



# PhD in INGEGNERIA GESTIONALE / MANAGEMENT ENGINEERING - 40th cycle

**THEMATIC Research Field: SUSTAINABLE ENERGY SYSTEMS: EXPLORING HYDROGEN'S  
ROLE IN SMART GRIDS FOR ECONOMIC AND ENVIRONMENTAL RESILIENCE**

**Monthly net income of PhDscholarship (max 36 months)**

**€ 1500.0**

In case of a change of the welfare rates during the three-year period, the amount could be modified.

## Context of the research activity

**Motivation and objectives of the research  
in this field**

The global energy landscape is undergoing a profound transformation driven by the urgent need to mitigate climate change, ensure energy security, and support sustainable economic development. Within this context, the integration of hydrogen into smart grids represents a promising frontier for achieving economic and environmental resilience.

My motivation for pursuing research in this area stems from a deep-seated interest in sustainable energy systems and the critical role that innovative management strategies play in their deployment and optimization.

Hydrogen, as a versatile energy carrier, offers unique advantages in balancing supply and demand in smart grids, enhancing grid flexibility, and enabling the integration of renewable energy sources. However, its effective integration into existing energy infrastructures presents complex challenges that span technological, economic, and regulatory domains. In the field of management engineering, it is of particular relevance the opportunity to explore how hydrogen can be strategically deployed within smart grid architectures to optimize both economic performance and environmental impact. There is a critical need to address how hydrogen can be strategically deployed within smart grid architectures to optimize both economic performance and environmental impact.

In particular, hydrogen offers a compelling solution to one of the most pressing challenges in renewable energy:



	<p>storage. Unlike conventional battery storage, which is often limited by capacity, cost, and material constraints, hydrogen can store large quantities of excess renewable energy over longer periods, providing a flexible, scalable, and sustainable storage solution. By converting surplus electricity into hydrogen through electrolysis, energy can be stored during periods of low demand and then converted back to electricity or used in other applications when needed.</p> <p>This capability not only addresses the intermittency of renewable energy sources but also enhances grid stability and resilience.</p>
Methods and techniques that will be developed and used to carry out the research	<p>The research will focus on several key objectives: (1) identifying the technological and economic barriers to hydrogen integration, (2) developing advanced models and tools for assessing the viability and scalability of hydrogen-based solutions, and (3) exploring policy frameworks to support effective implementation.</p> <p>Candidates will engage in interdisciplinary work, leveraging insights from management engineering, energy economics, and environmental sciences to inform strategic decision-making and policy development.</p>
Educational objectives	<p><b>Develop Advanced Analytical Skills:</b> Equip candidate with the ability to analyze complex energy systems and assess the economic, environmental, and technological implications of integrating hydrogen into smart grids. This includes mastering advanced modeling techniques and tools for evaluating hydrogen-based solutions.</p> <p><b>Cultivate Strategic Decision-Making Abilities:</b> Prepare candidate to make informed strategic decisions and policy recommendations by understanding the economic viability and scalability of hydrogen technologies, as well as the regulatory and market dynamics influencing their adoption.</p> <p><b>Build Research Competence:</b> Develop proficiency in conducting rigorous research, including designing and executing empirical analysis, analyzing data, and interpreting results.</p> <p>Candidate will also learn to communicate their findings effectively through research papers and presentations.</p>



<b>Job opportunities</b>	<p>Academic or Research Scientist: Pursue a career in academia or research institutions, focusing on advancing knowledge in sustainable energy systems, hydrogen technologies, and smart grid integration. This role involves conducting research, publishing findings, and contributing to academic discourse.</p> <p>Renewable Energy Consultant: Provide expert advice on integrating hydrogen technologies into existing energy infrastructures. Consultants assess the feasibility of hydrogen projects, recommend strategies for implementation, and help navigate regulatory requirements.</p> <p>Energy Policy Advisor: Develop and advocate for policies that support the adoption of hydrogen technologies in smart grids. This role involves analyzing policy impacts, recommending regulatory changes, and working with government and industry stakeholders.</p>
<b>Composition of the research group</b>	3 Full Professors 0 Associated Professors 0 Assistant Professors 3 PhD Students
<b>Name of the research directors</b>	D. Chiaroni, V. Chiesa, F. Frattini

<b>Contacts</b>
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<b>Additional support - Financial aid per PhD student per year (gross amount)</b>	
<b>Housing - Foreign Students</b>	--
<b>Housing - Out-of-town residents (more than 80Km out of Milano)</b>	--

<b>Scholarship Increase for a period abroad</b>	
<b>Amount monthly</b>	750.0 €
<b>By number of months</b>	6

<b>Additional information: educational activity, teaching assistantship, computer availability, desk availability, any other information</b>
In alignment with our commitment to fostering the academic and professional development of Ph.D. candidates, the program offers a range of resources and opportunities to support research and career advancement.



**Teaching Opportunities:** The program provides valuable teaching experiences, including positions as teaching assistants. This role will involve engaging with students, contributing to course development, and gaining practical instructional experience, all of which are integral to developing teaching skills and understanding educational methodologies.

**Desk and Computer Availability:** Candidates will be allocated a dedicated desk and access to a computer equipped with necessary software and tools for research activities. This workspace, located within the research facilities, will support a productive research environment and facilitate collaboration with fellow researchers.

- **Involvement in projects:** "For the overall development of their capabilities, PhD candidates will work on synergical projects to favour empirical data collection and network development for their career. Projects will give candidates the opportunity to work in group (peers and other senior professors)".
- **Teaching and tutoring:** "If coherent with the development of their doctoral program, the PhD candidate will have the opportunity to be involved in: teaching activities, tutoring to master students, tutoring to PhD candidates for administrative processes".
- **Italian knowledge (e.g. borsa co-finanziata da ente italiano):** "The interaction with key stakeholders requires a fluent knowledge of the Italian language".

**Funding for educational activities: 6.100,00 Euros for three years.**