PhD in Electrical, Electronics and Communications Engineering

Research Title: Vehicle-to-grid technology as a flexible resource for Grid Services: economic and technical feasibility studies

Funded by	Terna SpA

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Context of the research activity	Due to the decommissioning of thermal power plants as well as the increase of renewable generation, the TSO's means to guarantee the safety of the national grid are quickly changing in terms of amount of reserves and regulation performance. The described trend implies firstly the usage of new flexibility sources and solutions able to compensate the lack of regulation through demand response and distributed generation (including renewables) and energy storage systems. Furthermore, an additional topic that strongly affects the management of the grid is the development of new technologies, nowadays not widely used, such as electric vehicles that could represent, at the same time, a criticality as well as an opportunity for Terna. In that context, Terna intends to promote research and innovation initiatives aiming at testing and characterizing the regulation performance of electric vehicles, as well as developing specific regulation services fitting with the user needs.

Objectives	1. **Economic assessment**: the aim is to identify the clear economic value of using electric vehicles as grid resources, both for the benefit of the Grid as well as for the car user. The assessment will focus on: - finding a business model that is viable for all involved parties; - quantifying the value generated for the end user.

	2. **Technical feasibility study**: the study aims to evaluate the potential use of electric vehicles for the purpose of supplying Services to the Grid (e.g. load shifting) and it will include: - an analysis of the regulation performance achievable through electric vehicles and design of specific services - an analysis of the technical integration between Electric Vehicles and Terna's dispatching systems; - the identification and measurement of the critical parameters that result in optimal management of the electric vehicles' loads; - the aggregation capabilities of the electric vehicles.

Skills and competencies for the development of the activity	The candidate should have strong engineering background, especially focus on power electronic, electric and control systems. The following competences are required: - Knowledge of transmission grid and dispatching systems - Knowledge of Ancillary Services Market - Competences on Electric Vehicles and Energy Storage System - Experience of feasibility studies as well as modelling and simulation tools - Business case