LITHUANIAN
ENERGY
INSTITUTE

ANNUAL REPORT
2024

Lithuanian Energy Institute

2024 Annual Report
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Content

MESSAGE FROM THE DIRECTOR

I am honoured to present the Annual Report of the Lithuanian Energy Institute, which reflects the achievements of our institution, the dedication of our community, and our strategic vision for the future.

The past year has marked a period of significant transformation for the Institute — a time not only of adaptation to the evolving challenges of the energy sector, but also of proactive engagement in shaping the future of Lithuania's energy landscape. Change is an inherent aspect of progress, and at the Institute, it serves as a catalyst for innovation and scientific advancement.

Today, more than ever before, the research and expert activities conducted by the Institute are vital to ensuring the country's energy security. Our team's work in developing new technologies and methodologies directly contributes to strengthening Lithuania's resilience to energy disruptions and addressing issues of energy accessibility. I am proud that our scientific contributions shape national energy policy and support the development of a secure and sustainable energy sector.

Nonetheless, such progress would not be possible without our most valuable resource — people. We remain firmly committed to attracting, mentoring, and empowering the next generation of scientists. The engagement of young researchers brings renewed vitality to our work and ensures its continuity for years to come. The leadership demonstrated by our heads of the laboratories is invaluable in this process. Their ability to inspire, to set ambitious objectives, and to guide their teams with purpose plays a decisive role in the Institute's continued success.

Looking ahead, we acknowledge the complexity of the challenges that lie before us, yet we are equally confident in the opportunities they present. I am confident that through our collective efforts, by maintaining high standards in scientific research and strengthening international cooperation, we will continue to contribute meaningfully to the advancement of energy in both Lithuania and Europe.

I extend my sincere gratitude to all members of the Institute for their professionalism and commitment, to our partners for their trust and collaboration, and to public institutions for their support and recognition. Together, we are building a more secure, sustainable, and forward-looking energy future.

Director of LEI
Dr. Saulius Gudžius

MAIN FACTS OF 2024

In 2024, the Lithuanian Energy Institute had a total of **241** employees,
including **148** researchers and PhD students.

38 PhD students were enrolled,
Including **8** from abroad, and **8** dissertations were defended.

14 new international projects were initiated, along with **22** national projects

A total of **121** scientific publications were published in the Clarivate Analytics WoS database,
with **88 %** of the publications appearing in Q1 and Q2 journals.

4 long-term institutional research programs are being carried out

10 research divisions

Annual income of
12.5 million EUR*

74 R&D
contracts per year

*excluding funds transferred to partners

In the publication, the Lithuanian Energy Institute may be referred to as LEI or the Institute. Unless otherwise indicated, data presented here and elsewhere refer to 31 December 2024.

VISION OF LEI

The Institute is an internationally recognised centre of excellence for science, innovation and technology in energy and related fields.

MISSION OF LEI

To conduct research and develop innovative technologies in the fields of energy, thermal engineering, environmental engineering, measurement engineering, materials science and economics, to carry out fundamental and applied research, to participate in study processes, to transfer the results of applied research and innovations to industry, to advise the state, the government, public, private institutions, and companies on issues related to the development of sustainable energy in Lithuania, to cooperate actively with higher education institutions in the preparation of specialists for the Lithuanian society.

STRATEGIC OBJECTIVES OF LEI

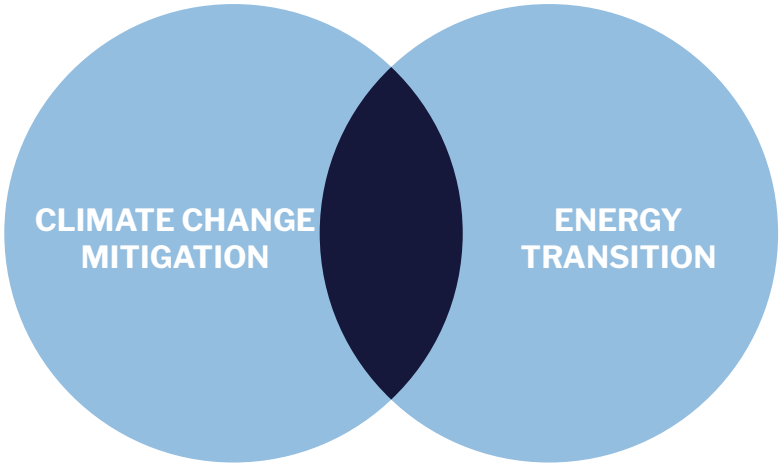
- To perform long-term international level fundamental and applied scientific research, to ensure international excellence in the fields of technology and social sciences, and carry out long-term fundamental and applied research and development of an international standard, which is necessary for the sustainable development of the Lithuanian energy sector and the rest of the Lithuanian economy sectors, and for its integration into the European energy systems and the European Research Area;
- in cooperation with industry, government and society, to transfer scientific knowledge and innovations into technically and commercially useful processes and equipments, ensuring the development of energy technologies and the rational evolution of energy systems, the security and reliability of energy supply, the efficient use of energy resources, the protection of the environment and the reduction of climate change;
- to disseminate scientific knowledge to the public and contribute to the creation of an innovation- and knowledge-based Lithuanian economy;
- initiate and actively participate in Lithuanian and international programme's projects, expand cooperation with Lithuanian and foreign research and educational institutions and scientists;
- to carry out the functions of the designated Institute in accordance with the provisions of the Law on Metrology of the Republic of Lithuania;
- in cooperation with universities, to train scientists of the highest competence for the conducting of research in the fields of economics, energy and the environment, and to ensure the attraction and development of doctoral students.

The Institute's main research areas include (but are not limited to):

- Renewable energy and technologies enabling it;
- Environmental impact of climate change and anthropogenic activities;
- Economic development research towards climate-friendly economy;
- Modelling of energy systems and research of their control systems;
- Safety and reliability studies on industrial and energy facilities;
- Thermal physics, gas and fluid dynamics and metrology;
- Decommissioning of nuclear facilities and radioactive waste management.

STRATEGIC DIRECTIONS

The Lithuanian Energy Institute distinguishes two main strategic R&D directions: climate change mitigation and energy transformation. These are supported by eight additional directions that encompass the key research areas in energy science.



- Research on economic development in the transition to a climate-neutral society
- Impact of climate change and human activities on water and energy resources
- Smart energy systems and Climate-neutral cities
- Advanced materials, Thin films and Nanomaterials
- Hydrogen technologies
- Bioenergy, Waste-to-Energy
- Nuclear Fission and Fusion energy
- Thermal physics, Fluid dynamics and Metrology

MAIN INDICATORS OF THE STRATEGIC PLAN

LEI successfully achieved its operational objectives. One of the Institute's key goals is to generate high-level knowledge that enhances the country's competitiveness. To support this objective, 14 new international programme projects were launched in 2024. This number has doubled since 2023. Additionally, the number of project proposals submitted to international programmes increased by 13% over the year.

Another important priority for the Institute is improving the effectiveness of PhD studies. In 2024, 80% of PhD studies were successfully executed — a 20% increase compared to 2023, and a 30% rise compared to 2022. This year, the total number of PhD students reached 38, with 8 PhD dissertations defended and 8 new PhD candidates admitted.

LEI Performance Monitoring Indicators (KPIs), 2022–2024

LEI Objectives and Measures	Indicators (KPIs) for 2022–2024	2022 m.	2023 m.	2024 m.
OBJECTIVE 1: Develop high-level knowledge that enhances national competitiveness	International programme projects initiated in the given year	9	7	14
	Additional indicator: Number of project proposals submitted to international programmes	35	40	46
Measure for Objective 1: To implement R&D activities in the scientific fields of energy and thermal engineering, environmental engineering, and energy economics	Number of articles per researcher published in Clarivate Analytics WoS journals (IF > 0.25, 5-year IF)	0.69	0.65	**0.64**
	Percentage of articles published in journals indexed in the CA WoS Journal Citation Reports that are in Q1 and Q2 quartiles	77	85	88
	Additional Indicators:			
	Number of articles per researcher published in Clarivate Analytics WoS indexed journals (IF > 0.25, 5-year IF)	0.96	1.29	**0.83**
	Funds from contracts, thousand euros	3586	3955	4436
	Funds for research infrastructure renewal, thousand euros	459	574	473
	Number of scientific presentations at international conferences* per researcher	0.92	0.79	0.83
OBJECTIVE 2: Increase the effectiveness of doctoral studies	Successful completion of doctoral studies, %	50	60	80
Measure for Objective 2: Ensure the preparation of doctoral dissertations	Total number of PhD students	42	40	38
	Number of PhD dissertations defended per year	1	4	8
	Additional indicator: Number of admitted PhD students	10	8	8

* An international conference is considered to be an event held abroad.
Indicators marked in blue refer to the full-time equivalent (FTE) per researcher.

HUMAN RESOURCES

SCIENTIFIC COUNCIL

The LEI Scientific Council is composed of both scientific and administrative staff, as well as representatives from institutions, enterprises, and organizations committed to the Institute‘s mission and the objectives outlined in its official documents. The Council‘s term of office is five years.

Based on the Director‘s proposals, the Scientific Council discusses and approves the Institute‘s structure and any amendments thereto; proposals to amend the Institute’s Statute; documents regulating scientific research at the Institute; internal regulations concerning the ownership of intellectual property; permanent or temporary commissions related to the coordination of research and experimental development (R&D) activities and project preparation; it also develops and approves the procedures for the evaluation and recruitment of scientific staff, and performs other functions.

