Lodz University of Technology

REPORT ON ACTIONS COMPLETED IN 2022 AT LODZ UNIVERSITY OF TECHNOLOGY WITHIN THE FRAMEWORK OF **THE RACE TO ZERO CAMPAIGN**

Introduction

Aware of its role in combating climate change, Lodz University of Technology has joined the international Race to Zero campaign, the goal of which is to achieve climate neutrality by 2050. As part of this initiative, the university has taken a number of measures to reduce greenhouse gas emissions and improve energy efficiency. These are summarized in the following report.

In the wake of Russia's attack on Ukraine, 2022 was marked by energy price spikes, which dramatically increased the university operating costs. In the reporting period, efforts were intensified to analyze the cost and performance of energy systems with a view to introducing measures to reduce energy consumption on the university campus, thereby reducing its carbon footprint.

ACTIVITY OF THE SUSTAINABLE DEVELOPMENT PANEL

The Lodz University of Technology Sustainable Development Panel has been active since 2020 to coordinate and implement efforts in the area of sustainable development goals on the university campuses. The panel, under the leadership of the Vice-Rector for Development, consisting of experts with different research expertise, and representing different organizational units of Lodz University of Technology, convened several meetings in 2022 during which sustainable development initiatives were discussed, including those concerning the reduction of the carbon footprint at Lodz University of Technology. Some of the actions proposed during the panel's deliberations were taken in 2022 and are detailed in this report.

One example of transnational exchange of good practice in sustainable development occurred during the study visit by partners from Dutch universities, as part of 'The Sustainable, social design' project. The panel met with representatives of the Royal Academy of Art, The Hague and the Design Academy Eindhoven. They attended a meeting with university leadership and members of the Sustainable Development Panel, where they explored opportunities for collaboration across a range of scientific disciplines. The guiding principle of the project formulated as ‚We, as a species, only have a future if our societal model changes. We need to re-think the fundamental pillars of society, and do so from both theory and bottom-up through design, allowing both to communicate with each other' (Kaethler, Boelen, 2020), draws attention to the fact that we need to change the way we think about the society of the future. Addressing the challenges of sustainability requires collaboration and effective communication. ‚Sustainable design', being the central theme of the project, is a focus of interest for all universities invited to participate. The purpose of the project is to share ideas, knowledge, experience, and best practice from the vantage point of different scientific disciplines and different countries.

The Sustainable Development Panel produced a comprehensive study, Lodz University of Technology on the path of sustainable development. Report for the period 2021-2022, which outlined the university's efforts to reduce its carbon footprint. An important part of the report was concerned with the Sustainable Development Goals: Goal 7 Affordable and clean energy, Goal 11 Sustainable cities and communities, Goal 12 Responsible consumption and production, Goal 13 Climate action. The report can be accessed by following the link: https://p.lodz.pl/sites/default/files/2023-03/RaportZrownowazonegoRozwoju_21_22_en.pdf

KEEPING TRACK OF THE CARBON FOOTPRINT

The key step toward reducing the carbon footprint is first to measure it. Given the large size of Lodz University of Technology premises, the range and the scale of its operations, this has not been an easy task.

The organization's carbon footprint can be assessed based on the data available in the literature for each product/process in use as well as the mode of transport in the supply chain, or from LCA (Life Cycle Assessment) indicator databases for products and processes provided in the literature or included in commercially operated databases e.g. ecoinvent, bundled with licensed software such as SimaPro, Umberto, or GaBi. With an understanding of their carbon footprint, organizations can more effectively manage emission levels, decarbonize processes, and thus reduce costs. Carbon footprint calculations vary in the scope of analysis, e.g. they may omit certain life cycle stages on account of insufficient data, the type of methodology used or the software used for carbon footprint calculation, among others.

SimaPro with ecoinvent 3.8 application software and the IPCC 2021 GWP 100a method were used to calculate Lodz University of Technology's carbon footprint. The results give TUL's quantified 2022 carbon footprint. The calculations were based on the information concerning utility usage on the campuses and in the halls of residence of Lodz University of Technology in the years 2019-2021. Table 1 shows the input data that served as the basis for the carbon footprint calculations.

