LITHUANIAN ENERGY INSTITUTE

ADMISSION TO PHD STUDIES FOR THE YEAR 2026

DOCTORAL RESEARCH TOPIC:

Research on energy systems integration, reliability, security and resilience to disruptions

RESEARCH FIELD:

Energetics and Power Engineering (T 006)

BRIEF DESCRIPTION OF RESEARCH TOPIC:

One of the key goals of the European Union's energy policy is to ensure a reliable, secure, and sustainable energy supply while pursuing a climate-neutral economy by 2050. Achieving this goal increasingly depends on energy system integration – the closer interaction between different energy infrastructures. In modern energy systems, the networks of electricity, heat, gas, hydrogen, transport, and information infrastructures are becoming deeply intertwined, forming a complex, dynamic, and interdependent system.

The growing share of renewable energy sources, the decentralization of energy production, digitalization, and active consumer participation in energy generation are transforming the operational principles of the energy sector. These changes increase the efficiency and sustainability of the system but also bring new challenges, as integrated energy systems become more sensitive to various disruptions – from technical failures or supply disruptions to cyberattacks, extreme climate events, or geopolitical threats. Therefore, it is increasingly important to understand how such interconnected systems operate, how they respond to disruptions, and what solutions can ensure their reliability, security, and resilience. To achieve this, new methodologies and modeling tools must be developed to comprehensively assess system behavior under both normal and disrupted conditions.

The research topic "Research on energy systems integration, reliability, security and resilience to disruptions" aims to develop methodologies and modeling tools for assessing energy system integration, reliability, security, and resilience to disruptions, as well as to create a methodology for energy system integration and assessment for smart climate neutral cities. The developed methodologies will be tested through modeling and analysis of various energy system integration, transformation, and disruption scenarios. The created models will enable the assessment of energy system behavior under normal conditions and in different disruption cases, including supply interruptions, cyberattacks, extreme climate events, and geopolitical threats.

The research will also examine the integration potential of renewable energy sources, energy storage, and hydrogen technologies, and their impact on the overall system's security, stability, and reliability. The developed methodologies will be applied to the analysis of the energy systems of selected cities, countries, or regions to assess how integration affects system reliability, security, and resilience under different integration and transformation scenarios. A dedicated methodology will also be developed for integrating and assessing energy systems of smart climate neutral cities, taking into account the interactions between heating, cooling, electricity supply systems, renewable energy sources, and energy storage technologies.

The developed and tested methodologies, together with the research results, will provide a basis for more informed decision-making in energy system development, modernization, and crisis management. They will also support the creation of visions for smart climate neutral cities and help implement them in the future. This research will contribute to the achievement of national goals in energy independence, security, and climate neutrality, providing a scientific foundation for the future energy transformation towards smart, sustainable, and resilient cities and regions.

Proposed dissertation topics:

1. "Development and pilot application of a methodology for assessment of integrated energy system security of supply and resilience to various disruptions".
2. "Development of a methodology for energy system integration and assessment for smart climate neutral cities".

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