On 29 March 2024, a meeting of the outgoing Scientific Council took place, during which LEI Director Dr. Sigitas Rimkevičius presented the Institute‘s annual activity report. Council Chairman Dr. Nerijus Striūgas reviewed the achievements of the Council during its term. To mark the end of the Council’s term, honorary LEI gold medals were awarded to the following members for their significant contributions to the Institute’s success: Vytautas Budreika (Advisor at the Ministry of Energy, Strategic Change Management Group), Tomas Daukantas (Head of the Legal and HR Group at the Ministry of Energy), Dr. Zita Duchovskienė (Head of the Technology and Innovation Division at the Ministry of Education, Science and Sport), and Inga Žilienė (Vice-Minister of Energy).

On 5 July 2024, during a general vote by the Institute‘s scientific staff, a new Scientific Council was elected. Dr. Vidas Lekavičius, Chief Researcher at the Laboratory of Complex Energy Studies, was elected as Chairperson, and Dr. Raminta Skvorčinskienė, Senior Researcher at the Laboratory of Combustion Processes, was elected Deputy Chair.

The Ministries of Energy and of Education, Science and Sport appointed the following members to the Council: Nemunas Biknius (Director of AB Amber Grid), Vytautas Budreika (Advisor at the Ministry of Energy), Tomas Daukantas (Head of the Legal and HR Group at the Ministry of Energy), Laima Taparauskienė (Director of the Department for Studies, Science and Technology at the Ministry of Education, Science and Sport), and Inga Žilienė (Vice-Minister of Energy).

The first meeting of the newly elected Scientific Council took place on 19 September 2024. The Council reviewed and discussed its rules of procedure and initiated updates to align the regulation with the Institute’s Statute. In 2024, the new Council approved the establishment of the following commissions: Academic Ethics, Doctoral Studies, Finance and Strategy, and the Commission for Evaluation and Appointments. It also prepared and adopted a procedure for the appointment and evaluation of heads of scientific divisions, ensuring active involvement of division staff in the selection process. Seven candidates for the positions of division heads were submitted to the Director for appointment.

LABOUR COUNCIL

The Lithuanian Energy Institute’s Labour Council is a collegial body which represents the interests of the Employees of the Institute, and defends their Labour, Profession, Economic and Social rights at work.

In its activities, the Council adheres to the principles of goodwill and respect for the legitimate interests of the employer. However, the Labour Council is independent of its employing entity (LEI), and the Employer is prohibited from influencing the Council’s decisions or interfering in its activities in any way.

On 20 March 2024, elections to the LEI Labour Council were held. Five members were elected to the LEI Labour Council:

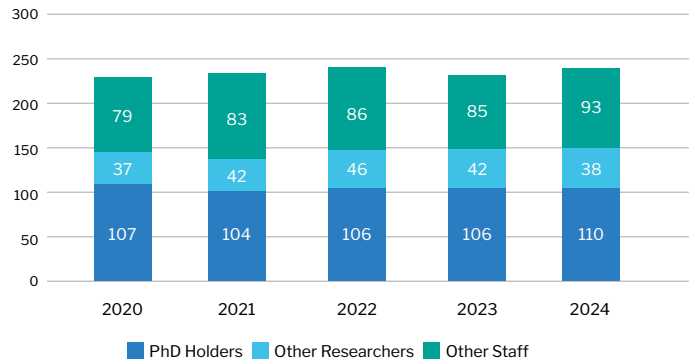
- Marius Praspaliauskas,
- Regina Kalpokaitė-Dičkuvienė,
- Asta Narkūnienė,
- Lina Murauskaitė,
- Andrius Šimonis.

Between April 2024 and February 2025, the LEI Labour Council held seven meetings, during which it approved the Council’s rules of procedure and addressed issues of concern to the Institute’s employees.

EMPLOYEES

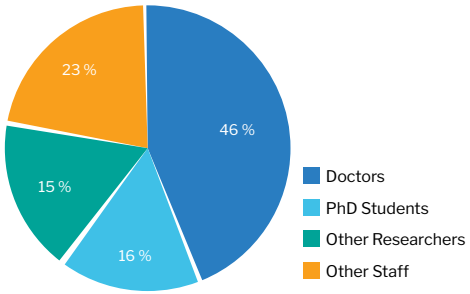
As of December 31, 2024, a total of 241 employees worked at LEI. Researchers, doctoral students, and other research personnel accounted for 61% of all employees, while specialists and other staff comprised 39%.

Employee Numbers (2020–2024)



Employee distribution in 2024

The distribution of researchers in 2024 was: senior researchers made up 25%, associate researchers 22%, researchers 17%, junior researchers 34%, and research fellows (interns) accounted for up to 2%.



On December 31, 2024, the employees consisted of:

85 Women

156 Men

50 years Average age of employees

EMPLOYEE ACHIEVEMENTS

On December 3, 2024, Dr. Tadas Kaliatka was elected as a member of the Young Academy of the Lithuanian Academy of Sciences for a four-year term.

In 2024, the Lithuanian Academy of Sciences (LMA) Algirdas Žukauskas Award in Thermal Physics and Energy was awarded to Dr. Nerijus Striūgas for his cycle of scientific works “Biomass and Waste Gasification for Sustainable Energy Production 2010–2024.”

DOCTORAL STUDIES

The Lithuanian Energy Institute considers the implementation of doctoral studies to be a particularly important activity, aiming to share experience and prepare specialists for the future. The Lithuanian Energy Institute has the right to conduct doctoral studies in three fields:

TECHNOLOGICAL SCIENCES

SOCIAL SCIENCES

Energetics and Power Engineering (T 006)

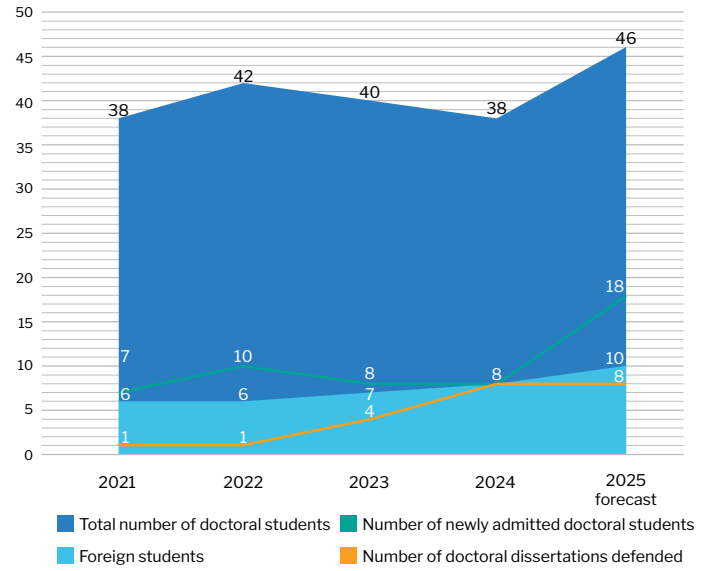
Environmental Engineering (T 004)

Economics (S 004)

Doctoral studies are implemented in collaboration with Kaunas University of Technology, Vytautas Magnus University, and Klaipėda University.

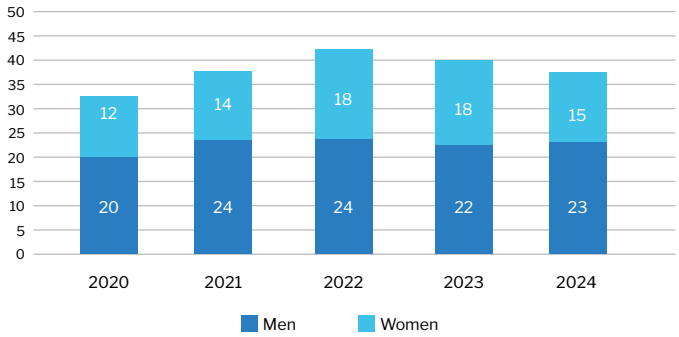
The total number of doctoral students this year was 38, including 8 foreigners. During the year, 8 doctoral dissertations were defended, and 8 new doctoral students were accepted.

Development of Doctoral Studies 2021–2025:



In 2024, out of the 38 doctoral students at LEI, 15 were women and 23 were men. Since 2020, the number of doctoral students has increased by 18%. The number of female doctoral students has risen by 25% during this period.

Doctoral students by gender, 2020–2024



During the four years of doctoral studies, students conduct scientific research and experimental development work, addressing scientific problems in the fields of energy and thermal engineering, environmental engineering, and economics.

Doctoral students participate in the largest scientific projects in the world and contribute to solving global energy problems through their scientific work.

Doctoral students conduct nearly all their research at the institute, where they are provided with the opportunity to use the latest laboratory equipment and consult not only with their supervisors but also with other researchers. Doctoral students actively participate in the institute's long-standing international conference for doctoral students and young scientists, „CYSENI", as well as other conferences.

DOCTORAL STUDENTS ACCEPTED IN 2024

The number of doctoral students accepted in 2024 is 8. Below is the list of accepted doctoral students and their dissertation topics.

IN THE FIELD OF ENERGETICS AND POWER ENGINEERING (T 006)

ZULFIQAR KHALIL

Storage of Synthetic Gas and Study of Production Process by Plasma-Chemical Decomposition of Organic Waste.

Scientific Supervisor dr. Žydrūnas Kavaliauskas.

KAROLIS LAŠAS

The Study of Smart Low-Temperature Heating and Cooling Supply Networks and Their Integration into Other Sustainable Energy Systems.

Scientific Supervisor dr. Sigitas Rimkevičius.

ANDRIUS TIMOFEJEVAS

The Effect of Variable Thermal Loads on the Operation of Building Microclimate Systems.

Scientific Supervisor dr. Kęstutis Valančius.

JULIUS VENCKUS

Investigation of Hydrogen Flame Propagation and Flow Structure and Dynamics in Larger Scale Confined Volume.

Scientific Supervisor dr. Mantas Povilaitis.

DILMUROD TUYMURODOV

Neutron Transport and Radioactive Processes Analysis in Particle Accelerators and Neutron Source Systems.

Scientific Supervisor dr. Gediminas Stankūnas.