Table 1. Inventory of utility consumption data for 2019-2021 in Lodz University of Technology buildings

Year	**2019**				
Type	**Water**	**Electricity**	**Central heating**	**Natural gas**	**area**
Unit	[m^3]	[kWh]	[GJ]	[kWh]	[m^2]
Campus A	48645,0	5211000,5	59743,1	696244,3	113009,5
Campus B	53194,5	4565137,1	39838,0	14846,9	124527,5
Halls of residence	78950,0	2313365,3	26871,2	290002,7	54181,9
Campus C, D (without the halls of residence)	7403,4	856114,9	6854,7	0,00	16018,2
Year	**2020**				
Campus A	30825,8	4111454,8	40306,8	876855,9	119544,8
Campus B	35825,7	3766078,4	33331,2	7931,2	124527,5
Halls of residence	45794,9	1457557,9	22594,0	185991,3	54181,9
Campus C, D (without the halls of residence)	4060,8	638228,9	5779,5	0,00	16018,2

Year	2021				
Campus A	39384,8	5280115,3	55937,9	865451,6	119544,8
Campus B	53994,7	4174310,8	43477,5	10164,7	124527,5
Halls of residence	49809,0	1430585,0	26343,0	122590,8	54181,9
Campus C, D (without the halls of residence)	5421,7	777193,9	7782,8	0,00	16018,2

The graphs in Figures 1 – 4 illustrate annual utility consumption by campus.

Figure 1. Annual water consumption on Lodz University of Technology campuses

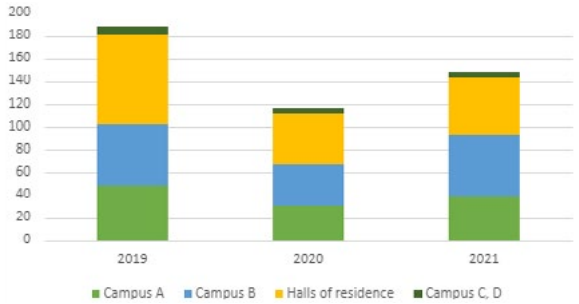


Table 2. Annual electricity consumption on Lodz University of Technology campuses

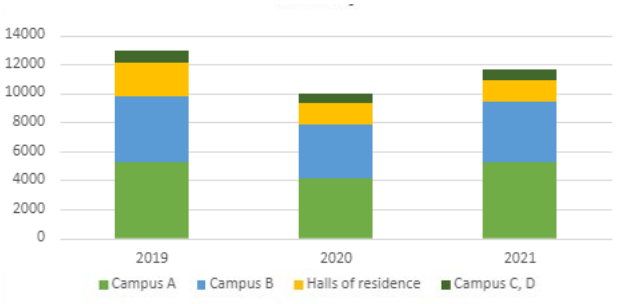


Figure 3. Annual heat consumption on Lodz University of Technology campuses

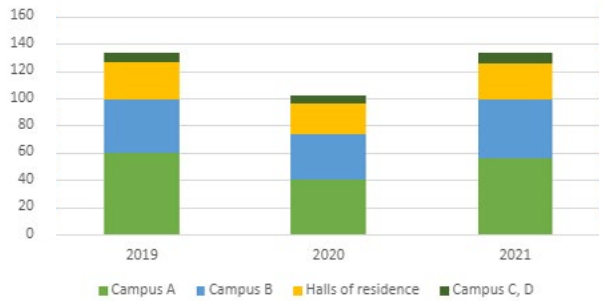
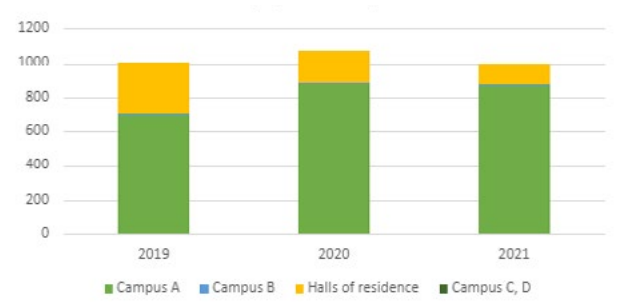


