ELECTRICAL, ELECTRONICS AND COMMUNICATIONS ENGINEERING

IIT - Design and Development of Seawater Electrolyzers Integrated with Energy Storage and Power Generation Systems

Funded By	FONDAZIONE ISTITUTO ITALIANO DI TECNOLOGIA [P.iva/CF:09198791007]
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Context of the research activity	The project focuses on the development of seawater electrolyzers designed for seamless integration within renewable energy and storage infrastructures. It aims to create efficient and durable systems that directly couple hydrogen production from seawater with solar or other renewable power sources, enhancing overall energy conversion, storage, and grid stability.
Objectives	The research aims to design and realize seawater-based electrolyzer systems that can be efficiently integrated with energy storage and renewable power generation technologies. While the electrochemical design ensures stable operation in marine environments, the core of the project is the development of an integrated architecture capable of linking hydrogen production to dynamic energy networks. The work will address both the optimization of seawater electrolysis performance and the engineering challenges of coupling the electrolyzer with storage units such as supercapacitors and batteries, as well as with intermittent energy sources like photovoltaic panels. The objective is to create a modular and scalable system where the electrolyzer operates as a flexible node within an energy ecosystem, balancing production and storage in real time. Key research activities include the study of materials and cell configurations suitable for long-term operation in seawater, the development of control strategies for energy flow management, and the assessment of the overall system efficiency under variable power inputs. The project will explore hybrid configurations that combine direct hydrogen generation with short- and long-term energy storage, enabling high energy autonomy and resilience in coastal or off-grid environments. Ultimately, this research will contribute to the advancement of integrated energy solutions by linking hydrogen production, renewable generation, and storage technologies into a unified, sustainable framework suitable for future

	clean energy infrastructures.

Skills and competencies for the development of the activity	The candidate must hold a STEM degree, demonstrate strong autonomy in experimental and system-level work, and possess teamwork and communication skills in English. Experience in energy systems integration, renewable technologies, or electrochemical devices will be considered an asset.