Inštitut za energetiko Institute of Energy Technology

Institute of Energy Technology

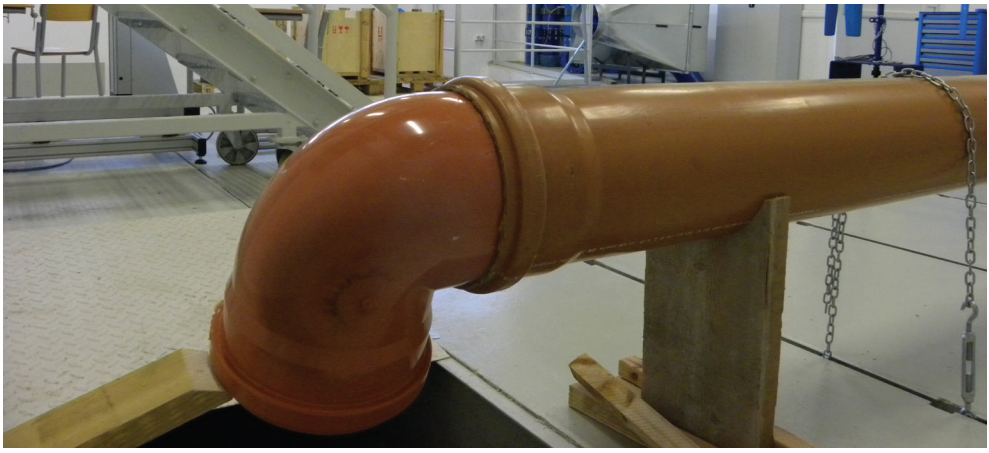
In addition to higher education, the Faculty of Energy Technology also carries out research in the field of energy technology. Most infrastructure and equipment required for research activities are available at the Institute of Energy Tehnology, where interdisciplinary research with a focus on research excellence is conducted. With the implementation of basic and applied research, new knowledge, new products, processes and services that raise the competitiveness of the economy are created. As part of its mission, the Institute for Energy contributes to the sustainable development of society.

Within Institute of Energy Technology, research is conducted by nine laboratories:

- Laboratory for Aero- and Hydro-Energy Technology (LAHET);
- Applied Electrical Engineering Laboratory (LAE);
- Laboratory of Ecology and Environment Protection (LEVO);
- Electric Machines and Drives Laboratory (LESP);
- Laboratory for Energy Conversion (LEP);
- Laboratory for Energy Management and Engineering (LABEMI);
- Nuclear Energetics Laboratory (LJE);
- Laboratory for Thermomechanics, Applied Thermal Energy Technologies and Nanotechnologies (LTTN);
- Laboratory for Virtual Engineering (CADER).

Laboratory for Aero- and Hydro-Energy Technology (LAHET)

The activities of LAHET are in the fields of science, development and applied research in following areas: mechanical and flow resonance issues, flow interactional problems, acoustic problems, developing and designing of wind technologies, hydraulic technologies and alternative energy technologies, all in accordance with the principles of an open thermodynamic approach.



Experimental model (physical models) tests on the (model-based) structure with air, water or simultaneously with both air and water flows are performed on the equipment available.

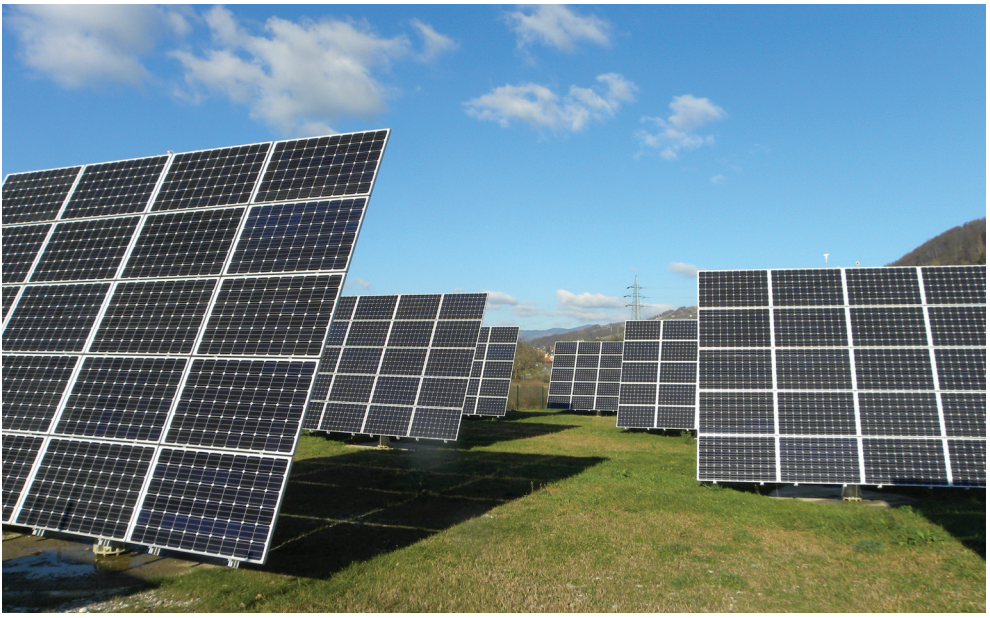
In the hydro part of the works, we can implement model-based testing of physical models of the entire hydroelectric power plant with its flow path (inlet/outlet channels, etc.). The simulation tests can be performed under practically all possible operating regimes, including flooding.

