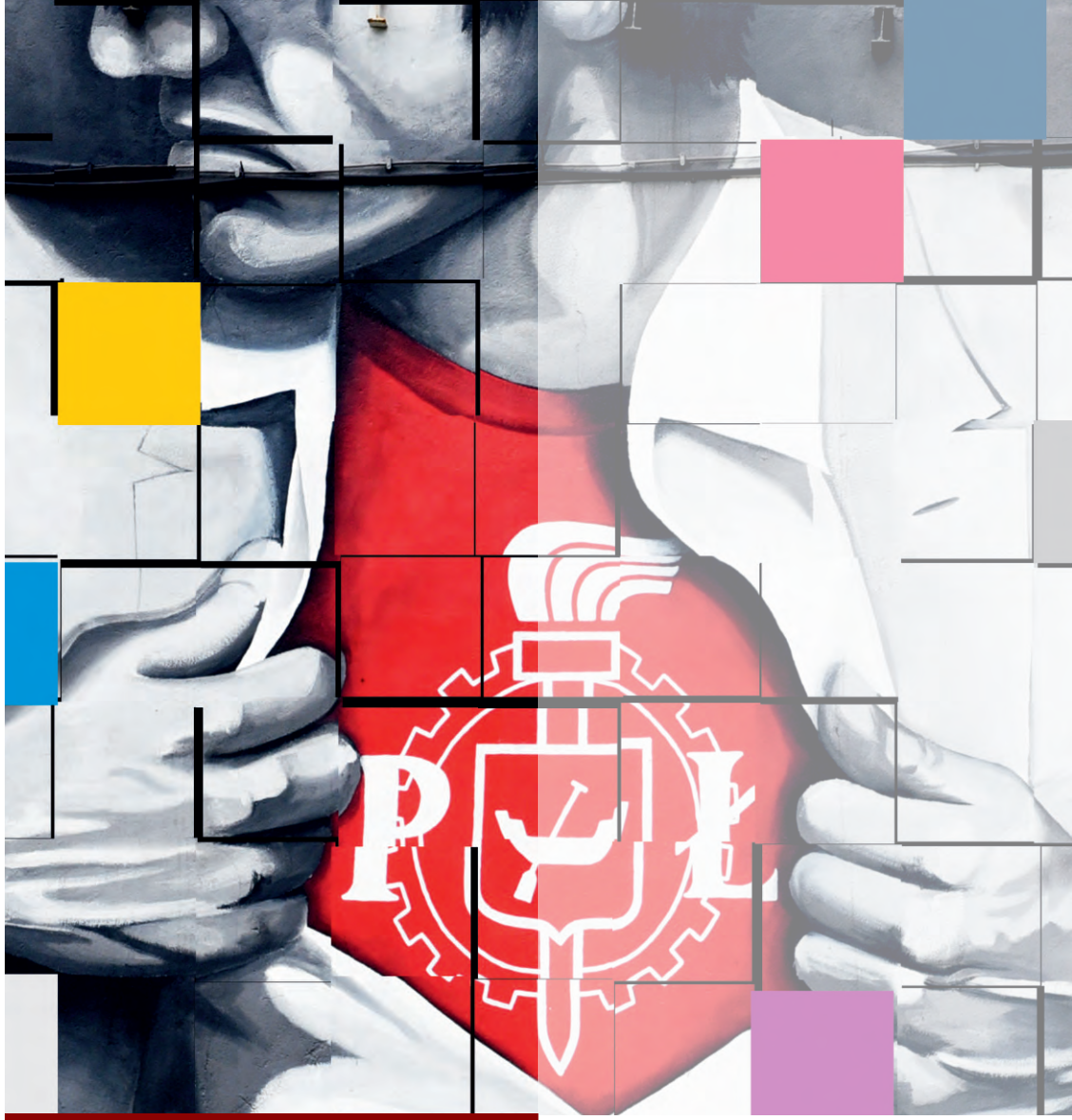


Lodz University
of Technology

LODZ UNIVERSITY OF TECHNOLOGY ON THE PATH OF SUSTAINABLE DEVELOPMENT. REPORT FOR THE PERIOD 2020-2021.

Ladies and Gentlemen,

we present to you a report, which is a summary of numerous activities undertaken by Lodz University of Technology in order to implement individual priorities developed as part of sustainable development. Dissemination of knowledge on this subject is an essential element in the education of students, doctoral students and university employees, perceived as an investment in the future of next generations, and at the same time a social manifestation of care for our environment.

Lodz University of Technology as the only university in Poland has joined the elite network of the European Consortium of Innovative Universities (ECIU), whose ambition is active involvement in the process of achieving the goals set as part of sustainable development in teaching and research projects. Our university understands this idea very well and wants to share its concepts in this area. By showing good practices, we want to effectively inspire socially responsible initiatives.

In order to facilitate individual recovery and development plans, I have established a Sustainable Development Team that develops and coordinates the work of our university in this area.

I would like to thank the Vice-Rector for Development, Prof. Paweł Strumiłło and the Team. Indeed it is thanks to you that the implementation of further ideas is possible. I cannot ignore the support of the members of the Promotion Section and the press officer who supervised the editing and graphic design of this report. I am proud of the involvement of the entire academic community, actively actively participating in actions undertaken in the area of socio-economic development not only of our university, but also of the whole country.

Together for a better future.

Prof. Krzysztof Jóźwik, TUL Rector

Dear Ladies and Gentlemen,

science, education and social responsibility – in each of these areas, the importance of sustainable development is increasing. A modern university must not only respond to its goals, but also create them.

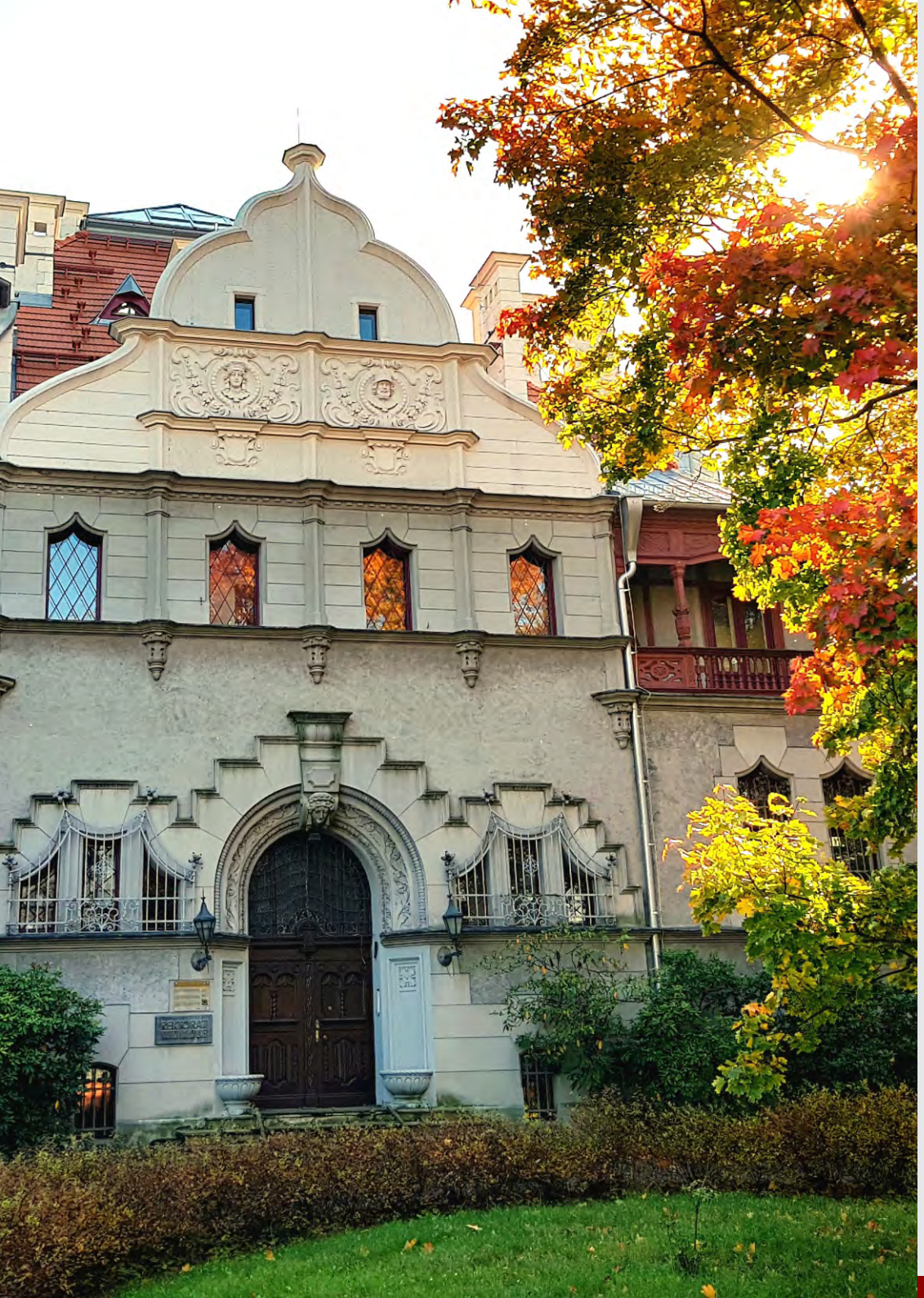
The 17 priorities set out in the United Nations 2030 Agenda are defined in five areas: people, planet, prosperity, peace and partnership. As a technical university, we set the directions of the most necessary activities that we can take in the field of scientific research and education in order to achieve the indicated goals more effectively.

Scientific achievements greatly influence social change. They determine what tools we use at work and how we move and communicate. This is evidenced by successive industrial revolutions. However, they leave their mark on the Earth's environment and climate. It must be made clear that we are facing global climate, energy and health challenges. The role of science and technological progress cannot be overestimated here. Lodz University of Technology, as one of the best technical universities in the country, actively takes up new challenges set by the Sustainable Development Goals.

I am proud to observe how employees, doctoral students and students of TUL take up research, teaching and infrastructure

challenges for the sustainable development of our city, region and country.

Prof. Paweł Strumiłło,
Vice-Rector for Development



TEAM FOR SUSTAINABLE DEVELOPMENT

- prof. Paweł Strumiłło - Vice-Rector for Development, Head of the Team
- dr inż. Anna Klepacz-Smółka - coordinator of the Green Campus area
- dr Monika Malinowska-Olszowy, TUL Prof. - coordinator of the Didactics area
- dr hab. Małgorzata Koszewska, TUL Prof. - coordinator of the Research area
- dr hab. inż. Sebastian Borowski, TUL Prof.
- Julia Chojnacka - President of the Student Government
- dr hab. inż. Robert Cichowicz, TUL Prof.
- dr inż. Irena Jałmużna
- mgr Justyna Kopańska
- mgr Adrianna Kozłowska
- dr hab. inż. Paweł Mierczyński, TUL Prof.
- dr inż. Michał Morawski, TUL Prof.
- mgr Adam Owczarek
- dr inż. Dorota Piotrowska, TUL Prof.
- dr inż. Tomasz Siewierski
- prof. dr hab. inż. Ireneusz Zbiciński
- dr inż. Katarzyna Znajdek

RESEARCH RESULTS

KNOWLEDGE OF SUSTAINABILITY AMONG STUDENTS AND STAFF APRIL 2021

OBJECTIVES OF THE STUDY:

1. assessment of **awareness and knowledge** of employees and students of Lodz University of Technology in the area of the 2030 Agenda and the Sustainable Development Goals;
2. assessment of **the importance** of the implementation of individual objectives for staff/students;
3. identification of the objectives on which the TUL staff/students may have the **greatest impact**,
4. identification of goals which, in the opinion of the TUL staff/students, should be **implemented in the first place**;
5. identification of the **biggest barriers** to the implementation of the SDGs (in private life, at work/during studies);
6. staff and students' evaluation of the **current activities of TUL** in the area of sustainable development;
7. **compiling ideas** on increasing the TUL involvement in sustainable development initiatives.

ABOUT THE STUDY:

The survey was conducted in April 2021, responses were collected by means of the Forms.

The survey was completed by **557 students** and **395 employees** of Lodz University of Technology, representing all organizational units of the university. The most numerously represented unit, both in the group of students and employees, was the **Faculty of Electrical, Electronic, Computer and Control Engineering**.

The group of students was dominated by full-time students, who accounted for **92%**, and the share of students of practical fields of study was **55%** and general academics **45%**. Half of the respondents in the student group were females, **44%** were males, the remaining **6%** of the respondents didn't specify their gendre.

In the group of employees, academic teachers were the most numerous, constituting **73%** of the respondents. Administrative employees accounted for **20%**, and engineering and technical employees **7%**.

As in the group of students, in the studied population **47%** were women, **46%** men, and **7%** of respondents refused to answer this question.

THE STUDY INCLUDED:

557 STUDENTS

395 EMPLOYEES

	STUDENTS	EMPLOYEES
Faculty of Mechanical Engineering	55	40
Faculty of Electrical, Electronic, Computer and Control Engineering	103	77
Faculty of Chemistry	54	28
Faculty of Material Technologies and Textile Design	20	21
Faculty of Biotechnology and Food Sciences	55	29
Faculty of Civil Engineering, Architecture and Environmental Engineering	86	35
Faculty of Technical Physics, Information Technology and Applied Mathematics	50	26
Faculty of Management and Production Engineering	61	38
Faculty of Process and Environmental Engineering	22	14
Logistics College	1	0
International Faculty of Engineering	43	0
Centre of Papermaking and Printing	2	3
Spatial Development College	4	0
Spatial Economy College	1	0
Interfaculty units	0	38
The rector's administration	0	27
The chancellor's administration	0	6
other	0	7

Diagram No. 1. Participation of TUL students and employees in the study broken into units.

RESEARCH TOOL

The development of the research tool was preceded by an analysis of existing research. It allowed for the proper selection of measurement scales as well as the method of formulating questions. In addition, the actual study was preceded by a pilot survey in both a group of students and employees.

The questionnaire contained **12 factual questions** on issues related to sustainable development and allowing to assess aspects related to knowledge, awareness, assessment of the importance of individual goals, personal impact of employees and students on their implementation, willingness to engage in activities related to the implementation of goals, barriers to implementation, as well as assessment of the TUL current activities in this area. The vast majority of aspects were measured on a five-point ordinal scale.

The questionnaire also included **3 open questions**, which allowed to collect ideas for new activities and initiatives that could be implemented at TUL.
The open question also allowed to assess the knowledge of initiatives already implemented in the area of sustainable development in the academic community.

STUDY RESULTS

The study showed that the concepts for which both employees and students rate their knowledge the highest are **sustainability and carbon footprint**. On the other hand, the least known concept among both groups was agenda 2030.

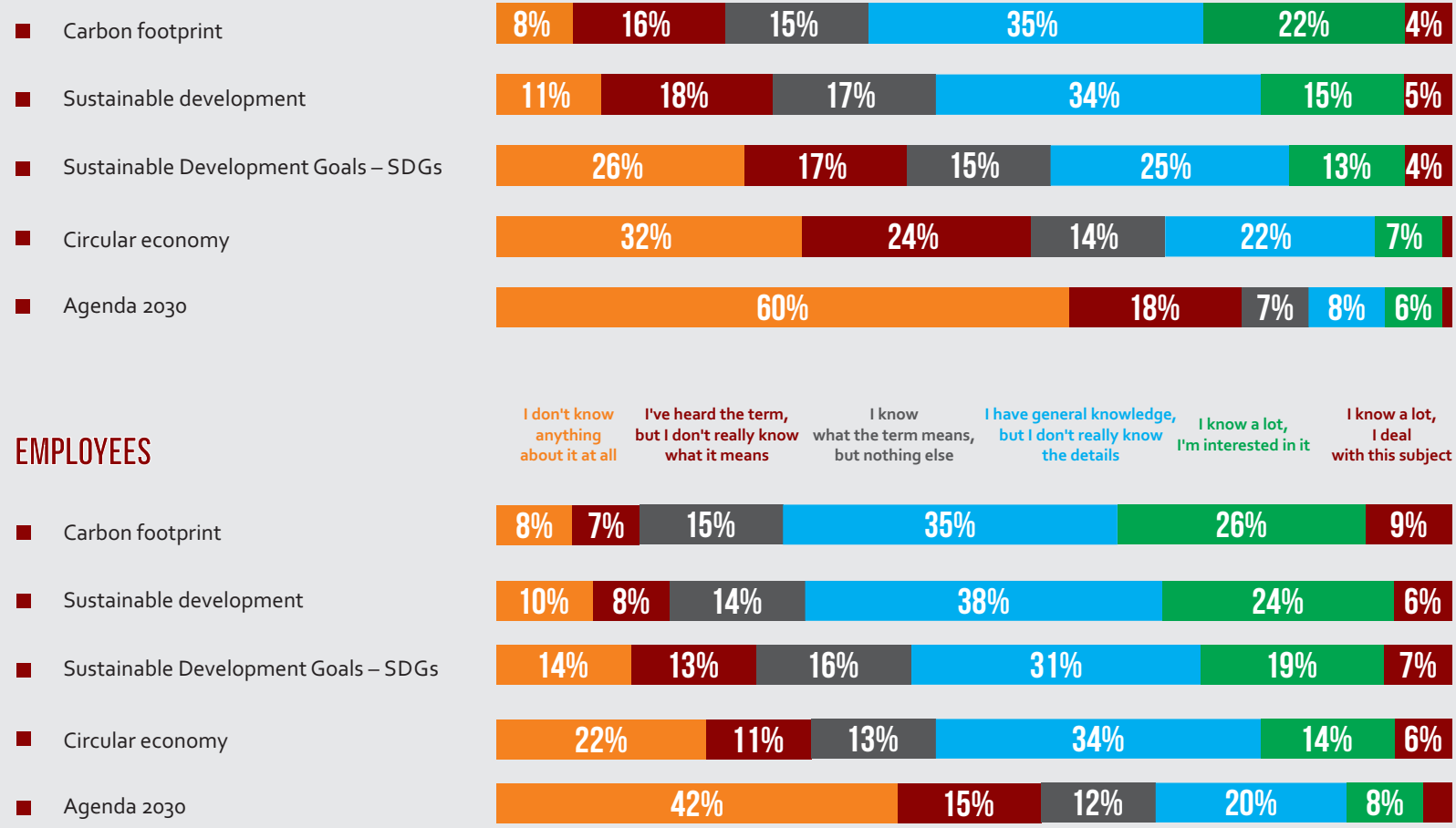


Diagram No. 2. Assessment of knowledge about concepts related to sustainable development among students and employees of Lodz University of Technology.

