Faculté des Sciences Appliquées
Laboratoire de Thermodynamique et d'Energétique
Integrated & Sustainable Energy Systems (ISES)

Master Thesis Proposal: Modelling system integration in future European energy system

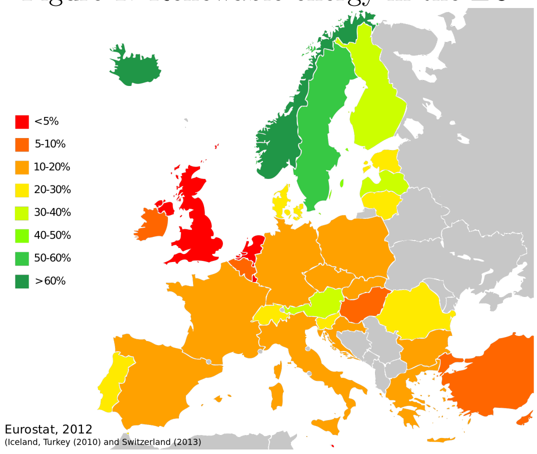
Advisor: Prof. Sylvain Quoilin

Academic Year 2025-26

Highlights of the work

1. Studying the impact of renewables (PV, wind) on the European grids
2. Participating to the development of the Dispa-SET and EnergyScope open-source models for European power systems
3. Evaluating the impact of sector coupling for the flexibility of the system

Figure 1: Renewable energy in the EU



Context

Most analyses of the future European energy system conclude that in order to achieve higher penetration of renewable energy, more cross-sectoral interactions are required. For example, excess energy from wind or PV can be use to charge electric vehicles, to generate hydrogen, or to preferably use heat pumps during certain times of the day. The considerations are referred to as "integrated energy systems" or "sector coupling" and require the connection between different specialized models to be simulated.

Since a few years, a collaboration between UC Louvain, the EU Commission (the Joint Research Centre in the Netherlands), the KU Leuven and the University of Liège has been established to develop and couple different simulation tools for the European energy systems. These tools include Dispa-SET, EnergyScope, RAMP Mobility.

Prof. Sylvain Quoilin (squoilin@uliege.be)
Allée de la Découverte 17 (B49) B–4000 Liège (Belgium)
Tel: +32 (0)4 366.48.22
url: http://ises.uliege.be/

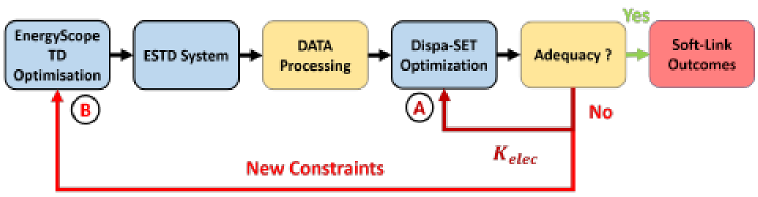


Figure 2: Using different models to simulate the European energy system

Objectives

The proposed Master Thesis will contribute to the development of the relevant models, and on their interconnection. It will focus on the extension of the existing unidirectional soft-linking approach (Figure 2), and the simulation of high shares of renewables together with different flexibility options (demand side management, sector coupling, transport electrification, storage...).

Requirements

The candidate should have a Bachelor in engineering and a background in Electrical/Electromechanical/Energy engineering. Knowledge or experience in, Python, linear programming and in energy markets is a plus.

Location

This final thesis will be performed mainly within ULiege, but with a possibility of an internship in a partner institution (UCLouvain, TU Delft, TU Berlin, Politecnico Milano). This constitutes a unique opportunity to get experience within top-ranked European energy research institutions, and to work in a motivating, multicultural and highly professional environment.

Informations

Further information can be obtained by directly contacting S. Quoilin by e-mail.

Prof. Sylvain Quoilin (squoilin@uliege.be)
Allée de la Découverte 17 (B49) B–4000 Liège (Belgium)
Tel: +32 (0)4 366.48.22
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