ABDUL KHALIQ KHAN

Numerical Investigation on the Cleaning of Harmful Solid Particles by the Action of Sound.

Scientific Supervisor dr. Edgaras Misiulis.

IN THE FIELD OF ENVIRONMENTAL ENGINEERING (T 004)

INESA SINKEVIČIŪTĖ

Study of Nano-Phytoremediation of Soil Heavy Metals Using Energy Plants.

Scientific Supervisor dr. Marius Praspaliauskas.

IN THE FIELD OF ECONOMICS (S 004)

AGNĖ VIČKAČKAITĖ

The Economic Impact of the Transition to Sustainable Practices in the Textile Industry.

Scientific Supervisor dr. Dalius Tarvydas.

DOCTORAL THESES DEFENDED IN 2024

In 2024, 8 doctoral dissertations were defended. Below is the list of doctoral students who defended their dissertations and their research topics.

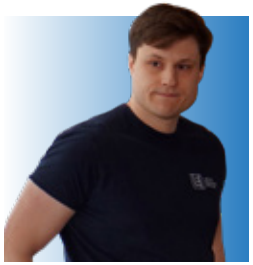
On February 21, 2024, the doctoral candidate from the Hydrology Laboratory, **SERHII NAZARENKO,** defended his doctoral dissertation on the topic

"Patterns of Low Flow and Hydrological Drought Risk Assessment in Lithuanian Rivers Under Climate Change"

(Technological Sciences, Environmental Engineering, T 004)

The dissertation was prepared on the basis of publications. The dissertation was written in English.

Scientific Supervisor – *dr. Jūratė Kriaučiūnienė*



On April 18, 2024, the doctoral candidate from the Thermal Equipment Research and Testing Laboratory, **GEDIMINAS SKARBALIUS**, defended his doctoral dissertation on the topic

"Molecular Dynamics Study of Energetic Characteristics of Evaporating, Condensing and Reflecting Molecules at the Liquid- Vapour Interface"

(Technological Sciences, Energy and Thermal Engineering, T 006)

The dissertation was written in English.

Scientific Supervisor – *dr. Algis Džiugys*

On August 27, 2024, the doctoral candidate from the Smart Grids and Renewable Energy Laboratory, **JUSTĖ JANKEVIČIENĖ**, defended her doctoral dissertation on the topic

"Assessment of Wind Energy Resources Potential in Extensive Urban Environments Under the Changing Climate"

(Technological Sciences, Energy and Thermal Engineering, T 006)

Scientific Supervisor – *doc. dr. Arvydas Kanapickas*

On August 30, 2024, the doctoral candidate from the Energy Systems Research Laboratory, **GINTARĖ STANKŪNIENĖ**, defended her doctoral dissertation on the topic

"Assessment of Energy Related Climate Change Mitigation Measures in Household"

(Social Sciences, Economics, S 004)

Scientific Supervisor – *prof. dr. Dalia Štreimikienė*

On August 30, 2024, the doctoral candidate from the Plasma Technologies Laboratory, **MINDAUGAS AIKAS**, defended his doctoral dissertation on the topic

"Investigation of Solid Waste Treatment by Utilising Atmospheric Pressure Thermal Plasma"

(Technological Sciences, Energy and Thermal Engineering, T 006)

Scientific Supervisor – *dr. Andrius Tamošiūnas*

On September 26, 2024, the doctoral candidate from the Thermal Equipment Research and Testing Laboratory, **JUSTAS ŠEREIKA**, defended his doctoral dissertation on the topic

"Investigation of the influence of active and passive control methods on the dynamics and structure of separated single-phase flow"

(Technological Sciences, Energy and Thermal Engineering, T 006)

The dissertation was written in English.

Scientific Supervisor –

2020 m. rugsėjis - 2024 m. vasaris – dr. Nerijus Pedišius (A. A.), nuo 2024 m. kovo – dr. Paulius Vilkinis

On September 27, 2024, the doctoral candidate from the Thermal Equipment Research and Testing Laboratory, **INESA KNIUIPYTĖ**, defended her doctoral dissertation on the topic

"Effect of environmental factors on the efficiency of biological remediation of soil pollution with heavy metals"

(Technological Sciences, Environmental Engineering, T 004)

The dissertation was prepared on the basis of publications.

Scientific Supervisor – *doc. dr. Jūratė Žaltauskaitė*

On November 20, 2024, the doctoral candidate from the Smart Grids and Renewable Energy Laboratory, **PAULIUS CICĖNAS**, defended his doctoral dissertation on the topic

"Development and efficiency investigation of the frequency stability algorithms for the hydro generators and power generation modules"

(Technological Sciences, Energy and Thermal Engineering, T 006)

Scientific Supervisor – *dr. Virginijus Radziukynas*

DOCTORAL STUDENTS' ACHIEVEMENTS

LEI supports its doctoral students in various ways. Each year, the institute awards incentive scholarships or bonuses to its doctoral students. A competition for the most outstanding young researchers is organized annually, with the winners receiving incentive scholarships or bonuses

MOST OUTSTANDING RESEARCHERS OF 2024, AWARDED BY LEI:

MOST OUTSTANDING BACHELOR'S STUDENT	**PAULIUS BUIDOVAS** (Laboratory of Combustion Processes)
MOST OUTSTANDING MASTER'S STUDENT	**JULIUS VENCKUS** (Laboratory of Nuclear Installation Safety)
MOST OUTSTANDING FIRST-YEAR DOCTORAL STUDENT	**ANDRIUS AMBRUTIS** (Laboratory of Nuclear Installation Safety)
MOST OUTSTANDING SECOND-YEAR DOCTORAL STUDENT	**IEVA KIMINAITĖ** (Laboratory of Combustion Processes)
MOST OUTSTANDING THIRD-YEAR DOCTORAL STUDENT	**JUSTINA JASELIŪNAITĖ** (Laboratory of Nuclear Installation Safety)
MOST OUTSTANDING FOURTH-YEAR DOCTORAL STUDENT	**JUSTAS EIMONTAS** (Laboratory of Combustion Processes)
MOST OUTSTANDING YOUNG RESEARCHER	**GEDIMINAS SKARBALIUS** (Laboratory of Heat-Equipment Research and Testing)

Young researchers, awarded the Honorary Professor Romas Viskanta Prize, established by the Vydūnas Youth Fund to encourage young scientists and doctoral students for their achievements in Energy research:

DR. GEDIMINAS SKARBALIUS
(Laboratory of Heat-Equipment Research and Testing), first prize

DR. LINA VOROTINSKIENĖ
(Laboratory of Combustion Processes), second prize

The Honorary Professor Romas Viskanta Prize is awarded to young scientists and doctoral students of LEI who are actively working in the fields of thermal physics, gas and fluid dynamics, renewable energy, nuclear and thermonuclear energy, and energy in general, and have achieved significant scientific results. Candidates must be active in the social, community, and cultural activities of various organizations and engage in the dissemination of scientific information. On June 28, 2024, the Vydūnas Youth Fund (USA) extended the agreement for the Honorary Professor Romas Viskanta Prize with the Institute for another five years.

RESEARCHERS' GRAND PRIX

JUSTINA JASELIŪNAITĖ, a doctoral student from the Laboratory of Nuclear Installation Safety, participated in the "Researchers' Grand Prix 2024" project, where she presented her research on the dissertation topic "Studies of Turbulence Induction in Unsteady Flow" and reached the event's final.

PROMOTION

In 2024, LEI organized national and international events to present the institute's activities, study and internship opportunities, and participated in the following events:

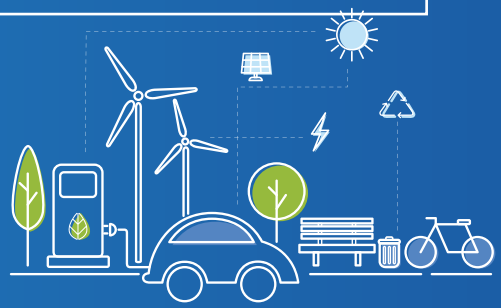
KARJEROS DIENOS	March 19: LEI participated in Vilnius University's Career Days event „VU KD'24";
karjera studijos	March 28-29: LEI took part in the career planning fair „Career & Studies 2024";
GRAVITY	April 21: LEI participated in Vilnius Tech's career day „GRAVITY";
ktu wanted	October 23: LEI participated in the „KTU WANTed Career Day 2024";
VDU JUNGTYS 2024	November 8: LEI participated in the event „VMU Connections".

CYSENI CONFERENCE

In 2024, LEI and LAMMC organized the 20th anniversary CYSENI 2024 International Conference for PhD Students and Young Scientists.

The conference was attended by 150 participants from 12 countries, and 7 keynote presentations were delivered.

CYSENI (Conference of Young Scientists on Energy and Natural Sciences Issues) is an annual event aimed at young scientists from Europe and around the world working in the fields of energy and environmental sciences. The goal of CYSENI is to help young researchers present their latest studies and establish long-term scientific connections.



SCIENTIFIC RESEARCH AND EXPERIMENTAL DEVELOPMENT

LONG-TERM RESEARCH AND EXPERIMENTAL DEVELOPMENT PROGRAMMES

In 2024, four long-term institutional R&D programs for the period 2022-2026 were carried out:

PROGRAMME 1

DEVELOPMENT AND INTEGRATION OF ADVANCED ENERGY TECHNOLOGIES.

Manager – Dr. Raimondas Pabarčius

OBJECTIVE

By continuing ongoing and initiating new numerical and experimental research, and by applying both established and novel research methods, the aim is to further develop advanced energy technologies, comprehensively assess their reliability, safety, and optimal integration into the overall energy network.

This newly initiated program represents the continuation of LEI's scientific research efforts, enabling the accumulation and transfer of Lithuanian scientists' expertise and knowledge to future generations, thus ensuring a sustainable environment and circular way of life.