Figure 4. Annual gas consumption on Lodz University of Technology campuses

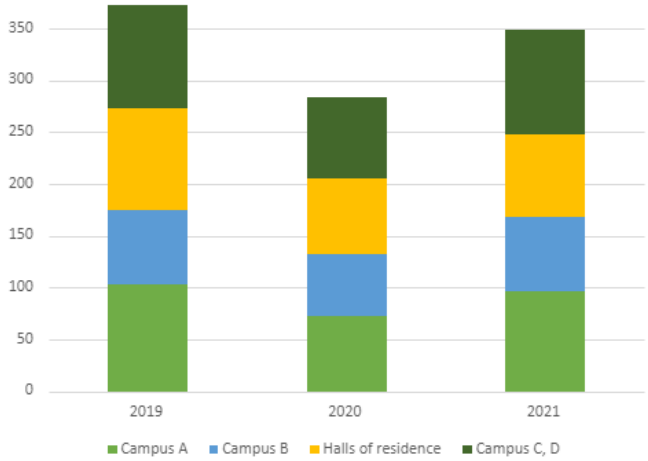


The carbon footprint of Lodz University of Technology in 2019-2021 was calculated based on the consumption information for each utility and the area of the building in square meters (Table 2).

Table 2. Carbon footprint for Lodz University of Technology buildings in 2019-2021 per m²

Year	2019	2020	2021
Type	**Carbon footprint per m2**		
Unit	[kg CO2-eq/m²]		
Campus A	103,2	72,8	96,7
Campus B	71,3	59,2	71,4
Halls of residence	98,2	73,2	79,9
Campus C, D (without the halls of residence)	99,7	78,9	101,1

Figure 5. Carbon footprint of Lodz University of Technology buildings in 2019-2021 per m²



The relevance of buildings to achieving climate neutrality is beyond dispute. Recent data show that buildings account for about 38% of global CO^2 emissions, with as much as 28% resulting from their operation (operational carbon) and the remaining 10% from the consumption of energy required to produce the materials and technologies used in construction (embodied carbon).

The data above clearly show the effect of the pandemic on the carbon footprint figures. In 2020 compared to 2021, the carbon footprint of the buildings on campus A was lower by as much as 30.4 kg/m2, representing a nearly 30% drop; a slightly smaller difference, at 25 kg/m2 (25.5%), was evident for the halls of residence and for campus C, D - close to 21 kg (21%); the smallest but equally noteworthy decrease was recorded for the buildings on campus B (12.1 kg/m2 or 17%). Complete data on utility consumption in 2022 are not available as of the date of publishing this report.

BUILDING LOCAL ENERGY SOURCES

In 2022, due to the soaring cost of electricity, the decision was made at Lodz University of Technology to intensify efforts to develop further local energy sources. This allows the university to become less dependent on external energy suppliers. Also, increased deployment of local sources fits in with the development of distributed generation, which reduces energy transmission costs and greenhouse gas emissions.

Solid effort on energy system cost and efficiency rationalization allowed us to identify viable technologies, as well as to prepare technical documentation and seek financing. Listed below are technological solutions we expect to be able to deploy:

- development of photovoltaic sources - the installed capacity of the solar panels is planned to be 3,500 kWp, which means more than 8,600 panels at 400 Wp each. In 2022, efforts were made to secure funding for the investment scheduled for execution in the coming years;

- utilization of heat pumps and waste heat;

- geothermal drilling - feasibility and cost-effectiveness studies were conducted in 2022;

- Lodz University of Technology joined the Mazovian Hydrogen Valley https://h2poland.eu/en/categories/hydrogen-valleys/masovian-hydrogen-valley/powstanie-mazowiecka-dolina-wodorowa/ and as a result, the university's transition to a hydrogen economy was under consideration.

Until 2021, photovoltaic installations had been in operation at Lodz University of Technology only at three buildings on campus A. The installations date back to around 2012, with a total capacity of 112 kWp; a number of them had also served research purposes.

