



PhD in INGEGNERIA ELETTRICA / ELECTRICAL ENGINEERING - 41st cycle

**THEMATIC Research Field: AUTONOMOUS ELECTRIC VEHICLES' FLEETS AND THEIR
INFRASTRUCTURE: DESIGN, DYNAMIC OPTIMIZATION AND ROUTING FOR OPTIMAL
EFFICIENCY**

Monthly net income of PhDscholarship (max 36 months)

1600.0

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**

Environmental sustainability is a top priority, and innovation in the automotive sector is moving towards environmentally friendly vehicles. Electric vehicles (EVs) represent the new frontier of sustainable mobility, helping to reduce GreenHouse Gas emissions (GHGs) and promote a cleaner, greener future. Unlike traditional petrol or diesel cars, electric cars are powered by batteries that can be recharged using renewable energy. This not only helps reduce air pollution but also promotes the use of clean and renewable energy sources. However, to foster the adoption of electric cars, it is crucial to develop a widespread network of charging stations. Many cities are already investing in fast and efficient recharging infrastructures that allow electric car batteries to be recharged conveniently and quickly. The focus of this work is on-road vehicles and in particular, on self-driving electric road vehicles, whose specific characteristics allow for a radically different formulation of the charging infrastructure optimization problem, which can rely on the dynamic reconfigurability of the vehicle fleet. The proposal aims at defining a new methodology for the design and optimal location of the recharging infrastructure and of the interaction with the vehicle fleet. The goal is to maximize the availability of the vehicles while balancing the load demand on the electric grid, based both on Grid-to-Vehicle and Vehicle-to-Grid connections.



Methods and techniques that will be developed and used to carry out the research	<ul style="list-style-type: none"> - Methods and tools for the coexistence of autonomous vehicles in the environment used to create an experimental setup capable of evaluating or validating design solutions. - Optimal sizing and layout method for charging infrastructure, based on a dynamic learning optimization approach, aiming at minimizing infrastructure and operational costs and maximizing vehicle efficiency and availability - Realization of a digital platform which, based on the technical properties of the vehicles, traffic data, and energy supply conditions, determines the optimal fleet and infrastructure sizing with the corresponding placement, infrastructure, and operational costs, and the optimal charging strategy in a dynamic and adaptive context - Dynamic analysis of how next-generation mobility scenarios that use renewable energies (e.g. photovoltaics, wind power), adapt to the needs of the urban context, and integrate effectively into the energy distribution network.
Educational objectives	<p>To prepare researchers with high scientific qualification, independent research capabilities in the area of electric transportation systems. This includes specific skills in modelling both technical and economic issues, simulations, critical analysis and validation of results. However, psychological and philosophical aspects will also be considered.</p>
Job opportunities	<p>The main opportunities are generally provided by R&D departments of small and large companies and innovative manufacturers, research centers, and EV charging system operators in collaboration with research groups in universities.</p>
Composition of the research group	<p>5 Full Professors 5 Associated Professors 5 Assistant Professors 20 PhD Students</p>
Name of the research directors	<p>Michela Longo</p>

Contacts
<p>michela.longo@polimi.it +39 02 2399 3759</p>



Research group:

<https://www.energia.polimi.it/en/energy-department/research/research-groups/electric-systems-for-energy-and-transportation/#c1812> <https://www.energia.polimi.it/it/dipartimento-di-energia/laboratori/laboratori-di-ricerca/electric-power-system-eps-lab/#c2478>
<https://www.energia.polimi.it/en/energy-department/laboratories/research-laboratories/photovoltaic-power-quality-and-lighting-system/#c1820>

Additional support - Financial aid per PhD student per year (gross amount)	
Housing - Foreign Students	--
Housing - Out-of-town residents	--

Scholarship Increase for a period abroad	
Amount monthly	800.0 €
By number of months	6

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

Increase in the scholarship for stays abroad: euro 800 (= 1/2 netto mensile) per month, for up to 6 months.

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.