PROGRAMME 2

INTERDISCIPLINARY RESEARCH ON DECARBONISATION AND ADAPTATION TO CLIMATE CHANGE.

Manager – Dr. Vidas Lekavičius

OBJECTIVE

Through interdisciplinary research in the social, natural, and technological sciences, to obtain and systematize new scientific knowledge necessary for assessing the impacts of climate change, selecting climate change mitigation measures, and preparing practical recommendations for the application of this knowledge.

PROGRAMME 3

INVESTIGATION OF PROCESS REGULARITIES AND RESULTING PRODUCTS IN INNOVATIVE ENERGY/TECHNOLOGICAL SYSTEMS THAT USE RENEWABLE RESOURCES.

Manager – Dr. Robertas Poškas

OBJECTIVE

To investigate the regularities of thermal, chemical, and hydrodynamic processes occurring in innovative technological systems, in order to address the challenges of the circular economy, the production of heat, electricity, and valuable materials, as well as related environmental issues.

PROGRAMME 4

NUMERICAL INVESTIGATIONS OF SAFETY ISSUES AND PROCESSES IN THE FACILITIES FOR SPENT NUCLEAR FUEL AND DECOMMISSIONING RADIOACTIVE WASTE STORAGE AND FINAL DISPOSAL.

Manager – Dr. Artūras Šmaižys

OBJECTIVE

To continue research aimed at ensuring the safe management and storage of radioactive waste and spent nuclear fuel generated during the decommissioning of the Ignalina Nuclear Power Plant, by assessing radiological impact and appropriate engineering solutions.

SCIENTIFIC PUBLICATIONS AND PATENTS

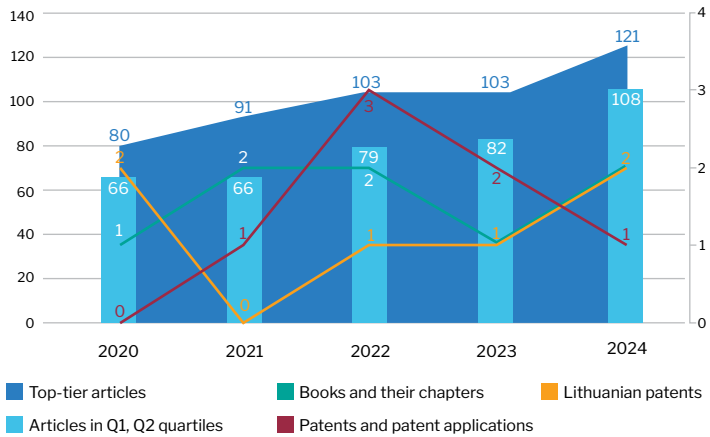
In 2024, a total of **121** scientific publications were published in the Clarivate Analytics WoS database.

88 % of the publications were published in Q1 and Q2 quartile journals.

In 2024, chapters were published in **2** monographs.

2 patents were registered in the Republic of Lithuania, and one patent application was submitted to the Icelandic Patent Office.

Scientific production development



ACHIEVEMENTS AND MAIN RESEARCH AREAS OF RESEARCH DIVISIONS

RESEARCH DIVISIONS OF THE LITHUANIAN ENERGY INSTITUTE:

- Center for Hydrogen Energy Technologies
- Laboratory of Energy Systems Research
- Smart Grids and Renewable Energy Laboratory
- Laboratory of Combustion Processes
- Plasma Processing Laboratory
- Laboratory of Materials Research and Testing
- Laboratory of Heat-Equipment Research and Testing
- Laboratory of Hydrology
- Laboratory of Nuclear Installation Safety
- Nuclear Engineering Laboratory

LABORATORY OF HEAT-EQUIPMENT RESEARCH AND TESTING

MAIN RESEARCH AREAS OF THE LABORATORY:

Processes and technologies for the efficient use of R.E.S. and reduction of environmental pollution

- physical and thermal properties of solid biomass and recovered fuel;
- fuel preparation methods and technologies;
- thermal conversion processes (combustion, gasification) of solid fuel;
- solid biofuel drying;
- solid biofuel dynamics and thermal conversion on moving grate and in fluidized bed;
- emission formation processes in heating appliances;
- efficiency of low capacity boilers and heating appliances fired by solid fuel.

Thermal physics, fluid mechanics and metrology

- flows mixing in chambers of limited dimensions and various geometry;
- permeability of gas mixtures through membranes;
- particulate emission reduction;
- flow dynamics in elastic channels;
- ultrasound propagation in flows;
- heat and mass transfer by molecular dynamics;
- maintenance of five national flow and pressure standards and assurance of measurement traceability.

LABORATORY ACHIEVEMENTS:

A new definition of the liquid-vapor microscopic interphase layer has been developed, based on the concept of an energetic barrier created by liquid molecules for vapor molecules.

This definition helps to better understand phase interactions at the microscale and has the potential to be applied in various fields of thermal and phase transition research.

An advanced laboratory data digitization system has been developed and implemented.

The goal of the system is to ensure the efficiency of daily laboratory operations and the accuracy of results. The system allows not only to significantly speed up the testing process, but also to reduce the need for human resources, ensuring data traceability and reducing the risk of errors.

h2 CENTER FOR HYDROGEN ENERGY TECHNOLOGIES

MAIN RESEARCH AREAS OF THE LABORATORY:

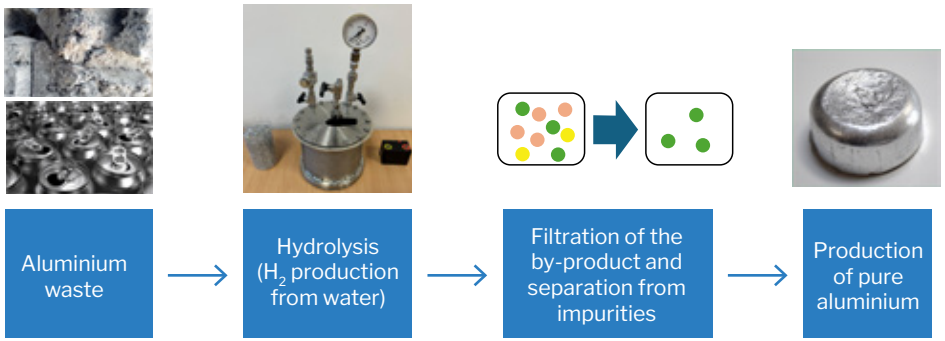
- research in the field of hydrogen energy technologies
- synthesis of hydrogen separation membranes and analysis of their properties;
- hydrogen production using water reactions with metals and nanoparticles of their alloys
- synthesis of metals and their alloy hydrides designed for hydrogen storage; analysis of their properties;
- synthesis of hydrogen fuel cell elements (anodes / electrolytes / cathodes) applying physical vapour deposition methods;
- analysis of NiMH battery electrode material properties.

LABORATORY ACHIEVEMENTS:

Joint patent application for the invention being co-developed with partners – Process for recycling aluminum from metal waste.

The invention involves an improved process for recycling aluminum scrap or waste, enabling the purification of aluminum waste to produce aluminum of higher purity than that found in the scrap or waste. The process includes dissolving aluminum waste in an alkaline solution to form a reaction mixture and purifying this mixture by removing one or more impurity-enriched precipitates.

The joint result of partner activities in the completed project “Aluminum in circle economy – from waste through hydrogen energy to alumina (ALICE-WHY)”.



LABORATORY OF COMBUSTION PROCESSES

MAIN RESEARCH AREAS OF THE LABORATORY:

- Investigation of gaseous, liquid and solid fuels combustion processes;
- Development and optimization of industrial combustion devices;
- Thermochemical (gasification, pyrolysis, carbonization) processing of biomass and non-hazardous waste;
- Liquid and gaseous biofuel synthesis research.

LABORATORY ACHIEVEMENTS:

A char-based catalyst was developed and applied in the pyrolysis process for biofuel production.

In the laboratory, a modified char-based catalyst was developed and applied in the pyrolysis process to improve the quality of liquid products. This catalyst increases the amount of aromatic compounds in the pyrolysis process by up to 50%, and the overall conversion efficiency into liquid products increases by up to 15%.

When applying the pyrolysis process for energy product recovery, char is produced, which can be used as a catalyst to improve the quality of liquid energy products. For this reason, this technology allows marine waste to be used for energy recovery, while also recovering carbon as a by-product, which is then used to improve the quality of liquid energy products from seaweed and fishing nets. The laboratory has developed new technologies for producing alternative biofuels from marine waste.

Application of an innovative concept for reducing fossil fuel consumption using combined friction resistance reduction methods.

The developed technology involves smartly adapted surfaces that optimize the vessel's interaction with water. This ensures reduced friction, increased speed, and a more sustainable future without additional fuel consumption. Since the main sources of energy currently are fossil fuels and natural gas—which are rapidly depleting in the Earth's crust—significant attention is being paid to renewable energy sources and energy extraction from alternative raw materials. For this reason, the potential of energy recovery technologies and their application is becoming increasingly relevant. In the maritime sector, it is essential to reduce resistance and fuel consumption by implementing innovative surface technologies and more efficient fuel usage methods. This would not only reduce CO_2 emissions but also optimize energy use.

LABORATORY OF MATERIALS RESEARCH AND TESTING

MAIN RESEARCH AREAS OF THE LABORATORY:

- Development and Research of Multifunctional Materials and Composites;
- Recovery of Valuable Materials from Multilayer Composites;
- Material Testing, Evaluation, and Analysis of Quality Indicators.