148 kWp of new PV capacity was developed at Lodz University of Technology in 2022. The passive building, powered solely by solar energy from photovoltaic panels whose capacity is 96 kWp, was put into operation. The building is also equipped with a 36kW heat pump. The renovated spaces in the building of the Faculty of Organization and Management, where solar panels with a capacity of 25 kWp had been installed, also came into operation in 2022. Furthermore, photovoltaic panels with a capacity of 28 kWp were installed in the modernized building of the pre-school of Lodz University of Technology.

IMPROVING BUILDING ENERGY EFFICIENCY

Improving energy performance of buildings on Lodz University of Technology campus is crucial if greenhouse gas emissions and carbon footprint are to be reduced as buildings are one of the main sources of emissions and energy consumption. The university, to the extent that its financial capabilities allow, has been carrying out thermal modernization of its facilities and investing in new energy-efficient buildings.

In 2022, new construction passive building was put into service. The investment was worth over 13 million zloty. The building has one underground floor and five floors above the ground, with a total area of 1,600 m2. Erected to serve the needs of the university administration and students, the building takes advantage of advanced technologies of energy supply from renewable sources, which directly contributes to cutting energy costs and carbon footprint reduction. One of the ways to achieve this is through proper thermal insulation, as well as by maximizing glazing on the south facade to capture solar heat, installing photovoltaic panels on the windows, the rooftop, and the facade, and deploying a heat pump.

A-15 Passive Bulding. Source: TUL archive

Also in 2022, the preschool building was put into use. The facility had undergone thermal modernization whose overall value exceeded 7.5 million zloty. The preschool is conveniently located on TUL campus, which means that TUL staff and students need not drive their children to daycare facilities elsewhere in the city, which also helps reduce TUL carbon footprint.

Another measure taken by Lodz University of Technology to reduce its carbon footprint in 2022 was to move the Faculty of Organization and Management from the historic and energy inefficient buildings on campus D in Piotrkowska Street to modern spaces in the building on campus B.

Lodz University of Technology preschool. Source: TUL archive

‚The Business Zone' into which the Faculty has moved into takes up four floors in the upgraded building. It has 17 modern classrooms with a capacity exceeding 450 seats, computer rooms, 2 conference rooms, 24 staff rooms, and 20 administrative office spaces. The building, which underwent deep thermal modernization, features solar panels installed on the south wall, and an environmentally friendly interior ventilation system.

Building of the Faculty of Organization and Management Source: TUL archive

The 2022 effort also marked the start of comprehensive thermal modernization of the building where the Center of Excellence for Universal Design will eventually be housed. The biggest challenge in the field of thermal modernization of buildings is the renovation of historic buildings on the campuses of Lodz University of Technology. Some of the university's facilities are located in adapted factory buildings and what used to be industrialists' residences dating back to the 19th century when the textile industry was booming in Łódź. The challenge here lies both in improving energy performance of these buildings while preserving their historic character, as well as the high cost of renovating buildings of historic value.

Before modernization. Source: Google street view

The building of the Center of Excellence for Universal Design after thermal modernization – design visualization. Source: TUL archive

REPLACING CONVENTIONAL LIGHT POINTS WITH ENERGY-EFFICIENT ONES

In 2022 , large-scale outdoor lighting replacement was carried out on the university campus. Outdated, energy inefficient streetlamps were replaced with energy-saving LED lights. Given that Lodz University of Technology campus covers an area of more than 37 ha, the upgrading process shall continue into 2023.

Old street light on campus A. Source: TUL archive

New LED street light on campus A Source: TUL archive

In 2021-2022, outdoor lighting replacement was carried out on campus A. In all, 145 streetlights were replaced. In addition, surveillance cameras were mounted on them. The total cost of the investment was 1.5 million zloty. Also, the bulbs in 200 street lamps were replaced with energy-efficient bulbs. The cost of the investment was approximately 20 000 zloty. The process of inventorying old inefficient lights in the university buildings was also started in 2022. Overall, roughly 6 000 light points were identified for replacement. Furthermore, 1.5 million zloty was secured to fund the replacement of the light points with new energy-efficient and also more long-lasting ones. About 500 light points have been replaced so far. The value of the investment to date has been approximately 130 000 zloty. The process of lighting upgrade will be continued in 2023. Apart from the replacement of lights, efforts are underway at the university to develop intelligent lighting management systems to enable programmable lighting control.