Have you seen this graphic before?

STUDENTS

28% YES	72% NO

EMPLOYEES

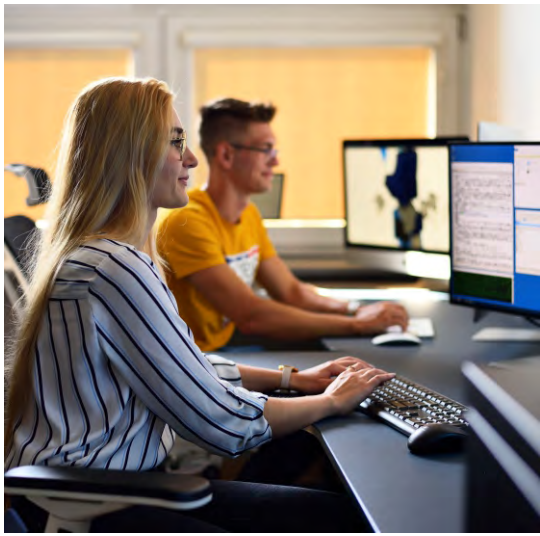
40% YES	60% NO

Diagram No. 3. Recognition of graphics promoting sustainable development goals.

By far the most popular source of information in both groups is the **Internet.**

The second place in the group of students was taken by information acquired during **classes** and **lectures,** while among employees as part of their **work.**

As many as **26%** of students and **20%** of employees do not know anything about the Sustainable Development Goals at all.



	STUDENTS	EMPLOYEES
from the Internet	49%	52%
at work / in classes / lectures (as part of study programs)	27%	31%
from TV	12%	15%
from other sources	11%	15%
from the research club / projects / initiatives implemented at the university	8%	—
from newspapers / printed magazines	7%	20%
from family/friends	6%	3%
from leaflets / brochures / posters	5%	5%
from the radio	3%	9%
I don't know anything about this topic at all	26%	20%
I don't remember / it's hard to say	11%	7%

Diagram No. 4. Sources of obtaining information on sustainable development.

Both students and employees assessed highly the need to **take urgent action in the implementation of SDGs in Poland**. Most of the objectives were rated above grade 4, on a scale of 1-5, where 1 meant "no action required" and 5 "urgent action needed". Employee ratings in this area were slightly higher than student ratings.

	STUDENTS	EMPLOYEES
Eradicating poverty	3,84	4,12
Eradicating famine, better nutrition and sustainable agriculture	4,25	4,24
Good health and quality of life	4,28	4,58
High quality education for all, lifelong learning	4,13	4,31
Gender equality	3,87	4,06
Clean water and good sanitation - sustainable management of water resources	4,5	4,64
Clean and accessible energy	4,3	4,56
Economic growth and decent work	4,22	4,24
Increased innovation and industrial development	3,96	4,17
Less inequalities, e.g. economic, social, ethnic, religious	3,68	3,89
Sustainable urban development (planned and informed)	3,92	4,07
Responsible consumption and production, i.e. not threatening the environment	4,29	4,44
Climate protection measures	4,38	4,52
Protecting life in oceans, seas, rivers and lakes	4,32	4,5
Conservation of nature on land, prevention of soil and forest degradation	4,38	4,52
War prevention, concern for strong democratic institutions and social justice	4,31	4,44
Cooperation between countries for common and equal development	4,06	4,21

Figure No. 5. The importance of achieving particular goals in Poland as assessed by students and employees (average score on a scale of 1-5, where 1 - not at all important, does not require action in the near future, and 5 - very important, requires urgent action).

Students considered **Goal 6 relating to the sustainable management of water resources** to be the most urgent to implement in Poland, followed by goals directly related to environmental issues, i.e. **climate protection, nature protection on land, as well as life in oceans, seas, rivers and lakes**. A relatively high ranking of 5th, in the students' opinion, was **Goal 16 on peace, justice and strong institutions**.

The least urgent, compared to all the goals, is, according to the students, Goal 10, relating to the prevention of economic, social, ethical and religious inequalities.

Employees, like students, considered Goal 6, relating to the sustainable management of water resources, to be the most urgent to implement in Poland. This was followed by objectives that take into account both environmental issues and quality of life, i.e. Goal 3 good health and quality of life, Goal 7 clean and accessible energy, nature conservation on land and Goal 13 climate protection measures and Goal 15 nature conservation on land. As in the group of students, Goal 10, relating to the prevention of economic, social, ethical and religious inequalities, was considered the least urgent in relation to all the goals.

STUDENTS AND EMPLOYEES CONSIDERED GOAL 6 RELATING TO THE SUSTAINABLE MANAGEMENT OF WATER RESOURCES TO BE THE MOST URGENT TO IMPLEMENT IN POLAND.

	STUDENTS	EMPLOYEES
Eradicating poverty	1,79	1,71
Eradicating famine, better nutrition and sustainable agriculture	2,13	1,94
Good health and quality of life	3,23	3,04
High quality education for all, lifelong learning	2,79	3,72
Gender equality	3,14	2,91
Clean water and good sanitation - sustainable management of water resources	2,57	2,54
Clean and accessible energy	2,27	2,54
Economic growth and decent work	2,46	2,29
Increased innovation and industrial development	2,66	2,82
Less inequalities, e.g. economic, social, ethnic, religious	2,64	2,15
Sustainable urban development (planned and informed)	2,05	1,95
Responsible consumption and production, i.e. not threatening the environment	3,48	3,28
Climate protection measures	3,51	3,15
Protecting life in oceans, seas, rivers and lakes	2,83	2,45
Conservation of nature on land, prevention of soil and forest degradation	3,03	2,65
War prevention, concern for strong democratic institutions and social justice	1,90	2,06
Cooperation between countries for common and equal development	1,70	1,96

Figure No. 6. The possibility to impact individual goals in the assessment of students and staff. (average score on a scale of 1-5; where 1-no possibility of impact and 5-possibility of significant impact)

Another important issue that respondents were asked about was the assessment of their personal impact on individual SDGs. The study showed that while we rate the importance of achieving individual goals very highly, our personal impact on these goals is much lower. In this case, in both groups of respondents, most of the goals were rated below the average grade 3, on a scale of 1–5, where: 1 meant 'no possibility of impact' and 5 'possibility of significant impact'.

It also occurred that in this case, the students rated the possibilities of their impact on most of the goals slightly higher.

The exception was Goal 4, which refers to quality education, where the staff rating was significantly higher than that of students, employees rated their impact slightly higher than students for the objectives: 9, 7, 16 and 17.

Students rated the possibility of them impacting Goal 13 – climate protection actions and Goal 12, which relates to responsible production and consumption, the highest, while the lowest was the possibility of influencing cooperation between countries for common and balanced development.

Staff rated the possibility to influence Goal 4 on the quality of education the highest, and the lowest on Goal 1 – the eradication of poverty.

Figure 7 shows the goals that students and staff believe require the most urgent action. It is worth noting that SDG 13 for climate action was rated highly in both groups in terms of both its relevance and its potential to influence its implementation (Figure 6).

The analysis of figures 5 and 6 allows us to conclude that Goal 6 relating to the sustainable management of water resources, which according to both groups requires the most urgent actions in Poland, at the same time has not been highly assessed in terms of the possibility of influencing its implementation.

STUDENTS

Clean water and good sanitation - sustainable management of water resources	4,5
Climate protection measures	4,38
Conservation of nature on land, prevention of soil and forest degradation	4,38
Protecting life in oceans, seas, rivers and lakes	4,32
War prevention, concern for strong democratic institutions and social justice	4,31
Clean and accessible energy	4,3

EMPLOYEES

Clean water and good sanitation - sustainable management of water resources	4,64
Good health and quality of life	4,58
Clean and accessible energy	4,56
Climate protection measures	4,52
Conservation of nature on land, prevention of soil and forest degradation	4,52
Protecting life in oceans, seas, rivers and lakes	4,5

Figure No. 7. Goals requiring the most urgent actions in the opinion of employees and students of Lodz University of Technology (average score on a scale of 1-5, where 1 - not at all important, not requiring action in the near future, and 5 - very important, requiring urgent action).

	STUDENTS	EMPLOYEES
few people around me know the SDGs and put them into practice, so it is difficult for me to recognize the discussion and activities in this area	3,78	3,61
without financial support, such activities are not possible	3,47	3,47
I don't have enough knowledge to be able to take any specific action	3,12	2,67
even if I think specific action needs to be taken, most people around me don't share that opinion	3,00	2,90
my actions cannot significantly improve the situation anyway	3,00	2,70
there is too much action/information and it is therefore difficult for me to understand what actions I could take	2,73	2,59

Figure No. 8. Barriers to the implementation of SDGs in the opinion of students and employees (average grade on a scale of 1-5, where 1- insignificant barriers, 5 - serious barriers).

An important objective of the study was also to assess the barriers to the implementation of the Sustainable Development Goals. In the opinion of both groups of respondents, the biggest barriers are related to the lack of knowledge and actions taken by people from the immediate environment. The second place was to do with the barriers related to the lack of financial support.

Comparing the ratings of both surveyed groups of respondents, it can be concluded that students rated significantly individual barriers slightly higher. This difference is particularly evident in the absence of sufficient knowledge to be able to take any concrete action and in the absence of faith that one's own actions can significantly improve the situation.

We also asked respondents to assess their own activity in the area of achieving the Sustainable Development Goals. The results of the study showed that employees rate their activity higher than students. **16% of students** and **7% of employees** declared that they did not have any activity in this area.

The overall activity of the university for sustainable development is assessed by the academic community at the intermediate level, with students slightly higher than the staff (the average grade of students is 3.18; and the staff is 2.92).

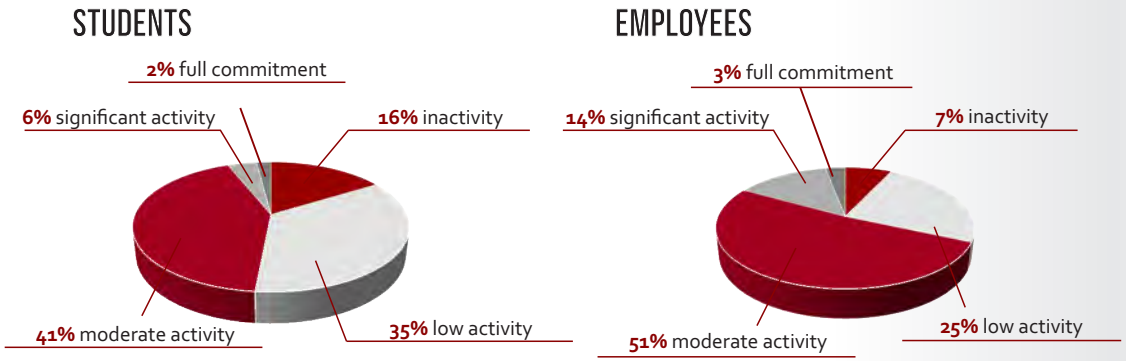


Figure No. 9. Assessment of own activity in a group of employees and students.

An extremely important objective of the study was also to assess the reception of the university's current activity in taking action to achieve the sustainable development goals by the academic community. The results of the survey showed that students rate the university activity in almost all areas higher than employees. The only exception was the assessment of the activity in the implementation of research projects for sustainable development, which the employees rated slightly higher.

	STUDENTS	EMPLOYEES
general assessment of the activity of the institution	3,18	2,92
study / work conditions	3,52	3,07
green campus	3,46	3,33
implementation of research projects related to these goals	3,40	3,48
waste reduction	3,12	2,81
creation and commercialization of technologies / products / services corresponding to these objectives	3,10	2,98
conducting educational activities / projects, popularization of knowledge in this area	3,00	2,64
energy saving	2,91	2,59
sustainable public procurement (taking into account ecological and social criteria when purchasing at universities)	2,87	2,43
encouraging workers and society to work towards these goals	2,83	2,4
reduced paper consumption	2,72	2,47

Figure No. 10. Comparison of the assessment of the university activity in taking action to implement the Sustainable Development Goals in the group of students and employees (average grade on a scale of 1-5, where 1-actions are not taken at all, and 5-actions are taken to a very high degree).

Students rated **study conditions** (3.46), **green campus initiatives** (3.46) and **sustainable research project activities** the highest (3.40).

These activities also ranked in the top three for employees with the highest rating for **completing research projects**, followed by **green campus initiatives**, and **working conditions** as the last one.

The lowest, although in different order in both groups, were assessed activities in the area of: green public procurement, activities encouraging employees and society to take action for the SDGs and reducing paper consumption.

In case of this question, it is also important to analyse the answer "**I cannot assess a given activity**". The percentage of this type of response was significantly higher for the student group and related to activities such as green procurement, waste reduction, implementation of sustainable research projects, and energy conservation.

Over **40%** of respondents could not assess this type of activity undertaken at the university.

The relatively high percentage of respondents in both groups were also unable to assess the activities in the field of creation and commercialization of technologies/services/products corresponding to the SDGs. So it seems that much better communication is needed in this area.

	STUDENTS	EMPLOYEES
general assessment of the activity of the institution	25%	25%
study / work conditions	14%	15%
green campus	34%	29%
implementation of research projects related to these goals	42%	41%
waste reduction	44%	28%
creation and commercialization of technologies / products / services corresponding to these goals	38%	41%
conducting educational activities / projects, popularization of knowledge in this area	21%	26%
energy saving	41%	19%
sustainable public procurement (taking into account ecological and social criteria when purchasing at universities)	56%	44%
encouraging workers and society to work towards these goals	29%	25%
reduced paper consumption	34%	17%
working conditions	14%	–

Figure No. 11. The percentage of respondents who are unable to assess particular types of activities undertaken at the university.

Respondents were also asked if they would like to get involved in initiatives related to the implementation of the SDGs. The vast majority of the academic community has expressed a desire to do so.

For employees, **nearly 70%** of respondents answered definitely and rather yes; for students, the percentage was slightly lower at just **under 60%**.

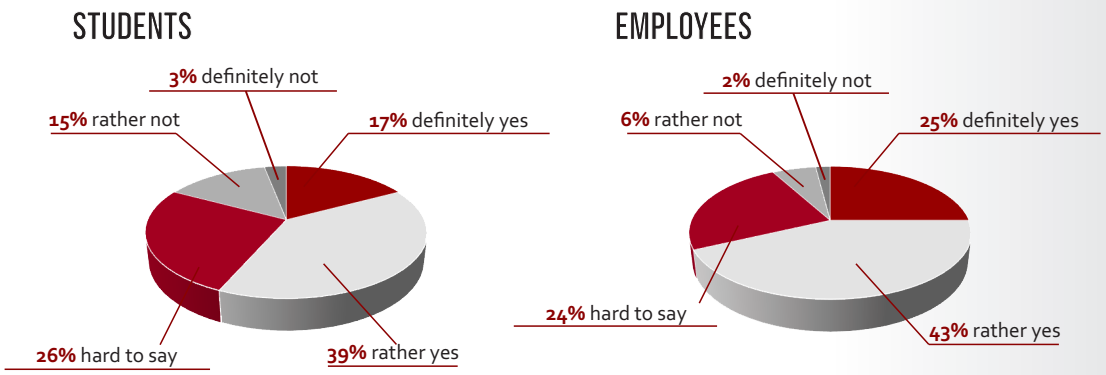


Figure No. 12. Willingness to engage in initiatives to address the Sustainable Development Goals.

Employees were also asked whether they incorporate sustainability issues (SDGs, circular economy, carbon footprint, etc.) into their classes.

Over **40%** of the surveyed employees include the subject of sustainable development in their classes, **10%** on the basis of the syllabus, and **31%** refer to this topic despite the lack of such issues in the syllabus. Only **2%** do not introduce this type of issue because they do not see the need. **34%** believe that this is not possible because their courses are not related to these issues.

