



ANNUAL REPORT

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Dr. Sigitas Rimkevičius Director of LEI

FOREWORD

Message from the Director

Year 2019 was full of important events for the Lithuanian Energy Institute. In June 2019, a new LEI Scientific Council was elected. It differs from the previous one by a larger number of members from outside organisations (now there are 6 of them). The reason of that was to attract more representatives of business, decision-makers and research institutions and thus to become more open and well-known, to gain experience from other institutions' management best practices. I am pleased that external LEI Scientific Council members are active, encouraging the Institute to improve in the organisation management and take more active actions on the issues of improving the efficiency of the Institute's work.

In July 2019, the Centre for Physical Sciences and Technology (FTMC), the Lithuanian Energy Institute (LEI), the Lithuanian Research Centre for Agriculture and Forestry (LAMMC) and the Science and Technology Park of the Institute of Physics established the Association of non-university research and technology organisations "RTO Lithuania". The partners of the Association will join forces in order to commercialise scientific knowledge more efficiently, transform it into new products or high value-added technologies and services.

In 2019, the Institute was successful in terms of both international and national projects as well as contracts from companies and other institutions, which enabled the Institute to have a larger budget, to create better conditions for attracting young researchers to the Institute, to establish an incentive bonus fund for the authors of the best articles, and to fund institutional projects with partners of SANTAKA Valley (Vytautas Magnus University, Kaunas University of Technology and Lithuanian University of Health Sciences). Attracting talented young people to the Institute remains a priority task that we will devote special attention to in order to ensure the Institute's perspective and development. I will seek to ensure that the Institute is actively involved in solving the challenges of climate change and sustainable energy development.

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ABOUT LEI

THE INSTITUTE IS

Mission:

INTERNATIONALLYTo perform energy, thermal, metrology, material engineering and socialRECOGNIZED ENERGY-sciences (energy economy) research; to create innovative technologies;RELATED RESEARCH,to perform fundamental and applied research, to participate in studyDEVELOPMENT ANDprocesses; to transfer applied research results to industry and business;INNOVATION (R&D&I)to consult governmental, public and private institutions and enterprisesCOMPETENCE CENTER.on the issues related with Lithuanian sustainable energy development;to actively participate (together with Higher Education institutions) in
preparing specialists for Lithuanian Science and Industry.

Strategic objectives:

• To perform long-term international level fundamental and applied R&D&I activities, which are necessary for sustainable development of Lithuanian Energy Sector and other Lithuanian economy branches as well as integration into the European energy system and European Research Area.

• To cooperate with business, governmental and public entities, to transfer knowledge to technically and commercially beneficial processes and facilities, ensuring development of innovative energy technologies, economy and security of energy sites and systems, efficient usage and energy sources, environmental pollution reduction and climate warming moderation.

• To spread scientific knowledge in society, to promote innovation and knowledge based Lithuanian economy development.

• To actively participate in EU R&D&I programmes and international projects, expand cooperation with internationally recognised research centers.

Areas of activity of the Institute:

- research and experimental activities in the fields of technology and social sciences.

LEI strategic R&D topics:



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Institute's research, development and innovation directions:

- 1. Thermal physics, gas and liquid dynamics and metrology research
- Research of materials, processes and technologies, devoted to use renewable energy sources, to develop hydrogen energy, to efficiently use energy sources and reduce environmental pollution
- 3. Safety and reliability research of nuclear and thermal nuclear power engineering and other industrial objects
- 4. Methods of nuclear waste management, also terminating the operation of Ignalina nuclear power plant
- 5. Simulation and management of power systems, energy economy

LEI in numbers

230+	Employees
130+	Researchers
20+	PhD students
10	Research laboratories
10 mn Eur	R&D infrastructure
7+ mn Eur	Annual income
60	Annual R&D contracts