It is possible to implement model-based tests on scaled physical models of pipe ducts, conduits, junctions, conversion, both in the open as well as in closed ducts (tubes).

Applied Electrical Engineering Laboratory (LAE)

LAE offers comprehensive services in the context of scientific research, the development of different hardware and software solutions, special educations and training for industry in the following fields:

- Electromagnetic energy converters (magnetic nonlinear dynamic modelling and the development of advanced experimental methods and measurement systems);
- Renewable sources and technologies (with focus on the utilization of solar and hydropower energy);
- Energy efficiency in buildings and industrial processes (research on smart grids and energy management, the development of methodologies, technologies and software solutions for determining the efficiency of industrial processes);
- Advanced sensor and measurement systems (research on hardware and software for detecting the potential of renewable energy sources, telemetry and applications in Energy Engineering).



Laboratory of Ecology and Environment Protection (LEVO)

With its laboratory equipment, LEVO can review the living environment, which represents the ecosystem in which we live and that has a direct impact on our health.

Laboratory equipment includes instruments for measuring the turbidity of drinking and waste water, enabling the detection of organoleptic changes of water, and detecting changes in its composition.

Devices for the measurement of residual chlorine in drinking water directly monitor the quality of the water.

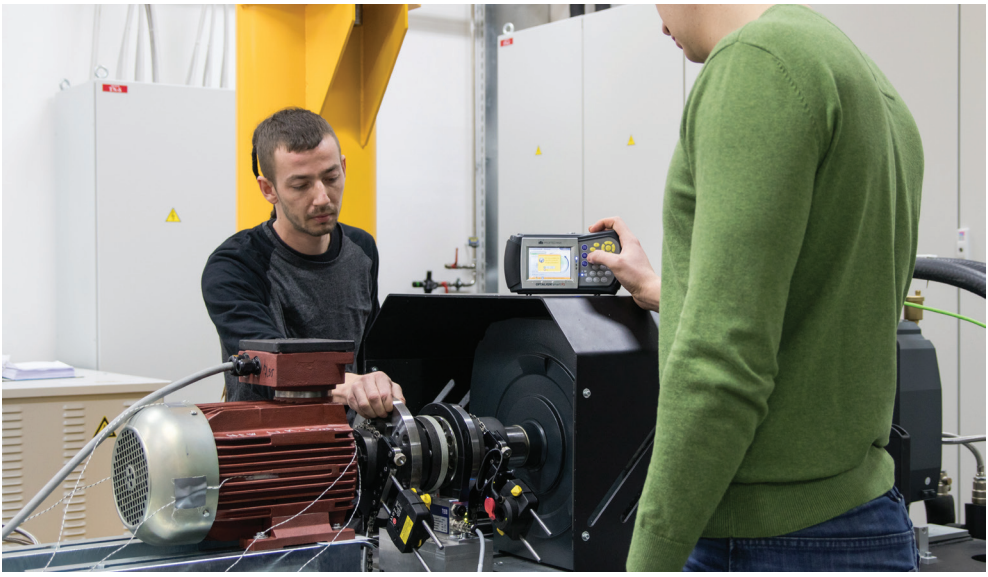
A spectrophotometer is used for the analysis of wastewater, drinking water, and water in cooling and heating systems.

