LITHUANIAN ENERGY INSTITUTE

ADMISSION TO PHD STUDIES FOR THE YEAR 2025

DOCTORAL RESEARCH TOPIC:

A numerical study of future sustainable changes in heating and cooling systems

RESEARCH FIELD:

Energetics and Power Engineering (T 006)

BRIEF DESCRIPTION OF RESEARCH TOPIC:

At the 2024 year, the “National Energy Independence Strategy” (hereinafter referred to as the Strategy) was prepared and presented. The strategy has been prepared in order to implement fundamental changes in the energy sector – to ensure that Lithuania produces as many energy resources as they are consumed and, by 2050, the energy sector becomes fully climate neutral. The uneven and unpredictable production of renewable sources will require energy infrastructure to be flexible, able to store excess energy and ensure its uninterrupted supply to all consumers.

In 2022, the share of RES accounted for 29.62 percent of gross final energy consumption. These results were mainly due to the share of RES, which accounted for 51.77% of final energy consumption for heating and cooling, and the share of RES, which accounted for 25.50% of total electricity consumption.

The energy sector must develop by Lithuania’s international obligations. The main commitment is the Paris Agreement, signed in 2015, which sets the goal of limiting the global temperature to 1.5 °C above the pre-industrial period. The countries of the European Union have agreed on the need to move towards climate-neutral technologies in the energy sector. This need is enshrined in the European Green Deal Communication.

Changes in the heat supply sector by 2050 will be determined by the following main directions: an increase in the energy efficiency of buildings, a shift towards energy-using technologies for the environment and the growing use of RES technologies. Overall heat consumption will gradually decrease as a result of climate change and increasing energy efficiency. The aim is to move away from the use of fossil fuels in the heating sector, to promote the transition to the use of electricity (heat pumps, electric boilers), waste and environmental energy. Due to the peculiarity of Lithuania’s climatic conditions, there are no plans to abandon biofuels completely; its use is planned for after 2050. DH systems developed in Lithuanian cities are one of the strengths of the Lithuanian energy sector, enabling to make large-scale and relatively rapid changes at the level of self-government by decarbonising heat supply and to use economies of scale for these changes.

District and decentralized supplied heat sectors should develop similarly: abandoning the use of polluting fuels, switching to RES, increasing the use of waste heat and environmental energy, introducing seasonal heat storage solutions where it is technologically possible and economically advantageous, and modernizing and expanding DH systems by connecting new consumers. Cooling energy production is expected to grow significantly by 2050, as the need for cooling energy will grow due to the emergence of demand in new buildings and the consequences of climate change.

Using numerically based technical management solutions can model the integrity of electricity and heat supply networks, the reliability of the operation of power supply networks through preventive maintenance based on forecasting models, load management and real-time monitoring. Preventive maintenance systems can model the prevention of equipment failures, and load forecasting can balance the supply and demand of electricity and heat energy in real time and optimize the use of renewable energy in the district heating sector. By integrating real-time and historical data, numerical models can contribute to increasing the flexibility of the power supply network, facilitating more efficient energy distribution, and reducing the likelihood of disruptions.

The vision of future urban development is smart cities, where numerical modelling and the combination of innovative technologies based on modelling will play an important role in promoting sustainability and reducing vulnerability. The modelling will justify the adaptation of supply and consumption infrastructure to the heat and cooling supply systems of the fifth generation.

Young scientists interested in pursuing doctoral studies in these areas are encouraged to contact the project supervisor for further information.

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