Membership in international organisations

- European Energy Research Alliance (EERA)
- World Bioenergy Association (WBA)
- European Safety, Reliability & Data Association (ESReDA)
- European Network of Freshwater Research Organisations (EurAqua)
- The European Association of National Metrology Institutes (EURAMET)
- Euro-Asian cooperation of national metrological institutions (COOMET)
- International Energy Agency Hydrogen Implementation Agreement (IEA HIA)
- Sustainable Nuclear Energy Technology Platform (SNETP)
- Implementing Geological Disposal of Radioactive Waste Technology Platform (IGD-TP)
- European Technical Support Organisations Network (ETSON)



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Map source: https://www.eera-set.eu/about-us/members.html

Long-term research and experimental development programmes (for the period of 2017 – 2022):

Development of future energy technologies, their safety and reliability research.

Manager – Dr. Habil. Eugenijus Ušpuras / Dr. Raimondas Pabarčius

Study on the effects of ionising radiation and other issues related to the decommissioning of nuclear power plants.

Manager – Dr. Artūras Šmaižys

Modelling and management of sustainable energy development

Manager – Dr. Dalia Štreimikienė

Research of the regularities of thermal and hydrodynamic processes taking place in innovative technological systems.

Manager – Dr. Robertas Poškas

Forecasts for the development of renewable energy sources, a study of efficient use and social impact.

Manager – Dr. Mantas Marčiukaitis

ACHIEVEMENTS OF LEI EMPLOYEES



The President of the Republic of Lithuania Ms. Dalia Grybauskaitė awards Dr. Habil. Vaclovas Miškinis On the occasion of the Day of Restoration of the State of Lithuania on 16 February, Dr. Habil. Vaclovas Miškinis, the Chief Researcher of the Laboratory of Energy Systems Research, an expert in energy planning and an active promoter of the national energy system, for his merits to the Republic of Lithuania and making Lithuania's name known in the world, was awarded the Cross of the Knight of the Order of the Lithuanian Grand Duke Gediminas.



Dr. Jūratė Kriaučiūnienė Chief Researcher, Head of Laboratory of Hydrology



Dr. Gediminas Stankūnas Chief Researcher, Laboratory of Nuclear Installation Safety

On 12 February 2019, at the General Assembly of the members of the Lithuanian Academy of Sciences, Dr. Jūratė Kriaučiūnienė (Chief Researcher and the Head of Laboratory of Hydrology) was elected as a Full Member of the LMA (Division of Biology, Medicine and Geosciences – Physical Geography). On 14 November 2019, by the Resolution of the Presidium of the Lithuanian Academy of Sciences, the Chief Researcher of the Nuclear Equipment Safety Laboratory Dr. Gediminas Stankūnas (Energy) was approved as a new member of the Young Academy of the Lithuanian Academy of Sciences. On 23 May 2019, during the Conference of Young Scientists on Energy Issues (CYSENI), the authorised representative in Lithuania of Vydūnas Youth Fund (USA) Ms. Jolita Kašalynienė presented Prof. Romas Viskanta Award for the 2018 achievements of young researchers of the Institute:

- Darius Jakimavičius (Senior Researcher)
 Laboratory of Hydrology;
- Simona Tučkutė (Senior Researcher)
 Center for Hydrogen Energy Technologies.

Basma Mahmoud Mohammed Fouad BORAI from Egypt's Nuclear and Radiological Regulatory Authority ENRRA was awarded the European Commission's International Co-operation and Development Division Honorary Sign for the results achieved during her training at LEI. The Award was presented at the EUROSAFE Forum, which was held in Cologne (Germany) on 4–5 November 2019.



Ms. Basma Borai was awarded the EC's International Co-operation and Development Division Honorary Sign

RESEARCH RESULTS

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Publication of research results

Structure of the Institute's publications of 2019

In 2019, 206 scientific papers were published.

Most of them (almost 60%) were peer-reviewed articles in journals.







Clarivate Analytics WoS database

Dynamics of articles referred in the Clarivate Analytics WoS database by quartiles



Horizon 2020

EU Framework Programme for Research and Innovation

LEI coordinated 2 out of 20 Horizon 2020 projects.

Institute's H2020 success rates

The success rates of LEI's participation in Horizon 2020 are higher than the EU average.