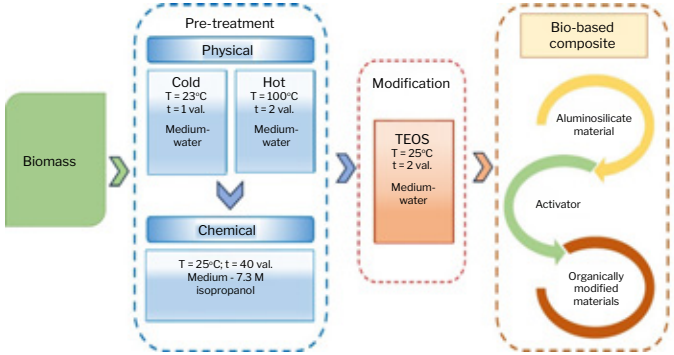
LABORATORY ACHIEVEMENTS:

Implementation of bio-based components into building material structures.

In the frame of the RTO Lithuania project "Application of 13C and 15N labelled isotope methods for research of climate change mitigation potential of recent winter wheat genotypes and common mugwort", the nanomaterials were used to functionalize the surface of wheat straw and ordinary mugwort (Artemisia dubia), enhancing their compatibility with the complex binding material.

Two types of wheat straw and mugwort were organically modified with a hydrophobic organosilane, creating a coating that improves the biomaterial's interfacial compatibility with the geopolymer and lime-based matrixes, improving the functional properties of bio-based composites.

Combining biomaterials' botanical properties with organic modifiers' catalytic effects created a novel material with enhanced performance and resistance to water ingress, merging nature and technology. Using renewable resources and an eco-friendly modification process with minimal ecological impact highlights the material's potential for sustainable construction practices.



NUCLEAR ENGINEERING LABORATORY

MAIN RESEARCH AREAS OF THE LABORATORY:

- Safety of spent nuclear fuel management;
- Safety of radioactive waste management;
- Assessment of different factors related to decommissioning of nuclear facilities using DECRAD (LEI) software;
- Waste heat recovery from flue gases during biofuel combustion and reduction of the amount of emissions from the exhaust;
- Waste heat recovery in aggressive process industries;
- Investigation of heat transfer and hydrodynamic processes in various systems and their components;
- Fire safety investigation.

LABORATORY ACHIEVEMENTS:

The laboratory is conducting projects related to actual EU-level topics on the development of a circular economy, reuse of waste heat, and decrease of harmful emissions.

Research is ongoing in the Project of EU Programme "Horizon 2020": "iWAYS – Innovative water recovery solutions through recycling of heat, materials and water across multiple sectors" (2020–2025 m.)

The project develops a set of industrial technologies and systems to recover water, heat, and, in some cases, materials from exhaust gas streams. The laboratory's main activity relates to waste heat recovery. In 2024, together with colleagues from Italy (SIMAM), the laboratory's researchers tested a prototype for contaminated condensate purification.

The laboratory is conducting projects related to the exceptional state-wide importance and significance of the Ignalina NPP decommissioning Megaproject.

ACTIVITIES ARE ONGOING IN THE FOLLOWING PROJECTS:

- "Engineering Services Associated with Dismantling of Ignalina Nuclear Power Plant Reactor-cores" (R3D);
- "Environmental Impact and Safety Assessments of the Reconstruction and Conversion of INPP Bituminised Waste Storage Facility into a Repository" (B-20) (subcontractor to "Svertas Group" UAB);
- "Technical Support Organisation Assistance to INPP in respect of Safety Analysis and Repository Waste Acceptance Criteria" (TSO.02) – direct funding from the European Commission.

ACTIVITIES HAVE BEEN STARTED IN NEW PROJECTS:

- "Services for the Overarching Environmental Impact Assessment of the Entire Ignalina NPP Decommissioning Process and Preparation of the Environmental Impact Assessment Report";
- "Dismantling of Steam Drum Separators in the Units 1 and 2 of Ignalina Nuclear Power Plant" (subcontractor to "Westinghouse Electric Spain, SAU").

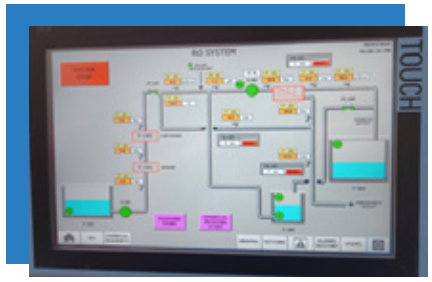
RESEARCH IS ONGOING IN THE PROJECT OF EU PROGRAMME "HORIZON 2020"("EURATOM"):

- "HARPERS – Harmonised Practices, Regulations and Standards in Waste Management and Decommissioning" (2022–2025).

Projects being conducted by the Laboratory relating to the unique long-term Megaproject of the implementation of a deep geological repository in Lithuania (Ignalina NPP):

Research was completed in the Project of EU Programme "Horizon 2020" ("Euratom"): "EURAD – European Joint Programme on Radioactive Waste Management" (2019–2024);

Research has started in the new Project of EU Programme "Horizon Europe" ("Euratom") "EURAD-2 – European Partnership on Radioactive Waste Management" (2024–2029).



PLASMA PROCESSING LABORATORY

MAIN RESEARCH AREAS OF THE LABORATORY:

- Development and research of direct current plasma sources for various applications;
- Investigation of processes and phenomena occurring in discharge channels, plasma flows, and currents;
- Diagnostics of plasma and high-temperature flows, and development of diagnostic tools;
- Interaction of plasma flows with materials in various plasma-based technological processes;
- Research and implementation of plasma processes for hazardous substance neutralization;
- Synthesis of catalytic and tribological coatings in a plasma environment and investigation of their properties;
- Plasma-based formation and modification of surface layers of structural materials;
- Synthesis and property analysis of micro- and nano-dispersed particles and mineral fibers from refractory materials;
- Generation of water vapor plasma and its use for fuel conversion and hazardous waste neutralization;
- Synthesis of hydrogen and synthetic gases in water vapor plasma.

LABORATORY ACHIEVEMENTS:

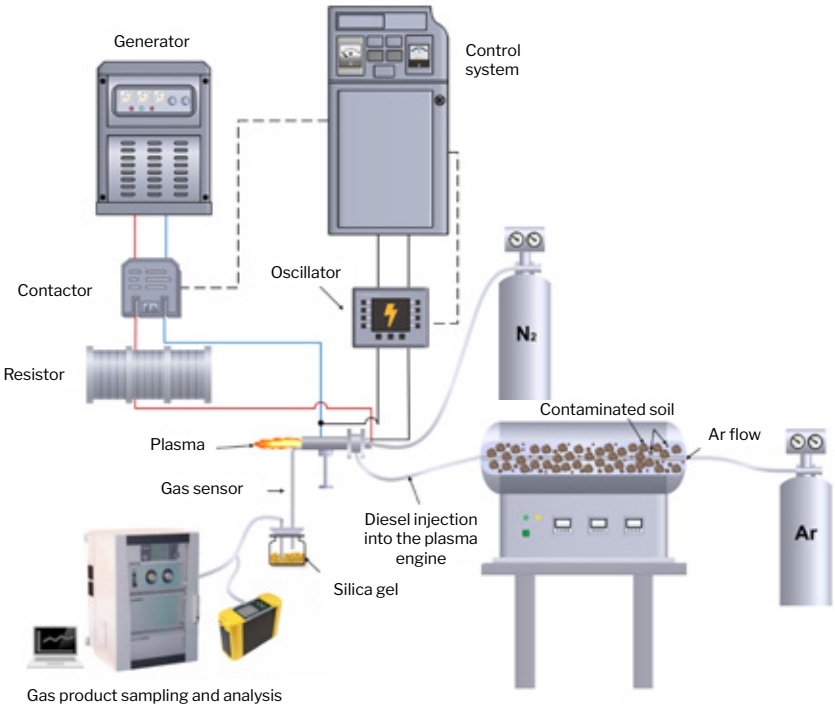
Lithuanian Science Council under the instrument Lithuanian Science Council Support for Scientific Research, Research Group Project "The development of plasma and pulsed electric field technologies for the treatment of the marine algae" has been implemented.

During the joint CPST-LEI "PLASMALGAE" project, a gliding arc discharge plasma reactor was developed for the treatment of marine and freshwater microalgae and their growth media, which allows for effective control of plasma composition by changing the power source parameters and air flow rates. Studies of the effects of plasma treatment showed that by controlling the discharge parameters, the concentrations of hydrogen peroxide, nitrites, and nitrates in algae growth media could be controlled, which directly affects and determines changes in the electrical conductivity and pH value of the medium. It was found that the marine algae I. galbana are more sensitive to the plasma treatment compared to the freshwater algae C. vulgaris. The developed pulsed electric field generation (CPST) and gliding arc discharge plasma (LEI) technologies allow for an effective increase in the permeability of microalgal cell membranes and ensure the release of valuable compounds, such as proteins and nucleic acids.

The Santaka Valley project "Plasma-catalytic conversion of gaseous products (H_2, CO_2) formed during remediation of diesel-contaminated soil into synthetic CH_4 (PURIFY)" has been implemented.

During the inter-institutional LEI-VMU "PURIFY" project, a prototype was developed that not only enables the remediation of soil contaminated with petroleum products but also reduces the negative environmental impact of CO_2 emissions released during thermal remediation by utilizing CO_2 as a feedstock for gaseous fuel production in the plasma environment. The project's implementation contributed to contaminated soil remediation, CO_2 emissions reduction, and alternative fuel (synthetic CH_4) production, aiming to address environmental and energy challenges.