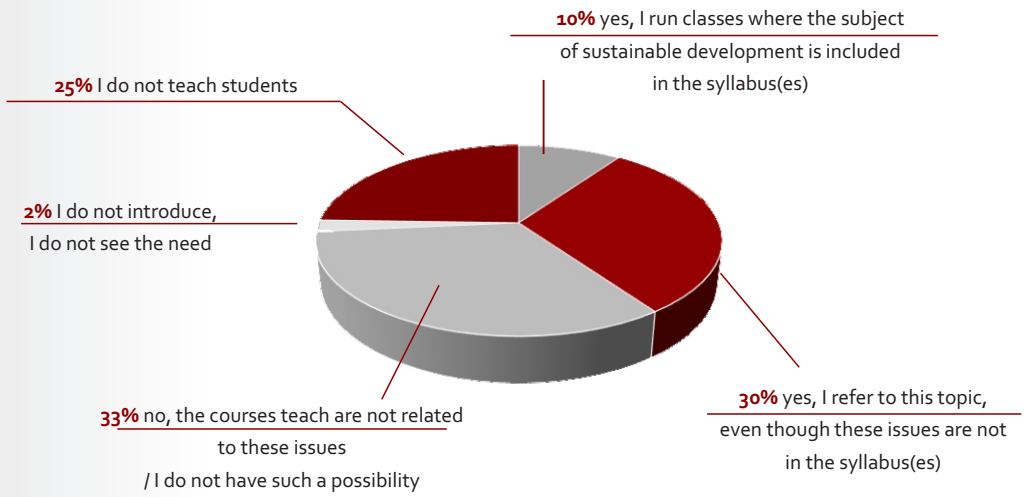


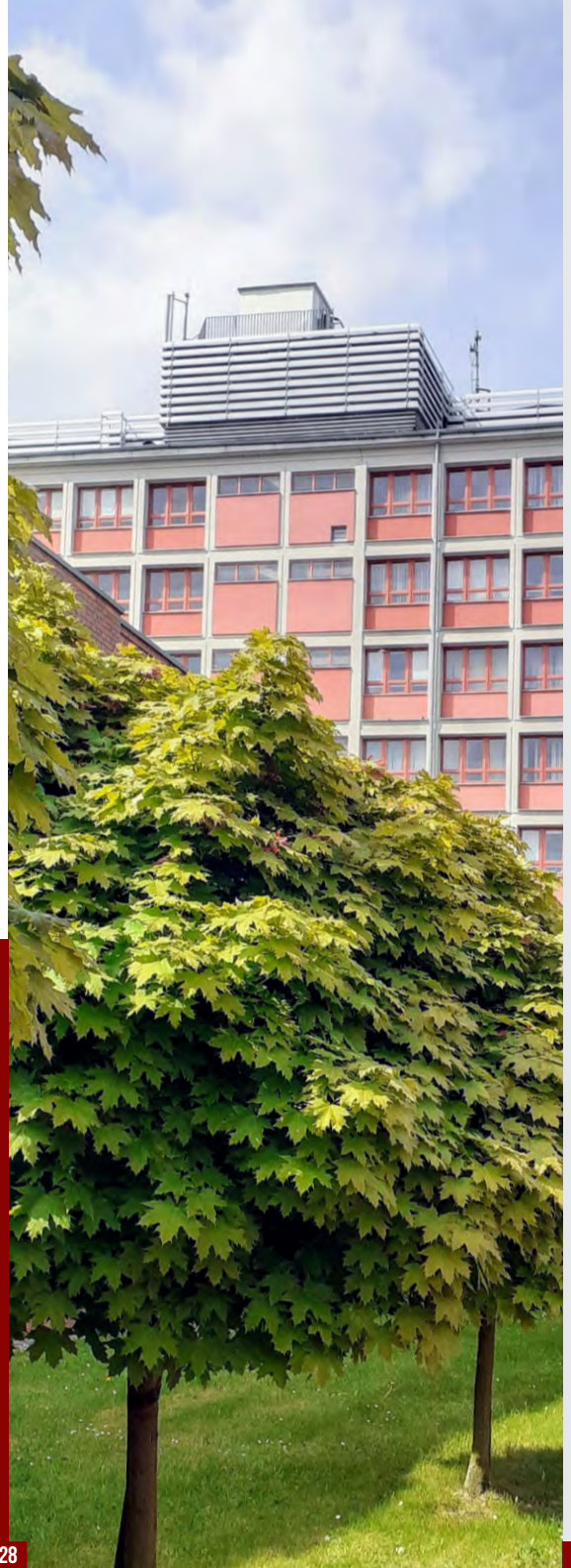
Figure No. 13. The presence of sustainability issues (SDGs, circular economy, carbon footprint, etc.) in classes run by employees.

An extremely important objective of the study was to **learn about the expectations of employees and students in the implementation of initiatives** related to the Sustainable Development Goals. In this case, the respondents had the opportunity to freely answer the open question and showed great activity in this area.

In the group of students, **297 open** responses and an additional **78 supplementary comments were obtained**.

In the group of employees, **277 employees** shared their observations on the expectations of the university and additionally **71 supplementary comments were obtained**.

THE SUBMITTED PROPOSALS FOR CHANGES WILL BECOME THE BASIS FOR PLANNING SPECIFIC ACTIONS IN THE COMING YEARS.



Most of the proposals for our university's involvement in the implementation of SDGs were submitted by students in the area of **green campus, education** and **promotional activities**. The proposals submitted by students and employees will be used in the further work of the Sustainable Development Team and will become the basis for planning specific actions in the coming years.

115 proposals in the area of "green campus" concerned mainly*:

- clean energy sources / reduced consumption (37),
- rational waste management (21),
- reduced bureaucracy, electronic circulation of documents (15),
- water and clean water savings (13),
- green areas around the university (11),
- catering/green food infrastructure (8),
- green transport/needs of cyclists (4),
- other / general (4),
- water dispensers (2).

96 proposals in the area of "education" mainly concerned*:

- education on sustainable development (in an interesting way) (45),
- quality of education in general (26),
- quality of education – practical aspects, better work, development of innovation, industry (8),
- quality of education – modern curricula (5),
- quality of education: quality, not quantity (4),
- other (8).

75 proposals in the area of "promotional activities" concerned mainly:

- promotional and awareness-raising activities (60),
- recommendations of concrete actions (15).

49 proposals in the area of "tackling inequalities/discrimination/stereotypes", mainly concerned:

- reducing inequalities (economic, social) and increasing tolerance (32),
- gender equality (17).

27 proposals in the area of "research - innovative technologies".

27 proposals in the area of "support in different areas".

21 proposals in the area of "cooperation / partnership".

* the number of entries for a given topic is given in parentheses.

CONCLUSIONS:

Knowledge of SDGs

- Despite the implementation of many initiatives and activities at TUL that fit into the sustainable development goals, the vast majority of the academic community have not previously encountered the graphics promoting these goals, and the concept of the 2030 Agenda.
- There is a clear need to raise awareness of the academic community in this area and to strengthen the communication of implemented activities.

Importance of implementation and the possibility of influencing individual SDGs

- The importance of achieving individual goals was assessed much higher than the possibility of personal influence on these goals.
- It seems crucial, therefore, to increase the belief of employees and students in the possibility of making real changes through the action they are currently implementing and thus motivate them to continue being active.

Barriers to the implementation of the SDGs

- The biggest barriers are related to the lack of knowledge and actions taken by people from the immediate environment and those related to the lack of financial support.

Assessment of sustainability activities

- A large percentage of declarations of the inability to assess many aspects of the university activity in the area of sustainable development clearly indicates the need for wider communication in this area.

Willingness to engage in initiatives related to the implementation of SDGs

- However, it is extremely positive that the vast majority of the academic community have expressed a willingness to engage in initiatives related to the implementation of SDGs.
- It is also encouraging to see the declaration of over 40% of the employees participating in the survey that they are already incorporating sustainability issues (SDGs, circular economy, carbon footprint, etc.) into their classes.

THE VAST MAJORITY OF THE ACADEMIC COMMUNITY EXPRESSED THEIR WILLINGNESS TO ENGAGE IN INITIATIVES RELATED TO THE IMPLEMENTATION OF THE SDGS.

GOAL 1

END POVERTY IN ALL ITS FORMS EVERYWHERE

1 NO POVERTY

NOBLE GIFT

Both students and employees of Lodz University of Technology have been actively involved in the Noble Gift campaign over the past few years, which brings together donors and poor families for whom dedicated aid is prepared.
The students and the staff of the Public Secondary School of Lodz University of Technology also participated in the project. Thanks to this initiative, help can reach out to those in need who are too helpless and alone to cope with their situation. Noble Gift also often helps to fulfil the dreams of children from poor families, often socially excluded by the lack of equipment such as a tablet or a computer.

CHARITY PARKRUN FOR CHILDREN FROM AN ORPHANAGE

Charity events in which Lodz University of Technology employees take part are undertaken as part of work-life balance, and often have a completely private dimension. An example of such a project is the Parkrun birthday run in Poniatowski Park in Lodz, which was initiated by an employee of the Faculty of Mechanical Engineering at TUL. In lieu of the customary gifts, the "birthday girl" asked for stationery and groceries to be collected for the wards of Orphanage No. 13.
Over 60 kilos of donations were collected.

STUDENT VOLUNTEERING

Since 2015 Polish Association of Civil Engineers and Technicians - Lodz Chapter has been implementing the Workcamp project every year. Young volunteers from Lodz University of Technology acquire sponsors, tools and materials in order to devote their time during the holidays and renovate the facility which needs such activities the most. Thanks to the initiative, in previous years wards of four orphanages in Lodz have gained new and better living conditions, the building intended for the Support Centre for Children and Families has been renovated, as well as the dilapidated building of the former secondary school.

Icons describing activities under each goal:

- didactics,
- processes,
- social commitment,
- research.

HELPING PEOPLE IN CRISIS OF HOMELESSNESS

Lodz University of Technology employees participate in numerous activities related to helping people in the crisis of homelessness, who are the group most threatened and affected by economic poverty.
An example of actions for the benefit of these people is the active cooperation of the Office for Persons with Disabilities of TUL with a streetworker (and, at the same time, an addiction therapist), through whom clothes and hygiene products are provided to homeless people. Individual units of Lodz University of Technology have also joined the "Homeless Box" project, which aims to help people without a home to leave homelessness and to help them with basic needs on their way to life stabilisation. Support goes directly to the person in need and meets their real needs.

WORKSHOPS FOR CHILDREN FROM DAY CARE CENTRES AND FOSTER FAMILIES

The staff of the Office for People with Disabilities at TUL actively participated in workshops organized by day-care centres for children from families who find themselves in difficult financial and living conditions. Employees of the Faculty of Biotechnology and Food Sciences held an open-air workshop entitled "Tent of Joyful Science" during the Foster Families Day picnic. A microbiological workshop for children from foster families was also prepared during the event, which took place on the TUL campus. Over time, these individual events have developed into a series of microbiological workshops and open-air meetings called "Science is fun", co-financed by the TUL Foundation and intended for children from foster families and orphanages.

SCIENCE SHOWS IN ORPHANAGES

Members of the Student Research Circle "NANO" conducted scientific demonstrations in orphanages number 13 and 17 in Lodz. Appropriately prepared experiments and scientific anecdotes helped to introduce the children to the world of chemistry. Thus began the idea of a "Circle for children", which will be implemented in subsequent years by NANO.

ST. NICHOLAS PARTY FOR NEEDY FAMILIES

Employees of the Faculty of Technical Physics, Information Technology and Applied Mathematics have been organizing the event "St. Nicholas Day".
It is an event aimed at helping a family in need who, thanks to the support, have the chance to improve their difficult situation and spend a happy Christmas. An online fundraiser is organized to help the selected family and the funds are used, for example, to purchase a laptop for remote learning. Food, cleaning products and school supplies for children are also collected. Every donated product is a significant support to a family in need.

FINANCIAL AID FOR STUDENTS AND STAFF

Employees of TUL can benefit from various forms of financial assistance thanks to the Social Benefits Fund.
In 2020. 2,605 children of the employees of TUL benefited from subsidised self-organised holidays during the winter and summer holidays, 102 employees received monthly benefits - subsidy to pay the fees for children's stay in nurseries and kindergartens.
Nine people benefited from loans for obtaining their first independent flat or for improving their housing conditions. Loans for the renovation and modernisation of flats, granted on favourable conditions, were in great demand. They were received by 126 people. Non-repayable financial aid was provided to 280 people. Students and participants of doctoral studies at TUL are also eligible to apply for benefits. In 2020. 718 students received maintenance grants and 510 students received an increase in their maintenance grant for living in a hall of residence or other accommodation. 891 students were granted the Rector's scholarship, 127 students were granted a scholarship for the disabled and 212 students were granted financial aid.

GOAL 2

END HUNGER, ACHIEVE FOOD SECURITY AND IMPROVED NUTRITION AND PROMOTE SUSTAINABLE AGRICULTURE

2 ZERO HUNGER

NEW GENERATION FRUIT AND VEGETABLE PRESERVES

The overweight problem and obesity of children are becoming more and more relevant and noticeable. The Institute of Fermentation Technology and Microbiology at TUL conducts research on the impact of modern generation of food products on this group of recipients, and in particular on the possibility of eliminating metabolic complications caused by excessive body weight. These products are unsweetened fruit and vegetable preserves, enriched with a fibre preparation with prebiotic properties, additionally acceptable by children and adolescents organoleptic characteristics and adequate storage stability.

SUSTAINABLE DEVELOPMENT OF THE FOOD ECONOMY

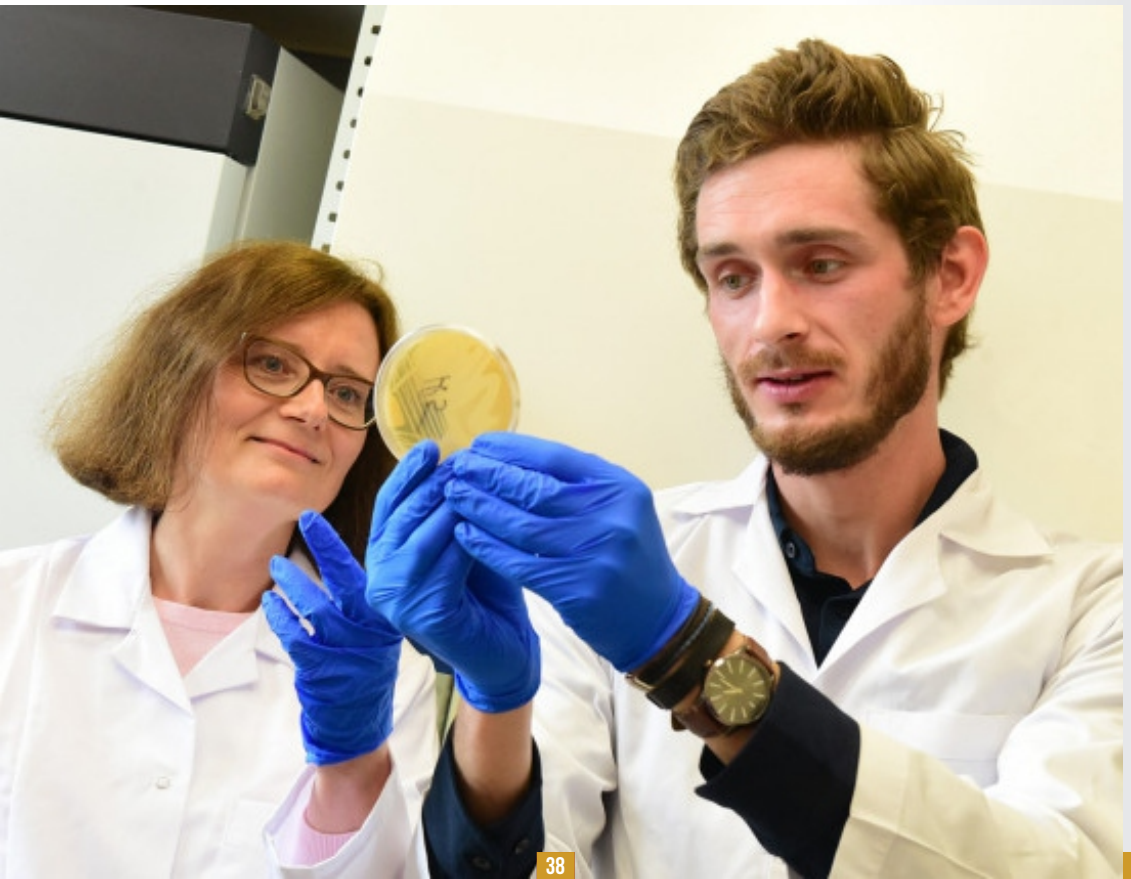
The aim of the subject pursued in the field of food technology and human nutrition is to familiarize students with issues related to the sustainable development of the food economy in the sectors of the food industry, agriculture and biodiversity. The acquired knowledge raises the awareness of the future management of production plants and enables them to act in accordance with the assumptions of the 2030 Agenda. With the skills gained, students are able to develop safer, green and competitive products and services in the agricultural and food industry sectors.

INNOVATIVE KOMBUCHA PRODUCTION TECHNOLOGY

Kombucha is a fermented tea drink with a number of health-promoting properties. Scientists from the Institute of Fermentation Technology and Microbiology at TUL are working on the project: "Development and implementation of innovative kombucha production technology".

In the production of kombucha, tested and selected strains of acetic acid bacteria, lactic acid bacteria and yeast, selected plant extracts with a high concentration of bioactive compounds and infusions of selected tea mixtures, obtained in cold and hot extraction, will be used.
This method of production will allow for creating a product with new sensory features and increased pro-health effects.

Prof. Edyta Kordialik-Bogacka and Dr Eng. Hubert Antolak, with selected plant extract



WORLD HUNGER

Students from the Faculty of Management and Production Engineering, as part of their specialisation project laboratory, carried out an activity involving the creation of a graphic message relating to the topic "Hunger in the world - some people go hungry, others throw food away: how to provide food for everyone". The target audience was school children. Students had to identify the needs of representatives of this group and determine the methods of constructing the message adequate to these needs and the level of perception. The aim of the project was to make young people reflect on the problem of hunger in the world and stimulate their curiosity in identifying threats resulting from the devastation of ecosystems. The implementation of the project also contributed to deepening students' knowledge and increasing their involvement in promoting knowledge about hunger.

ECOLOGICAL BEE PROTECTION PRODUCT

For several years, an intensification of the phenomenon of the so-called mass extinction syndrome of the honeybee has been observed. The main cause is bee diseases caused by various types of micro-organisms, as well as pesticides used on a massive scale. The reduction of the population of these insects has a very negative impact on agricultural production and natural ecosystems. To prevent this, the project carried out by scientists from the Department of Environmental Biotechnology at TUL envisages the production of an ecological preparation containing strains of lactic bacteria with pro-health potential for bees. The project is funded by the WFOŚiGW in Lodz.

FOOD AND NUTRITION MANAGER

Lodz University of Technology has launched a new field of study Food and Nutrition Manager. Engineering studies are conducted at the Faculty of Biotechnology and Food Sciences in a full-time mode. Students of this major gain knowledge in the field of food and nutrition technology, management and marketing, also in the context of sustainable development. After completing their training, they will be able to manage the service of catering companies in the hotel, catering or agritourism industry.

3 GOOD HEALTH AND WELL-BEING

GOAL 3

ENSURE HEALTHY LIVES AND PROMOTE WELL-BEING FOR ALL AT ALL AGES

USE OF CRUSTACEAN SHELL IMPLANTS IN PERIPHERAL NERVE REGENERATION

Repairing damaged peripheral nerves is one of the most difficult problems in medicine. Recent studies have shown that these nerves have the intrinsic capacity to regenerate. Unfortunately, they are inhibited by the unfavourable biological environment at the site of damage. A promising technique for the regeneration of peripheral nerve damage is the use of chitosan-based implants.