CONTINUAL MONITORING OF ENERGY CONSUMPTION

Increasing the observability of energy consumption at the level of individual buildings and administrative units is one of the main objectives driving the measures taken at Lodz University of Technology to reduce its carbon footprint. The measures undertaken are intended to encourage building administrators to rationalize energy consumption.

Measuring energy usage individually for as many TUL buildings as is possible will allow us to identify where the highest energy consumption occurs and to take steps to reduce it. Installation of additional electric meters began in 2021 and by the end of 2022 more than 70 meters were installed. The cost of the investment was 130 000 zloty. Installing high-tech meters enables real-time monitoring of energy consumption with simultaneous reading transmission.

Types of electric meters used in the university buildings. Source: www.fif.com.pl

SUSTAINABLE, LOW-EMISSION TRANSPORT

Lodz University of Technology has pledged to reduce its carbon footprint by advancing sustainable and low-carbon transport. Since the beginning of 2022, two electric vehicle charging stations have been available on Campus B. This measure is particularly meaningful because there is a growing interest in electromobility, and with it, the need to charge vehicles. The university's commitment to the development of electric vehicle charging infrastructure is also an important step in reducing greenhouse gas emissions and reducing the negative impact of transport on the environment. At the same time, promoting the development of zero-emission modes of transport at the university also serves to encourage greater interest in electromobility not only among students and employees, but also among individuals and companies cooperating with the university.

Furthermore, in 2022, as one of the measures to ensure that university campuses are better connected to the public transport system in Łódź, an additional bus stop in Politechniki Avenues, adjacent to campus B, was established in consultation with the Municipal Transport Company. Bolstering public transport accessibility is intended to make it a more popular choice for the university students and staff.

Electric vehicle charging stations on campus B. Source www.elo.city

GREEN CAMPUS AND CAMPUS NEIGHBORHOOD

Another floral meadow of nearly 1,000 m² was seeded at Lodz University of Technology in 2022 as yet another measure to mitigate the negative effects of climate change. Unlike lawns, flower meadows feature a number of different plant species, which increases their biodiversity and can help increase their ability to absorb carbon dioxide. The meadows need not be mowed very often either. Rather they are mowed only once a year. They help retain water in the soil and protect it against erosion, thereby helping alleviate greenhouse gas emissions associated with soil degradation. On top of that, flower meadows reduce urban heat island effect, which is especially important during hot weather spells in the summer.

In an effort to support biodiversity, in 2022, nesting boxes for swifts were mounted on the facade of the multi-story building next to Bishop Michał Klepacz Park on campus B. Due to urban development and modernization of buildings, swifts have fewer and fewer nesting sites. Swifts are very useful birds, as they feed on insects, e.g., mosquitoes and flies that are a nuisance to humans. Swifts help control populations of insects and thus reduce the need for pesticides and insecticides in the park, the manufacturing of which adds to the carbon footprint.

The academic community of Lodz University of Technology, mindful of the importance of vegetation and its impact on the quality of life of the city's residents and on the condition of the environment, submitted in 2022, as in the preceding years, another ‚green' project to the Participatory Budget of Łódź. The proposal ‚Green Campus Garden on Skorupki received the highest number of an votes cast by the residents of the Stare Polesie district of Łódź and will be executed in 2023 with the funding provided by the Office of the City of Łódź. The project, prepared by staff and students, involves sidewalk renovation in the street adjacent to the campus, new landscaping, as well as energy-efficiency upgrade of the street lights.

Flower meadow next to TUL Main Library. Source: TUL archive

Swift nesting boxes mounted on the building of the Institute of Architecture and Urban Planning. Source: TUL archive

Follow the link to the design visualization: Zielony kampus Politechniki Łódzkiej w głosowaniu Łódzkiego Budżetu Obywatelskiego.