DEVICE PROTOTYPE



LABORATORY OF NUCLEAR INSTALLATION SAFETY

MAIN RESEARCH AREAS OF THE LABORATORY:

Nuclear energy technology research:

- Safety and reliability of operating nuclear power plants
- Advanced nuclear small modular reactor technologies, their safety and reliability
- Nuclear decommissioning technologies, safety and reliability

Research on fusion technologies and particle accelerators (CERN and others):

- Transport of elementary particle and activation of materials
- Safety and reliability of nuclear fusion facilities

Thermodynamic application in development of innovative products and technologies:

- Fundamental and applied research in thermal physics
- Numerical research of fluid dynamics

Research on integration, reliability, security and resilience of energy systems:

- Climate-neutral smart cities and their systems integration
- Security of energy supply and resilience of energy systems
- Reliability and structural integrity of building structures and piping's systems.
- Safety, reliability and risks of industrial facilities and processes

LABORATORY ACHIEVEMENTS:

Advanced nuclear small modular reactor technologies, safety and reliability:

- 29 May 2024 LEI has been admitted to the European Industry Alliance on Small Modular Reactor established by the EC and participates in three Working Groups: TWG2 - Technology and R&D&I; TWG6 – Nuclear Safety and Safeguard; TWG7 - Fuel Cycle and Waste Management
- 16 September 2024 LEI signed the Letter of Intent with the US Department of Energy to collaborate on advanced small modular reactor technologies, safety analysis and waste management solutions

3 June 2024 LEI joins the Lithuanian Particle Physics Consortium:

- Participation in the consortium enables scientists to actively engage in international particle physics research carried out in collaboration with CERN.
- The LEI plays a particularly important role in the n_TOF experiment by conducting neutron research relevant to nuclear energy and applied physics, thereby strengthening its scientific potential and international cooperation.
- Participation in the consortium is a key step toward full CERN membership, which offers additional benefits in science, industry, and representation.

Applied research and innovation development in cooperation with Astra LT, AB:

Development of innovative aseptic and ultra-hygienic containers and tanker trucks:

Project objective - Successful implementation of R&D activities to create two world-class innovative products: new aseptic containers (AT) and ultra-hygienic containers (UHT) with completely new solutions that eliminate the risks of overpressure and vacuum implosion.

Development of innovative composting technology and equipment:

Project objective - to create a new, world-class smart composting technology and facility that will enable manure waste, together with phosphogypsum waste, to be processed into safe and useful products.

In the context of these projects, laboratory researchers investigate heat and mass transfer processes, as well as structural integrity challenges in designs.

SMART GRIDS AND RENEWABLE ENERGY LABORATORY

MAIN RESEARCH AREAS OF THE LABORATORY:

- Mathematical modeling of energy systems and networks, and investigation of control-related issues;
- Modeling and optimization research of information and control systems in energy systems;
- Research on the integration of renewable energy technologies into electrical power systems.

LABORATORY ACHIEVEMENTS:

Research on the Virtual Network as a Product in the Electricity Market.

The study aimed to develop a power management model for electricity storage systems, which defines the actions, procedures, and cooperation framework between the participants in the power management process—namely, the transmission system operator and the operator/company of the electricity storage system. The model ensures a smooth, prompt, controlled, and accountable reservation and activation of storage system capacities for providing the overload mitigation service for the transmission system operator.

The model specifies the compliance of power management actions with the transmission system operator's instructions, the content and sequence of communication processes and data exchange, and the requirements for the technical management infrastructure.

The model details the actions of the process participants and the technical conditions for implementing it. Two implementation phases are distinguished: the first assumes no competition among energy storage systems, while the second considers intersystem competition in providing services to the transmission system operator.

Client: Litgrid AB

Study on Ensuring the Continuity of ORLEN Lietuva AB Thermal Power Plant Operations in the Event of a Lithuanian Energy System Failure.

In the event of a significant failure in the Lithuanian power system, this study examines the feasibility of maintaining the operation of ORLEN Lietuva AB's thermal power plant and oil refinery under island mode conditions following a total blackout of the national electricity grid.

As part of the study, mathematical models of the thermal power plant and the oil refinery were developed to simulate transient processes. In addition, an operational algorithm was designed to facilitate the transition of both facilities into autonomous (island) operation mode.

A comprehensive technical and economic assessment was carried out to identify the technologies necessary to ensure reliable and stable operation of the plant and refinery under such conditions.

Client: ORLEN Lietuva AB

LABORATORY OF HYDROLOGY

MAIN RESEARCH AREAS OF THE LABORATORY:

- Research of renewable energy sources under climate change;
- Environmental impact studies on energy and water transport infrastructure development;
- Application of remote sensing and artificial intelligence for the research of water bodies;
- Research of hazards of hydrological extremes and their management under climate change;
- Numerical modeling of hydrodynamic processes of waves, currents and sediments.

LABORATORY ACHIEVEMENTS:

The project „Ice-jam flood risk management in Latvian and Lithuanian regions with respect to climate change" is launched.

In the framework of the Interreg Latvia-Lithuania Cross Border Cooperation (ICEREG) project "Ice-jam flood risk management in Latvian and Lithuanian regions with respect to climate change" (ICEREG), for the first time, the development of ice jam flood models in Lithuanian rivers has been started using the HEC-RAS hydrodynamic modelling system and the Finnish Environment Institute's ice jam model (SYKE).

The ICEREG project aims to improve the management of ice jam flood risk by developing comprehensive flood hazard maps and improving the conceptual model of ice jam formation, particularly in the context of climate change. Although Lithuania has included flood risk reduction and management in its climate change adaptation plans, the dynamics of ice jam floods remain unexplored. As an additional source of flood risk, ice jams pose a significant risk due to their sudden formation and extensive flooding. The unpredictability of ice jam floods formation adds to this challenge, and a better understanding of the meteorological and hydrological conditions that lead to these floods is essential.

Therefore, for the first time in Lithuania, a conceptual model of ice jam floods formation is being developed within the framework of this project, using the ice jam model of the Finnish Environment Institute (SYKE). Meanwhile, the HEC-RAS hydrodynamic modelling system helps to simulate and assess potential inundation areas due to ice jam flooding. The developed and combined ice jam and hydrodynamic models will help to improve the existing flood warning system.

LABORATORY OF ENERGY SYSTEMS RESEARCH

MAIN RESEARCH AREAS OF THE LABORATORY:

- Economic modelling at micro and macro level, analysis and solution of economic and social problems, development and application of economic models of various types (micro-simulation, cost-pro duction, general equilibrium);
- Analysis and mathematical modeling of the development and functioning of various systems related to the decarbonization of the economy and climate change mitigation, including complex studies on the integration of different systems (technical, natural, and social), the use of renewable energy sources, and their impact on the environment. Formation and analysis of medium- and long-term development scenarios, policy formulation;
- Analysis of the optimal allocation of generation, reservation and balancing capacities in power systems and interconnectors. Finding optimal ways to balance the use of energy from renewable energy sources;
- Research on transport decarbonization. Studies on smart charging of electric vehicles and the potential use of alternative fuel production to balance the intermittent generation of renewable energy sources;
- Research on the long-term development links between building renovation and the construction of new energy-efficient buildings with the development of energy systems.
- Environmental impact assessment of energy, analysis and impact evaluation of abatement technologies and environmental protection measures;
- Analysis, impact assessment and development of recommendations on measures to integrate renewable energy sources and improve energy efficiency;
- Research on climate change mitigation and the promotion of behavioral changes among households, assessment and integration of residents‘ preferences in this field using methods such as willingness-to-pay and others for climate change mitigation, as well as the formulation of climate change mitigation policy measures in this area;
- Research and development of modern management and marketing solutions in the energy sector aimed at building a welfare society.

LABORATORY ACHIEVEMENTS:

Further development of mathematical models of the LIFE IP EnerLit project modeling framework for the elaboration of the National Energy and Climate Action Plan:

- Mechanisms for modeling energy policy measures were elaborated and implemented in energy consumption and energy supply models, and modeling principles for energy storage were developed to enable more correct modeling of short and long-term energy storage in mathematical models for long-term energy planning;
- The possibility of analyzing energy efficiency measures in the context of industrial transformation was introduced in the industry model. Links to the results of energy audits of industrial enterprises were developed - a comprehensive data need for modeling was identified, recommendations for conducting energy audits and processing of audit data were provided;
- Training for the Lithuanian Energy Agency on the use of the developed models was provided

Other research activities:

- The implications of the introduction of the EU ETS-2 system in Lithuania for households (in terms of energy poverty) and micro-enterprises were analyzed. The enterprises vulnerable to the EU ETS-2 system were identified and changes in their business indicators were analyzed;
- A set of indicators for assessing the effectiveness of municipal waste management policy has been developed in line with the country‘s legal obligations and policy objectives, and an evaluation of the policy‘s effectiveness has been launched;
- Contacts with foreign partners and research on measuring gender and age inequalities in decarbonization processes and equity were initiated;
- The impact of time resolution and different ways of representing renewable energy generation technologies in long-term planning models on the results obtained was analyzed;
- Continued research on positive energy districts – identifying key enabling factors, decision-making processes, and challenges.

APPLIED SCIENTIFIC RESEARCH

LEI conducts applied research to meet the needs of both the public and private sectors. In 2024, the value of commissioned work exceeded

EUR 2 million.

COMMISSIONED RESEARCH INCLUDED THE FOLLOWING SERVICES:

- preparation of studies,
- environmental impact assessments,
- technology development,
- methodology development,
- model development,
- accredited testing of thermal equipment.

SOME OF THE MOST SIGNIFICANT CONTRACTS IN TERMS OF VALUE AND SCOPE ARE RELATED TO:

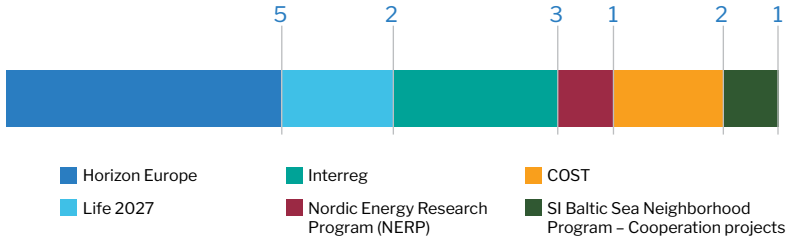
- the management and storage of radioactive waste at Ignalina NPP,
- issues related to electricity transmission networks,
- innovative solutions in the renewable energy sector.

