Research Activities at Kaunas University of Technology Addressing the Security and Resilience Challenges of Power Systems Transitioning to Renewable Energy Sources

Dr. Jonas Vaičys
Department of Electrical and Power Systems

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Research & Project Areas

EMT & Overvoltage Studies

Technoeconomic Studies

Power System Stability Studies

Other Activities

EMT & Overvoltage Studies

Surge Arresters in the Distribution Network

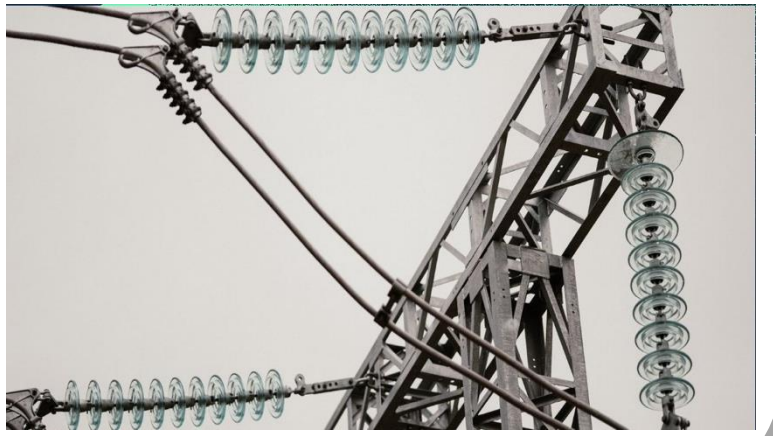
Selection of measures to reduce the negative impact/effect of overvoltage on electricity distribution network

(Contractor: DSO)

Induced Voltage Levels in Overhead Lines

Determination of permissible electromagnetic field parameters in overhead line protection zones of the transmission network

(Contractor: TSO)



Techoeconomic Studies

Power System Adequacy

Probabilistic adequacy assessment of the Lithuanian electricity system for 2013-2018, 2022-2025, 2025 -2030

(Contractor: UAB EPSO-G)

Connection Feasibility Studies

Feasibility study of grid connection for supplying self-needs and providing ancillary services from an offshore floating storage and regasification unit (FSRU)

(Contractor: AB Klaipėdos nafta)

Techno-economic Studies

Wind Farm Technologies

Economic feasibility study related to WF installation

(Contractor: AB ORLEN LIETUVA)

Energy Storage Technologies

Identification of optimal BESS parameters before and after synchronization with continental Europe

(Contractor: UAB EPSO-G)

Electrolysis Units

Feasibility assessment of electrolysis units connecting to TSO 330/110 kV network

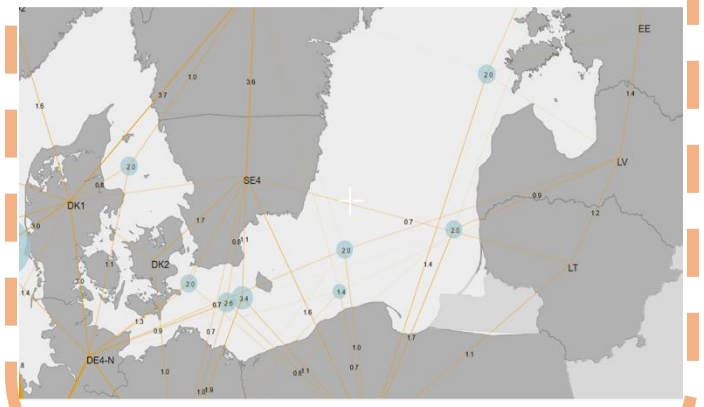
(Contractor: AB ACHEMA)

Other Activities

Offshore Energy Hubs in the Baltic Sea (BaltHub)

in collaboration with Nordic Energy Research

The aim was to analyze the cost effectiveness of energy hubs in the Baltic Sea region

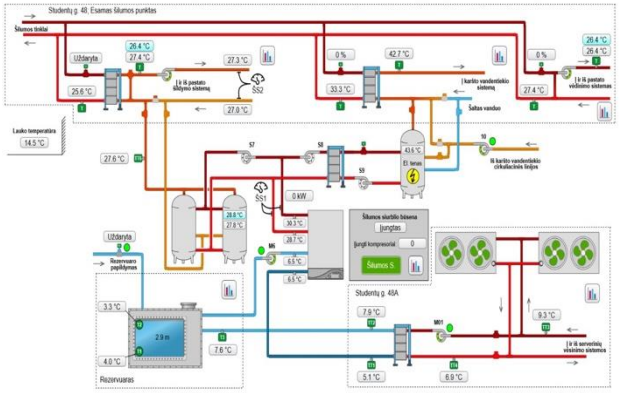


Neutral Earthing Concept in Distribution Network

Analysis of different neutral earthing concepts to ensure safety, reliability and effective fault management

Hybrid Seasonal Energy Storage System

The aim was to design and deploy a hybrid storage system which utilizes residual heat from local data center



Power System Stability Studies

Renewable Energy Source Penetration

1. Study of RES penetration capacity in Estonian power system

(Contractor: EE TSO)

2. Feasibility study on connecting power plants using renewable energy sources to the 330-110 kV Lithuanian electricity transmission network by 2030

(Contractor: TSO)

Energy System Analysis Tool

Development of probabilistic power grid analysis tool for critical energy infrastructure resilience

(Contractor: European Commission)

Power Flow Limitation Into Lithuanian Grid

1. Study to identify possible measures to restrict electricity supply from the Astravets nuclear power plant

(Contractor: TSO)

2. Study of scenarios for restricting the entry of electricity produced by Belarusian nuclear power plants into the Lithuanian market

(Contractor: TSO)

Real Time Discrete Simulator

Main time step: ~25 – 50 µs

Sub-step: ~1 – 3 µs

Communication protocols:
IEC 61850 GOOSE, MODBUS,
DNP3, IEC-60870-5-104

GTDI: 0-50V

GTDO: 5-30V DC

GTAI: 0-50V

GTAO: +- 10V

HV GTFPI: 0-250V

LV GTFPI: 0/5V

2 racks (8 cores in total) enables the analysis of:

- HV network section with several substations and lines; and
- A large renewable plant + grid + protection system in real time.

HIL applications:

- SEL controller & Axion relays
- SEL Time-Domain Line Protection relay

Case studies:

- Virtual relay protection concept testing
- Grid forming inverter stability testing
- Cyber security and resilience testing

Activities in collaboration with spin-offs since 2020:

43

Grid connection studies for RES and BESS developers (~2.4 GW)

20

Completed consultancy studies

6

Ongoing projects in Latvia

1

Ongoing innovation project with Lithuanian TSO