A method for the rapid detection of bacteria in drinking and waste water is based on the verification of the enzymatic activity in living bacterial cells. This is a specific detection of the presence of bacteria and does not include other taxonomic groups.

With devices for measuring the quality of air and IR cameras, the quality of life and protecting the environment is improved.

Electric Machines and Drives Laboratory (LESP)

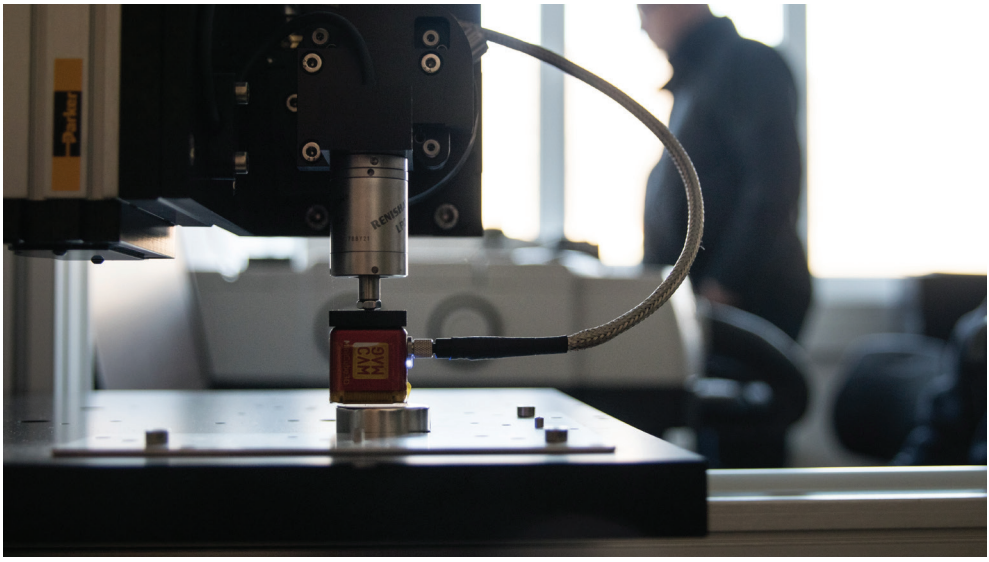
The LESP working group includes researchers working in the field of design, modelling, control and testing of different types of electric machines and drives. Research work for industry is focused on: energy conversion in electrical machines, development of new electrical machines topologies, electric machine diagnostics, magnetic field analyses, heating of electrical machines, prediction of electric machine characteristics, modeling of energy phenomena in nonlinear magnetic materials, energy efficiency improvement of electrical machines, development of calculation and experimental methods for the determination of electric machines parameters, measurements of load and efficiency characteristics and development of electric machine control. LESP is a reliable industrial partner for these applications: household appliances, industrial drives, electric propulsion for electric vehicles and vessels, electric traction drives, generators for wind energy conversion systems, drives for fans, compressors, and pumps.



Laboratory for Energy Conversion (LEP)

LEP carries out research in the field of:

- Design of electric machines:
  - Development of new software solutions for the design of electrical machines using analytical and numerical methods;
  - Measurement of the characteristics, local demagnetization and quality of permanent magnets using clips obtained by the scanner with a magnetic camera;
- Technologies for exploiting renewable energy sources:
  - Design of wind generators;
  - Design of solar power plants;
  - Biomass and renewable energy sources;