According to European Commission's data as of 06.01.2020.



ACCORDING TO THE NUMBER OF IMPLEMENTED HORIZON 2020 PROJECTS, LITHUANIAN ENERGY INSTITUTE IS AMONG TOP 3 LITHUANIAN INSTITUTIONS.

108 H2020 PROJECT APPLICATIONS SUBMITTED WITH INVOLVEMENT OF LEI: 23 PROJECT APPLICATIONS

WERE FUNDED.

Lithuanian Energy Institute in international programmes (projects portfolio):

- Horizon 2020 20 projects
- 7th Framework 24 projects
- 6th Framework 14 projects
- 5th Framework 11 projects
- Intelligent Energy Europe 31 projects
- IAEA 14 projects
- EuropeAid 4 projects
- COST Programme 25 projects
- EUREKA 4 projects
- INTERREG Programmes 4 projects
- Nordic Energy Research Programme 2 projects

H2020 programme projects started in 2019:

- 1. Management and Uncertainties of Severe Accidents (MUSA), coordinator CIEMAT, Spain
- Reduction of radiological consequences of design basis and design extension accidents (R2CA), coordinator IRSN, France
- 3. Towards European licensing of Small Modular Reactors (ELSMOR), coordinator VTT, Finland
- 4. StakeHolder-based Analysis of Research for Decomissioning (SHARE), coordinator CEA, France

- 5. Enabling On-Bill Financing for Residential Building Energy Efficiency Renovations in Europe (Ren-on-Bill), coordinator Creara Consultories SL, Spain
- 6. Monitoring EU energy efficiency first principle and policy implementation (ODYSSEE-MURE), coordinator ADEME, France
- 7. European Joint Programme on Radioactive Waste Management (EURAD), coordinator ANDRA, France









PHD STUDIES AT THE INSTITUTE



Doctoral studies

LEI in cooperation with Lithuanian universities implements joint doctoral studies in the following science fields:



Technological sciences, two programmes in in cooperation with Kaunas University of Technology and Vytautas Magnus University.

Social sciences, one programme in cooperation with Kaunas University of Technology and Klaipėda University.

PhD studies in numbers

During 1992–2019, 78 doctoral theses have been defended at the Lithuanian Energy Institute

In 2019, 10 doctoral students have been admitted

By the end of 2019, 24 PhD students have been carrying out their studies

Doctoral theses defended in 2019:

- Marius Praspaliauskas. Thesis "Investigation of sewage sludge pyrolysis products and residual solid material influence to fibre hemp biomass production" (Energetics and Power Engineering). Scientific Supervisor – Dr Nerijus Striūgas.
- Vytautas Akstinas. Thesis "Assessment of floods of Lithuanian rivers and their risk in the context of climate change" (Environmental Engineering). Scientific Supervisor – Dr Jūratė Kriaučiūnienė.
- Edgaras Misiulis. Thesis "Numerical investigation of the blood flow in compliant arteries" (Energetics and Power Engineering) Scientific Supervisor Dr Algis Džiugys.
- Andrius Tidikas. Thesis "Investigation of neutron transport and radioactive processes in Nuclear Fusion devices" (Energetics and Power Engineering).
 Scientific Supervisor – Dr Gediminas Stankūnas.



Since 2003 LEI organises annual international Conference of Young Scientists on Energy Issues (CYSENI).

The main goal of the Conference is to discuss issues and perspectives of energy sector worldwide; as well as to allow young scientists to develop their skills and networking.

PhD students, postdocs, master students and all other young scientists doing research on energy issues are welcome to the Conference as speakers and participants.

PARTICIPATION IN THE CONFERENCE IS FREE.



MORE INFORMATION AT WWW.CYSENI.COM.

FINANCIAL RESULTS

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Financial results

Financial dynamics 2013-2019.

Both, State budget subsidies and funding from other sources, increased considerably in last two years. It was achieved due to the good evaluation of Institute's results by international experts and active participation of LEI researchers in national and international projects. In total, the Institute income had increased by 50 % in last two years.