Chitosan is a natural polymer produced by organisms in quantities exceeding 10 tonnes per year. The natural origin of chitosan means that it has beneficial biological properties for biomedical applications. A new method for manufacturing chitosan implants to regenerate damaged peripheral nerves has recently been developed at the Faculty of Process and Environmental Engineering. Studies have shown that chitosan implants show adequate biocompatibility and bioactivity. The use of chitosan implants may contribute to progress in the regeneration of damaged nervous tissue, i.e. a recovery of lost functions which is rapid and as complete as possible.

The new method of their production makes it possible to obtain a product with more favourable properties than the materials used so far, which should increase the effectiveness of the therapy, limit its side effects and reduce treatment costs (by reducing the costs of casing production and hospitalisation time).

PSYCHOLOGICAL SUPPORT FOR THE TUL COMMUNITY

Since 2007, Lodz University of Technology has had an Academic Help Centre, which cooperates with an addiction therapist, a coach and a psychologist, providing specialist educational and psycho-prophylactic support. This is an initiative implemented by the Disability Office, which offers free individual psychological consultations for TUL students, PhD students, graduates and employees.

The Centre offers development-oriented sessions, psychological short-term support and assistance in emergency situations. Meetings with the psychologist take place at the Disability Office or online. Approximately 20 consultations per week took place between 2020 and 2021 as part of this initiative. During this period, additional support was put in place for people struggling to adapt to a new and difficult situation caused by the coronavirus pandemic.

NEW PROTECTIVE CLOTHING FOR PREMATURE INFANTS

The skin of a premature infant is characterised by low cohesiveness between the dermis and the epidermis, which causes the processes of heat and water loss through the skin to be much faster than in infants with a developed epidermal layer. As a response to this problem, employees of the Institute of Material Science of Textile and Polymer Composites have developed a technology of protective clothing that ensures the physiological comfort and safety of a premature baby. Newly developed clothing products for premature babies reduce water loss through evaporation and at the same time provide thermal comfort. The developed material structures ensure the transport of mass and moisture, which maintains the thermal balance ensuring the safety of premature babies. The work takes into account the variable raw material composition and structure of a multilayer textile product in correlation with the general condition of the premature baby.
It is expected that the introduction of further improvements and innovations in the technology of clothing products for premature babies, whose primary function will be the protection of health and life, will positively influence the improvement of conditions in Neonatology Wards. This will reduce the number of children under-going long-term treatment as well as the number of adverse events due to hypo-thermia or excessive water loss. It will also improve the psychological comfort of parents of premature babies who will be given clothes instead of polythene plastic bags.

DRESSINGS FOR CIVIL AND UNIFORMED SERVICES

There are no universal dressings on the market for use by civilian and uniformed services to help reduce mortality resulting from bleeding. In response to this problem, a consortium of Lodz University of Technology (the Faculty of Chemistry, the Faculty of Materials Technology and Textile Design), Bella Sp. z o.o., TRICOMED SA and the Military Institute of Hygiene and Epidemiology has developed a dressing kit comprising an absorbent dressing integrated with a bandage, a tampon for gunshot and stab wounds, a non-woven haemostatic gauze and a tactical stasis for heavy bleeding wounds. The innovative, complementary dressing kit for soldiers, uniformed services and medical professionals is versatile and easy to use. It minimises the time taken to dress wounds and, in the case of a tampon for gunshot or stab wounds, an absorbent dressing integrated with a bandage and a non-woven fabric, the haemostatic effect is significantly improved compared with products currently available on the market.
The dressing kit significantly reduces the time needed for medical staff to dress and also allows for safe medical evacuation. The main assumption of the proposed solution is to stop bleeding in 2-3 minutes. The developed universal dressing will be able to complement the individual medical package of the soldier. The project results respond to market needs, make the products competitive in relation to solutions offered so far by other companies and exhibit high innovative qualities.

READING COLOUR IMAGES BY MEANS OF SOUND

People with disabilities are often excluded from social life because their environment is not adapted to their perceptual or physical abilities. One of the most serious obstacles is lack of vision. Enabling such people to perceive reality enhances their comfort of living. Help came here from the scientists from the Faculty of Technical Physics, Computer Science and Applied Mathematics. Their proposed method of reading the colours of images by means of sound consists in digitizing the image and then mapping the colour space of the image onto the sound space. The result of this mapping is stored in the memory of a computer, whose input is connected to a motion sensor located above the image, and whose output is connected to a sound source, each sound of which is assigned a different value of the colour space. The image viewer is then told which sounds are assigned to which colours in the image. The image viewer stands in front of the image in the space where the sensor registers movement. The hand, in turn, is placed as a reading marker on the background of any area of the image and, after a message is sent from the sensor to the computer program about the position of the marker on the background of the image, a sound is emitted corresponding to the colour of the area of the image indicated by the viewer.

MAGNETIC RESONANCE IMAGING POSSIBLE IN CHILDREN

During a functional magnetic resonance imaging (fMRI) test, the patient is required to perform set activities for a specified period of time and at a certain rhythm (the excitations evoked in the brain by these activities are subject to analysis). Unfortunately, such an examination is difficult in the case of children who are unable to repeat the given movements with sufficient concentration. This causes them to be excluded from this type of diagnosis. Research has been carried out at the Faculty of Technical Physics, Computer Science and Applied Mathematics and it resulted in an interactive system to support the examination of children using functional magnetic resonance imaging (fMRI). The system is based on specially designed computer games that can be played by the patient inside the fMRI scanner, which allows for the execution of motor and visuomotor paradigms (appropriate stimulation as part of the designed game).
The system is implemented at the Polish Mother's Memorial Hospital. The use of interactive systems (in particular, computer games) to improve the way people perform tasks may not only be applicable to children.

The problem of exclusion caused by the inability to perform certain medical or developmental procedures is also faced among the elderly and disabled as well as in other application areas (e.g. rehabilitation).

SMART MEDICINE DISPENSER

An easy-to-use device helping patients to take their medication properly has been designed, in collaboration with physicians and caregivers, by a team of students from the Ubicomp Student Research Group and the Staff of the Institute of Applied Computer Science, with which the Research Group in question is affiliated. It also allows the patients, their caregivers and doctors to monitor compliance with treatment recommendations. This solution is especially dedicated to the elderly who often forget to take their pills.
The system alerts the patient to take the medicine using LEDs and a sound. The programmable dispenser utilises user-entered data, and a mobile app linked to the device allows caregivers to monitor treatment remotely. The modular architecture of the smart dispenser also allows storage of medication that are taken on an ad hoc basis. The administration of medicines is done through a website.

SPORTS PROGRAMME FOR PEOPLE WITH DISABILITIES

Sport is not only a way of achieving good health, but also a means of having a positive impact on the social situation of the participant. For people with varying degrees and types of disability, physical activity acquires particular value.
The sports facilities of the TUL Sports Centre are being constantly adapted to the needs of people with disabilities. The Sports Bay was designed and built as a disabled-friendly facility. The swimming pool is located on level 0, right at the entrance to the facility from the car park. Wheelchair users will not encounter any ramps or obstacles on their way to the ticket offices or to the pool.
A spacious, separate changing room is a place where visitors can easily prepare for swimming or other water activities.
The Sports Bay has joined the Lodz Barrier Free Card.
Its holders are offered entry to the swimming pool with a 40% discount.
A sports section for people with disabilities was created, i.e. the AZS Integration Sports Section, in the University Sports Association (AZS) of Lodz University of Technology. It aims to create suitable conditions to allow students with disabilities to increase their participation in various forms of sporting activities.

The impulse to create the section was the "AZS Integration Polish Championships", which were held for the first time in 2016. It is a series of sports competitions for people with disabilities conducted to promote sport in the academic environment. The project is aimed at students, doctoral students and employees from all over Poland who practise or want to practise amateur sport. The opportunity to compete in sport enables people with disabilities to join or return to an active life. The Championships include competitions in such disciplines as boccia, badminton, table tennis, swimming and shooting. In 2021, Lodz University of Technology was the organiser of the Polish Integration Championship in Weightlifting.

Medallists from Lodz University of Technology, Prof. Witold Pawlowski, Vice-Rector for Student Affairs, and coaches.

NOVEL BOTTLE-BRUSH COPOLYMERS AND OSTEOARTHRITIS

Osteoarthritis is a contemporary epidemiological challenge affecting more than 20% of the world's population and the leading cause of mobility impairment in society. There are no diagnostic methods to detect the condition in the early stages of the disease, which ultimately leads to surgical intervention and prosthetics. Research conducted in the Faculty of Chemistry is an answer to this problem. Their aim is to determine the relationship between the structure of articular cartilage and the degree of development of osteoarthritis, which will allow to understand the mechanism of degeneration of joint cartilage and the possibility of diagnosing the disease in its early stages. This will enable the design, synthesis and verification for applications in degenerative disease at different stages of disease progression of novel copolymers with bottle-brush topology. The obtained polymers will constitute model substances (analogues) of lubricin. The research program includes the development of a methodology for the determination of interactions of polymers with the surface of cartilage tissue and characterization of the properties of the obtained systems.

The project aims to develop a diagnostic method based on the analysis of Raman spectra of articular cartilage obtained with a specially designed probe. Ultimately, the planned therapy will allow to introduce a copolymer with the structure of the so-called polymer brush directly into the affected joint.

NOVEL TREATMENTS FOR ARACHNOPHOBIA

According to statistics, fear of spiders affects about 10% of the population. Members of the Ubicomp Student Research Group at the Faculty of Electrical, Electronic, Computer and Control Engineering have developed an unconventional way to combat this one of the most common phobias. Modern treatments for arachnophobia are mostly based on the use of virtual reality technology: simulated contact with a virtual spider has proven to be an effective way to overcome fear. However, doctors note that the lack of physical interaction causes problems in managing patients' reactions in face-to-face contact situations. The students' project addresses these demands by allowing remote contact with a living spider. The students proposed using the robotic arm in exercises with living animals in zoos.

The developed system consists of a robotic arm controlled by hand movements, placed inside a terrarium with spiders and the control interface: a flexible sleeve and glove, responsible for capturing the user's movements. This allows for quasi-direct interaction with the spider, and touch is simulated through a haptic response: vibration motors located in the glove mimic sensory experiences. Tests conducted in a simulated environment have shown the great potential of the solution in the therapeutic context, among others.

A SOUND MIND IN A SOUND BODY

Students and employees of Lodz University of Technology participate in many physical activities organised by the university. In autumn and spring, they can take part in bicycle rallies on routes of various length and difficulty. They are very popular with the academic community.

Every year, in late spring, there is also a running competition, namely the Rector's Cup Run. This sporting event has been taking place since the 1980s. Originally, only students competed in it, but now both students and staff of Lodz University of Technology take part in the Rector's Cup. Around 800 people take part in the event every year. During the last edition of the run, participants had to cover a distance of 2.5 km in Prince Józef Poniatowski Park, located near the university. TUL employees have also been taking part in the Lodz Business Run event for several years now. In 2021, the 10th anniversary edition of the run was held, in which 20 employees of Lodz University of Technology competed, representing various units and faculties. Funds from participants' contributions go towards helping people with mobility impairments.

VIBRATING WIRELESS COLLAR FOR THE VISUALLY IMPAIRED

A navigation system for blind and partially sighted people travelling on foot has been designed by students from the Ubicomp Student Research Group at the Institute of Applied Computer Science and the staff of the Institute. In cooperation with doctors and physiotherapists, they have developed a special collar that is used to provide information about the direction of movement and the necessary manoeuvres. The collar encodes geographical directions and simple manoeuvres into short vibratory pulses felt by the person wearing it around their neck. It is wirelessly controlled by a microcontroller and connects via Bluetooth to popular navigation devices such as Google Maps.

Most existing solutions are based on audio communication. An innovative approach to the problem is to use the sense of touch on the neck as a channel to transmit information about the suggested direction of movement. Thanks to this solution, a visually impaired person does not need to use their hearing (their key sense for perceiving the outside world) to move, but only feels gentle stimuli in the neck area. This is important for improving not only safety on the road, but also for the increased comfort and confidence of people with disabilities. Pulses are made by tiny vibration motors, at appropriate intervals or at moments requiring a manoeuvre. The collar is made of breathable sports fabric. Tiny vibration actuators can be placed wherever the user wishes.

ROBOT THERAPY PROJECT: SUPPORT FOR THERAPISTS OF AUTISTIC CHILDREN

The Robot Therapy project was implemented in collaboration between Lodz University of Technology, the Academy of Fine Arts and the Navicula Foundation. Its aim was to develop devices and programmes to support therapists working with profoundly disabled children, especially those with autism. A total of nine educational devices were created (e.g. SensorBox, Smart Sleeve, Blocks, sensory mat, soft Panda robot or interactive pillow) of various forms to support sensory therapy, as well as applications enabling the graphic programming of these devices. The programmability of the devices allows therapists to change the way they work in order to adapt them to the therapy of a specific child or to take into account the progress of that therapy. They can interact with different stimuli, of varying intensity, according to the therapeutic plan: this could be sound, light, temperature, vibration or movement. The prototypes of educational-therapeutic devices are to help in the therapy of sensory disorders of children with combined disability, i.e. autism and intellectual disability, under the care of the Navicula Centre in Lodz.

The patients of this centre have many sensory, communication, cognitive and social disorders and deficits. The devices designed as part of the project are intended to help children develop and overcome these disorders. Thanks to such interactive aids and toys, children learn to interact, learn appropriate behaviour and reactions when in contact with their environment. The project also aimed to explore how a robotic environment could reduce therapist burnout. The project focuses on helping the therapist or parent not only with the therapy itself, but also in relieving the therapist and making his or her work more pleasant as caring for children with profound disabilities is associated with a high risk of burnout. The therapeutic aids developed in the project and their entire programming environment are based on the actual needs of the therapists and are oriented towards the therapist-child relationship. More information.

GOAL 4

ENSURE INCLUSIVE AND EQUITABLE QUALITY EDUCATION AND PROMOTE LIFELONG LEARNING OPPORTUNITIES FOR ALL

4 QUALITY EDUCATION

MASTERS OF DIDACTICS AND MENTOR YOUR FUTURE

These projects aim to empower students and discover their talents, as well as encourage independence. Both programmes are connected with an innovative method of developing creativity, namely tutoring. The aim of the "Masters of Teaching" programme is to improve the competencies of academic staff in this area and to use the methods learned in their work with selected students.

"Mentor Your Future" is an initiative of the Student Government of Lodz University of Technology addressed to the most ambitious students.

The idea behind the Mentor Programme is for the mentor to work with the student to develop their own educational and career path, develop their potential, prepare them for the challenges ahead, and broaden their professional experience.

DESIGN THINKING

TUL was the first university in the region to establish a creative problem-solving lab - Design Thinking - in 2013. Currently, at each faculty, students are taught to create innovative projects, products and services based on a deep understanding of problems and user needs. Classes are conducted in modern, fully equipped classrooms that support development and teamwork.

LODZ ACADEMY OF PBL

For several years, Lodz University of Technology has been successfully implementing the problem-based learning model, creating attitudes of self-reliant knowledge seeking and development while supporting the improvement of teamwork and communication competencies.

As part of the Integrated University Programmes 3 project, a new educational model was developed, and implemented at the International Faculty of Engineering. This model introduces a three-module project block at engineering faculties, which gradually develops the skills of creative problem solving and at the same time shapes the character of a young explorer, promoting such values as inquisitiveness and persistence.

The new solutions are also used by students of the Polish-language faculties who can choose an interdisciplinary problem-based project as part of their elective courses.

TUL QUALIFICATIONS IN THE INTEGRATED QUALIFICATION REGISTER

As part of the Integrated Qualification System, Lodz University of Technology has developed over 100 descriptions of synthetic characteristics of full qualifications. Thanks to this, TUL disseminated information about its own teaching and research offer in the Integrated Qualification Register, which gathers in one place data on all qualifications awarded in the education and higher education system, as well as on qualifications acquired as part of non-formal and informal education in Poland. This activity is aimed at supporting the lifelong learning policy and building the personnel potential based on highly qualified employees.

CASE STUDY COMPETENCE TEST

Lodz University of Technology is the only university in Poland that confirms the quality of the awarded qualification, and thus the quality of the higher education diploma, in a comprehensive manner. In addition to the diploma examination, an original competency-based examination model was developed based on the case study methodology. This examination verifies the student's attainment of the aggregated key competencies defined for the programme of study. It consists in analysing descriptions of selected, specific events from the field/discipline of study along with all their complexities and difficulties. Training and organisational support for the implementation of this formula are offered by the Learning Centre - Teaching Support Section.

TUL AS LEAD PARTNER OF THE INFORMATICS CHAMPIONSHIP CENTRE

The aim of the project is to improve the competencies of persons conducting extracurricular classes which develop IT interests and to activate young people gifted in IT. The ICC project is a comprehensive concept of supporting Polish IT education aimed at educating gifted students with the involvement of the best technical universities in the country. Individual activities are intended to strengthen students' desire to develop their interest in algorithmics and programming. They also serve to popularise the idea of IT competitions and help to select teams capable of competing in IT competitions at the national and global level.

FRENCH ACADEMY OF YOUNG ENGINEERS

At the beginning of October 2017 IFE, in cooperation with the French Embassy in Poland and the international association Agence Universitaire de la Francophonie (AUF), opened a prestigious long-term project for young people from Lodz and the Lodz region called the French Academy of the Young Engineer (FAYE). The aim of the project is to promote the development of young people in the field of French technology and culture, as well as to show them the great opportunities that knowledge of the French language gives them in their future professional life.

For the first editions of the project, comprising a year-long cycle of classes, schools from Lodz voivodship have been invited, which for years have been promoting the French language and culture of France among their students. Adepts of the Academy not only learn French under the supervision of an experienced native speaker, but also participate in a series of workshops with representatives of French companies. Every year, students of the Academy create unique group projects, concerning social problems from the area of the city, region or the whole country.

Graduates of the French Academy of Young Engineers with Assoc. Prof. Eng W. Pawłowski, TUL Prof., Vice-Dean for Student Affairs.

