



PhD in INGEGNERIA ELETTRICA / ELECTRICAL ENGINEERING - 39th cycle

**PNRR 117 Research Field: DECARBONIZATION OF THE ELECTRICAL SYSTEM AND
MANAGEMENT OF VOLTAGE PROFILES IN THE PRESENCE OF SIGNIFICANT
PENETRATION OF RENEWABLE SOURCES**

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**

The research has the goal of applying operational research methodologies to improve the monitoring and control of power system security, with particular attention to reactive power management.

This goal is in agreement with the general and particular goals of DM 117 as it tends to the promotion of industrial research activities in companies willing to improve their skills in fields strictly related to the goals of PNRR. The activities within this PhD program are related to Mission 2 “Green revolution and ecologic transition”, dealing with large infrastructures (the transmission grid) and to the renewable integration (Mission M2C2).

The specific research activity is related to the voltage security of large transmission systems in the presence of larger and larger shares of non-dispatchable renewable generation. Among other technical issues, the presence of less and less synchronous machines, able to provide inertia and short-circuit power and power system strength. The goal of the research is to look for a better understanding of the impact that reactive power has on the transmission system voltage control, including both traditional and innovative voltage control devices (e.g., synchronous condensers, STATCOMs, SVCs) and the role of Distribution System Operators. The research will focus on the planning and operation implications and on



	the procedures to optimize the presence and the use of reactive power sources.
Methods and techniques that will be developed and used to carry out the research	Methods and techniques are derived from the operational research, both traditional mathematical programming and data-driven engineering tools developed in the last years by mathematicians. Some tools are already available at the Italian Transmission System Operator (Terna SpA) Control Centre, and they are assumed to be further developed to include more accurate technical and economical evaluations.
Educational objectives	The goal is to provide knowledge in a twofold approach: from the mathematical and control point of view, it will be important to study new optimization methods suitable for the nonlinear problem of reactive power optimization. From the economical point of view, it is important to understand what is the role of DSOs in the general voltage control, which has a consequence also on the regulation of reactive power tariffs.
Job opportunities	The PhD can take advantage of the experience gained to apply for any position in the R&D departments of transmission or distribution system operators. Also consulting companies and EMS producers will be interested in such expertise, as well as Regulators (ARERA in Italy) and international associations (like ENTSO-E, for example)
Composition of the research group	2 Full Professors 3 Associated Professors 1 Assistant Professors 8 PhD Students
Name of the research directors	Prof. Alberto Berizzi

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elettrici-per-lenergia-e-i-trasporti/

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

National Operational Program for Research and Innovation	
Company where the candidate will attend the stage (name and brief description)	Terna Rete Italia SpA
By number of months at the company	6
Institution or company where the candidate will spend the period abroad (name and brief description)	Institute of Energy & Climate Research IEK-10: Energy Systems Engineering Forschungszentrum Juelich GmbH D-52425 Jülich
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.