- **Budget subsidies** funding from the budget of the Republic of Lithuania according to the achieved results.
- International programmes funding funds received during the reporting year for the results of implemented projects of international programmes (H2020, INTERREG, EuropeAid, IAEA).
- Economic contracts funds received for the services and works performed for companies and institutions.
- **EU Structural Funds Tenders** projects funded by the EU Structural Funds.
- Tenders by the Research Council of Lithuania, Agency for Science, Innovation and Technology, Ministry of Economy and Innovation – the funds received for the projects financed by state institutions.



ACHIEVEMENTS OF RESEARCH DIVISIONS

ACHIEVEMENTS OF RESEARCH DIVISIONS

KEY ACHIEVEMENTS OF

LITHUANIAN ENERGY

INSTITUTE'S SCIENTIFIC

DIVISIONS (LABORATORIES)

FOR THE YEAR 2019.

Research divisions of the Lithuanian Energy Institute:

- Center for Hydrogen Energy Technologies
- Laboratory of Energy Systems Research
- Laboratory of Systems
 Control and Automation
- 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

HYDROGEN RESEARCH AND NANOTECHNOLOGIES

CENTER FOR HYDROGEN ENERGY TECHNOLOGIES

Center for Hydrogen Energy Technologies

Main research areas of the center:

- Research in the field of hydrogen energy technologies: synthesis and properties analysis of hydrogen separation membranes; hydrogen production using direct reactions of water and plasma activated metals, storage of hydrogen in metal hydrides; synthesis of hydrogen fuel cells using physical evaporation technologies.
- Investigation of the properties of the materials forming the electrodes of nickel – metal hydride batteries.
- Synthesis and application of metal oxides and oxyhydrides for photocatalytic water treatment, photochromic devices, etc.
- Synthesis and analysis of properties of nanoclusters for biological objects (plant growth activation, destruction of pathogenic derivatives).

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Key achievement of the laboratory for the year 2019:

A method for deposition of Zn phase metal impurities with photocatalytically active ZnO coatings in visible light has been developed

The method allows to dynamically stabilise the transformation of metal-oxide formation modes during reactive magnetron sputtering and to form coatings of mixed metallic (Zn) and oxidised (ZnO) zinc phases under unbalanced conditions.

Advantages of the method: wide range of controlled microstructure and optical properties of coatings; the width of the forbidden band was reduced; the photocatalytic activity of ZnO was extended to the visible region.

Potential application: disinfection of contaminated water, LED, microelectronics, etc.

Patent of the Republic of Lithuania: "Method for precipitation of metallic zinc phase impurities containing photocatalytically active zinc oxide coatings", No. 6731.

[Works are carried out during the TiZO Project 09.3.3-LMT-K712-01-0175, which is funded under the Research Council of Lithuania measure "Development of Scientific Competences of Scientists, other Researchers and Students through Practical Research Activities"]. A method for deposition of Zn phase metal impurities with photocatalytically active ZnO coatings in visible light

New gas phase composition control method stabilises reactive magnetron sputtering process in significantly wider range of parameters and allows to deposit photocatalytically active zinc oxide films with controllable amount of metallic phase.



ENERGY SECTOR DEVELOPMENT ANALYSIS

LABORATORY OF ENERGY SYSTEMS RESEARCH

Laboratory of Energy Systems Research

Main research areas of the laboratory:

- Economic modeling at the micro and macro level. Analysis and solutions of economic and social problems. Development and application of various types of economic models (microsimulation, input-output, general equilibrium).
- Mathematical modelling and analysis of systems development and operation, systems integration and decarbonisation of the national economy. Formation and analysis of medium to long-term development scenarios and policy proposals.
- Analysis of optimal allocation of generation, reservation and balancing capacities in energy

systems and interconnectors. Elaboration of optimal approaches for balancing intermittent energy generation from renewable energy sources.