TUL LIBRARY

Lodz University of Technology Library is the largest technical library in the region. Its activities are primarily focused on meeting the needs and expectations of the academic community of its home university. The Library also fulfils a public function by making its printed resources (books - 247,766 volumes, journals - 135,70 volumes) and electronic resources available to all those who are interested. The Library is also active in promoting culture and art aimed at the local community - art exhibitions in the Biblio-Art Gallery and author meetings in the Literary Vestibule.

CHILDREN'S UNIVERSITY OF LODZ

ŁUD was established in 2008 and successfully organises workshops and lectures for children and young people, which take place in the laboratories of TUL. They are mostly conducted by academics of the university, but lecturers and experts in various fields, from home and abroad, are also invited. The main programmes are: ŁUD for Seven-year-olds, ŁUD for children aged 8-12, ŁUD for Alumni - for young people aged 13-17, and Volunteer Junior. The Young Explorers' Pathways project was also implemented as part of the ŁUD initiatives. In 2020, 1,100 children aged 8-12 took part in the basic ŁUD programme. The ŁUD lends a mini science centre, the Minipheanomenta, whose creator is Prof. Lutz Fisser from Flensburg, to primary schools. ŁUD also participates as a partner in the project "PHERECLOS - Partnerships for pathways to Higher Education and science engagement in Regional Clusters of Open Schooling", which is coordinated by the Children's University of Vienna. The project involves collaboration between schools and academic centres with the aim of creating shared learning environments. The project will create six "Local Education Clusters" that will act as enablers of innovation in education, bringing together schools and other actors in the education system.

PUBLIC SECONDARY SCHOOL OF LODZ UNIVERSITY OF TECHNOLOGY PLOPŁ

There is a Public Secondary School of Lodz University of Technology. It was the first academic secondary school in Lodz. It is an important link in the cycle of training engineering staff for industry. The curriculum includes additional subjects of science (mathematics, physics, chemistry, biology, and computer science) and foreign languages (mainly English).

Classes in these subjects are conducted on an extended basis, partly by lecturers from the University in the University's laboratories. Thanks to the high demands placed on the teaching staff and students, in a very short time the Public Secondary School of Lodz University of Technology has become one of the best educational institutions in Poland.

Inauguration of the school year in the Public Secondary School of Lodz University of Technology

TUL UNIVERSITY OF THE THIRD AGE

UTW was established in 2006 as an integral organisational unit of the University, in response to the educational needs of seniors. The activities of the UTW are aimed at the psycho-physical and social activation of older people.

Classes take place in an academic year consisting of two semesters. Students participate in popular science lectures covering topics related to the achievements of science and technology, health promotion, or legal proceedings. In addition, they can develop their skills in the following sections: information technology, new technologies, foreign languages, visual arts, history, bridge, tourism, as well as enjoy various gymnastics classes and the swimming pool in the Sports Bay of Lodz University of Technology. In total, 476 hours of classes were conducted for 577 students in the 2020/21 academic year.

TRAINING PROGRAMMES

Lodz University of Technology successfully implements projects aimed at improving the competencies of both students and academic, managerial and administrative staff. In accordance with the needs of the economy, labour market and society. The Integrated University Programme includes workshops, courses, training, study visits, as well as internships in companies and summer and winter schools. Moreover, the project Didactics 2.0 was realised, which included training courses for teachers wishing to improve their competencies in modern didactics (PBL, DT, CT), e-learning, information management, and foreign languages. Selected training courses were also held in foreign units.

Lodz University of Technology awarded the title of "University in the cloud". In the picture: Rector of TUL, Prof. Krzysztof Jóźwik and education director of Microsoft Polska Cecylia Szymańska

EDUCATION IN THE ERA OF COVID-19

TUL very quickly and effectively implemented solutions related to the introduction of remote learning as a result of the SARS-CoV-2 outbreak, also due to the change in the university's IT policy and management in this area. In 2018, the University IT Centre of TUL was established, which, together with the E-Learning Centre, ensures, among other things, the implementation of basic network services for the academic environment of TUL (e.g. EDU-ROAM), offers a webinar platform and the WIKAMP e-learning platform, which enables the sharing of teaching materials and online testing. In the last year, the webinar system at the Lodz University of Technology has been expanded and improved (the number of web sessions and web auditoriums has increased fivefold).

A series of webinars and training workshops for teachers on the use of remote teaching tools, especially the newly developed Microsoft365 environment, has also been prepared. As early as in the winter semester 2020/2021, synchronous teaching and a number of other solutions concerning the verification of learning outcomes or the defence of diploma theses have been introduced. All information and legal acts related to the functioning of the university in the state of the pandemic are placed on a dedicated website.

In recognition of its investment in the development of digital skills and competencies of its students, lecturers and administrative staff, Lodz University of Technology was awarded the prestigious "University in the Microsoft Cloud" prize.

GOAL 5

ACHIEVE GENDER EQUALITY AND EMPOWER ALL WOMEN AND GIRLS

5 GENDER EQUALITY

GENDER EQUALITY AMONG PERSONNEL

A considerable part of scientific achievements of Lodz University of Technology is due to women who constitute 37% of employees in the research and teaching group, 35% in the research group, and 43% in the teaching group. Among all the employees of Lodz University of Technology, women account for 51%. In the management staff of the university, the deans of four of the nine faculties are women. The percentage of all women among deans and vice-deans is 55%. Women constitute 42% of heads of departments or institutes at Lodz University of Technology. The percentage of all women among all managerial functions at the university is 47%. Women account for 39% of the university's PhDs, 35% of employees holding post-doctorate degrees and 26% of professors employed at TUL.

GENDER EQUALITY PLAN

At TUL, a team for developing a Gender Equality Plan (GEP) has been established. The purpose of the team's work is to develop a university GEP. The Gender Equality Plan covers four areas:

- institutional infrastructure,
- gender balance in leadership and decision-making,
- gender equality in recruitment and career development,
- work-life balance.

GENDER EQUALITY AWARENESS TRAINING

"Counteracting discrimination and mobbing" is one of the training options implemented for employees of Lodz University of Technology as part of the project "Accessible Lodz University of Technology". The workshop aims to develop skills in identifying, preventing and responding to mobbing, harassment and discrimination in those responsible for managing the work of others.

These phenomena threaten the atmosphere and efficiency of work, disintegrate the team, lead to apathy as well as lack of initiative and activity on the part of employees. All employees should be sensitized to undesirable behaviours, i.e. behaviours that, when growing, may lead to phenomena such as mobbing.

51%

OF ALL EMPLOYEES OF TUL ARE WOMEN

INTERNATIONAL DAY OF WOMEN AND GIRLS IN SCIENCE

Lodz University of Technology promotes the International Day of Women and Girls in Science, which falls on February 11. As part of promotional activities, the university participates in projects and activities that influence changes in women's careers. Meetings are organized during which the important role of women in science is emphasized and initiatives are implemented to encourage female students to take an interest in research careers.

GIRLS AS ENGINEERS

The campaign called "Girls as engineers! Girls go science!" is the largest project promoting technical, engineering and science majors among young women in Poland and Central-Eastern Europe. The initiative, launched by the Conference of Rectors of Polish Technical Universities and the Perspektywy Educational Foundation, aims at breaking stereotypes and encouraging girls to take up technical studies. Lodz University of Technology has actively participated in the campaign for 15 years.

PERSPEKTYWY WOMEN IN TECH

Together with the Perspektywy Educational Foundation, we carry out activities from the "Women in Tech" series. So far, the activities have included the international conference "Women in Tech Summit" – the largest event for women in this part of the world, "Women in Tech Camp" – for female students, doctoral candidates and IT graduates, as well as mentoring programs.

PERSPEKTYWY WOMEN IN TECH SUMMIT

THE STATUTE OF LODZ UNIVERSITY OF TECHNOLOGY

Resolution No. 88/2019 of the Senate of Lodz University of Technology of 10 July 2019 specifies respect for equality in the provision: Lodz University of Technology takes initiatives supporting the development of science, economy and culture, shaping the new face of Lodz and the country. Lodz University of Technology is a common good of employees, students and doctoral students, and is guided by the principles of respect for their dignity and rights. It also respects the equality of their rights and obligations in accordance with the Constitution of the Republic of Poland.

GOOD PRACTICES IN ORGANIZING COMPETITIONS FOR ACADEMIC STAFF POSITIONS AT TUL

The code of "Good practices in organizing competitions for academic staff positions at Lodz University of Technology" regulates the issues of open, transparent and merit-based recruitment. This document constitutes the implementation of the HR Strategy for Scientists developed at Lodz University of Technology as part of its application for the HR Excellence in Research. Good practices presented in the Code also refer to the provisions of the "European Charter for Researchers" and the "Code of conduct for the recruitment of researchers". The Charter sets out the rights and obligations of researchers and institutions employing them, while the Code sets out the principles for the recruitment of researchers which should be observed by employers.

REGULATIONS OF THE INTERNAL ANTI-DISCRIMINATORY POLICY

The document was introduced by Regulation No. 50/2019 of the Rector of Lodz University of Technology of 23 September 2019, on the introduction of regulations on anti-discrimination practices at Lodz University of Technology. It covers the issues of equality in the drafting of job advertisements, recruitment, establishment and termination of employment, conditions of employment, promotion, access to training, etc. It states that any form of discrimination, including harassment and sexual harassment, is unacceptable. It points out that the Commission is to recruit in a fair manner and apply transparent rules for selecting candidates. It also regulates the rights to equal pay for equal work of equal quality. The regulations are available on the university website.

THE LABOUR CODE AND WORK REGULATIONS AT TUL

The Labour Code regulates gender equality in Article 113: any discrimination in employment, direct or indirect, in particular on the grounds of gender, age, disability, race, faith, nationality, political beliefs, union membership, ethnic origin, religion, sexual orientation, employment for a definite or indefinite period, full-time or part-time employment – is unacceptable. These provisions are reflected in the Work Regulations of Lodz University of Technology. Paragraph 94 of Section VIII (Counteracting Discrimination and Mobbing) states that: unequal treatment constitutes discrimination in employment, in particular on grounds of gender (...), subject to the provisions of the Labour Code.

THE EUROPEAN CHARTER FOR RESEARCHERS

The European Charter for Researchers, respected at Lodz University of Technology, sets out, among other things, the principles of gender balance and staff selection. Funders and/or employers should aim to ensure representative gender balance at all levels of staff, including academic supervisors and managers. This should be achieved on the basis of an equal opportunities policy during recruitment and at subsequent career stages, but without lowering quality and qualification criteria. To ensure equal treatment, there should be an appropriate gender balance in committees for the selection and evaluation of candidates. Committees that select candidates should represent a variety of backgrounds and qualifications, and be characterized by an appropriate gender balance as well as, where necessary and possible, be composed of members from different industries (of the public and private sector) and disciplines, including individuals from different countries with relevant experience to evaluate candidates. Where possible, a wide range of candidate selection practices should be used, such as external expert assessment and face-to-face interviews with the candidate. Members of the candidate selection panel should be properly trained.

6 CLEAN WATER AND SANITATION

GOAL 6

ENSURE AVAILABILITY AND SUSTAINABLE MANAGEMENT OF WATER AND SANITATION FOR ALL

THE LATEST PLASMA TECHNOLOGY IN WATER TREATMENT

The Department of Molecular Engineering conducts research on self-purification of water during photochemical processes in sunlight. The photosensitised oxidation process in a heterogeneous system can compete with the photocatalytic oxidation process so commonly used.
The application of plasma catalytic nanomaterials and the use of plasmas to remove chemical and biological pollutants have a positive impact on sustainable development policies, including environmental protection. Furthermore, the work on radiation-initiated catalytic disinfection processes, especially of wastewater containing antibiotic-resistant bacteria and antibiotic resistance genes, fits perfectly into the EU-wide policy on pharmaceuticals and on reducing the spread of antibiotic resistance. The results of the study confirmed the possibility of natural solar application to remove xenobiotics, antibiotic-resistant bacteria and anti-biotic-resistant genes from the aquatic environment.

MINIMISATION OF POLLUTANT EMISSIONS

Researchers from the Faculty of Civil Engineering, Architecture and Environmental Engineering and specialists from the Group Sewage Treatment Plant in Lodz are developing a monitoring, early warning and sustainable management system for sewage treatment plants that minimises emissions of pollutants into the aquatic environment. The system will use data from the city's existing storm overflow metering and rain gauges. It will forecast the flow, concentrations and pollutant loads at the inlet to the treatment plant, allowing early warning of toxic inputs and hydraulic overloading during periods of rainfall.
The system created will allow optimal control of the treatment processes and, as a result, sustainable management of the plant.

EDUCATION - SUSTAINABLE MANAGEMENT OF WATER RESOURCES

In the educational offer of TUL there are many majors and specializations educating future engineers who are aware of the challenges connected with water mana-gement issues, depleting water resources and the need for taking action. These include environmental engineering, chemical and biochemical engineering, architecture, construction, networks and installations in environmental engineering.

GOAL 7

ENSURE ACCESS TO AFFORDABLE, RELIABLE, SUSTAINABLE AND MODERN ENERGY FOR ALL

7 AFFORDABLE AND CLEAN ENERGY

MODERN TECHNOLOGICAL SOLUTIONS IN THE ENERGY VALORIZATION OF BIOMASS

Anaerobic digestion (AD)

AD is one of the ways of converting biomass into a gaseous fuel – biogas or hydrogen, depending on how the process is carried out. Biological conversion of biomass to energy is carried out in many units of TUL. An example is the thermophilic two-stage process of anaerobic digestion of various bio-waste generated in households with an innovative microbiological preparation developed at TUL, supporting the processes of hydrolysis and preliminary decomposition of lignocellulosic substances.

Particularly noteworthy are the research carried out in cooperation with industrial partners. Scientists from the Faculty of Biotechnology and Food Sciences are developing an innovative technology for converting fruit and vegetable waste into methane, hydrogen and high-value organic fertilizer.

It is based on a two-stage AD process of fruit waste, where hydrogen is recovered in the first stage and methane in the second. The obtained results will be used to develop a biogas installation in the Warmia Fruit and Vegetable Processing Plant in Kwidzyn.

The implementation of the technology will allow for the management of waste at the place of its origin, and the energy obtained will be used in the production process of frozen food. The use of digestate as a valuable fertilizer will contribute to the introduction of circular economy on the premises of the plant.

NEW TRENDS IN WASTE TREATMENT

New trends in waste processing developed by scientists, TUL used in cooperation with KSC "Polish Cukier" S.A., developing biomass processing technology.
This interdisciplinary project has created an industrial installation in which waste generated during sugar production is processed into a mixture of hydrogen and methane by means of two-step fermentation. In addition, an innovative installation for storing hydrogen in the form of metal hydrides was created, which will also be used to produce electricity and heat, ensuring energy self-sufficiency of the sewage treatment plant in the sugar factory.

THERMO-CHEMICAL PROCESSES

At TUL, a modern technology of biomass torification using superheated steam is being developed. Thanks to it, it will be possible to produce fuel blends, biochar as an additive to fertilizers and activated carbon, as well as to recover by-products (e.g. formic acid and acetic acid), which have so far been burned, i.e. irretrievably lost, increasing the emission of waste gases.

EFFICIENT CONVERSION AND USE OF SOLAR ENERGY

The issue of obtaining energy from solar radiation is studied at TUL in various aspects of, among others, modern solar panel constructions as well as their operation in the aspect of the stability of the power grid.

SAFE, STABLE OPERATION

The dynamic development of the RES sector (especially photovoltaics in the prosumer sector) in Poland has brought a significant change in the structure of low-voltage power grids. The presence of these sources in distribution networks affects the operating conditions of the network. The Institute of Electrical Power Engineering at TUL, together with leading transmission partners and other universities, as part of the PROSUMENT project, coordinates research on the development of advanced methods of controlling the operation of photovoltaic sources, which will allow to increase the production of renewable energy in prosumer installations while maintaining stable operation of the network and system.

MODERN CONSTRUCTION MATERIALS

Parallel to the research on hybrid systems, scientists from the Department of Semiconductor and Optoelectronic Devices at TUL created the basis for the construction of photovoltaic cells using layers containing ZnO nanoparticles as energy converters. It is an innovative solution that provides a solid foundation for the further stage of photovoltaic development. The use of radiation converting layers based on zinc oxide nanoparticles will enable more effective use of solar radiation in the photovoltaic process. The use of a cheap material such as ZnO and inexpensive layering methods will reduce energy costs.

HYBRID PANELS

Useful energy can be obtained from solar energy in two ways – as electricity in photovoltaic elements or as thermal energy in solar collectors. Photovoltaic panels usually have an efficiency of 12-18%, while the rest of the solar energy is converted into heat in them, increasing the temperature of the photovoltaic elements. This has a negative impact on the efficiency of photovoltaic conversion of the panel. Unfortunately, it decreases with an increase in the temperature of the element by 0.4-0.9% for each degree above the rated temperature. The Department of Semiconductor and Optoelectronic Devices at TUL located at the Faculty of Electrical, Electronic, Computer and Control Engineering conducts research on an extremely promising technique that improves the efficiency of a photovoltaic panel. The aim is to make this type of panel as a hybrid, containing an integrated photovoltaic part and a thermal energy collector. Such a system provides both electricity and heat, while cooling the photovoltaic elements. It is often called the PV/T system and in the version with a water collector, and its total efficiency of converting solar energy into useful energy can reach up to 50-60%.

HETEROGENEOUS CATALYSTS IN THE PRODUCTION OF ALTERNATIVE FUELS

New methods for the synthesis of heterogeneous catalysts developed at the Institute of General and Ecological Chemistry enable the production of multifunctional, unique catalytic systems enabling the production of fuels from renewable sources (e.g. alcohols or hydrocarbons) by reforming, Fischer-Tropsch synthesis, transesterification reactions and hydrocracking. Depending on the process conditions and the catalyst used, it allows the production of alternative fuels – from light hydrocarbons and isoalkanes (gasoline and jet fuel) to ethyl esters of higher fatty acids (biodiesel).
New extremely efficient, selective and stable heterogeneous catalysts applied to carbon oxide systems or nanotubes are being developed, above others, to produce hydrogen, an ecological clean fuel, in the process of oxy-steam reforming of methanol, methane or LNG.
Both modern liquid and gaseous fuels obtained by catalytic means reduce or completely reduce exhaust emissions, thus reducing environmental pollution.

