



PhD in SCIENCE, TECHNOLOGY AND POLICY FOR SUSTAINABLE CHANGE - 38th cycle

THEMATIC Research Field: DEVELOPMENT OF A TECHNO-ECONOMIC METHODOLOGY FOR THE ANALYSIS OF NUCLEAR-RENEWABLE INTEGRATION IN CARBON NEUTRAL SCENARIOS

Monthly net income of PhDscholarship (max 36 months)

€ 1400.0

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

Energy is a key pillar in the transition to a sustainable world. The objective of obtaining ?affordable and clean energy? (SDG 7) should be accomplished limiting the CO₂ emission to combat the climate change (SDG13). Recent events have been also pointed out the need to ensure energy in difficult geo-political scenario.

To achieve these goals, several pathways have been outlined from different organization (IPCC, IEA, ?) and the majority of them foresees a role for nuclear energy not only in the electricity market but also in hard-to-abate sectors (heating, transportation, industry?).

In this light, the integration of nuclear with other energy sources and carriers is a cutting-edge research topic to satisfy the aforementioned objectives. The aim of such system is to coordinate nuclear energy with renewable energy sources, accumulation systems as battery, hydrogen production and other cogeneration systems (e.g., heating district and desalination).

The PhD project will develop a methodology for a comprehensive evaluation of the presence of nuclear energy, and especially the Small Modular Reactors (SMRs) and the Advanced Modular Reactors (AMRs) in an integrated energy system characterized by a high penetration of renewable energies in a carbon-neutral



	scenario. The methodology is aimed at evaluating both the technical and the economic performances with an attention to the compliance with the safety requirements requested by nuclear installations.
Methods and techniques that will be developed and used to carry out the research	A comprehensive approach will be adopted to address the multidisciplinary characteristics of the problem. An object-oriented modelling approach based on Modelica language will be used to develop a dynamics simulator for the hybrid system aimed at evaluating the constraints and the dynamics at the plant level. Techno-economic optimizer (e.g., PERSEE, RAVEN,...) will be also employed to considerate different aspects (resources, technology development, market potential) in a long time scale.
Educational objectives	This activity will allow the student to gain knowledge and understanding in the role of the nuclear energy for future energy scenarios, giving the opportunity to become an expert in the integration between nuclear and other energy sources both from a technical and economics point of view. The presence of a European project where the research activity is integrated will allow the student to interact with the main European institutions in this research field.
Job opportunities	<p>The job opportunities for a PhD graduate in this research area are:</p> <ul style="list-style-type: none"> - Academic career in the field of innovative nuclear reactors and energy scenario assessment - Industry involved in the development of SMR and AMR - Research centre and support organization
Composition of the research group	1 Full Professors 2 Associated Professors 1 Assistant Professors 10 PhD Students
Name of the research directors	Prof. Stefano Lorenzi

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	700.0 €
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. The educational activity will be discussed based on the candidate's competences.

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 PhD program's regulations.

Computer availability:

individual use.

Desk availability:

The candidate will be hosted at Department of Energy in Bovisa campus