SCIENTIFIC PROJECTS

In 2024, **46** new international project proposals were submitted, **14** new international projects were launched, and **22** national projects were initiated.

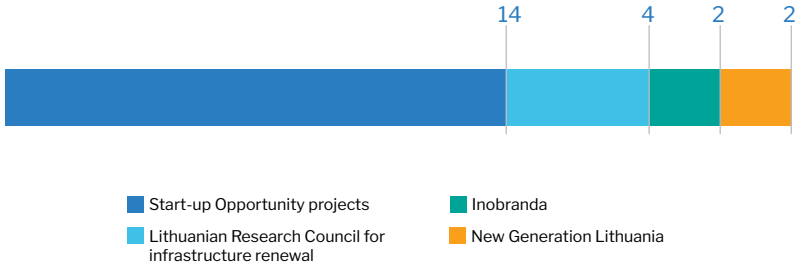
In 2024 there were launched 5 projects under the “Horizon Europe” program, 2 projects under the “Life 2027” program, 3 projects under the “Interreg” program, 1 project under the Nordic Energy Research Program, 2 projects under the “COST” program, and 1 project under the “SI Baltic Sea Neighborhood Program”.

INTERNATIONAL PROJECTS INITIATED IN 2024



In 2024, 14 Seed Funding projects, 4 infrastructure renewal projects funded by the Research Council of Lithuania, 2 projects under the “Inobranda” program, and 2 projects under the “New Generation Lithuania” program were launched.

NATIONAL PROJECTS INITIATED IN 2024



INTERNATIONAL PROJECTS STARTED IN 2024

In 2024, 14 international projects were started, the descriptions are provided below.

"HORIZON EUROPE" PROGRAM PROJECTS

Project **"Renewable and Waste heat valorisation in Industries via Technologies for Cooling production and energy Harvesting (RE-WITCH)".**	Aim of the project is to deliver cost-competitive, game-changing solutions in the field of sustainable industrial cooling and heating. **Project period:** 1 January 2024 – 31 December 2027. **Project manager:** dr. Rolandas Urbonas.
Project **"Ensuring Assessment of Safety Innovations for SMR (EASI-SMR)".**	Aim of the project is to share the insights gained during the project about European LV-SMR projects, primarily: NUWARD SMR – a French-designed reactor generating 170 MW of electricity; LDR-50, a Finnish 50 MW centralized heating reactor project. **Project period:** 1 September 2024 – 31 August 2028. **Project manager:** dr. Tadas Kaliatka.
Project **"Consumer Demand Flexibility in Electricity Use (CoDeF)".**	Aim of the project is to train 15 innovative, highly qualified experts for Europe through specialized doctoral studies, who will be able to implement and improve energy flexibility solutions in the electricity system, thus contributing to the development of clean, low CO_2 emissions energy. **Project period:** 1 September 2024 – 31 August 2028. **Project manager:** dr. Virginijus Radziukynas.
Project **"European Partnership on Radioactive Waste Management – 2 (EURAD-2").**	Aims of the project are: support Member States in developing and implementing their national RD&D programmes for the safe long-term management of their full range of different types of radioactive waste through participation in the RWM Joint Programme; develop and consolidate existing knowledge for the safe start of operation of the first geological disposal facilities for spent fuel, high-level waste, and other long-lived radioactive waste, and supporting optimization linked with the stepwise implementation of geological disposal facilities; building on the achievements of EURAD-1 and PREDIS, maintain a knowledge management system that enhances transfer of knowledge between organisations, Member States and generations. **Project period:** 1 October 2024 – 30 September 2029. **Project manager:** dr. Povilas Poškas.
Project **"A groundbreaking Route via Green Methanol Towards High-Efficiency Local Energy Supply (ResMe2E)".**	Aim of the project is to revolutionize small-scale green energy production by developing systems for generating green methanol from biogenic residues and converting this synthetic fuel into electricity using a highly efficient Brayton cycle. **Project period:** 1 September 2024 – 31 August 2027. **Project manager:** dr. Rolandas Paulauskas.

"LIFE 2027" PROGRAM PROJECT

Project **"Integrated water management in Lithuania (LIFE SIP Vanduo)".**	Aim of the project is to ensure good status of surface and marine waters in Lithuania by implementing the National Water Sector Plan in accordance with the Water Framework Directive and the Marine Strategy Framework Directive. **Project period:** 1 January 2024 – 31 December 2033. **Project manager:** dr. Vytautas Akstinas.

Project **“Re-Energize (LIFE23-CET-Re-Energize)”.**

Aim of the project is to revitalise the workforce in the heat pump sector through detailed assessment and strategic action planning.

Project period:
1 October 2024 – 30 September 2027.

Project manager: dr. Egidijus Babilas.

Coordinator of the project is Lithuanian Energy Institute.

“INTERREG” PROGRAM PROJECTS

Project **“Low Calorific Gas for Green Power Production (LoCaGas)”.**

Aim of the project is twofold: the production of green electricity and heat, which in itself contributes to GHG reduction if the corresponding use of fossil fuels is offset, and reduction of GHG gases by reduction of spontaneous methane emission from landfills and elimination of methane emissions from different types of off-gases.

Project period:
1 July 2024 – 30 June 2027.

Project manager: dr. Rolandas Paulauskas.

Project **“Ice-jam flood risk management in Latvian and Lithuanian regions with respect to climate change (ICEREG)”.**

Aim of the project is to enhance the management of ice-jam flood risk by developing comprehensive flood maps and refining the conceptual model of ice-jam flood formation, particularly in the context of climate change.

Project period:
1 February 2024 – 31 January 2026.

Project manager: dr. Jūratė Kriaučiūnienė.

Project **“Decarbonization of district heating systems (DecarbonDHS)”.**

Aim of the project is to promote the decarbonization of district heating systems and facilitate the transition towards sustainable and low-carbon solutions, by integrating renewable energy sources, energy efficiency, utilizing waste heat from industry and incorporating energy storage technologies.

Project period:
1 July 2024 – 30 June 2027.

Project manager: dr. Rimantas Bakas.

“NORDIC ENERGY RESEARCH PROGRAM” PROGRAM PROJECT

Project **“Plastic waste conversion to methanol through water vapor plasma gasification and advanced catalytic synthesis (E-Pla2Meth)”.**

Aim of the project is efficiently recycle plastic waste into green methanol.

Project period:
1 August 2024 – 31 July 2026.

Project manager: dr. Rolandas Paulauskas.

Coordinator of the project is Lithuanian Energy Institute.

“COST” PROGRAM PROJECTS

Project **“Fatigue Benchmark Repository (CA23109)”.**

Aim of the project is to create an experimental fatigue database that will be easily accessible for conducting comparative calculations.

Project period:
25 September 2024 – 24 September 2028.

Project manager: dr. Remigijus Janulionis.

Project **“A pan-European network of Ocean Tribology (CA23155)”.**

Aim of this Ocean Tribology Center (OTC) COST Action is to create a pan-European-wide network of countries with a strong offshore affiliation for promoting collaboration and knowledge-sharing towards the development of sustainable, reliable and energy efficient ocean systems.

Project period:
4 September 2024 – 3 September 2028.

Project manager: dr. Liutauras Marcinauskas.

“SI BALTIC SEA NEIGHBORHOOD PROGRAM” PROGRAM PROJECTS

Project **“Roots for Remediation: Collaborative Phytoremediation in Post-Catastrophe Environments (ROOTS)”.**

Aim of the project is to deepen and further develop cooperation in bio-remedial technologies for sustainable recovery of land, water and air in the Baltic Sea region after environmental catastrophic events.

Project period:
August 2024 – 31 July 2025.

Project manager: dr. Inna Pitak.

SCIENTIFIC INTERNSHIPS

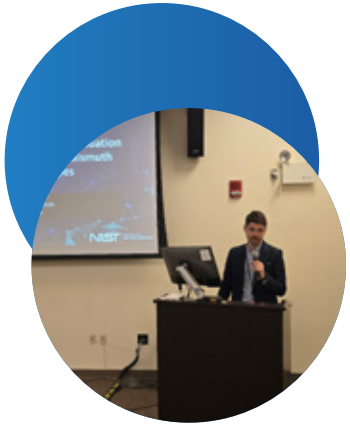
In 2024, LEI scientists and a PhD student participated in three internships (duration – 30 days or more).

DR. ANDRIUS TAMOŠIŪNAS

A chief research associate from the Plasma Technologies Laboratory completed a research internship at the Technical University of Munich in Germany from May 30, 2023 to December 2, 2024. He was one of twelve invited professors participating in the REDEFINE H2E project at the Technical University of Munich. The main goal of the project is to develop a circular hydrogen economy based on a single integrated concept comprising just three key elements. This unique synergy between electrical gasification (e-Gas), reversible solid oxide cells (rSOC), and biocatalytic synthesis (Biocat)—supported by various system-level aspects and modeling (SLAM)—enables an ideal representation of the entire hydrogen value chain with maximum efficiency and flexibility.

IEVA KIMINAITĖ

A PhD student and junior research associate from the Combustion Processes Laboratory undertook a research internship at the Technical University of Munich in Germany from February 6, 2024 to January 31, 2025. The topic of the internship was **“Thermochemical Conversion of Plastic Waste into Multifunctional Carbon and Hydrogen Gas.”** The objective of the internship was to obtain results necessary for the preparation of her dissertation and to conduct high-temperature pyrolysis experiments on plastic waste to produce carbon and hydrogen-enriched gases. Key outcomes: the kinetics of plastic decomposition were studied on a smaller scale using a wire mesh reactor; the recovery of carbon and hydrogen-enriched gases was carried out on a larger scale using a fixed-bed reactor. The obtained data were published in a Q1 MDPI journal „Polymers“ and presented as a talk at the 19th Edition of the Global Conference on Catalysis, Chemical Engineering & Technology (CAT 2024) in Rome. A second article based on the results of the internship is currently in preparation.