MODERN SOLUTIONS AT TUL CAMPUS

Passive building

On the TUL campus, a passive office building was built for the needs of the administration and students of Lodz University of Technology. The structure, with a total area of 1600 m2, will be powered exclusively by solar energy, which will significantly reduce operating costs. The building has been modernized according to the latest technologies. It is equipped with photovoltaic panels, placed in the windows, on the roof and façade of the building. In addition, heat pumps are installed in the building, which will allow to reduce the energy consumption needed for current operation.

EXPLOITATION OF RENEWABLE ENERGY SOURCES

TUL is implementing an ambitious, long-term, plan for the development of renewable energy sources to the energy needs of the university campus. At the moment, photovoltaic installations with a total capacity of 15.5kW, wind turbines with a capacity of 11kW and fuel cells with a capacity of 2.4kW are installed on the TUL campus. In 2020, renewables provided 16MWh of clean electricity.

DIDACTICS

Lodz University of Technology has in its educational offer a number of faculties, in the programs of which there are subjects related to the production and processing of clean energy. The subjects focus on energy production, transfer and distribution. Ecological energy sources are an example of a specialty implemented at the second degree studies at the Faculty of Process and Environmental Engineering at TUL as part of the field of Environmental Engineering.
On the other hand, at the Faculty of Civil Engineering, Architecture and Environmental Engineering, classes related to both alternative / renewable energy sources and sustainable construction are carried out, among others in the field of first and second degree studies - environmental engineering in construction. Graduates of TUL find employment in companies and institutions involved in the design and installation of devices using renewable energy sources, in the power industry and heating, as well as in regional and local government agencies operating within the framework of renewable energy sources and energy efficiency, as well as in scientific institutions. Students take part in scientific projects related to renewable energy sources. TUL has modern didactic laboratories, among others waste management, or modern laboratory stations for testing heat pumps, solar collectors.

GOAL 8

PROMOTE SUSTAINED, INCLUSIVE AND STABLE ECONOMIC GROWTH, FULL AND PRODUCTIVE EMPLOYMENT AND DECENT WORK FOR ALL

8 DECENT WORK AND ECONOMIC GROWTH

DEVELOPMENT OF STAFF COMPETENCES

As part of the implementation of the Integrated Programme of Lodz University of Technology, the competences of the university's teaching staff are being improved in the following areas: English, didactics, e-learning, presentation skills and attractiveness of education. Managerial and administrative staff develop their skills in the areas of language competence, project management (certified and non-certified), team management, interpersonal communication, work organisation, preparing presentations, stress management and preventing professional burnout, among others. In addition, training is provided on the use of the POL-on system and Excel, public procurement in EU projects, public procurement law, technology transfer and coaching and mentoring. There are also a number of study visits and overseas training in leading units around the world. 40 managerial and administrative staff improve their competences by taking part in post-graduate and MBA courses. A number of organisational changes and improvements are planned in areas affecting the efficiency of university management.

INDUSTRY SEMINAR ENTITLED: "SHAPING PRO-ENVIRONMENTAL MARKET BEHAVIOUR - THE CHALLENGE FOR SCIENCE AND THE ECONOMY".

The industry seminar organised by the Department of Production Management and Engineering was held as part of the international Circular Week series of events. Its theme focused on building and promoting an innovative and sustainable economy. It was attended by entrepreneurs interested in exchanging information, networking on proenvironmental behaviour of producers and consumers, sustainable development, circular economy, LCA.

TRADE UNION REPRESENTATIVES

There are three trade unions at Lodz University of Technology. Their representatives play a very important role in ensuring cooperation between management and staff. They support the TUL employees in their efforts to achieve better working conditions, pay rises and social security. They also strive to provide good quality education. They also offer material and legal assistance.

PUBLIC PROCUREMENT POLICY AT TUL

All TUL activities relating to the procurement of goods and services must comply with applicable laws, regulations, directives, etc. The university manages its property in accordance with the principles of economy, efficiency and legality. When making public expenditures, it is also guided by the principles of purposefulness and economy, taking into account the need to achieve the best effects from given expenditures, the optimum selection of methods and means to achieve the assumed objectives, the need for timely execution of tasks.

ICT CENTRAL POLAND CLUSTER

Lodz University of Technology is the initiator and coordinator of the ICT Central Poland Cluster, which represents and integrates the ICT industry in the region. It strengthens the position of the ICT industry in the region and creates conditions for its further dynamic development. It has an important and recognizable voice in the discussion on the future and directions of the region's development, being a source of initiatives supporting innovativeness and cooperation of the economic, academic, scientific and local government environments, as well as providing substantive and opinion-forming support for initiatives submitted by other entities participating in economic life.

HUMAN RESOURCES DEVELOPMENT POLICY

TUL makes it possible to conduct scientific research or development work and to train scientific staff at the highest world level. This is done in accordance with the principles of academic freedom and freedom of creativity, respecting academic values. With a view to further dynamic development, the university is taking strategic actions resulting from the implementation of the content of the principles of the European Charter for Researchers and the Code of Conduct for the Recruitment of Researchers These include the following areas:

- implementation of good practices in staff recruitment and strengthening the competences of administrative support staff;
- promoting worker mobility;
- promoting and disseminating research results;
- career guidance and support for young academics;
- specialised training in the area of commercialisation and knowledge transfer and other forms of support for cooperation with industry.

GOAL 9

BUILD RESILIENT INFRASTRUCTURE, PROMOTE INCLUSIVE AND SUSTAINABLE INDUSTRIALIZATION AND FOSTER INNOVATION

9 INDUSTRY, INNOVATION AND INFRASTRUCTURE

5G RESEARCH NETWORK IN LODZ

Construction of the 5G research network on the campus of Lodz University of Technology began in November 2019, followed by its launch a year later. The network construction project is carried out by Digital Innovation Hub (Digital Innovation Hub 5G) - DIH5G uniting: Institute of Communications - National Research Institute (leader), Lodz University of Technology and Ericsson and FundingBox.

DIH5G is an ecosystem connecting suppliers and customers of technology in the 5G area, providing intermediation between customer companies and technology providers and R&D centres. Ericsson has installed base stations and a 5G core on the campus of Lodz University of Technology. The network operator is the university. This modern infrastructure gives the opportunity to conduct research to a large group of researchers, and soon TUL students will also be able to use the pilot infrastructure as part of their classes, e.g. selectable blocks.
In the near future, DIH5G will provide micro entrepreneurs and small and medium-sized entrepreneurs with access to specialized infrastructure enabling testing and validation of solutions using 5G technology.
The 5G network project on the PŁ campus was financed by the Ministry of Development.

ARTIFICIAL INTELLIGENCE ASSISTING DRIVERS

Scientists from the Faculty of Technical Physics, Information Technology and Applied Mathematics, in cooperation with Inelo, construct an intelligent system that verifies the driver's work. When analysing the indications of sensors connected to the vehicle in real time, the driver's work is checked and suggestions are generated for improving driving style. In addition, the system analyses the remaining areas of drivers on an ongoing basis, suggesting such a sequence of interruptions, which, taking into account the projected traffic volume on the roads, will result in reducing the travel time, which consequently reduces the carbon footprint.

INNOVATION INCUBATOR 4.0

Lodz University of Technology, as a leader of a project composed jointly with Jan Dlugosz University in Czestochowa, received the funding of PLN 1 899,100 (including 1 179,100 for the Polish Academy of Sciences) to directly support research works applicable in industry. The project was ranked on the second place of the ranking list, just behind the University of Warsaw, among 37 rated ideas.

COMMERCIALIZATION OF INNOVATION

The institutes and departments of Lodz University of Technology have been appointed representatives of unit managers for commercialization of innovation.
The Plenipotentiaries support the Technology Transfer Section of TUL in recognizing innovative scientific research with high commercialization potential. The network of such internal contacts in the university enables faster and more effective promotion of research among entrepreneurs and industrial partners.

CENTRE FOR INNOVATION AND ENTREPRENEURSHIP

The Centre for Innovation and Entrepreneurship of Lodz University of Technology supports the activities undertaken by the university in the field of transfer and commercialization of new technologies. The Centre offers training and advisory services aimed mainly at graduates and young academics who want to pursue their business ideas and start their own businesses. The unit also offers individual consultations with experts who will help choose an effective technology commercialization strategy and find a business partner. The Centre operates the Technology Transfer Section, which carries out comprehensive activities aimed at promoting TUL as a scientific centre that offers innovative technologies with global standards. The Technology Transfer Section also participates in creating effective links between the university's scientific community and industry. It is very involved in the promotion and popularization of the idea of academic entrepreneurship by taking important initiatives aimed at both encouraging Polish technical thought to the economy and raising entrepreneurs' awareness of opportunities for commercial use of knowledge and innovative solutions created at the university.

GOAL 10

10 REDUCED INEQUALITIES

REDUCE INEQUALITY WITHIN AND AMONG COUNTRIES

A REPRESENTATIVE OF TUL IN THE COMMITTEE FOR EQUALIZING EDUCATIONAL OPPORTUNITIES AT THE CONFERENCE OF RECTORS OF ACADEMIC SCHOOLS IN POLAND IN TERM 2020-2025

The Commission for Equalization of Educational Opportunities at KRASP was established at the initiative of Krakow universities in 2016. It includes representatives of 15 academic centres, which are most advanced in providing educational support to students with disabilities and in need of special educational services. One of the committee representatives is the employee of TUL. The committee works on setting standards of educational support, as well as eliminating inequalities in access to academic education.
This is possible by promoting good practices, sharing knowledge with schools less advanced and also providing opinions on legal acts and regulations, e.g. the documents of MEiN (Ministry of Education) concerning students with disabilities.
The Commission also collaborates with NCBiR in the development of expert studies and model solutions for the "Accessibility Plus" program.

IN SEARCH OF BETTER PENSION SCHEMES

In the Department of Management, TUL, a project on better pension systems has been implemented. Taking into consideration data from over 20 countries and suggested indicators , such factors as income adequacy, efficiency and redistribution of pension schemes were measured, also across different pension regimes. The innovation of the project meant the multidimensional approach to the measurement and evaluation of analyzed categories. The findings showed that there is no relation between the state and the market as to the pension income adequacy, however there is an impact on pension system effectiveness, especially when it comes to the labor market.

EUROPEAN IDENTITY IN BUSINESS AND EVERYDAY BEHAVIOUR

The project "Comparative Analyses of European Identities in Business and Every-Day Behaviour: EU-CAB" , which has been worked on since 2018 on the Faculty of Management and is co-financed by the EU, is part of the Erasmus plus Strategic Partnership program in sector university education and it is going to be continued until December 2021.
The project involves field-based empirical research in the area of social studies. During studio visits the participants acquire competencies of working in an international team and in research methodology, as well as they also learn about other European countries and European systems in general. The aim of the project is to examine the extent to which a clearly visible shift towards nation-oriented states, as a result of the migration crisis, can be observed, both in economic and social sphere of life and how it affects human identity and human behavior. The project is being carried out by: Duale Hochschule Baden-Wurtemberg (coordinator), EM Strasbourg Business School, Lodz University of Technology, University of Cergy-Pontoise, University Institute of ISMAI, Budapest Business School, Porto Polytechnic, University of Lodz, South-Eastern Finland University of Applied Sciences.

COLLABORATION WITH SOUTH-EAST ASIAN COUNTRIES

One of the most important operations to reduce inequalities, within and between countries is to ensure equal access to education and to offer opportunities for skills development in the poorest regions and countries, which is a prerequisite for economic advancement. Since 2019 the Institute of Electrical Power Engineering has been collaborating with countries of south-east Asia region on the project eACCESS (EU- Asia Collaboration for accessible Education in Smart Power Systems) financed by EU Erasmus- CBHE (Capacity Building in Higher Education). The project objective is modernization of the education program, introduction of new methods and teaching tools. Development of teaching infrastructure including advanced laboratories in the field of renewable energy and sustainability in five partner universities from Bhutan, Nepal and Indonesia, is also a priority. The coordinator of the project is TUL, Lodz, while the support to achieve the goals is from partner universities from Greece and Great Britain.
The project eACCESS is a continuation of earlier collaboration, which started with partner universities from south-east Asia in the project SmartLink and concentrated on university exchange (students, doctoral students and university employees) with e.g. Bangladesh, Bhutan, India and Indonesia.

SUPPORT FOR THE DISABLED

BON (Office for People with Disabilities) at TUL offers support for students, doctoral students and university employees. A disability coordinator has been appointed at TUL in every department. In 2020 students in the number of 175 used the BON services. The university mainly offers their support to the disabled students in the form of specialist equipment, and organization of additional individual classes within the program of Individual Study Organization (IOS). Other forms of help include transport assistance, psychological assistance in Polish and English, also online within the framework of the Academic Trust Centre, addiction prevention and vocational activation training, training of the teaching and administrative staff on disability issues. For students with disabilities BON organized workshops developing psychological and social skills and for TUL employees trainings on digital accessibility to electronic documents and web accessibility in terms of creating, editing and auditing were offered in accordance with Web Content Accessibility Guidelines. BON has also cooperated with the Lodz branch of Fujitsu in organizing online The Open Day for the students. The event was held to celebrate the International Day of People with Disabilities. Twice a year the BON office publishes a free of charge magazine AION- Akademicki Informator Osób Niepełnosprawnych (Academic guide for people with disabilities) which is sent to all universities in Poland and other educational institutions (high schools, technical schools and non-governmental organizations). In 2021 The National Centre for Research and Development awarded TUL with PLN 15mln in the competition for the disabled students and employees assistance.

FOUNDATION OF TUL

The aim of projects implemented at TUL for the disabled students is to activate and increase participation in social life, develop interpersonal skills and overcome stereotypes regarding disabilities. So far, the following projects: Aron, Diamond Grinder (Szlifiernia Diamentów) and Academic Development School (Akademicka Szkoła Rozwoju) have been successfully carried out. These are meant to create favourable conditions in order to strengthen the students' self-reliance and the need for fulfilment.

GOAL 11

MAKE CITIES AND HUMAN SETTLEMENTS INCLUSIVE, SAFE, RESILIENT AND SUSTAINABLE

11 SUSTAINABLE CITIES AND COMMUNITIES

EDUCATION FOR SUSTAINABLE URBAN DEVELOPMENT

TUL educational offer includes many fields of study that educate future Bachelors and Masters of Science who are aware of the challenges of rapid urbanisation, planners who effectively manage urban resources. Among the proposals are Architecture, Bioeconomy and Sustainable Bioeconomy, Biotechnology, Civil Engineering, Chemistry of Building Materials, Energy Systems in the Built Environment, Environmental Engineering, Environmental Engineering in Civil Engineering, Urban Revitalisation, Spatial Planning, and Transport.

THE GREEN GAME THAT IS A NEW WOONERF ON THE MAP OF LODZ

Thanks to the initiative of TUL students and employees who prepared two projects as part of the Participatory Budget, a new place full of greenery and good energy has appeared on the city map. In this way, two university campuses were connected by a beautiful walking path. A lane for cyclists, bicycle racks and traffic restrictions for cars were created. Green enclaves with benches and food gardens encourage Lodz residents to visit the area. Thanks to this initiative, the Stare Polesie housing estate has been enriched with a friendly space full of greenery, and Stefanowskiego Street has become a showcase of the district, just like the historic villas in Skorupki Street and the beautiful Klepacz Park, which are part of TUL campus.

UNIVERSITY BICYCLES

In 2010 International Faculty of Engineering (IFE) of Lodz University of Technology met the needs of foreign students, wanting to make it easier for them to function and stay in Poland. To this end, the IFE donated bicycles purchased by Lodz University of Technology to the student organisation ESNEYE. Thanks to this initiative, exchange students can commute freely to university, explore the city and, at the same time, lead and promote a healthy lifestyle.

"ENERGY PROCESSING" AND "MICROWORLD - MACRO-WORLD" AT EC1

Two educational trails: "Energy processing" and "Microworld - Macroworld" have received scientific patronage of Lodz University of Technology. Both trails belong to the permanent exhibition of the Science and Technology Centre EC1. The "Energy Processing" trail refers to the history and character of the former Lodz Power Plant complex. It leads through the interiors of the historical buildings of the switching station, engine room, boiler room and cooling tower. The trail ends in the control room, where you can take part in a strategy game related to energy management and conservation. "Microworld - Macroworld" trail includes multimedia, interactive presentations, providing content concerning micro and nanosystems, atomic and subatomic physics and chemistry, including molecular chemistry. It is a unique place for the citizens of Lodz.

SMART SEMINAR AND LIVEABLE CITES AS WELL AS INTERNATIONAL CONGRESS "REGENERATION OF INDUSTRIAL CITIES"

Lodz University of Technology actively participates and co-organizes events promoting the idea of sustainable industrial cities as part of the sixth edition of the Partner Cities Forum "Smart and Liveable Cities" organised at TUL.

Representatives of the City of Lodz and its partner cities shared their experiences and examples in implementing a holistic approach to urban planning, revitalisation, climate adaptation and smart city solutions. In turn, the challenges faced by modern industrial agglomerations competing internationally were discussed during the International Congress "Regeneration of Industrial Cities". The issues of cultural and industrial heritage, the system of innovative industrial city, and urban modernisation were among the discussed topics. It was emphasised that a modern industrial city, which in the specific life cycle of manufactured products considers the spatial effects of global processes of production, exchange, consumption, and recycling is a city that produces useful products and services without burdening other societies and other countries with negative externalities. The Congress was an opportunity for a comprehensive debate on the problems of urban regeneration and the role of the business community in this process, the importance of cultural and industrial heritage as a revitalisation resource. Polish experience confronted with the experience of the West in the conditions of restructuring manufacturing activity and the needs of reindustrialisation made it possible to indicate new mechanisms and conditions allowing for a quicker response to the needs of the environment.

