LITHUANIAN ENERGY INSTITUTE

ADMISSION TO PHD STUDIES FOR THE YEAR 2026

DOCTORAL RESEARCH TOPIC:

Research of stationary household heating devices and development of technologies for pollution reduction and efficiency improvement

RESEARCH FIELD:

Energetics and Power Engineering (T 006)

BRIEF DESCRIPTION OF RESEARCH TOPIC:

According to the Environmental Protection Agency (EPA), in 2023 the energy production sector in Lithuania emitted approximately 6.6 kt of PM2.5 and 6.8 kt of NMVOC into the ambient air, the largest share of which originated from stationary fuel combustion in households (84.5% and 38.1%, respectively). Although this percentage has been slightly decreasing in recent years, the proportion of households burning solid fuels remains high and significant.

From 2030, air quality standards for eleven pollutants will become stricter in accordance with the requirements of the Directive of the European Parliament and of the Council on ambient air quality and cleaner air for Europe. The new directive will halve the annual limit values for the main air pollutants, including particulate matter PM10 and PM2.5.

Older low-power (<50 kW) household combustion devices are of simple design and typically emit high levels of pollution due to incomplete fuel combustion. To reduce ambient air pollution, households are encouraged to upgrade to more efficient heating devices or to install additional equipment that reduces emissions, improves environmental performance, and increases efficiency.

Analysis of emissions depending on fuel type, operating conditions (laboratory and, in pilot cases, real-life) and environmental parameters will enable the selection of appropriate emission reduction methods. The use of cleaner fuels, biomass-based fuels, or recovered fuels—either as mixtures or with the addition of combustion-improving additives—can not only enhance combustion efficiency but also contribute to the sustainable utilisation of waste fuels and industrial by-products.

Indicative monitoring of sensors and emissions to identify inefficient device operation would allow the application of integrated emission reduction approaches, such as combustion process control and automation or particulate reduction measures using deposition principles.

Work Objective – To develop and experimentally validate integrated technologies aimed at reducing emissions and increasing the energy efficiency of stationary household heating devices by analysing combustion process behaviour, the influence of fuel composition and operating conditions on emissions, and by applying advanced combustion control, automation, and particulate matter deposition methods.

Scientific Tasks of the Work (Dissertation Topics)

- Optimization of solid fuel combustion processes and development of emission reduction technologies for stationary household heating devices.
- Development of automated combustion control systems and indicative emission diagnostics.
- Application of acoustic and electrostatic particle deposition methods in low-power household heating appliances.

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