Source: TUL archive

ENVIRONMENTAL AWARENESS RAISING ACTIVITIES

Lodz University of Technology conducts research work and a number of educational and outreach activities related to environmental protection, sustainable development, and carbon footprint reduction. Below are some examples to note of projects conducted by Lodz University of Technology researchers in 2022.

Development of a monitoring, early-warning, and sustainable management system for wastewater treatment plants to reduce the discharge of pollutants from urbanized areas into the aquatic environment in collaboration with the Group Wastewater Treatment Plant in Łódź.

Development and implementation of sustainable solutions in the production and use of bioplastics to protect the land and marine environment in Europe. The main purpose of the BIO-PLASTICS EUROPE is to contribute sustainable strategies and solutions for biodegradable plastics to support the EU plastics strategy and promote a closed loop economy. Over the course of the project, researchers will address innovative product design, development of health and safety standards, product end-of-life options, and environmental and economic assessment of product life cycle.

The Sustainability and Procurement in International, European, and National Systems (SAPIENS) is the single most ambitious, interdisciplinary research and training program, bridging sustainability and public procurement topics. SAPIENS' focus is on interdisciplinary research on public procurement which takes into consideration social and environmental challenges of the 21st century.

Digital FLEXible Industries for Reliable Power Grids with High Penetration of Variable Renewable Energy Sources (VRES) is a 4-year Horizon Europe project, worth over €17 million, which is expected to yield solutions to support smart energy transformation in large industrial plants. The consortium partners will implement smart systems to ensure reduced energy consumption, use of renewable energy sources, waste heat recovery, and CO2 emissions reduction. The project could generate direct savings of about 154 GWh of electricity annually.

Furthermore, it is worth to note the activity of TUL student science groups in 2022, e.g., Lodz Solar Team, Iron Warriors Team, and Generative Urban Small Turbine (GUST). Student science groups are frequently involved in research projects on environmental protection and sustainability. This helps their members learn about and gain skills in these areas, which they can then share with others during lectures and seminars. Also, student science groups organize actions and communication campaigns related to their projects. They compete in international competitions: Lodz Solar Team (electromobility), GUST (wind energy), Iron Warriors (reduction of fuel consumption), which are aimed at raising environmental awareness among students and the larger community.

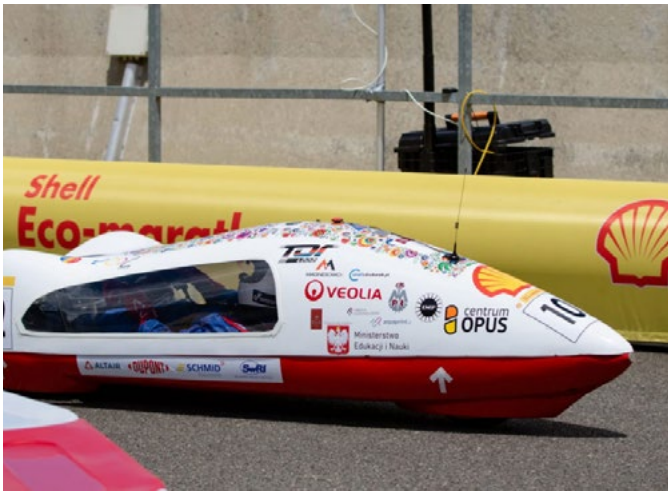
Lodz Solar Team represented the university and Poland in the Cruiser category at the 2022 iLumen European Solar Challenge in Belgium at Circuit Zolder, winning in the overall classification the title of European Champions. Eighteen teams competed in the event, in two categories: Cruiser and Challenger.

Meanwhile, students working on the Iron Warriors team took part in the 2022 EcoMarathon - a competition held in France during which participants compete to cover the longest distance on 1 liter of fuel.

Lodz University of Technology GUST research group students once again took the second place on the award podium of the International Small Wind Turbine Contest 2022 organized by Delft University of Technology in the Netherlands. The GUST team presented a four-blade horizontal axis wind turbine for household use.

