From Lab to Grid:
NTI Technologies Powering Energy Transformation

NIKOLA TESLA INSTITUTE

Automation & Regulation Department
University of Belgrade, Serbia

Partnering with industry, utilities, and research institutions for scalable impact.

Website: www.ieent.org
Phone: +381648259704

contact: Ilija Klasnić and Jasna Dragosavac
ilija.klasnic@ieent.org | jasna.dragosavac@ieent.org

From Lab to Grid:
NTI Technologies Powering Energy Transformation

NIKOLA TESLA INSTITUTE

📚 Who We Are

- Research-focused organization in **electrical engineering and energy systems**.
- **70+ engineers**, including **20 full-time researchers** and **25+ actively involved in R&D projects**.

⚡ Our Strenghts

- Strong collaborations with **Utilities Companies** and **Power Generation Companies (e.g. Hydroelectric plants)** can bring **meaningful Use Cases and Data.**
- Specialists in **power grid**, **power electonics, control and SCADA systems**, **generator and transformer monitoring and testing**.

🏆 Our Achievements

- **85%** of annual **8M EUR revenue** generated through **market-driven collaborations**.
- Trusted by industry leaders for **applied innovation** and **technology transfer**.

Greenet

What we offer for CL5 topics

HIL solutions

Power converters design

NIKOLA TESLA INSTITUTE

Control concepts

Meaningful Use-cases

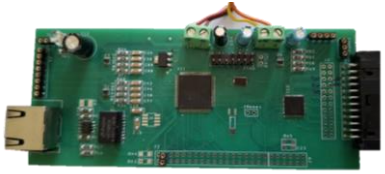
HIL solutions implemented in laboratory

Relevant for: HORIZON-CL5-2025-D3-17

Hardware-In-the-Loop (HIL) testbed for **Turbine Governor (TG)**

- Includes **Simulink** environment, motor with frequency drive, encoder, positioner, synchronizer
- Enables **realistic testing** of various TG types and operating modes
- Equipped with local and remote control- **SCADA** integration
- **Main goal**: full development and verification of TG in HIL conditions

PLC / SCADA in control room
implemented in Regional control centre



Robust & versatile **in-house hardware** as **our HIL** solution

HIL turbine governor **testbed**

Control concepts, algorithms, embedded control, PLC and SCADA

Relevant for: HORIZON-CL5-2025-D3-17, HORIZON-CL5-2025-D3-18

Embedded control on MCU, DSP, FPGA;
Control of power electronics (inverters, rectifiers, DC-DC, AC-AC);

- Excitation system of synchronous machines (from 7 A to 7,000 A);
- Isolated and grid-tied voltage source inverters;
- Motor Drives;
- Battery management;

Coordinated control of distributed power sources and power grids.

- ✓ Optimal and robust control algorithms;
- ✓ AI design and MCU + MPU implementation;
- ✓ Advanced measurement system and protections;
- ✓ Industrial LAN-based and wireless communication;
- ✓ PLC and SCADA of industrial systems;

Power converters design - for industry graded application

Relevant for: HORIZON-CL5-2025-02-D3-11, HORIZON-CL5-2025-01-D5-01

Specific contribution to the topics:

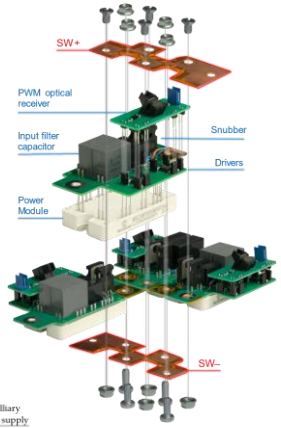
HORIZON-CL5-2025-02-D3-11:

•High-density inverter design (GaN, SiC) to supply synthetic inertia & advanced grid services support
•Smart hardware HIL testing and control for multi-inverter interaction

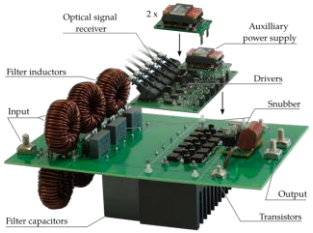
HORIZON-CL5-2025-01-D5-01:

- **Efficient bidirectional wireless charging**

systems with robust power electronics, EMC compliance, and grid integration



Laboratory prototypes
TRL 3-4



Validated prototypes
TRL 5-6

Industry graded solution
TRL 8

Experience:

Participation on **Spanish** national project **Wi-Batt** and one with **Spanish** company **Indra.** More than 100 projects for the national utility ***Elektroprivreda Serbia.***

NIKOLA TESLA INSTITUTE

Greenet

Case Study 1 – Smart Hydropower Integration for Flexibility and Biodiversity

Relevant for: HORIZON-CL5-2025-02-D3-04

Specific contribution to the topic:

- **Case study** of two operational **SmallHydro** plants in Serbia.
- **IoT network** for real-time monitoring and predictive analytics.
- **AI module** for optimization based on weather patterns (temperature & precipitation), proactive load balancing and efficiency improvement.
- **Ecological water management**: Eco-minimum flow regulation, sediment management, flood control, climate-adaptive river management.
- **Active** engagement of **Institute of Social Sciences** (https://idn.org.rs/en/researchers/).

Case study sites:

Brusnik SmallHydro (1260 kW, Kaplan)

Stenjevac SmallHydro (902 kW, Francis)

Cluster approach - **industry partners, SSH experts, and RI** for full societal and technological readiness!

Technology profile:

- Hybrid system: **SmallHydro + IoT + AI**.
- TRL 4–5 target through real-life demonstration!
- Real-time data collection and predictive control for operational and ecological optimization.

Case Study 2 - Integrated DSO–TSO Approach for Flexible and Resilient Grids

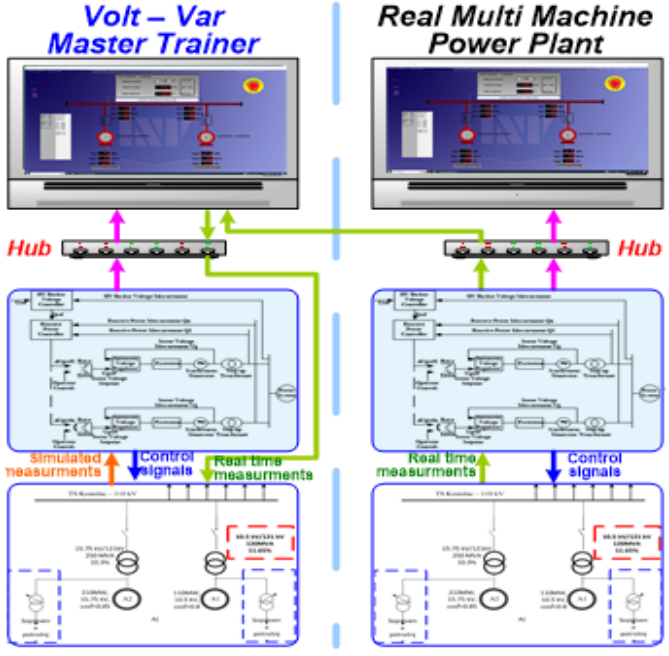
Relevant for HORIZON-CL5-2025-D3-18, HORIZON-CL5-2025-D3-17

Specific contribution to the topics:

- **Cluster** approach involving Transmission System Operator (TSO), Distribution System Operator (DSO), and research institute.
- Integration of **smart substations** with power electronics, IEDs, and unified data analytics.
- Development of **advanced control and operation tools** for coordinated RES management across voltage levels..
- **Real-time monitoring and AI-assisted decision-making** for fast identification and mitigation of grid disturbances.

Technology profile:

- Targeting **TRL 7-8** through operational pilots.
- Optimal and robust control algorithms;
- AI design and MCU + MPU implementation;
- Advanced measurement system and protections;
- Industrial LAN-based and wireless communication;
- PLC and SCADA of industrial systems;



PLC / SCADA based Power Plant & network Simulator for **full development and verification**

Strategic Focus:
Horizon Europe 2025–2026 Calls
(Cluster 5: Climate, Energy and Mobility)

What we are looking for:

- **Collaborations** with industry, utilities, and research partners to co-develop and deploy advanced solutions for smart grids, flexible generation, and energy system resilience within Horizon Europe Cluster 5 projects.

- **Coordinators** which wants / needs to include our expertise (innovation in control systems, RES integration, and AI applications) and case studies in a project

jasna.dragosavac@ieent.org
ilija.klasnic@ieent.org