- Transport decarbonisation research. Investigation of possibilities to balance intermittent electricity generation from renewable energy sources by means of smart charging of electric vehicles and alternative fuel production.
- Research on the impact of building renovation and long-term development of new energy-efficient buildings on the development of energy systems.
- Environmental impact analysis of the energy
sector. Analysis and impact assessment of emission abatement technologies and environmental measures.

- Analysis and impact assessment of renewable energy integration and energy efficiency measures as well as preparation of recommendations based on the analysis.
- Research on climate change mitigation and promotion of behavioral changes in households. Assessment and integration of population preferences in this field by applying willingness to pay for climate change mitigation and other methods. Development of climate change mitigation policy provisions in this field.
- Research on modern management and marketing solutions for energy facilitating the creation of a welfare society.

Key achievements of the laboratory for the year 2019:

- The H2020 Project REEEM has been completed:
 - » Together with scientists from the University of Stuttgart, recommendations have been drawn up on the socio-economic aspects of energy transformation.
 - » In cooperation with the scientists of Aalto University an innovative energy security assessment methodology and the Baltic Energy Security Study have been prepared.
- A methodology has been developed to assess the socio-economic impact of the installation of electricity storage facilities in the power system (an economic study with Ignitis gamyba AB).

- Significant progress has been achieved in developing a mathematical model for analysis of the long term development and decarbonisation of the country's transport sector. New modelling approaches on smart electric vehicle charging and vehicle age distributions were developed and applied to the model (project coordinated by IAEA).
- Determination of national emission factors for atmospheric emissions in energy, industry and agriculture (Performed together with the Centre for Physical Sciences and Technology and funded by the on-demand research projects supported by the Research Council of Lithuania).

CONTROL OF ENERGY SYSTEMS

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LABORATORY OF SYSTEMS CONTROL AND AUTOMATION

Systems Control and Automation Laboratory

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Main research areas of the laboratory:

- mathematical modelling of power systems and networks, investigation of their control issues;
- modelling and optimisation research of ICTbased control systems of power systems;
- research on the integration of renewable energy sources (wind, solar, etc.) and distributed generation into power systems;



Key achievement of the laboratory for the year 2019:

Completion of H2020 project EnergyKeeper. LEI scientists have contributed to the development of a redux-flow battery smart control system and its algorithms for energy storage and provision of additional/ system services (frequency and voltage management) that will enable optimisation of the income of the battery owners/ consumers.

Project group - 10 partners from 6 countries.
Project duration - 36 months,
01.01.2017 - 31.12.2019.
Project estimate - EUR 4 million.







The smart prosumers concept for the "EnergyKeeper" project

COMBUSTION RESEARCH

LABORATORY OF COMBUSTION PROCESSES

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.

Investigations of combustion and other thermochemical processes in order to valorize a biomass and waste usage for alternative biofuel and chemical production, reduce the environmental emissions and increase technology efficiency. Key achievement of the laboratory for the year 2019:

Development of thermochemical biomethane production technology under the project:

"Development of innovative biomethane production technology using catalytic thermochemical conversion method". 2017-2021.

The project has received funding from European Social Fund (project No 01.2.2-LMT-K-718-01-0005) under grant agreement with the Research Council of Lithuania (LMTLT). **The Aim of the Project** – to increase knowledge and technology transfer of biomass and waste thermochemical conversion to biomethane gas. **Project objective** – to create and verify an innovative concept of biomethane production.



Notable contracts of 2019:

- "Investigation on syngas assisted combustion for flexible and low emission operation in industrial boilers" Contractor: The Research Council of Lithuania
- "Development of an innovative biomethane production technology by applying a catalytic thermochemical conversion"
 Contractor: The Research Council of Lithuania
- "Flexible combined production of power, heat and transport fuels from renewable energy sources" Contractor: The European Comission via Horizon 2020 programme
- "Research and development of technologies for biofuel use efficiency increase and emissions reduction" Project partner Enerstena UAB Contractor: Lithuanian Business Support Agency (LVPA)

PLASMA PROCESSING AND APPLICATION

PLASMA PROCESSING LABORATORY

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Plasma Processing Laboratory

