



PhD in SCIENZE E TECNOLOGIE ENERGETICHE E NUCLEARI / ENERGY AND NUCLEAR SCIENCE AND TECHNOLOGY - 39th cycle

THEMATIC Research Field: ELECTRO-THERMAL ENERGY STORAGE SYSTEMS

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

In the frame of the transformation of the energy sector, strongly urged both by the need for decarbonization and concern for global issues, the deployment of renewable energy sources for power generation is currently mostly based on solar and wind energy, which are typically only intermittently available, and require to be integrated with appropriate storage systems. Different storage systems exist, but recent years have only seen a build-up of short-duration energy storage system. However, medium- and long-term electricity storage system are also strongly needed, particularly in the industrial context. In this situation, the development of electrothermal energy storage (ETES) systems, designed to store renewable electricity (RE) and heat with the aim of restituting them as needed, is highly promising.

The scope of this PhD project, within the context of the HE Sehrene project, is the overall ETES design and system optimization for several case-studies; techno-economic assessment will also be tackled. The research addresses specifically the integration of the innovative ETES components : (i) the heat-pump, featuring an innovative design, with a high coefficient of performance, (ii) the thermal energy storage system, based on a Phase Change Material distributed in a novel metallic Kelvin cells-like foam, and (iii) the ORC plant, featuring improved operating parameters.



Methods and techniques that will be developed and used to carry out the research	<p>Research activity is theoretical and focused on simulation and optimization of the overall ETES system, with different boundary conditions, according to the considered use-cases.</p> <p>Use of the following computational tools is required:</p> <ul style="list-style-type: none"> - Aspen Plus software, for the calculation of mass and energy balances of every component - Simulation and optimization software (e.g. Matlab, Python) for the simulation and optimization of both the design and the operating conditions
Educational objectives	<p>The PhD candidate will work in a highly motivated and qualified large research group, and will be involved in an EU project. The PhD candidate will gain experience, knowledge and skills in the analysis of energy conversion processes from different points of view.</p> <p>Specifically, the PhD candidate will:</p> <ul style="list-style-type: none"> - acquire expertise about ORC and Heat Pump technology - acquire specific modelling experience on the design and optimization of the ETES system - become proficient user of software for process simulations (Aspen Plus), and optimization (Python, Matlab).
Job opportunities	<p>This research activity will qualify the candidate for future academic and research positions, as well as for a highly qualified professional career as consultant or in industries/organizations operating in the energy sector</p>
Composition of the research group	<p>5 Full Professors 7 Associated Professors 7 Assistant Professors 40 PhD Students</p>
Name of the research directors	Paola Bombarda, Giampaolo Manzolini

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

Scholarship Increase for a period abroad	
Amount monthly	750.0 €
By number of months	6

Additional information: educational activity, teaching assistantship, computer availability, desk availability, any other information

Educational activities: Financial aid per PhD student is available for purchase of study books and material, funding for participation in courses, summer schools, workshops and conferences, instrumentations and computer, etc. This amount is equal to 10% of the annual gross amount, for 3 years.

Teaching assistantship:

Availability of funding in recognition of supporting teaching activities by the PhD student. There are various forms of financial aid for activities of support to the teaching practice. The PhD student is encouraged to take part in these activities, within the limits allowed by the regulations.

Computer availability: individual use.

Desk availability: individual use.

Awards will be recognized to the PhD candidate up to Euro 1500 (gross amount, after completion of the I year); Euro 3500 (gross amount, after completion of the II year); Euro 5000 (gross amount, after completion of the III year) in case of exceptional achievements in the research project, subject to the evaluation of the research director.