TUL CARES ABOUT MONUMENTS

In the middle of the 19th century, Lodz factory owners took steps to establish Polytechnic Institute in Lodz. They made property contribution by transferring their buildings and land for this purpose. Unfortunately, as a result of a strong objection from the occupational authorities of the Russian Tsar, this enterprise did not succeed. However, one hundred years later, Lodz University of Technology was founded and situated in this very area, on the premises of the above mentioned industrial and estate buildings. The university authorities converted and adapted industrial property and residential villas to make them useful for the university needs. There are fourteen historical buildings on TUL campus, and the university authorities make sure they remain in the best possible condition and are a permanent element of the campus landscape, where modernity blends with the tradition of post-industrial Lodz.

TUL Rector's Office is located in Reinhold Richter Villa, whose construction was completed in 1904. The villa represents a range of styles: Gothic, Mannerism and Art-Nouveau. Numerous Antique and Renaissance elements decorate the interior. The Dean's Office of the Faculty of Process and Environmental Engineering is located in the Neo-Renaissance Oskar Schweikert Villa, built in 1888.

PARK OF BISHOP MICHAL KLEPACZ

Since 2017, the park located in the centre of Lodz is owned by Lodz University of Technology, therefore it has been included in one of the University's campuses. The area of the park is 3.3 ha. It remains a generally accessible public space, which is willingly used by the inhabitants of Lodz. The park contains numerous trees, nature monuments and shrubs, and Scilla Siberica bloom beautifully in early spring. The obtained co-financing made it possible to conduct tree care activities and maintain the proper health and aesthetic condition of trees in the park. Maintenance cuts and planting were conducted, many new species of trees and shrubs appeared. These activities positively influenced the natural values and aesthetics of the park listed in the register of historic monuments.

ACOUSTIC CLIMATE IN URBAN SPACE

The noise issue in urban areas is one of the environmental hazards and is regarded as pollution. The concentration of noise in urban areas is most often related to economic activities, which generate industrial noise, or to transport, which is responsible for traffic noise. Given the prevalence and density of roads, it is traffic noise that has the greatest impact and significantly affects the natural environment and people's quality of life. Researchers at the Faculty of Organisation and Management, TUL found an answer to these problems. The aim of one of their studies is to monitor, control and manage noise in urban space using health indicators in order to designate "quiet areas". Currently, acoustic maps drawn up in the EU countries are used only to designate areas exposed to excessive industrial or communication noise and to determine the M index, which characterises the extent to which the acceptable noise level is exceeded and the number of inhabitants in the area. However, from 2022 the EU law will require the development of strategic acoustic maps to forecast changes in the acoustic climate in a given area.

It will therefore become important to manage the acoustic environment, considering indicators describing health effects, such as extreme noise annoyance (HA) or extreme sleep disturbance (HSD).

The research conducted at the Faculty includes benchmarking of cities using methods of health indicators in acoustic maps, conducting acoustic surveys in reference points, and preparing IT tools in developing and visualising acoustic maps. The project will also develop urban space management strategies to minimise noise from various sources. Another research problem dealt with by researchers at the Faculty of Organisation and Management, TUL is the development of intelligent materials minimising communication noise, which would allow for appropriate design of acoustic protections along transport routes. The research includes analysis of materials with absorption characteristics and resonance (with properties to reduce noise generated by transport infrastructure), assessment of the possibility to capture pollutants from the air and development of absorption-resonance structures to absorb acoustic energy. The work will develop noise-absorbing material that will be evaluated in a laboratory environment with the possibility of testing it in real conditions. The research will be used to develop new systems/ /materials.

ENVIRONMENTAL ASPECTS OF SUSTAINABLE DEVELOPMENT IN URBAN SPATIAL PLANNING

The dynamically progressing process of urban development entails many problems concerning both environmental degradation, climate change and the need to provide comfortable living conditions for inhabitants. Excessive heat and impaired air exchange have become characteristic features of the climate of modern cities. The research conducted at the Faculty of Civil Engineering, Architecture and Environmental Engineering is aimed at developing a methodology of assessing the influence of selected building structures on aerodynamic and thermal conditions, establishing relations between building type and microclimate conditions, defining local zones for Lodz, and developing cartographic methods, based on GIS, in the form of urban climate maps for selected areas of Lodz. As part of the ongoing research, work has been undertaken to use GIS to determine the ground roughness parameters, which allow to delineate potential ventilation corridors for specific areas of Lodz, and a method has been developed using laser light beams to measure the turbulent air flow caused both by the impact of buildings and ground thermal conditions. In response to climate warming and the phenomenon of Urban Heat Island (UHI) resulting from an increase in average air temperature, an increase in the number of boiling days, and an increase in air pollution, the Faculty has also undertaken research to determine the particularities of Lodz Larger Urban Zone, taking into account diverse urban forms. The aim of the research is to provide information on the quality of the urban environment and to identify areas requiring the introduction of adaptation strategies. The next step is to analyse the effectiveness and select optimal adaptation solutions. The implemented solutions will translate into beneficial changes in environmental parameters, including temperature reduction, improved air quality, space aesthetics, and improved human thermal comfort. Cooperation at the university-city level will contribute to planning activities that increase the city's resilience to current and future extreme phenomena.

GOAL 12

ENSURE SUSTAINABLE CONSUMPTION AND PRODUCTION PATTERNS

12 RESPONSIBLE CONSUMPTION AND PRODUCTION

FROM WASTE MATERIAL TO EDIBLE PACKAGING

Guided by the principles of sustainable development, the team from the Institute of Food Technology and Analysis has developed a technology for obtaining packaging from plant waste, and not from raw materials originally intended primarily for consumption, so as not to take away from future generations the production and nutritional raw material. The developed technology assumes the use of up to 65-90% of various plant production waste in the production of packaging and disposable dishes. The manufacturing methods used and the developed recipes assume the use of only natural raw materials, without the use of chemical compounds. The introduction of these solutions allowed us to design an innovative edible packaging made from vegetable and waste raw material. The method has been filed for patent protection.

GREEN PACKAGING BASED ON VEGETABLE RAW MATERIALS

Currently, there is a huge problem associated with the disposal of polymer waste, and above all disposable packaging for food, cosmetics and other articles. Most often, such packaging cannot be reworked due to the fact that they have admixtures of various polymers in their composition.

A rational solution seems to be the production of biodegradable materials, produced from plant polymers, which for several years has been the main goal of the Faculty of Chemistry, TUL. The introduction of this solution to the market will be beneficial for people and the environment, because green packaging, based on plant raw materials, will solve the problem of disposal of packaging materials.

WASTE OR RAW MATERIAL?

The agri-food industry generates large amounts of waste biomass. Scientists from the Faculty of Biotechnology and Food Sciences are developing technologies that will allow to manage bio-waste in an effective and multidirectional way. The research is carried out in the BIO-STRATEG project financed by the National Centre for Research and Development. As part of the project, an experimental pulp dryer was carried out, using waste heat from the sugar factory. The results of this research were commercialised after the end of the project, which is already bringing measurable economic and environmental effects.

The developed technologies received 5 gold medals at international exhibitions of inventions and the "Łódź Eureka" statuette awarded by the Council for Higher Education and Science at the President of the City of Lodz for outstanding scientific achievements.

BIODEGRADABLE FOOD PROTECTION FILM

In the era of the growing amount of plastic waste from industry, proper packaging management is extremely important. Biodegradable packaging is gaining an increasing share of the global market. An innovative solution of scientists from the Faculty of Biotechnology and Food Sciences is a film with properties that extend the shelf life of food, and at the same time fully biodegradable and compostable.
This solution may in the future become an important element of the packaging market in the context of pro-ecological changes. For their idea in 2020, the team of scientists received a nomination in the prestigious Polish Intelligent Development 2020 competition in the Scientists of the Future category and a distinction in the "I have an idea for a startup" 2020 edition organized by the City of Lodz. The title of the awarded project is "Biodegradable packaging for food packaging with shelf life properties – Biofoil with Chicory/ Naturefoil".

WHEN OIL MEETS OZONE

The Institute of Natural Products and Cosmetics of Lodz University of Technology conducts research on new ingredients of cosmetic masses obtained from vegetable oils after the ozonolysis process. It is on the basis of such experimental substances that the cosmetics of the future will be created, thanks to which the industry will give up the addition of preservatives, such as parabens or formaldehyde derivatives. The final product is ozone-free and environmentally friendly.

SUSTAINABLE PUBLIC PROCUREMENT

Scientists from the Institute of Marketing and Sustainable Development implement the project: "Sustainability and Procurement in International, European and National Systems – SAPIENS Network", funded under the EU's Horizon 2020 programme Marie Curie Skłodowska.
The project is the world's largest interdisciplinary doctoral program, combining the issues of sustainable development and public procurement. In order to implement the principles of sustainable development in the practice of public procurement, economists, lawyers and engineers have joined forces.

MECHANICAL AND CHEMICAL ENGINEERS FOR ENVIRONMENTAL PROTECTION

Scientists from the Institute of Turbomachinery, the Institute of Materials Science and Engineering and the Institute of General and Ecological Chemistry are working on a prototype of a device for the safe processing of aerosol containers. The research is carried out as part of the ECO-AEROSOL project obtained from NCBiR by CSD-ECO.

VEGAN LEATHER

Industrial Biotechnology students as part of the PBL project at IFE, developed a material that is vegan leather. Apleather is very strong and durable, and above all it is fully biodegradable and does not contain substances harmful to the environment. In addition, the material can be easily dyed, which makes it attractive for the production of consumer goods.

BIODEGRADABLE PACKAGING FILM

At the Faculty of Biotechnology and Food Sciences, work is being carried out on the production of a new, biodegradable packaging material. The designed film does not contain synthetic substances and is made of waste bioplastic, which is potato starch with the use of plant extract and additives that improve physical properties. Thanks to its antimicrobial properties, it better protects packaged products from rapid deterioration of their quality and microbiological spoilage.
The designed film meets the standards applicable to packaging. It is important to use waste raw materials for its production as a source of bioactive substances.

SENSORY PACKAGING BASED ON BIOPOLYMERS

Research conducted at the Faculty of Material Technologies and Textile Design is focused on the development of an innovative product in the form of a biodegradable film, containing a printed sensor of temperature change from minus to positive in an irreversible way. The use of this type of product in frozen food packaging will allow you to objectively determine whether the stage of defrosting and re-freezing has not occurred after freezing in further transport processes or during storage.
In addition, these tests are to be used to develop a biodegradable film that can be used on products subjected to deep freezing.

CIRCULAR SOLUTIONS

In the 4th edition of the nationwide Stena Circular Economy Award – Leader of the Circular Economy in the category "Proposals for the implementation of circular economy", an idea submitted by students of Lodz University of Technology was distinguished. Students of Management and Production Engineering were awarded for the project "Reusable courier packaging". Its aim is to minimise waste production by introducing reusable packaging from "green" polymers.

GOAL 13

13 CLIMATE ACTION

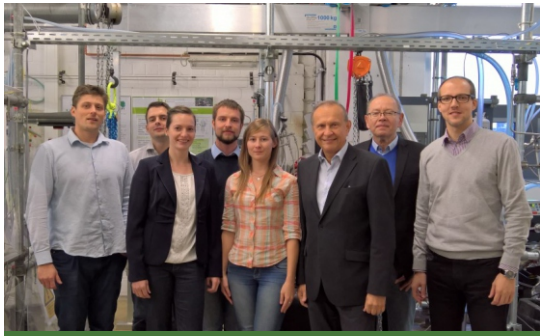
TAKE URGENT ACTION TO COMBAT CLIMATE CHANGE AND ITS IMPACTS

NEW NANOCATALYTIC STRUCTURAL FILLINGS FOR CARBON DIOXIDE HYDROGENATION PROCESSES

Inhibiting the increase in the concentration of CO_2 in the atmosphere coming mainly from the combustion of fuels is a challenge for the modern world. The question arises of what to do to reduce the concentration of CO_2 in the atmosphere. It seems that the best way to solve this problem is to use carbon dioxide as a raw material for the production of useful compounds such as methane, methanol, dimethyl ether, formic acid and others.
This approach will reduce the concentration of CO_2 in the atmosphere and include it in the process of industrial recirculation. The Department of Molecular Engineering at TUL (Faculty of Process and Environmental Engineering) conducts research on the design at the molecular level and production using plasma of thin-film catalytic systems with high stability and activity, the purpose of which is to be used in industrial modern structural reactors intended for CO_2 hydrogenation processes leading to the production of useful products.

INNOVATIVE EQUIPMENT FOR INTENSIFIED REMOVAL OF CO_2 FROM WASTE GASES, INVITES

Currently, in Poland, 95% of energy comes from coal combustion, while Poland and Germany jointly emit about 25% of carbon dioxide produced throughout Europe for the needs of the power industry. Before alternative energy generation methods are sufficiently developed, it is necessary to improve the technology for removing CO_2 from waste gases. The INVITES project developed two potentially most effective gas absorption technologies, i.e. stationary fillings dedicated to the purification of gas streams from CO_2 and RPB (Rotating Packed Bed) technology. The INVITES project was carried out as part of the Polish-German cooperation for sustainable development "STAIR". A consortium was established to implement the project, including the German company ENVIMAC, while the Polish side is represented by employees of the Department of Environmental Engineering at TUL (Faculty of Process and Environmental Engineering) and OMNIKON. Learn more.



COMPONENTS FOR THE STORAGE OF THERMAL ENERGY

Transparent elements of external partitions, in terms of physical parameters, are one of the weakest elements of the building's housing. The value of the heat transfer coefficient of glazing is on average four times higher than that of opaque partitions, which causes a significant increase in heat loss in winter. In addition, in summer, their relatively high solar permeability is a source of undesirable heat gains, causing overheating of rooms and entire buildings. The implementation of the project assumes the development, implementation and testing of an innovative system that allows to improve the energy efficiency of the building and its functional properties, promote environmentally friendly technologies and sustainable and effective use of solar radiation energy. In this way, the energy efficiency of buildings is improved and thus significantly reduces greenhouse gas emissions by reducing the energy consumption of the building. The project was carried out at the Department of Environmental Engineering at TUL (Faculty of Process and Environmental Engineering).

ENERGY CLUSTERS

The TEAC calculation programme developed at Lodz University of Technology is used to analyse Energy Clusters. It will facilitate: the definition of an urban area considered as an Energy Cluster, carry out an analysis of thermo-modernisation of the analysed area, check the possibility of using renewable energy sources, carry out an economic analysis (financial viability) and an ecological analysis (environmental viability) of the indicated area. This type of analysis can be useful for the development of distributed energy (popularisation of renewable energy sources in residential buildings), the development of smart-grid areas and the improvement of energy security, as well as for the planning of sustainable urban areas.

URBAN DRAINAGE SYSTEMS

One of the effects of climate change is the occurrence of weather anomalies, including heavy rains. Drainage systems in cities, generally built about 100 years ago, now pose many problems. Popular difficulties include, among others, hydraulic overload, flooding and so-called urban floods (resulting, among others, from the increase in sealed surfaces and climate change, manifested by more frequent occurrence of intense rainfall), emission of pollutants into the aquatic environment, disruption of the natural water cycle.

For this reason, it is necessary to analyse the functioning, modelling and modernization of sewage systems. Among the activities undertaken to get rid of obstacles, it is worth mentioning the need to manage rainwater, among others, with the use of green infrastructure and systems for their collection and economic use, as well as optimization of the operation of sewage treatment plants and the study of pollutant emissions to the aquatic environment and the possibility of reducing it. It is also important to monitor precipitation and the quantity and quality of sewage in the sewage system (also online).

14 LIFE BELOW WATER

GOAL 14

CONSERVE AND SUSTAINABLY USE THE OCEANS, SEAS AND MARINE RESOURCES FOR SUSTAINABLE DEVELOPMENT

BALTIC UNIVERSITY PROGRAMME (BUP)

The Baltic University Programme focuses on issues of sustainable development, environmental protection and democracy in the Baltic Sea Region. Participants of the Programme are universities in the countries of the Baltic Region, including Lodz University of Technology. The following types of courses are organised as part of the programme:

- Environmental Science of the Baltic Sea Basin,
- Environment of the Baltic Sea,
- Baltic Sea Region — Culture, Politics, Society,
- Peoples of the Baltic,
- Sustainable Development of the Baltic Region,
- Sustainable Water Management,
- Sustainable Social Development and City Planning.

The programme offers university-level courses for both lower years and masters students and continuing education for teachers and professionals. Annually, courses are organized in more than 225 colleges for a total number of approx. 9000 students.

Baltic University Programme (BUP) is an international academic network established in 1991, whose participants include universities in the countries of the Baltic Sea Region.

It is now one of the largest university chains in the world with around 90 member institutions. The aim of BUP is to support universities in spreading knowledge about broadly understood sustainable economic, ecological and social development in the Baltic Sea Region. The programme is based on cooperation between academic centres, but also other social institutions, e.g. local authorities and sustainable development organisations in the said region. BUP is active in education, research, information and projects.

Baltic University Programme is an interdisciplinary programme bringing together all types of universities - humanities and technical, higher educational and economic schools, agricultural and medical universities. It is coordinated at the international level by the BUP Secretariat at Uppsala University Sweden. In Poland, the national Baltic University Centre is located at the Lodz University of Technology. More information.

BUP publishes annual reports on its activities, which are made available on the Organization's website.

