LITHUANIAN ENERGY INSTITUTE

ADMISSION TO PHD STUDIES FOR THE YEAR 2026

DOCTORAL RESEARCH TOPIC:

Synthesis of Sustainable Synthetic Fuels and Energy Products through Thermochemical Processes

RESEARCH FIELD:

Energetics and Power Engineering (T 006)

BRIEF DESCRIPTION OF RESEARCH TOPIC:

With the growing global demand for energy, which is projected to increase by more than 40% till 2050, and the need to reduce dependence on fossil fuels, the development of sustainable energy sources has become increasingly important. Currently, more than 80% of the world's energy is still derived from oil, natural gas, and coal, which significantly contributes to the rise of greenhouse gas (GHG) emissions. In the European Union, over 25 million tonnes of plastic waste are generated each year, of which less than 30% is recycled, while the remainder is often incinerated or landfilled. Therefore, it is essential to develop advanced waste and biomass conversion and product purification technologies that enable the production of sustainable synthetic fuels, energy carriers, and/or chemical products.

One of the potential solutions involves thermochemical processes such as pyrolysis, gasification, and hydrothermal conversion, which can efficiently transform organic-based materials into value-added liquid, gaseous, and solid products. Recent studies have shown that, under optimized conditions, these processes can achieve energy conversion efficiencies of up to 60–80%, while the use of catalysts can further enhance product selectivity.

The scientific problem addressed in this research lies in the limited understanding of the mechanisms governing thermochemical processes and the influence of various parameters on process efficiency, product composition, and reaction pathways. This knowledge gap hinders the optimization of energy conversion and product synthesis technologies for improved performance and sustainability.

The scientific objective is to investigate the behavior of selected organic feedstocks (such as biomass, plastics, and polymer wastes) under different thermochemical conditions in order to develop knowledge and methodologies that enable the optimization of their conversion into sustainable energy and chemical products.

Possible topics within this thematic area include:

- Conversion of plastic wastes to energy products using catalytic and pressurized pyrolysis methods.
- Plastic to hydrogen and carbon through hybrid pyrolysis–catalytic reforming processes.
- Purification of products obtained from thermal conversion using adsorption and non-thermal plasma methods.

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