



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

**PNRR\_352 Research Field: ENERGY MANAGEMENT SYSTEM FOR EMOBILITY DISTRIBUTED RESOURCES**

<b>Monthly net income of PhDscholarship (max 36 months)</b>
<b>€ 1400.0</b>
In case of a change of the welfare rates during the three-year period, the amount could be modified.

<b>Context of the research activity</b>	
<b>Motivation and objectives of the research in this field</b>	<p>The progressive increase of the share of renewable energy sources in the national and global energy scenario, is one of the most relevant key goals of the very next future. The decarbonization process, the so called ‘green revolution’ and the Ecological transition are also one of the Mission of the PNRR Programme, specifically with mission M2C2.1 Among the numerous challenges posed by the transition to more sustainable energy and mobility systems there is the need to efficiently coordinate the operation of numerous resources scattered over large areas. The research program of the PhD project is oriented towards the development of models and algorithms aimed at an optimized economic dispatching of distributed energy resources. In particular, the research should focus on the flexibility services that can be provided to the electrical grid by coordinated charging of electric vehicles collocated on the same region. The PhD candidate will be involved in the research activities related to the agreement between Politecnico di Milano and Atlante (<a href="https://atlante.energy">https://atlante.energy</a>). Scope of the research project is the development of a control scheme that allows a portfolio of diverse assets (e.g.: EV chargers, energy storage systems, and PV generators) to participate in energy and ancillary services markets. Different European markets must be considered. The designed control scheme should be implementable on Atlante's</p>



	<p>infrastructure of distributed energy resources and charging points.</p>
<p><b>Methods and techniques that will be developed and used to carry out the research</b></p>	<p>The models and algorithms will leverage on and, eventually, extend the existing body of knowledge on the operational optimization of aggregated energy systems. The approach will be based on state-of-the-art optimization techniques such as Mixed Integer Linear Programming. The approaches will be devised to take into account: i) the uncertainty affecting predicted variables, through stochastic optimization techniques, and ii) the computational and communication limits of the system, by means of distributed optimization techniques. The resulting control scheme should be able to achieve the lowest possible operating cost, without compromising the actual operation of the system. The project is at the intersection of different fields of investigation: energy engineering, electrical engineering, and computer science. The PhD candidate is thus expected to interact with a multidisciplinary team of researchers.</p>
<p><b>Educational objectives</b></p>	<p>The PhD candidate will grow professionally, acquiring transversal skills in advanced optimization and control methods for distributed systems and energy markets. Furthermore, the PhD candidate will learn about the challenges of energy transition and mobility electrification, principles of energy modeling (including programming simulators), and day-to-day operation of a station for charging of electric vehicles. At the same time, the candidate will also be able to strengthen some soft skills, such as:</p> <ul style="list-style-type: none"> <li>• The ability to acquire new knowledge autonomously</li> <li>• Critical assessment</li> <li>• Communication and scientific communication, both oral and written</li> <li>• Time management</li> <li>• Project management</li> </ul> <p>Teamwork, in a multidisciplinary and international group. Moreover, the PhD program foresees advanced programming/coding courses and scientific writing classes.</p>



<b>Job opportunities</b>	This research activity will qualify the candidate for future academic and research positions, as well as for a highly qualified professional career in industries or organizations operating in the energy and electrical fields. Collaborating institutes: Atlante, Nhoa
<b>Composition of the research group</b>	4 Full Professors 7 Associated Professors 5 Assistant Professors 15 PhD Students
<b>Name of the research directors</b>	Giampaolo Manzolini; Emanuele Martelli

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

<b>Scholarship Increase for a period abroad</b>	
<b>Amount monthly</b>	700.0 €
<b>By number of months</b>	6

<b>National Operational Program for Research and Innovation</b>	
<b>Company where the candidate will attend the stage (name and brief description)</b>	Atlante ( <a href="https://atlante.energy">https://atlante.energy</a> )
<b>By number of months at the company</b>	6
<b>Institution or company where the candidate will spend the period abroad (name and brief description)</b>	to be defined
<b>By number of months abroad</b>	6

<b>Additional information: educational activity, teaching assistantship, computer availability, desk availability, any other information</b>
<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</p>



regulations. **Computer availability:** individual use. **Desk availability:** individual use. Accommodation in Politecnico's Residences (<http://www.residenze.polimi.it>) is available for PhD candidates; special rates will be applied to selected out-of-town candidates (detailed info in the call for application). **Research period abroad:** Our candidates are strongly encouraged (6 months minimum is mandatory) to spend a research period abroad, 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).