15 LIFE ON LAND

GOAL 15

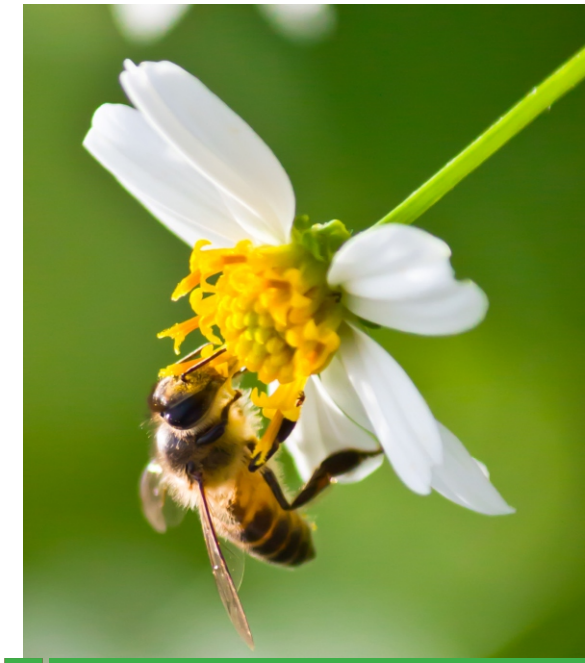
PROTECT, RESTORE AND PROMOTE SUSTAINABLE USE OF TERRESTRIAL ECOSYSTEMS, SUSTAINABLY MANAGE FORESTS, COMBAT DESERTIFICATION

FLOWER MEADOWS AND HEDGEHOG HOUSES

For several years, the Idea Box campaign has been organized at Lodz University of Technology, under which employees and students of TUL can submit their ideas for the development of the university. In this way, a flower meadow was created – a place for bees, butterflies and other insects. Establishing meadows of this type brings many benefits, e.g. it creates a better microclimate in urban areas, filters rainwater and air, including stopping dust, creating smog. In addition, flower meadows lower the air temperature and prevent the soil surface from heating up – they support the fight against the so-called urban heat island, especially on hot days. They are also a refuge for up to 300 species of animals: small mammals, reptiles, amphibians, insects and pollinators, including bees, which, collecting pollen, perform a useful function in the ecosystem. Another project implemented as part of the Idea Box are hedgehog houses – an endangered species that remains under strict protection in Poland. Without human help, hedgehogs may soon become scarce. The houses are to help them safely survive the winter, but also – located away from the paths, in a less accessible corner of the park – they will be a shelter for them all year round.

ECOLOGICAL BEE PROTECTION PRODUCT

For several years, an intensification of the phenomenon of the so-called mass extinction syndrome of the honeybee has been observed. The main cause is bee diseases caused by various types of microorganisms, as well as pesticides used on a massive scale. The reduction of the population of these insects has a very negative impact on agricultural production and natural ecosystems. To prevent this, the project carried out by scientists from the Department of Environmental Biotechnology at TUL envisages the production of an ecological preparation containing strains of lactic bacteria with pro-health potential for bees. The project is funded by the Voivodship Fund for Environmental Protection and Water Management in Lodz.



SMART HIVES

Over the past 20 years, there has been a dramatic decline in the population of the honey bee (Apis Mellifera). Although the main reason for this situation is seen in intensive agriculture and the mass use of pesticides, it is not entirely clear what this phenomenon is caused by. At the Faculty of Electrical, Electronic, Computer and Control Engineering at TUL, a team was formed that developed and offers as a start-up a device for remote monitoring of hives. Smart Hives support beekeepers in running the apiary and provide an easy-to-use hive monitoring system.

The beeHUB device created by the team performs precise measurements of among others weight, sound, temperature and humidity.

They allow the beekeeper to check whether the hive is well insulated, whether there is no moisture in it through which the frames could rot, and allows for controlling the tabernacles and cavities in the hive.

The apiaries are looked after by the mobile application "Intelligent Hives". It can be mounted on a smartphone, tablet or computer and track what is happening to the hive from anywhere at any time.

The application facilitates the detection of diseases, swarms, conducting inspections of the hive, planning tasks, as well as keeping disease records of bee colonies.

It analyses the collected data and presents conclusions that allow for a quick response. Thanks to this, experienced beekeepers are able to take actions crucial for the health and life of bees. On one of the roofs of the Department, hives equipped with the developed system were installed.

USE OF PLANT BIOMASS FOR THE PRODUCTION OF CHEMICAL COMPOUNDS

One of the main threats to civilization is the depletion of fossil fuel resources and increasing environmental pollution. A way to prevent this situation is to use renewable raw materials such as plant biomass for the production of chemical compounds. However, selective catalysts are necessary here and scientists from the Faculty of Chemistry at TUL are working on them. The research is carried out in cooperation with partners from France (University of Strasbourg, Ecole Normale Superieure in Lyon), from Germany (University of Aachen, among others), from Japan (Shibaura Institute of Technology).

The stable catalysts based on base metals developed in the project enable efficient biomass conversion and obtain chemical compounds with a wide range of industrial applications. A new method of catalyst synthesis focuses on the use of sunlight.

More information.

SURFACE WATER POLLUTION TESTING

Freshwater scarcity is a global problem. The increase in demand for water, and at the same time the deterioration of its quality, results from the intensive development of agriculture and industry. Poland is a country particularly threatened by water scarcity, therefore, in addition to the rational use of water resources, it is also necessary to constantly control the quality of surface water. As part of the project conducted by the Faculty of Chemistry at Lodz University of Technology, systematic monitoring of surface water in the Lodz region made it possible to identify the main sources of pollution and determine the dynamics of changes in water composition in temporal and spatial terms in selected rivers. The results of the research can be used by local authorities and other entities responsible for the development of environmental protection and water management plans in the Lodz Voivodeship. The analyses carried out should contribute to the improvement of the status of surface waters.

BIODEGRADABLE MASKS

Protective masks, which have become widespread around the world due to the coronavirus pandemic, are becoming garbage after consumption, which increasingly threatens the environment. Scientists from the Institute of Material Science of Textile and Polymer Composites of the Lodz University of Technology together with partners – the Central Institute for Labour Protection and the Institute of Biopolymers and Chemical Fibres – have developed biodegradable masks that will disappear in the compost environment after 6 weeks after discarding. Already patented masks have bactericidal properties. Currently, scientists are working on antiviral properties and modifying filters so that the surface of the mask can destroy viruses attached to it. The new masks will have the same barrier properties as those commonly used to protect against aerosols. However, they differ in material. Classic masks are made of olefins, the degradation time of which reaches hundreds of years. The new masks are made of biodegradable polylactide, obtained as a result of the synthesis of lactic acid, while lactic acid is, for example, a product of the fermentation of starch from corn.

Polylactide kept in compost conditions after 6 weeks breaks down into chemical compounds accepted by the natural environment, that is, it simply disappears.

Masks must still have an anti-virus function. Scientists will use chemical compounds in them and modify the surface of the filters in such a way that viruses, after sticking to the mask, are destroyed by it.

More information.

TUL ALSO CLEANS UP THE WORLD

As an academic community, TUL is actively involved in activities for the benefit of the natural environment, which is why this year, as in previous years, the university takes part in the World Cleanup Day, the next edition of which is organized in cities around the world. During this year's campaign, TUL again took part in the #TrashChallenge – a competition with teams from Lodz companies and institutions, which consists in collecting as many bags full of waste as possible.

More information.

FROM THE INSIDE OF THE PLANT TO SERVE THE ENVIRONMENT

The BIOREM project "Modern technology of bioremediation of soils contaminated with creosote oil in the area of Nasycalnia Podkładów S.A in Koźmin Wielkopolski" is financed by the National Centre for Research and Development (NCBR) as part of the Regional Scientific and Research Agendas. One of the main objectives of biotechnology in relation to environmental protection is the use of biological processes to effectively clean the environment. The most important here is the technology of bioremediation. It is the use of the degradation activity of microorganisms to convert toxic organic compounds into less toxic or completely harmless components for the environment, such as carbon dioxide and water. The aim of the BIOREM project is to develop a modern technology for bioremediation of soil contaminated with creosote oil in the area of the Railway Sleepers Saturation Plant.

The project is implemented in a consortium consisting of the Institute of Wood Technology in Poznań (leader), Poznan University of Technology, Lodz University of Technology and Nasycalnia Podkładów Kolejowych S.A. in Koźmin Wielkopolski. Creosote oil is a product of coal tar distillation, used for wood impregnation. It is classified as a non-indifferent agent for the environment, and its removal is considered very complicated. The IBMiP Industrial Biotechnology team at the Faculty of Biotechnology and Food Sciences has extensive experience in developing microbiological and enzymatic biopreparations effective in removing hydrocarbons, as well as in optimizing and implementing bioremediation technologies on an industrial scale. One of the tasks of the TUL team is to select microorganisms effective in the degradation of creosote oil components.

Assoc. Prof. Eng. Olga Marchut-Mikołajczyk at the Premises of Nasycalna Podkładów Kolejowych S.A

GOAL 16

PROMOTE PEACEFUL AND INCLUSIVE SOCIETIES FOR SUSTAINABLE DEVELOPMENT, PROVIDE ACCESS TO JUSTICE FOR ALL

16 PEACE, JUSTICE AND STRONG INSTITUTIONS

DIVERSITY MANAGEMENT

The Diversity Management project classes at the Interdisciplinary Doctoral School at TUL present social aspects of diversity as one of the key challenges for contemporary organizations. During the course, attitudes are developed free from stereotypes, racial, ethnic, national, religious or gender prejudices. Classes allow for developing skills to solve problems arising in the organization and having their origin in diversity.

MODERN MANAGEMENT CONCEPTS

The module of intercultural management and diversity management is conducted for the direction of management of the second degree at the Faculty of Management and Production Engineering. The course provides a presentation of the social aspects of diversity as one of the key challenges for contemporary organizations. It forms attitudes free from stereotypes, racial, ethnic, national, religious or gender prejudices. It shapes skills, which come down to solving problems, emerging in the organization, and having their sources in diversity.

HUMAN RIGHTS AND TECHNOLOGY

Human Rights and Technology project classes are held at the Interdisciplinary Doctoral School, TUL. The course presents and develops issues related to human rights in the contemporary world and the perception of these rights in various contexts. During the course, the international legal framework on human rights is reviewed, referring to basic principles such as equality, non-discrimination, freedom, integrity and dignity contained in international agreements and conventions.

ETHICAL AND SOCIAL ASPECTS OF MANAGEMENT

The Management and Human Rights module was created within the course Ethical and Social Aspects of Management in the Digital World in the II-cycle Management programme. The course presents and develops issues related to human rights in the contemporary world and the per-ception of these rights in various contexts. During the course, the international legal framework on human rights is reviewed, referring to basic principles such as equality, non-discrimination, freedom, integrity and dignity contained in international agree-ments and conventions.

MAN-BUSINESS TECHNOLOGIES

The "Man-Business-Technologies" Open Science Seminars is an initiative of the Humanities Group and the Institute of Social Sciences and Technology Management. Throughout the lecture, topics related to a holistic view of society, economy and technology and their relationships are addressed.

Among the most important issues are:

- the universal dimension of technology and the human condition;
- the impact of the enlightenment vision of progress and the economic vision of the free market on contemporary social reality;
- relations of science, ideology and politics, that is, political responsibility of scientists;
- risk society and safety - questioning scientific expertise;
- responsibility and moral consequences of economic and technological development.

The analysed concepts and symbols describe modern civilization. Distinguished guests who present the results of the research are invited to participate in the seminars. There are also open meetings and discussions for academics, doctoral candidates and students.

STUDENT GOVERNMENT AND STUDENT SCIENCE CIRCLES

Student Government and Student Science Circles are very active at Lodz University of Technology. The university works closely with them and provides financial, legal and practical support. The Vice-Rector for Student Affairs meets regularly with all parties to discuss the policies and strategies of TUL, ensuring that students are included in the life of the university.

Members of the Student Government of TUL - winners of the Forum of Technical Universities

DEMOCRATIC REPRESENTATION OF THE UNIVERSITY

Once every four years, the election of the Rector of Lodz University of Technology takes place. The selection is made by the University Electoral College. It consists of 112 people, representing all groups of employees, students and doctoral candidates of Lodz University of Technology. Candidates for Rector to the University Election Committee can be put forward by: The Council of Lodz University of Technology and any member of the university community with passive suffrage.

HR STRATEGY FOR RESEARCHERS AT TUL

European Charter for Researchers and the Code of Conduct for the Recruitment of Researchers were issued in 2005 as a recommendation from the European Commission. The documents are addressed to researchers, employers and research funders working in the public and private sectors. The European Charter for Researchers describes the rights and obligations to which scientists and the institutions employing them and the organisations that provide funding for research. The Code of Conduct for the Recruitment of Researchers describes the rules for recruiting researchers that institutions and employers should follow, ensuring equal treatment in the ongoing recruitment process.

Lodz University of Technology is aware that both the Charter of Researchers and the Code of Conduct have a real impact on ensuring appropriate conditions for work and conducting scientific research. They also emphasize the value of the work of people conducting research. Thus, TUL decided to start the process of implementing the provisions of the Code and Charter by submitting a declaration of support for the principles contained in these documents. European Charter for Researchers and the Code of Conduct for the Recruitment of Researchers contain forty rules. An internal analysis carried out at the university showed that most of the national regulations, internal laws and good practices at TUL comply with these principles.

COMMITTEE FOR GOOD ACADEMIC PRACTICES

The Committee for Good Academic Practices is concerned with the formulation of opinions and conclusions on cases involving breaches of good academic practice. In particular, they refer to behaviour that is in breach of the duties of an academic teacher, nepotism, abuse of power, running a competitive business against Lodz University of Technology, lack of respect for intellectual property, the use of non-substantive criteria in evaluating the work of academic teachers and students, discrimination, undermining the authority and scientific competence.

GOAL 17

STRENGTHEN THE MEANS OF IMPLEMENTATION AND REVITALIZE THE GLOBAL PARTNERSHIP FOR SUSTAINABLE DEVELOPMENT

17 PARTNERSHIPS FOR THE GOALS

BALTIC UNIVERSITY (BUP) AT LODZ UNIVERSITY OF TECHNOLOGY

At Lodz University of Technology there is an Associated Secretariat of the BUP, which coordinates BUP activities in Poland. The Baltic University, established in 1991 and coordinated by Uppsala University, forms one of the largest university cooperation networks in Europe. About 90 active universities from the Baltic Sea Region have started cooperation in the field of education for sustainable development, climate neutrality, as well as democracy.
The Associated Secretariat at TUL organizes and supports the creation of conferences, seminars, courses, summer schools, training cruises for students, doctoral students, academic teachers from all scientific disciplines and fields of study from Polish universities. Over the past 5 years, about 200 students, doctoral students and teachers from Polish universities have actively participated in the activities of BUP. Learn more.

POLISH-ITALIAN COOPERATION

Cooperation with the University of Florence, initiated in 2018 and culminating in 2019 with the signing of an agreement between universities, allows for setting common directions of activities in the field of sustainable development. Activities are carried out both in the scientific, didactic and project fields. The result of the co-operation are scholarships funded as part of the NAWA programme in the area of "Innovative management of enterprise resources in a circular economy" for an employee of the Department of Production Management and Logistics and students from the University of Florence. Discussions within the framework of meetings in Rome, Milan, Florence and Lodz gave rise to joint initiatives. The first of these was the submission of two projects: "Plastic – no problem" and "Innapes".

Participants of the meeting summarizing the cooperation between the University of Florence and Lodz University of Technology

SUSTAINABLE EDUCATION AND SCIENCE

ESSSR (European School of Sustainability Science and Research) is an inter-university consortium of members who share an interest in science and sustainability issues. It is a key organisation, bridging the gap in the coordination of teaching and research in the field of sustainable sciences in European universities. The result of co-operation with HAW HAMBURG is the submission of the project to Horizon 2035.

BIO-PLASTICS EUROPE PROJECT

It is estimated that, on average, globally, about 30% of plastic waste is unmanaged and goes directly to waters and soils. Until now, more attention has been paid to plastic pollution of waters. Perhaps for the simple reason that there waste is more visible. Meanwhile, the concentration of microplastics in the soil in some regions of the world reaches up to several thousand particles per kilogram of dry soil. The object of research of scientists from the Faculty of Civil Engineering, Architecture and Environmental Engineering, TUL as part of the "Bio-plastics Europe" project are innovative plastics obtained from renewable raw materials (bio-based plastics) produced by TUL partners in this project. These materials will be assessed for their phytotoxicity, toxicity to soil fauna and their impact on the laboratory-scale model soil ecosystem. The results of the research can be used by plastics manufacturers. Bio-plastics Europe focuses on sustainable strategies and solutions for bioplastics to support the EU-Plastic strategy and promote circularity in the economy.
The aim of the project is not only to conduct research, but also to raise public awareness. The project is implemented in a consortium: TUL is one of its 22 partners.

FIGHTING CANCER TOGETHER

The Faculty of Technical Physics, Information Technology and Applied Mathematics together with pharmaceutical companies carry out research on the method of administering drugs to cancer patients. The result of the three-year collaboration was the planning of dosing protocols for complex therapies for chronic myeloid leukemia and multiple myeloma.

WE LEARN FROM THE EXPERIENCED

Cooperation with the University of Florence and CIHEAM Bari from Italy resulted in the acquisition of experts with many years of experience in the implementation of innovative projects in the area of sustainable development. Students of the Master of Operation Management within the subject of Technology and Innovations Management indicate the areas of the economy of our region that require changes in the light of the assumptions adopted by the EU New Green Deal for Europe. The prepared drafts of the projects were presented to a group of stakeholders from the region in order to spread education in the areas of sustainable development and stimulate joint initiatives.

GREAT ORCHESTRA OF CHRISTMAS CHARITY

For years, the university has been actively participating in the Finale of the Great Orchestra of Christmas Charity, during which funds are collected for children and seniors. During the 29th edition of the Great Orchestra of Christmas Charity, almost 400 volunteers were involved in the activities of the staff at TUL. The staff, which was organized by the Faculty of Management and Production Engineering and the university authorities, collected a record PLN 345,000. Money was collected by students, employees and rector's authorities.

DEAROMATIZATION ACTIVITIES

Scientists from the Faculty of Chemistry of TUL together with Sichuan University: Chengdu, Sichuan, CN (West China School of Pharmacy) in the Sheng 1 project funded by the National Science Centre are conducting research on providing new ways of activating and innovative asymmetric reactions of aromatic carbonyl compounds. The result of these activities is the development of new methods of functionalization of aromatic systems, which allows to deepen and enrich knowledge about their reactivity. The developed methodologies have the potential to be used as innovative tools for the preparation of new drugs, pesticides and other organic compounds of utilitarian importance. Cooperation with scientists from China will allow to broaden the range of synthetic skills of both research groups and improve international communication in science.

Rector and Vice-Rectors of TUL - volunteers of the Great Orchestra of Christmas Charity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