



PhD in SCIENZE E TECNOLOGIE ENERGETICHE E NUCLEARI / ENERGY AND NUCLEAR SCIENCE AND TECHNOLOGY - 38th cycle

THEMATIC Research Field: DEVELOPMENT OF TECHNO-ECONOMIC, FINANCIAL AND BUSINESS MODELS FOR GENERATION IV REACTORS

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

The importance of low carbon energy sources in the efforts against rapid climate change makes nuclear energy part of a sustainable energy mix. Fundamental improvement, particularly regarding intrinsic safety and reduced nuclear waste generation, is possible using advanced nuclear designs. Heavy metal cooled systems such as the lead fast reactor (LFR) combine the advantages of a fast reactor system that reduces waste with the intrinsic safety related properties such as the high boiling point, chemical inertia and improved heat transfer. The objective of EURATOM-funded project ANSELMUS - "Advanced Nuclear Safety Evaluation of Liquid Metal Using Systems" is to contribute significantly to the safety assessment of heavy-liquid-metal (HLM) systems. The project will experimentally validate key safety related sub-systems including the safety rods, failed fuel pin detection and the coolant chemistry control system. Moreover, ANSELMUS will look into the societal impact of HLM reactors by assessing the integration of LFR in a mixed energy landscape, including economical aspects, and by addressing social and ethical considerations of advanced nuclear technologies. In particular, the techno-economic analysis and the financing and business model development of the integration of LFR's with load following (LF) by co-generation into a low carbon energy mix will be the main objectives of this



	research.
Methods and techniques that will be developed and used to carry out the research	<p>The techno-economic analysis will include CAPEX and OPEX for LFR focusing on the cogeneration mode. Cost drivers such as the “economy of scale” and “industrial learning” will be modeled. The financing and business model will address the causes able to increase construction costs, trigger delays and reduce operating performance, the main goals being risk identification, allocation to the most appropriate stakeholders, financing strategies and, finally derivation of a viable business model.</p> <p>Simulation tools will be used or developed on purpose. LFR and BOP modelling: RELAP, MODELICA (object oriented approach). Techno-economic modelling: INCAS (INtegrated model for the Competitiveness Analysis of Small-medium sized reactors), Matlab environment, discounted cash flow (DCF) method.</p>
Educational objectives	<p>This activity will allow the student to gain a high-qualified know-how and expertise in the nuclear energy & innovative reactors area, with a balanced experimental and modelling approach. 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.</p>
Job opportunities	<p>The job opportunities for a PhD graduate in this research area are motivated by the strong need of new nuclear experts to substitute a generation of experts in the retirement phase in:</p> <ul style="list-style-type: none"> •European nuclear industry activities for post-Fukushima retrofit on current fleet, for new nuclear build in EU and in the international market; •New start-ups in the nuclear sector (SMRs, GenIV reactors); •International Research Centres.
Composition of the research group	<p>1 Full Professors 2 Associated Professors 0 Assistant Professors</p>



	10 PhD Students
Name of the research directors	Marco Ricotti, 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
<p>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. The amount is equal to 10% of the annual gross amount, for 3 years.</p> <p>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.</p> <p>Computer availability: individual use.</p> <p>Desk availability: individual use.</p>