Also in 2022, Lodz University of Technology, the City of Łódź, the Embassy of the Kingdom of Denmark in Poland, and Danfoss signed a cooperation agreement to improve energy efficiency of Łódź's building stock. Under this new venture, students, in close cooperation with the City, will prepare an analysis and develop a plan to improve energy efficiency of buildings in the selected quarters of Łódź.

TUL Lodz Solar Team during the iLumen European Solar Challenge in Belgium. Source: TUL archive



Bolid Eco Arrow 3 built by Iron Warriors taking part in Shell Eco-Marathon in Nogaro, France. Source: TUL archive

In 2022, TUL research staff, as a body of experts, organized open lectures and debates, recorded podcasts on sustainability, environmental protection, and renewable energy, some with the participation of invited experts. Presented below are selected activities undertaken in 2022:

In March, in the lobby of the Alchemium Building of the Faculty of Chemistry, in cooperation with the Embassy of Switzerland in Poland, CLEANTECH, a mobile exhibition on clean technologies, officially opened at Lodz University of Technology. In May 2022, as part of the National Innovation Fair of Polish Universities and Research Institutes held at EC1 in Łódź, Lodz University of Technology organized a panel discussion with the participation of invited experts called ‚Chemistry and materials engineering - offering for a closed loop economy'.

In June 2022, the university prepared a technical panel discussion, one in the ‚TECHNOLOGIES OF TOMORROW - debates at Lodz University of Technology' series. The theme of the meeting was „RES + Smart Energy Management = Energy Independence?". The panel was held in the framework of the Business and Sustainable Development Forum organized by the Marshall Office of Łódź Voivodeship.

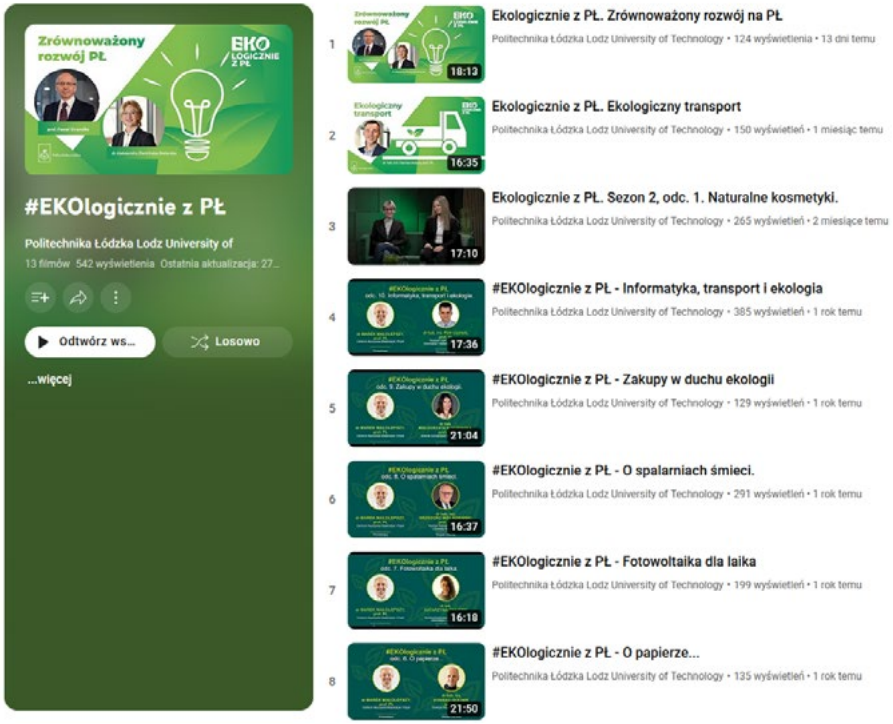
Lodz University of Technology was also a technical partner and coordinator of the discussion ‚Trends in the development of innovation in the power sector', organized within the framework of the European Economic Forum - Łódzkie

Team GUST International Small Wind Turbine Contest 2022 in the Netherlands . Source: TUL archive

2022, which was held in December. The panelists discussed different aspects of innovation in the power sector, both in terms of conventional power generation as well as in the areas of what is known as ‚clean energy' - photovoltaics and wind turbines, distributed generation, and energy storage.