DR. MANTAS POVILAITIS

A chief research associate from the Nuclear Facilities Safety Laboratory is currently undertaking a research internship at the National Institute of Standards and Technology (NIST) in Gaithersburg, United States, from November 13, 2024 to an expected end date of April 18, 2025. The aim of the internship is to develop a model for an alternative cooling solution for the thermal column of the NIST nuclear reactor. During the internship, a 3D model of the reactor’s thermal column was created, the current water-cooling system was simulated, and initial calculations using helium as an alternative coolant were performed. A modeling system has been prepared for further optimization studies, which will be continued by the National Institute of Standards and Technology itself.

PARTNERSHIPS IN LITHUANIA AND ABROAD

PARTNERSHIPS IN LITHUANIA

In its efforts to develop innovations needed by the national industry, LEI actively participates in networks of Lithuanian industrial organizations. Below is a list of networks in which the Institute is a member:

- Association “RTO Lithuania”
- Lithuanian State Research Institutes Directors’ Conference
- Association “Santaka Valley”
- Lithuanian Nuclear Energy Association
- Lithuanian Association for Energy Economics
- Lithuanian biomass energy association
- Lithuanian Electricity Association
- Lithuanian Engineering Industries Association
- Lithuanian Research Library Consortium
- Lithuanian Thermotechnical Engineer’s Society
- National Lithuanian Energy Association
- Lithuanian Association for Hydrogen Energy
- Smart Energy Digital Innovation Hub
- Lithuanian Hydrogen Platform
- Lithuanian Confederation of Industrialists
- Lithuanian Solar Energy Asssociation (LSEA)

COOPERATION AGREEMENTS ESTABLISHED WITH HIGHER EDUCATIONAL INSTITUTIONS IN 2024:

On November 15, 2024 an agreement was signed with Panevėžio kolegija Higher Education Institution.

On December 17, 2024 an agreement was signed with Kauno kolegija Higher Education Institution.

The purpose of these agreements is to strengthen cooperation in the joint execution of scientific activities.

PARTNERSHIPS ABROAD

LEI, in conducting scientific research and experimental development, collaborates with domestic and international energy market participants, as well as scientific and business organizations. Active membership in international organizations is crucial for executing international scientific activities.

LEI is a member of several well-known international organizations, and through its participation in their activities, it deepens its understanding of scientific research development, policy issues, and the latest problems in specialized topics:

SCIENTIFIC RESEARCH DEVELOPMENT AND POLICY ORGANIZATIONS:

- European Association of Research and Technology Organisations (EARTO)
- European Energy Research Alliance (EERA)
- European Association of Research Managers and Administrators (EARMA)

NUCLEAR ENERGY ORGANIZATIONS

- Sustainable Nuclear Energy Technology Platform (SNETP)
- The FuseNet Association
- CERN Baltic Group
- European Atomic Energy Society
- European Safety, Reliability & Data Association (ESReDA)
- European Technical Safety Organisations Network (ETSON)
- Implementing Geological Disposal of Radioactive Waste Technology Platform (IGD-TP)
- Industrial Alliance on Small Modular Reactors

METROLOGY RESEARCH ORGANIZATIONS

- The European Association of National Metrology Institutes (EURAMET)
- International Measurement Confedetation (IMEKO)

HYDROLOGY RESEARCH ORGANIZATIONS

- European Network of Freshwater Research Organisations (EurAqua)

In 2024, agreements were made with two U.S. institutions.

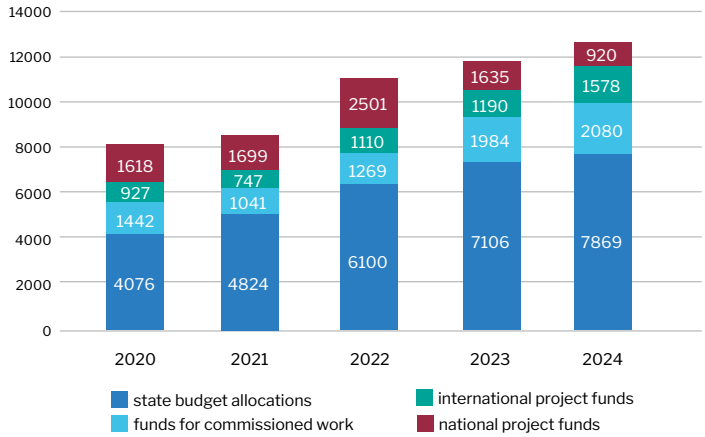
On September 16, a memorandum of understanding was signed with the U.S. Department of Energy regarding cooperation in the following areas: advanced small modular reactor technology, safety analysis, and waste management solutions.

On December 19, a joint activity agreement was signed regarding the Massachusetts Institute of Technology (MIT) International Science and Technology Initiatives (MISTI) program consortium for Lithuania, coordinated by Vytautas Magnus University (VDU). The agreement formalizes the joint activities of the consortium partners aimed at strengthening cooperation between Lithuanian and U.S. scientific and governmental institutions, businesses, and other research and applied activity organizations. The consortium partners include: Vytautas Magnus University, Kaunas University of Technology, Vilnius University, Vilnius Gediminas Technical University, Vilnius Academy of Arts, Klaipėda University, Lithuanian Institute of Agrarian and Forest Sciences, Lithuanian Energy Institute, Ignitis Group JSC, Lithuanian Railways JSC, Novian Ltd.

FUNDING

The LEI budget consists of state budget allocations, funds for commissioned work, international project funds, and national project funds.

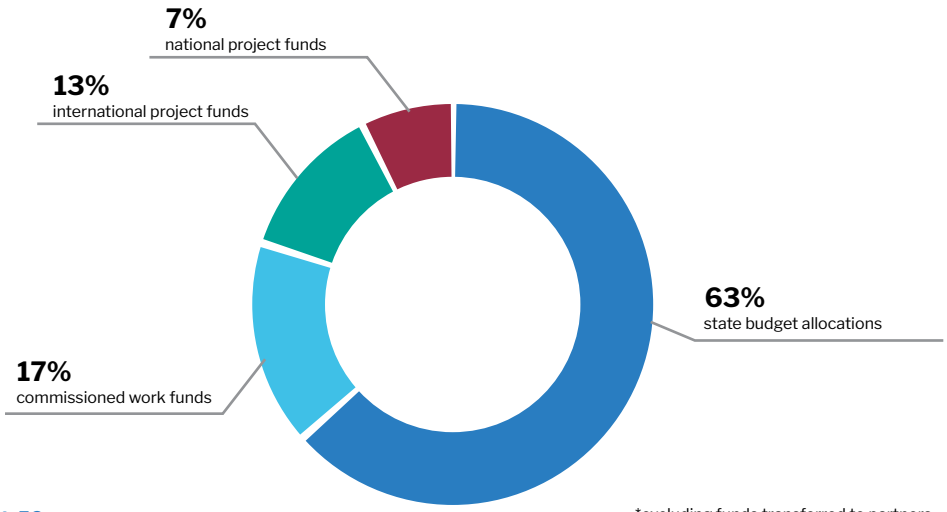
Dynamics of funding, 2020 – 2024



REVENUE AND COSTS STRUCTURE FOR 2024

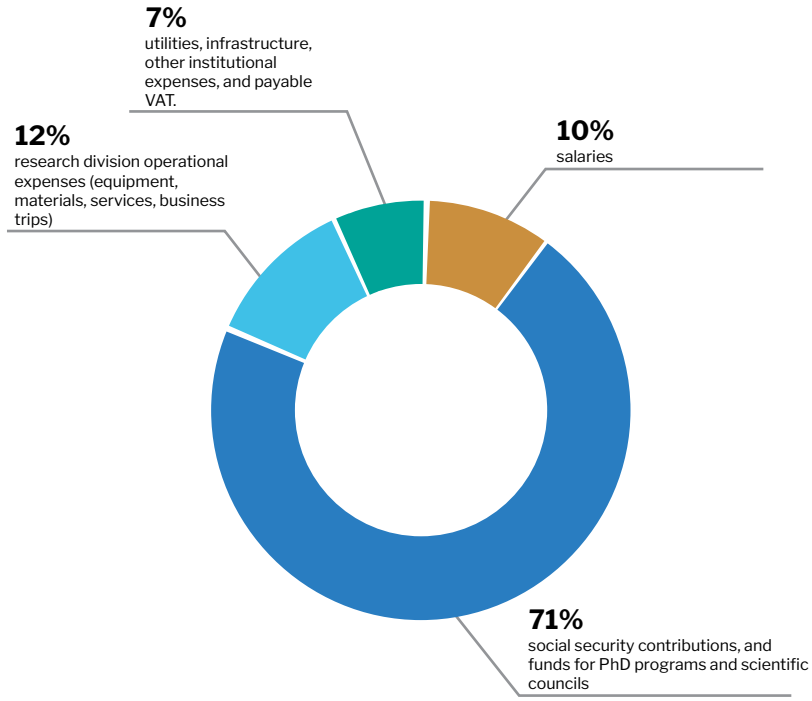
In 2024, the LEI revenue amounted to 12,447.4 thousand EUR*, with the following breakdown: 63% from state budget allocations, 17% from commissioned work funds, 13% from international project funds, 7% from national project funds.

Revenue structure in 2024



In 2024, the costs were distributed as follows: 81% for salaries, social security contributions, and funds for PhD programs and scientific councils; 12% for research division operational expenses (equipment, materials, services, business trips); 7% for utilities, infrastructure, other institutional expenses, and payable VAT.

Distribution of costs in 2024



*excluding funds transferred to partners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