



PhD in INGEGNERIA ELETTRICA / ELECTRICAL ENGINEERING - 40th cycle

**PNRR 630 Research Field: SISTEMI ELETTRICI PER L'ENERGIA: PIANIFICAZIONE DELLA
RETE ELETTRICA DI DISTRIBUZIONE**

Monthly net income of PhDscholarship (max 36 months)

€ 1800.0

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**

Worldwide, in this area, the research is focusing on the energy transition, generation sustainability, energy communities, electric systems operation and final uses of electricity. Therefore, one of the main pillars of the research carried out at the Department of Energy in these fields includes Generation (as RES, Dispersed Generation), Smart and Micro Grids (in AC and DC), Storage and Power Quality. In this regard, particular attention is paid to the control, security and optimization of the power system also considering regulatory issues and electricity markets. Another important pillar deals with final uses of electricity, such as electric systems for transportation (railway, urban and subway applications), lighting systems, electro-thermal and electro-magnetic applications. In this regard, particular attention is paid to the development of hybrid DC/AC networks and electric vehicle (as impact of charging stations).

The proposed research, in particular, is focused on the Optimal Planning of the Distribution grids. Actually, in modern electric distribution grids, effective planning is crucial to ensure reliable, efficient, and sustainable power delivery. As the integration of renewable energy sources, electric vehicles, and smart grid technologies increases, optimal planning becomes essential to manage the complexity and variability of the grid. This research on "optimal planning of distribution grids" aims to develop strategies that enhance grid resilience, minimize operational costs, and accommodate future technological



	<p>advancements. The main driver to be evaluated are: evolution of distributed generation by renewable resources, evolution of heat pump and electrification of the energy needs, e.mobility.</p>
<p>Methods and techniques that will be developed and used to carry out the research</p>	<p>System modelling through modern methods based on probabilistic procedures (Montecarlo-based), fuzzy logic, neural networks, artificial intelligence, genetic algorithms, chaos theory, game theory and other theory system analysis, together with traditional mathematical tools and programming, big data analysis, order reduction techniques. For the proposed project, a major focus will be on the optimization techniques and on GIS tools, in charge to gather detailed data of the area under investigation and to optimally identify the best electrification approach.</p>
<p>Educational objectives</p>	<p>Prepare researchers with high scientific qualification, autonomous research ability in the Power System area: this includes specific skills in modelling of both technical and economic issues, simulations, critical analysis and validation of results</p>
<p>Job opportunities</p>	<p>The main opportunities are offered, typically, by R&D departments of both small and large innovative companies and manufacturers, research centres, Transmission and Distribution Operators, Regulating authorities, Generation Companies. Finally, the academia is also an option.</p>
<p>Composition of the research group</p>	<p>2 Full Professors 3 Associated Professors 2 Assistant Professors 20 PhD Students</p>
<p>Name of the research directors</p>	<p>prof. Marco Merlo</p>

Contacts	
<p>email: marco.merlo@polimi.it Phone: +39 02 2399 3762 www.e4g.polimi.it https://www.energia.polimi.it/en/energy-department/research/research-groups/electric-systems-for-energy-and-transportation/#c1812</p>	



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	900.0 €
By number of months	6

National Operational Program for Research and Innovation	
Company where the candidate will attend the stage (name and brief description)	DEVAL
By number of months at the company	6
Institution or company where the candidate will spend the period abroad (name and brief description)	Université Grenoble Alpes & Universidad de Sevilla
By number of months abroad	6

Additional information: educational activity, teaching assistantship, computer availability, desk availability, any other information

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.

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.

Computer availability: *individual use*.

Desk availability: *individual use*.

The candidate will have a personal desk and a laptop. The research group also provides workstations for intensive computing.