Apart from organizing in-person open conferences and seminars, the staff of Lodz University of Technology also share their wealth of knowledge via online dissemination and communication channels. One example of these efforts undertaken in 2022 is the series #EKOlogicznie z PŁ (available on the TUL Facebook profile and YouTube channel) where our experts share their knowledge on topics related to ecology, advise on how to be a responsible consumer, and suggest what decisions are worth considering to protect the environment. In 2022, 5 episodes in this series were developed: About paper...; Photovoltaics for laypeople; What you should know about waste incinerators; Green shopping; IT, transport, and ecology

Pro-environmental actions addressed directly to students and staff are also an important strand of the Lodz University of Technology Race to Zero activities. In 2022, they included a clean-up action around the campus held on the International Earth Day. TUL staff and students once again took an active role for the environment by cleaning up the area separating the two campuses. More than twenty bags of waste were collected, ranging from bottles to hair dryers and, for example, plastic tubes of considerable size.



List of #EKOlogicznie z PŁ episodes. Source: TUL archive

TUL staff and students during the clean-up action. Source: TUL archive

To promote environmentally responsible attitudes, the university's 2022 Sustainable Development Panel developed a resource publication presenting the 10 principles of responsible use of energy. The material is intended for both staff and students of Lodz University of Technology, and is an example of good practice in raising awareness and promoting greener lifestyle.

Another example of good practice toward reducing the carbon footprint by cutting down on paperwork is the electronic document management system launched at Lodz University of Technology in 2022. A test version of the Electronic Document Management (EZD) system was implemented in 2021. Eventually, paper-based communication at Lodz University of Technology will be replaced with digital communication. The elimination of paper will streamline the exchange of letters and the management of processes, reduce the costs of the university's operation and, above all, save trees. Thanks to the EZD system, we should reduce energy use and the costs of printing toners, printer and photocopier maintenance, etc.

10 RULES
OF RESPONSIBLE ENERGY CONSUMPTION

1		Adjust your heating and cooling temperature settings based on your actual needs and the time of year. Make sure to turn off the heating/air conditioning before opening the windows.
2		Unless you are planning to use them, unplug/power off (including standby power) all your devices, even if it is just for a day or a night.
3		Read your device user guide. Choose settings that save energy, e.g., enable screen saver, activate standby to suit your needs, and turn off any services and servers you do not need.
4		Check the energy efficiency of your equipment. Consider replacing it once you find you can get the job done with a more energy-efficient item. Only buy equipment that that meets the latest energy efficiency standards.
5		Make maximum use of daylight. Adjust your desk to take advantage of the location of the windows and radiators.
6		Report any malfunctions of the heating, cooling, lighting, and plumbing systems, as well as drafty windows, to the building manager.
7		When making tea or coffee, boil only as much water as you and/or your co-workers actually need
8		The motor of an elevator consumes about 20kW. Based on 2022 energy cost, that is about 30 groszy per run. When possible, opt for the stairs.
9		To maximize their energy efficiency, make appliances such as air conditioners, radiators, and ventilators are regularly cleaned and serviced.
10		Be aware there is a functioning electronic document management system (EZD). Print only when and what you absolutely need to.

Resource material promoting the 10 rules of responsible energy consumption. Source: TUL archive

Conclusion

Lodz University of Technology has been pursuing an ambitious plan to reduce its carbon footprint to achieve climate neutrality by 2050. The 2022 Report describes a number of set of complementary actions, including carbon footprint monitoring, local energy source development, improving building energy efficiency, modernization of the lighting system, ongoing monitoring of energy consumption, sustainable and low-carbon transport, green re-development of the campus, and awareness-raising and outreach activities, all of which are to be continued in the years to come. Achieving climate neutrality will require acquiring adequate funding for investment and modernization in the coming years. We will also steadily work toward raising members of the academic community's awareness so that we can reach the goal we have set of reducing the university's greenhouse gas emissions.

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of Technology

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