Title of the thesis	**O**ptimal techniques for **S**mart grid **C**harging of **A**utonomous electrical vehicles with **R**enewable energy sources
Acronym	OSCAR
Reference number	029

Hosting institution	**Employer**
Centrale Lille Website: https://centralelille.fr/	Centrale Lille Website: https://centralelille.fr/
Hosting research unit 1	**Hosting research unit 2**
Name: Laboratoire d'électrotechnique et d'électronique de puissance de Lille Acronym: L2EP Identification number: EA 2697 Address: Bâtiment Esprit, avenue Paul Langevin - 59650, Avenue Paul Langevin, 59650 Villeneuve-d'Ascq Website: http://l2ep.univ-lille.fr/	Name: INRIA (Institut National de Recherche en Informatique et Automatique) Equipe : Integrated Optimization with Complex Structure. Acronym: INOCS Identification number: Address: Parc Scientifique de la Haute Borne 40, Avenue Halley, Bat A, Park Plaza F 59650 Villeneuve d'Ascq Website: https://team.inria.fr/inocs/
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Thesis information

Keywords	Autonomous Electrical Vehicles, Charging station, renewable energy sources, Smart Cities, Power systems
Abstract	This project aims to remove obstacles to the transport electrification and tackles two societal challenges regarding green mobility ***: CO2 reduction in cities and dusts for the planet as well as development of charging infrastructures*** The task is to establish the concepts and frameworks allowing autonomous or semi-autonomous electric vehicles (AEV) to interact and communicate in symbiosis with an intelligent electrical network including renewable energy production and storage. The project consists in defining a tool: i) to design and locate charging infrastructures equipped with renewable energy (RE) production in order to meet users expectations taking into account the uncertainty of the RE production and ii) to inform and guide unoccupied AEV to the available and most "suitable" charging infrastructure ("Autopilot" option by telephone). This last step is performed in order to satisfy local constraints in the distribution network (exceeding the maximum capacity, under voltage, etc.), maximise the RES use and minimize the charging costs. This project raises strategical and operational issues. From a *strategical point* of view, the design in terms of locations, sizes of charging stations as well as RE production capacities has to be determined. From an *operational point* of view, where and when to charge EV has to be determined in order to minimize the energy cost as well as the production and

	network distribution electricity peaks, and maximize the use of renewable generation. Considering autonomous vehicles or semi-autonomous vehicles allow us to assume that the EV charging decisions are defined by a central energy management system in charge of managing all the system. In this project, our goal is to solve two problems. i) A Stochastic design problem to jointly determine the design variables (location, number of charging station and renewable energy production) in two different time scales in an uncertain environment related to the transportation demand, the renewable energy production and electricity peaks ii) A deterministic AEV charging problem leading to the resolution of a deterministic mixed-integer optimization problem in a short period of time for which the production of renewable energy can be finely estimated at the temporal level. For this common research project, the candidate will work either at L2EP (Power system team) or INRIA (INOCS group) at Villeneuve d'Ascq (France). https://team.inria.fr/inocs/ http://l2ep.univ-lille.fr/?page_id=575&lang=en **Issues**: - Methodological tools for an holistic model including mobile AEV and existing charging stations in an urban electrical network - Deterministic flexible load demand management of AEV - Mixed Integer optimization Stochastic optimization and robust control to take into account uncertainties in renewable energy production, grid constraints, and EV load demand.
Expected profile of the candidate	Candidates should have a master's degree in electrical engineering or in process optimization. The candidate with the following knowledge will be preferred: · Fundamental knowledge about the power system operation, control and analysis · Good knowledge in optimization theory and stochastic problems, familiar with one of the optimization software, such as Cplex or Conopt. · Knowledge/experience about distributed networks, energy systems modelling and operation.
Application procedure & Eligibility criteria	The application procedure and eligibility criteria are detailed on the European doctoral programme PEARL website www.pearl-phd-lille.eu. The funding is managed by the I-SITE ULNE foundation which is a partnership foundation between the University of Lille, Engineering schools, research organisms, the Institut Pasteur de Lille and the University hospital. The application file will have to be submitted before March 31, 2021 (10:00 AM - Paris Time) and emailed to the following address : international@isite-ulne.fr.
Net salary and Lump Sum	A net salary of about €1,600 + €530 per month to cover mobility, travel and family costs.