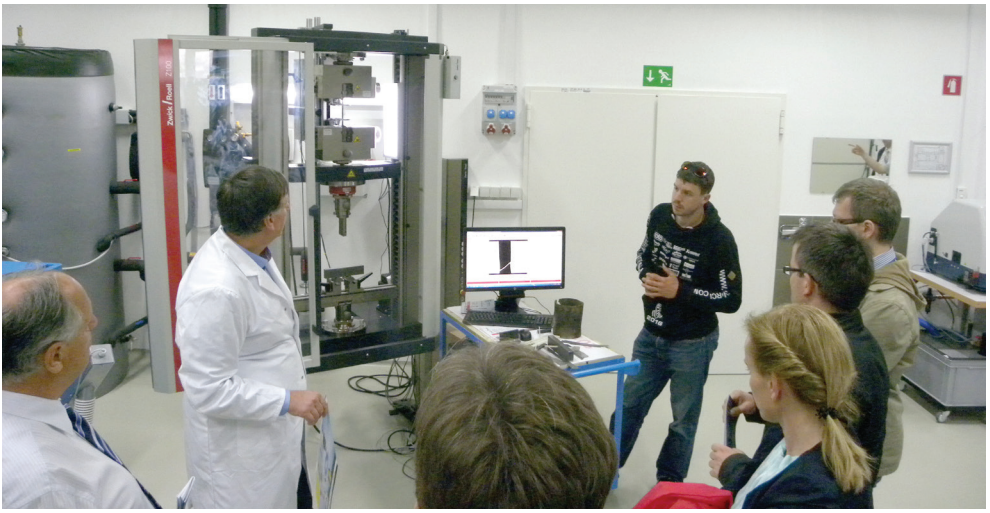


- Measurements in energy technology;
- NET metering - energy self-sufficiency:
  - Design and implementation of smart measurement systems in the energy sector;
- Design of energy control systems;
- Planning of energy policies;
- Optimization of power consumption;
- Application of genetic algorithms for optimization in energy systems;
- Design of electric vehicles;
- Elaboration of life cycle assessment for the evaluation of environmental impacts;
- Calculations of operating states of power systems.

Laboratory for Energy Management and Engineering (LABEMI)

LABEMI carries out research in the field of:

- Energy engineering: developing pressure vessels, pipelines and reservoirs, making welding draft and processes, monitoring quality and execution of supervision at demanding welding applications, fracture mechanics of energy components;
- Biomass: consultancy, testing of new energy agriculture products, testing of all types of burners and biomass, co-generation-tri-generation with biomass combination and making of technical documentation with calculation for district heating;
- Energy-efficient buildings: consultancy for energy reconstruction of buildings, making and preparing of elaborate and rough outlines of energy solutions for zero- and low-energy buildings, making documentation of process, fire and explosive safety, thermography of buildings, preparing and issuing of energy certificates and energy audits of buildings, designing micro generators of heat for passive and low-energy buildings;



- Energy management: monitoring of energy consumption in buildings, consultancy with measures for efficient energy management, making of CNS for energy system with consumption optimization, energy project management.

Nuclear Energetics Laboratory (LJE)

The laboratory has equipment for radiation surveys of the working environment and also simple measurements of radioactivity. The sensitive scintillation gamma spectrometer and alpha spectrometer are intended for more demanding measurements and research work. This equipment enables us to participate in research and development related to future radwaste depository and existing nuclear facilities.

The laboratory also has equipment for the vacuum deposition of thin layers, which is supported with equipment for electrical characterization of structures. The system is capable of deposition of inorganic layers, as well as layers of organic semiconductors which could serve as a basis for different detectors of ionizing radiation. Based on the results of previous work, we expect that we will be able to make different organic semiconductor thin-layered structures that could be used for the detection and measurement of ionizing radiation.

Laboratory for Thermomechanics, Applied Thermal Energy Technologies and Nanotechnologies (LTTN)

LTTN deals with interdisciplinary problems in the research areas of thermodynamics, mechanics and electromagnetic effects. Within this laboratory educational, professional and scientific activities are carried out. The activity of the laboratory covers the following areas:

- Thermomechanics;
- Fluid mechanics;
- Nanotechnologies and microtechnologies in energy technology;
- Hydrogen and methanol technologies;
- Heat exchangers; heat converters and mass exchangers;
- Use of geothermal energy; biogas and biomass;
- Use of solar energy;
- Heating; cooling and air-conditioning systems;
- Maintenance of thermoenergetic devices.

Laboratory for Virtual Engineering (CADER)

CADER is an interdisciplinary service facility enabling access to the tools, expertise and collaborative opportunities needed to support high edge research, academic initiatives and innovative uses of technology in the general areas of:

- Teaching and learning;
- Modelling, animation and design;
- Visualization and simulation;
- Virtual and rapid prototyping, 3D printing;
- Application development.

The laboratory equipment consists of:

- a 3D visualization room with massive parallel computer support for analyses and simulation (Catia, SolidWorks, ANSYS) and use of real-time 3D rendering tools on a corner-cave visualization system (3.3×3.5m);
- High-end 3D printers: EnvisionTEC Xtreme, CubePro trio, TypeA Series1 with accessories for high-quality products from various materials. 3D printing and virtual reality can be used to help better visualization of products in three-dimensions, making them more tangible.