Main research areas of the laboratory:

- development and research of DC plasma sources for wide range of applications
- research of processes and phenomena taking place in discharge channels, exhaust plasma jets and flows
- diagnostics of plasma and high-temperature flow and development of diagnostic measures
- research on interaction of plasma jets and substances in various plasma-technological processes
- generation of water vapor plasma and its application for fuel conversion and neutralization of hazardous waste

- research and implementation of plasma neutralization process of hazardous substances
- synthesis of catalytic and tribological coatings in plasma ambient and analysis of their properties
- research of thermal and heterogeneous processes for reacting product flowing around catalytic surface
- formation and modification of constructional material surfaces in plasma
- synthesis of micro- and nano- dispersed granules and mineral fiber from hardly meltable materials and analysis of their properties



Innovative experimental plasma-chemical reactor for treatment of various materials has been developed, designed and manufactured:

- Scientific fundamentals of plasma decomposition of various substances have been developed in the laboratory
- The characteristics of the electric arc in the reactor have been determined
- Arc interaction with the treated material has been identified
- The electric arc behaviour and properties in the reaction chamber have been investigated

Reactor application:

- Degradation of hazardous substances and wastes
- Melting of inorganic metal oxides
- Synthesis of new materials and alloys



Operating plasma-chemical reactor



Samples of molten ceramic materials

New and continued projects in 2019:

INTERREG:

 Cluster On Anaerobic digestion, environmental Services and NuTrients removAL (COASTAL Biogas)

Research Council of Lithuania financed projects:

- Plasma-chemical reactor for treatment of various materials: development, construction, research and application
- Development of Innovative biomethane production technology using catalytic thermochemical conversion method
- Formation of Graphene oxide and Transition metal oxides nanostructurized composites, modification and research

MATERIALS RELIABILITY

LABORATORY OF MATERIALS RESEARCH AND TESTING

Laboratory of Materials Research and Testing

Main research areas of the laboratory:

- Reliability of power plant facilities: research of metal aging processes and degradation of properties due to the impact of operational factors
- Development and research of multifunctional materials and composites
- Testing of materials, assessment and analysis of their qualitative indicators



Key achievements of the laboratory for the year 2019:

Improving the safety of NPP by filling data gaps in the assessment of environmental fatigue (H2020 Project INCEFA Plus)

The project aims to investigate the fatigue degradation of steels used in nuclear power plant reactors and to provide their condition assessment recommendations. Experimental studies of austenitic 304L steel were performed, the standardized results of which can find application in developing steel fatigue assessment methodologies that are as close as possible to the real conditions of NPP operation.

Development and research of multifunctional materials

To increase the efficiency and economy of the biomethane production, a new type of catalyst was developed. A material with a porous heterostructure (PHS) and a high specific surface area that can be used as a catalyst support for a methanation reaction catalysis has been synthesised.



Main applied research of the laboratory:

The laboratory performs applied research under contracts with companies and organizations:

- Business services for research in the fields of plastics, plastic pipes, insulated heat pipes and building materials
 - Research on utilization of sewage sludge-biomass gasification residue in cement-based materials; binary and ternary systems combinations with nanomaterials for functional and environmental benefits
- Corrosion failure analysis of galvanized steel hot water supply pipelines and ethylene glycol supply pipelines used in air conditioning system, identifying main corrosion factors and presenting recommendations Contractor: Kauno arena UAB
- Study of fusion of polyethylene pipe joints used in gas supply system.
 Contractor: Energijos skirstymo operatorius AB
- Identifying the cause of 330 kV high voltage power line failure Contractor: Lietuvos energijos gamyba AB
- Examination of pipeline elements and remaining lifetime assessment Contractor: ORLEN Lietuva AB

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FLUID DYNAMICS AND METROLOGY RESEARCH

LABORATORY OF HEAT-EQUIPMENT RESEARCH AND TESTING

Laboratory of Heat-Equipment Research and Testing



Main research areas of the laboratory:

