



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

THEMATIC Research Field: ENERGY SCENARIOS AND TECHNO-ECONOMIC EVALUATION OF INNOVATIVE NUCLEAR 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	<p>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 as well as to consider the environmental footprint in terms of raw materials, land use and water resources. 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, innovative reactors as Small Modular Reactors (SMRs) and Advanced Modular Reactors (AMRs) play a key role in the next decades, both at World and at European level. Moreover, flexible operation and cogeneration capabilities (hydrogen, district heating, desalination, biofuels production, ...) allow SMRs/AMRs to be highly integrable with renewable energy sources. Those promising features justify the investigation of innovative reactors deployment in Italian as well as European energy scenarios. The PhD project will develop tools to evaluate the technological, economic\business case and safety feature of innovative reactors in the framework of an integration of Italian and European energy scenario. The analysis will</p>



	<p>include i) the techno-economic analysis of the cogeneration capabilities of innovative nuclear reactors, ii) the development of an ad-hoc tool for the analysis of the introduction of nuclear technology in the Italian energy scenario, and iii) the study of the safety aspects introduced by the hybridization of the nuclear systems. The research is financed by ENEL and the PhD candidate is required to work in collaboration with the company.</p>
<p>Methods and techniques that will be developed and used to carry out the research</p>	<p>A comprehensive approach will be adopted, to address the potential role of innovative nuclear reactors in the Italian/European energy mix. Energy scenario analysis (up to dynamic analysis) to evaluate SMR/AMR energy supply, cogeneration and energy service capabilities will be the main investigation method. The methods and techniques to be used will be of numerical-modelling type. Among the state-of-the-art codes: modelling for the simulation and resolution of the Italian electricity market (taking into account in particular the economic equilibrium levels of the various generating sources); MODELICA (object oriented modelling); IAEA suite for energy planning (MAED, MESSAGE, WASP, FINPLAN, SIMPACTS, ISED).</p>
<p>Educational objectives</p>	<p>The PhD candidate will develop a comprehensive approach, devoted to address both the energy scenario identification and analysis. A critical analysis capability will be nurtured during the whole PhD programme. A further objective will be to gain a high-qualified know-how and expertise in the nuclear energy and innovative reactors area. Team working and problem solving capabilities will be key educational objectives as well.</p>
<p>Job opportunities</p>	<p>The emerging candidate's profile will be highly attractive: in the research environment, where cross-disciplinary skills are more and more appreciated; in the expanding field of innovative, new generation nuclear reactors (where, besides large companies, also start-ups are emerging in the World, in Europe and also in Italy); in the nuclear as well as in the non-nuclear utilities, interested in</p>



	evaluating the potentialities offered by innovative nuclear reactors; in the energy intensive industrial sectors, concerned about energy availability and affordability
Composition of the research group	1 Full Professors 2 Associated Professors 2 Assistant Professors 12 PhD Students
Name of the research directors	Prof. Marco Ricotti

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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>Increase in the scholarship for stays abroad: euro 700 per month, for up to 6 months.</p> <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. This 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. Desk availability: individual use.</p> <p>Awards: Awards will be recognized to the PhD candidate up to Euro 1500 (gross amount) per</p>	



year, in case of exceptional achievements in the research project, subject to the evaluation of the research director.