



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

**PNRR\_351\_DOTT\_RICERCA Research Field: ARTIFICIAL INTELLIGENCE AND ADVANCED SIMULATION FOR THE RISK AND RESILIENCE OF ENERGY SYSTEMS EXPOSED TO CLIMATE CHANGE**

**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**

Systems, Structures and Infrastructures (SSI) for energy production, transmission and distribution systems must be designed to function for several years. This requires accounting for the changing environmental (climate) conditions under which they are foreseen to operate. Currently, it is known that the world is experiencing increasing frequency and severity of extreme weather events. Therefore, there is a need to extend current models and methods of risk analysis to allow considering, with scientific rigor, different future climate scenarios, which may directly affect the efficiency and adequacy of energy systems, and their security, safety, reliability, while allowing for flexibility within the integrated national energy system in which they are installed (Mission#2,PNRR).

**Methods and techniques that will be developed and used to carry out the research**

The research activity aims at developing innovative artificial intelligence and advanced simulation techniques for allowing accurate and computationally feasible risk and resilience assessments frameworks, accounting for the uncertainties affecting the future climate change projections and the associated natural hazards, due to the expected increase of ambient temperature, sea level, wind speed, etc. Methods and techniques to be considered for this (in an integrated manner) are: Markov



	<p>models, Dynamic Bayesian Belief Networks, (Advanced) Monte Carlo Simulation methods, Particle Filtering, Kriging, Gaussian Processes, Deep Artificial Neural Networks, Convolutional Artificial Neural Networks, Generative Adversarial Networks, Reservoir Computing, Support Vector Machines, Grey-box models, Genetic Algorithms, Evolutionary Optimization, Reinforcement Learning. The PhD student will benefit from the competences of the international and interdisciplinary research team of the LASAR Group of Politecnico di Milano (<a href="http://www.lasar.polimi.it">www.lasar.polimi.it</a>). A world-renowned international host institution will be associated to the research project, at which the PhD student will spend a secondment period of at least 6 months. Collaborations with industry are sought, from which the PhD student could benefit in terms of opportunities to apply the developed methods on industrial use cases from the energy sector.</p>
<p><b>Educational objectives</b></p>	<p>To prepare a RAMS (Reliability, Availability, Maintainability and Safety), Risk and Resilience professional, expert and competent researcher with the technical skills, algorithmic knowledge and system analysis capabilities for evaluating and making decisions for preventing and managing the risk of energy systems, with also specific domain expertise and consideration of climate change effects for a sustainable energy transition.</p>
<p><b>Job opportunities</b></p>	<p>RAMS, reliability, maintenance, safety, risk engineer and manager, data analyst in support of decision making for complex energy systems (e.g., energy generation and distribution, nuclear, chemical, etc.) design, operation, management and regulation, researcher in national and international research centers and universities.</p>
<p><b>Composition of the research group</b></p>	<p>2 Full Professors 1 Associated Professors 1 Assistant Professors 12 PhD Students</p>
<p><b>Name of the research directors</b></p>	<p>Enrico Zio</p>

<p style="text-align: center;"><b>Contacts</b></p>	
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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)	--

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Scholarship Increase for a period abroad	
Amount monthly	700.0 €
By number of months	6

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National Operational Program for Research and Innovation	
Company where the candidate will attend the stage (name and brief description)	
By number of months at the company	0
Institution or company where the candidate will spend the period abroad (name and brief description)	
By number of months abroad	6

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By number of months at the company	0
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By number of months abroad	6

Additional information: educational activity, teaching assistantship, computer availability, desk availability, any other information
<p><b>Educational activities:</b>            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 about Euro 5700.</p> <p><b>Teaching assistantship:</b>            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><b>Computer availability:</b>            Individual use.</p> <p><b>Desk availability:</b>            individual use.</p> <p><b>Accommodation in Politecnico's Residences</b> (<a href="http://www.residenze.polimi.it">http://www.residenze.polimi.it</a>)            Available for PhD candidates; special rates will be applied to selected out-of-town candidates (detailed info in the call for application).</p>



**Research period in other institutions:**

Our candidates are strongly encouraged (6 months minimum is mandatory) to spend a research period in Public Administration institution, joining high-level, research groups in the specific PhD research topic, selected in agreement with the Supervisor.

An increase in the scholarship will be applied for periods up to 6 months (approx. 700 euro/month - net amount).