Processes and technologies for the efficient use of Renewable Eenergy Sources 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





Flow dynamics in micro channels

LEI scientists provide research and certification services to Axioma Metering UAB in developing **TPL – 0-1** new series of wide range ultrasonic flow meters: AXIØMA **IDEA** DN15, $Q_3 = 2.5 \text{ m}^3/\text{h}$, $Q_3/Q_1 = 400$; **TPL – 2-3** DN25 - DN40, $Q_3 = 6.3 \text{ m}^3/\text{h}$, $Q_3/Q_1 = 400$. TPL - 4**PROTOTYPE** AXIØMA Numerical studies of flow dynamics in measurement chambers ٠ E **TPL – 5** Experiments and testing • TPL - 6CONFORMITY ASSESSMENT AXIØMA

Conformity assessment of developed ultrasonic flow meters: certification in accredited notified activities

TPL - 8 MANUFACTURING TPL - 9 Quality management system maintenance in production

Key achievement of the laboratory for the year 2019:

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HYDROLOGY RESEARCH

LABORATORY OF HYDROLOGY

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Laboratory of Hydrology

Main research areas of the laboratory:

- Analysis of climate change and river runoff variation
- Research of extreme hydrological phenomena in the context of climate change
- Research of wave, hydrodynamic, and sediment processes in water bodies
- Research of environmental impact of energy and transport objects
- Collection and analysis of data on Lithuanian water bodies (rivers, ponds, the Curonian Lagoon, and the Baltic Sea)

Key achievement of the laboratory for the year 2019:

The project "Ecological Flow Estimation in Latvian–Lithuanian trans-boundary River Basins" (ECOFLOW) of Interreg Latvia-Lithuania Cross-Border Cooperation Programme has been successfully implemented.



Hydromorphology

Limit values for summer precipitation have been selected from multi-annual observations During site studies, river hydromorphology has been studied and hydrological characteristics have been measured

The suitability of hydromorphological habitats for selected fish species has been studied

Ecology

The impact of HP on aquatic ecosystems was investigated using the MesoHABSIM model

Hydropower

E-debit

For the first time in Lithuania, an ecological flow assessment methodology has been proposed



Project duration: 01.04.2017 – 31.03.2019 Project website: http://url.lei.lt/ecoflow

The Project was financed by Latvian-Lithuanian Cross-Border Cooperation Programme 2014–2020.



New and continued projects in 2019:

INTERREG:

• Cluster On Anaerobic digestion, environmental Services and NuTrients removAL (COASTAL Biogas), coordinator FNR, Germany

Projects related to environmental monitoring and development of the Klaipėda State Seaport:

- Analysis of meteological and hydrological data of Klaipeda Seaport
- Environmental Impact Assessment of Klaipeda State Seaport Inland Navigation Channel from PK21 to PK85 (Hydrodynamic Modeling)

Projects related to assessment of impact of hydro power plants on the environment:

• Evaluation of water level fluctuations in the Kaunas HPP reservoir

SAFETY AND RELIABILITY STUDIES OF ENERGY AND INDUSTRIAL FACILITIES

LABORATORY OF NUCLEAR INSTALLATION SAFETY

Laboratory of Nuclear Installation Safety

Main research areas of the laboratory:

- Safety, reliability and risk assessment of industrial facilities and energy systems
- Safety and reliability assessment of operating and new generation nuclear power plants
- Safety and reliability assessment of thermonuclear fusion installation
- Decommissioning safety and risk assessment of nuclear installations and radioactive waste disposal facilities

- Failure analysis and engineering assessment of complex technical systems
- Assessment of the strength of structures, piping and other systems components
- Reliability assessment of hydraulic supply networks (heat, water, gas, etc.)
- Assessment of security of energy supply
- Fundamental and applied research in thermal physics.

