NEST Laboratory – Network for Energy Sustainable Transition

Mission

To accelerate the transition towards a **sustainable, efficient, and resilient energy system** through advanced research, technological innovation, and interdisciplinary collaboration.

Context

Part of a national research network funded under the **National Recovery and Resilience Plan (PNRR)**, involving universities, research centers, and industry partners.

NETWORK FOR ENERGY SUSTAINABLE TRANSITION

Key research domains

Clean Hydrogen & Final Uses

- Electrolysis technologies
- Integration of hydrogen into existing energy systems
- Decarbonization of hard-to-abate sectors

Energy Storage

- Advanced thermal energy storage solutions
- Innovative materials for higher energy density
- Improving system flexibility and efficiency

Environmental Monitoring for Energy Efficiency

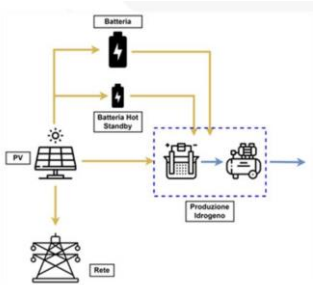
- Smart sensing systems
- Indoor environmental quality
- Energy optimization in buildings

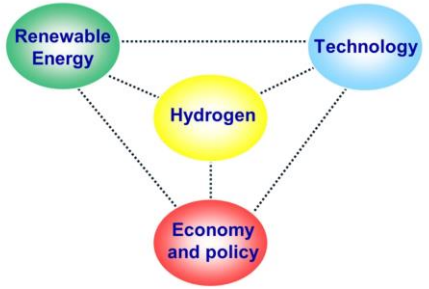
Research area: hydrogen

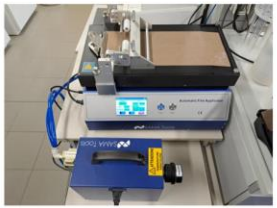
Clean Hydrogen and Final Uses

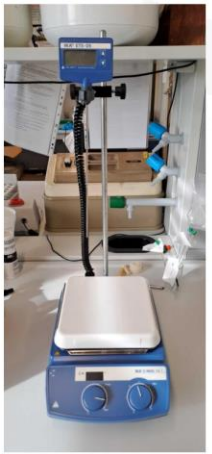
- Electrolysis technologies (design, characterization and testing of components and devices for hydrogen production and use)
- Final uses of hydrogen (integration of hydrogen into existing energy systems)

The equipment used for this spoke is part of an **extended and distributed interdepartmental laboratory,** in cooperation with other departments of the University of Pisa.









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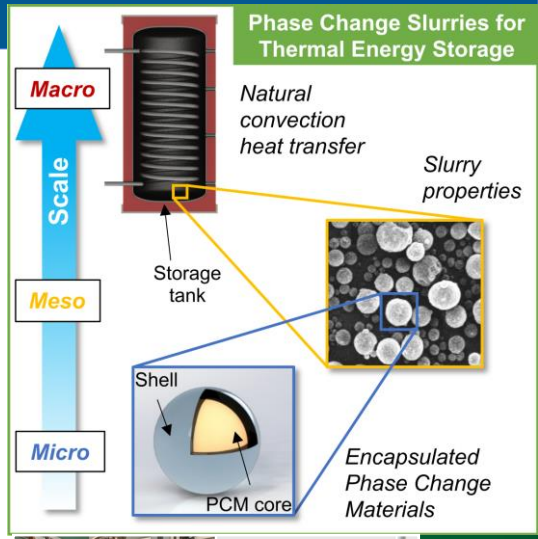
Research area: energy storage

Phase Change Slurries used in Thermal Energy Storage

- Thermophysical properties characterization and evaluation of heat-transfer performances
- Experimental studies on natural/mixed convection in both “hot” and “cold” storage operating conditions
- Storage modelling and simulation
- Combining real hardware with dynamic models, emulating realistic loads and weather conditions, enabling fast optimization of energy system configurations and control strategies



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Research area: environmental monitoring

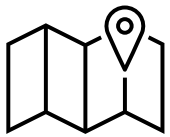
Improving energy efficiency and indoor comfort in buildings:

- Measurements of illuminance, CO_2 concentration, temperature, and relative humidity
- Support for energy optimization and design of high-comfort environments

Some of the last published research activities

Title	Year	Journal
Development of bio-based flexible polyurethane foams incorporating phase change materials for thermal energy storage applications	2025	Materials Today Sustainability
Techno-Economic Assessment of Electrification and Hydrogen Pathways for Optimal Solar Integration in the Glass Industry	2025	Solar
Experimental characterisation of heat transfer and energy storage performance in agitated microencapsulated phase change slurries	2025	International Communications in Heat and Mass Transfer
Integrated Plant Design for Green Hydrogen Production and Power Generation in Photovoltaic Systems: Balancing Electrolyzer Sizing and Storage	2025	Hydrogen
Energy Savings in University Buildings: The Potential Role of Smart Monitoring and IoT Technologies	2025	Sustainability
Renewable Electricity and Green Hydrogen Integration for Decarbonization of “Hard-to-Abate” Industrial Sectors	2024	Electricity
Beyond water: Physical and heat transfer properties of phase change slurries for thermal energy storage	2024	Cell Reports Physical Science

Contacts



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