



# PhD in INGEGNERIA ELETTRICA / ELECTRICAL ENGINEERING - 38th cycle

**PNRR\_351\_PUBBL\_AMMIN Research Field: DIGITAL TWINS TO IMPROVE GOVERNANCE  
OF ENERGY RESOURCES AND CONSUMPTION IN GOVERNMENT REAL ESTATE: FROM  
INTEGRATED USE OF RENEWABLES AND STORAGE TO DIGITAL LOAD PLANNING  
TOOLS**

<b>Monthly net income of PhDscholarship (max 36 months)</b>
<b>€ 1300.0</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>	
<p><b>Motivation and objectives of the research in this field</b></p>	<p>The goal of the research is to develop models integrated with advanced simulation techniques, data analysis (machine learning and reinforcement learning) that can constitute a digital twin of the energy consumed and produced (renewable sources, cogeneration and self-generation) in the real estate of public administrations. The innovative tools developed can then be utilized to support the institutional design of energy services aimed at improving the effectiveness of public administration action and at the same time foster the digital transition of public administrations in the context of energy transition, contributing to the redesign and simplification of organizational models in the field of energy management. The first part of the activity will consist of an audit to understand what forms of generation and energy loads are present in PA assets to date, in order to individuate a mathematical model that can describe them. Next, some of these candidate resources will be identified for flexibility, and optimization and planning algorithms based on Reinforcement learning will be studied on them. The final phase will consist of the definition of procedures and best practices to be implemented in PA and the identification of related indicators.</p>
<p><b>Methods and techniques that will be developed and used to carry out the</b></p>	<p>Starting with the building system with its energy sources</p>



<b>research</b>	<p>and consumption, data collection tools will be defined to establish a data-driven model (digital twin) to determine any flexibilities in loads and outputs. Then algorithms will be identified to provide in the form of dashboards some decision-support tools such as forecasting consumption and building occupancies.</p> <p>Finally, algorithms based on reinforcement learning will be developed for optimal production and consumption planning with the aim of integrating renewable sources, storage systems and flexible loads.</p>
<b>Educational objectives</b>	<p>The aim is to form highly qualified PhD candidates in: develop and managing numerical simulation and analysis of electrical systems and circuits in the Digital twin and BIM contest.</p>
<b>Job opportunities</b>	<p>Successful fulfilment of the research programs associated with these Scholarships will provide PhD candidates with the qualifications required to seek employment in the public sector, in diversified industry and university sectors in the EE field.</p> <p>The public administration and enterprise involved are Citta metropolitana di Milano, University of Oviedo, MIT, Sew Eurodrives, Siemens.</p>
<b>Composition of the research group</b>	<p>1 Full Professors 2 Associated Professors 1 Assistant Professors 3 PhD Students</p>
<b>Name of the research directors</b>	<p>Prof. Giambattista Grusso</p>

<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>	--



Scholarship Increase for a period abroad	
Amount monthly	650.0 €
By number of months	6

National Operational Program for Research and Innovation	
Company where the candidate will attend the stage (name and brief description)	Citta Metropolitana di Milano
By number of months at the company	6
Institution or company where the candidate will spend the period abroad (name and brief description)	University of Oviedo
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. This amount is equal to 10% of the annual gross amount, for 3 years.</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</b> in Politecnico's Residences (<a href="http://www.residenze.polimi.it">http://www.residenze.polimi.it</a>) is available for PhD candidates; special rates will be applied to selected out-of-town candidates (detailed info in the call for application).</p> <p><b>Research period abroad:</b> 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.</p>