New H2020 programme projects started in 2019:

- 1. Management and Uncertainties of Severe Accidents (MUSA), coordinator CIEMAT, Spain
- 2. Reduction of radiological consequences of design basis and design extension accidents (R2CA), coordinator IRSN, France
- 3. Towards European licensing of SMR (ELSMOR), coordinator VTT, Finland
- 4. StakeHolder-based Analysis of Research for Decomissioning (SHARE), coordinator CEA, France
- 5. Enabling On-Bill Financing for Residential Building Energy Efficiency Renovations in Europe (Ren-on-Bill), coordinator Creara Consultories SL, Spain



National business cooperation:

- Tank design and 3D modelling of heat and mass transfer during heat treatment of products inside tanks (Astra LT AB)
- Development and EU market placement of a new DUPLEX steel tank semi-trailer (Astra LT AB)
- Hydraulic modelling of district heating network in Utena city, assessment of hydraulic modes and heat losses (Utenos šilumos tinklai UAB)
- Numerical study of ammonia condensing unit to optimize work processes (Achema AB)



Map of district heating network hydraulics



NUCLEAR AND THERMAL ENGINEERING

NUCLEAR ENGINEERING

Nuclear Engineering Laboratory

Main research areas of the laboratory:

- SAFETY OF SPENT NUCLEAR FUEL MANAGEMENT
 - » Interim storage
 - » Disposal in deep geological repositories
- SAFETY OF RADIOACTIVE WASTE MANAGEMENT
 - » Treatment
 - » Temporal and interim storage
 - » Disposal in near-surface repositories
- ASSESSMENT OF DIFFERENT FACTORS RELATED TO DECOMMISSIONING OF NUCLEAR FACILITIES USING DECRAD (LEI) SOFTWARE
 - » Strategy selection
 - » Safety assessment

- » Assessment of dose rates to workers and residents
- » Evaluation of radwaste qualities, labor cost, dismantling duration, etc.
- WASTE HEAT RECOVERY FROM FLUE GASES DURING BIOFUEL COMBUSTION AND REDUCTION OF THE AMOUNT OF EMISSIONS FROM THE EXHAUST
- INVESTIGATION OF HEAT TRANSFER AND HYDRODYNAMIC PROCESSESS IN VARIOUS SYSTEMS AND THEIR COMPONENTS
- FIRE SAFETY INVESTIGATION

H2020 projects started and continued in 2019:

Started:

- European Joint Programme on Radioactive Waste Management (EURAD), coordinator ANDRA, France
- 2. StakeHolder-based Analysis of REsearch for Decommissioning (SHARE), coordinator CEA, France

Continued:

- 1. Bentonite mechanical evolution (BEACON), coordinator SKB, Sweden
- Thermal treatment for radioactive waste minimisation and hazard reduction (THERAMIN), coordinator VTT, Finland



Fire modeling with PYROSIM



Modeling of temperature fields with ANSYS

Colaboration with businesses in 2019:

- 1. Fire analysis of buildings 150, 151/154, 158/2 and their installations (Ignalina NPP)
- 2. Services of preparation of the Maišiagala radioactive waste storage facility decommissioning Project description, other documentation necessary to obtain a decommissioning licence, and Maišiagala radioactive waste storage facility demolition Project (Ignalina NPP)
- New system of thermo-chemical biomass and waste treatment for industrial low capacity heat and electricity generation installations (BioPower Industries UAB)

- 4. Environmental impact assessment and safety assessment of the reconstruction of the INPP bitumen radioactive waste storage facility and its reorganization into a repository (with Svertas Group UAB)
- Analysis of consequences of possible nuclear and radiological accidents at the Ignalina NPP's nuclear facilities (Ignalina NPP)
- 6. Research and development of technologies for the increase of biofuel use efficiency and emission reduction (Enerstena UAB)
- Assistance to INPP by Technical Support Organisations in the Field of Radiological Characterisation for Block A1 (Reactor and auxiliary systems) (financing institution: CPMA)

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 European Energy Research Alliance (EERA) website
 https://www.eera-set.eu/about-us/members.html
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 Ms. Dalia Grybauskaitė awards Dr. Vaclovas Miškinis
 auth. Office of the President of the Republic of
 Lithuania, official photo by Robertas Dačkus
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