



Università degli Studi di Genova

DITEN – Dipartimento di Ingegneria Navale, Elettrica, Elettronica e delle Telecomunicazioni

THESIS PROPOSAL

Object: **Thesis in collaboration with ETH Zurich** (Swiss Federal Institute of Technology)

Supervisor: Prof. Stefano Bracco, Prof. Federico Delfino, Prof. Silvia Siri (DIBRIS)

Topic: “Optimal design and operation of distributed energy systems in microgrids”

Project Description:

The increasing share of decentralized intermittent renewable power reinforces the relevance of flexibility to balance local production and consumption. Decentralized multi-energy systems (MES), that is, systems based on renewable energy sources (RES) and integrating multiple energy carriers (e.g., electricity, heat, etc.) allowing for energy conversion and storage, are promising options to cope with this challenge. Within this framework, storage systems have recently caught much attention due to their ability to compensate the seasonal intermittency of renewable energy sources. However, compensating renewables fluctuations at the seasonal scale is particularly complicated and expensive. The optimal design and optimization of such distributed energy systems is complicated since it implies large size optimization problems. Furthermore, the uncertainty related to the input data, such as renewable generation, energy prices, and end user demand, plays a relevant role at such time scales. Within the framework of an interdisciplinary project, the ETH researchers developed an optimization tool for the optimal design of decentralized MES systems. The primary goal of the MES is to provide different services (e.g. electricity, heat, cooling) to defined end users, taking into account all the aforementioned challenges. The research activity spans a wide range of topics, ranging from the modeling of conversion and storage technologies to the development of optimization algorithm to improve the design of integrated systems.

In this context, the students' task may comprise a literature review on the different approaches adopted to design decentralized MES and a modelling activity aimed at improving the optimization tool developed at ETH by also validating it using real data collected at the Savona Campus microgrid. Several aspects of the optimal design of MES will be investigated, and the economic and environmental characteristics of various storage systems and renewable power plants will be analyzed; moreover, the attention will be focused on the development of novel optimization strategies to improve the reliability and robustness of the design of decentralized MES.

Period: about 6 months from June 2018 to March 2019

Number of positions: 2 maximum

Student Profile:

Candidates have to be students attending the II year of one of the following M.Sc. Courses:

- M.Sc. in Energy Engineering (Savona Campus)
- M.Sc. in Electrical Engineering (Genova)
- M.Sc. in Mechanical Engineering (Genova)

Application:

Applications must be submitted by sending the Curriculum Vitae (with the Annex reporting the list of marks) to stefano.bracco@unige.it within May 15, 2018.

Selection:

The students will be selected through the evaluation of their Curricula Vitae and through a public interview which will be held on May 16, 2018 at 11 a.m. at Savona Campus (CENS office, Lagorio Building).

Contact:

For any further details, please send an e-mail to stefano.bracco@unige.it

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DITEN – Department of Naval, Electrical, Electronic and Telecommunication Engineering