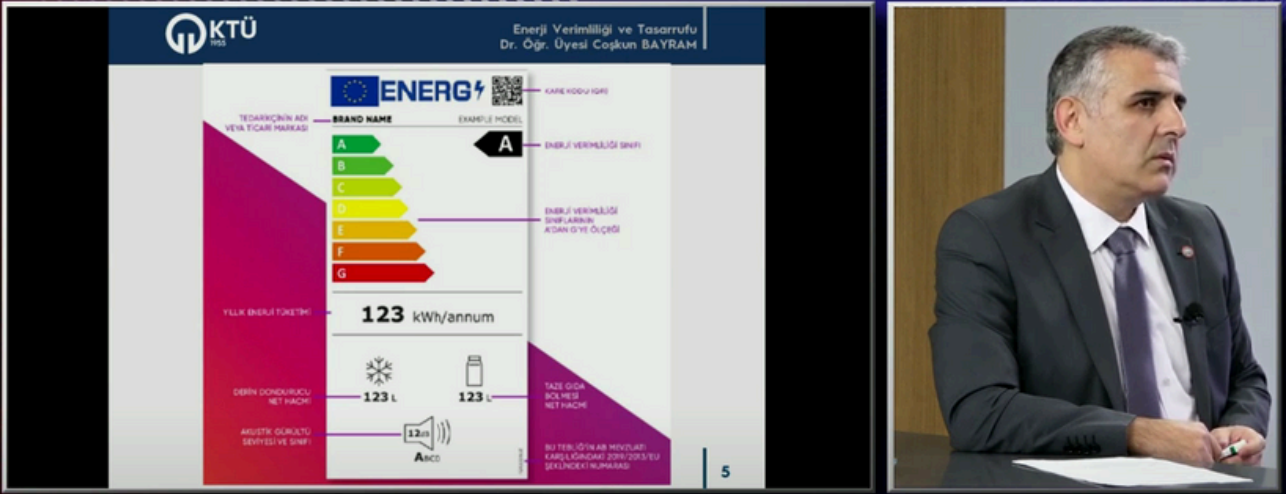
Discourse and Scientific Contributions Towards Clean Energy

At the “Academica: Applied Physics and Related Technologies” event organized by the KTU Faculty of Science, Department of Physics on May 23, 2024, topics in applied physics such as superconductivity, nuclear fusion, and maglev train technologies were discussed. These subjects were directly linked to themes relevant to SDG 7, including energy efficiency, clean energy generation, and sustainable transportation.

The role of superconductors in clean and virtually limitless energy production in global initiatives like the ITER fusion reactor project, the potential of maglev trains to reduce carbon emissions, and Turkey’s scientific contributions in these areas were highlighted. Additionally, the importance of guiding young researchers toward R&D activities in the energy field through TÜBİTAK-supported projects was emphasized.

This event demonstrates that KTU contributes to SDG 7 not only through engineering but also via interdisciplinary engagement in the fundamental sciences.





DR. ÖĞR. ÜYESİ COSKUN BAYRAM

Discourse and Scientific Contributions on Clean Energy

In an interview conducted with KTU Of Faculty of Technology, the concepts of energy efficiency and energy conservation were examined in detail. It was emphasized that energy efficiency refers to providing the same service with less energy, while energy conservation involves reducing energy waste through individual behavioral changes. Both approaches were highlighted as critical from both environmental and economic perspectives.

The discussion also addressed Turkey's significant reliance on energy imports and its impact on the trade deficit, demonstrating that energy efficiency is not only a technical matter but also a national strategic priority. Practical methods for reducing energy consumption in daily life were presented, including using high-energy-class appliances, operating devices at full capacity, unplugging unnecessary equipment, and running heating and cooling systems efficiently.

Furthermore, it was stressed that energy efficiency supports environmental sustainability by reducing harmful emissions from fossil fuels and remains one of the most effective steps in the energy transition, even as renewable energy investments increase. Within this context, the interview illustrates that KTU contributes to SDG 7 not only through technological and infrastructural investments but also by promoting societal awareness and behavior change among individuals.



[Talk on Energy Efficiency and Conservation](#)



Sürdürülebilir binalar



Sinpaş Eko Town/ Emre Arolat Mimarlık



Mimari Tasarım ve Sürdürülebilirlik

Discourse and Scientific Contributions on Clean Energy

In a talk featuring Assoc. Prof. Dr. Ayça Araz Usta Ömeroğlu from the KTU Faculty of Architecture, topics aligned with SDG 7 were discussed within the framework of sustainable architectural approaches, including energy efficiency, the reduction of fossil fuels, and the promotion of renewable energy use. The discussion highlighted how international certification systems such as BREEAM and LEED contribute to reducing the carbon footprint through efficient energy use, natural ventilation, green roofs, and the selection of recyclable materials in sustainable building design.

Additionally, the importance of bioclimatic design principles and nature-compatible urban planning was emphasized, noting their critical role in reducing building energy demand and supporting the transition to clean energy. This talk demonstrates that KTU contributes to SDG 7 in the field of architecture through interdisciplinary approaches.



[Talk on Architectural Design and Sustainability.](#)





Academic Contributions

In the Times Higher Education Impact Rankings 2024, KTU made a significant leap in SDG 7, moving from the 601–800 band in 2023 to the 201–300 band in 2024. In 2024, a total of 98 scientific articles indexed in the Scopus database, covering topics such as energy efficiency, renewable energy systems, and sustainable energy management, demonstrated the university's research capacity and international visibility in this field. In addition, 11 conference papers were presented at national and international scientific events, 6 master's theses and 2 doctoral theses were completed, supporting the production of high-quality knowledge in the energy domain. Furthermore, 4 book chapters, 2 review articles, and 1 book review were published, contributing to the academic literature. At KTU, 2 undergraduate courses with energy-related content were offered, providing students with foundational knowledge in sustainable energy technologies.

Throughout 2024, KTU took remarkable steps to raise awareness of sustainable energy management, encourage the development of innovative technologies, and strengthen student engagement. Policies developed in areas such as energy efficiency, renewable energy technologies, education, and industry partnerships enabled the university not only to transform its own operational processes but also to achieve high impact in knowledge production. In this context, KTU stands out not merely as an institution that reduces energy consumption but also as a higher education actor that enhances energy awareness, generates knowledge, and produces solutions through multi-stakeholder collaborations.





Sustainable KTU

This publication has been prepared by KTU Office of
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