Detailing consumption data for prospective studies of large energy systems

Internship with G2ELab's SYREL group

- **keywords:** Prospective energy models, distribution networks, data analysis;
- **Localization:** G2ELab, GreEn-Er building;
- **Start date:** February 2024 (flexible)
- **Continuation with a Ph.D.:** not provided by default. To be discussed during the internship.

Context

Major changes are needed in Europe's energy system if we are to meet the objectives of the Paris climate agreements. Electricity grids will have to adapt to the new location of production units and the evolution of energy flows. To plan changes in line with viable solutions for the future, energy forecasting models are being developed. This internship is part of a thesis on the prospective modeling of the European energy system, and more specifically on the evaluation of the role of distribution networks in this evolution. This analysis is made possible by coupling economic (POLES) and technical (Backbone) models. The combination of flexibility solutions is studied via a choice of modeling granularity that will enable a better understanding of the dynamics of power grid evolution in the distant future, thus proposing to decision-makers the key stages in the development of future energy systems in a series of prospective scenarios drawn from the literature.

However, the models used have limited temporal and geographical resolution, which needs to be improved to take account of local constraints linked to future changes. The data available are generally at the scale of countries or large regions. To obtain more realistic data at a local level, disaggregation strategies need to be developed. In other words, we need to take a national figure and distribute it realistically across the country. For example, we realize that distributing electricity consumption by region according to the number of inhabitants is not very precise, as many other factors come into play (type of heating, density of housing, types of industry, etc.). The aim of this internship is therefore to understand the mechanisms that explain the current geographical distribution of electricity consumers at the European level and to anticipate their future distribution using the tools developed by the PhD student.

This involves modeling and understanding the major phenomena behind energy consumption, based on a wide variety of socio-technical criteria.

Description of the work

In addition to bibliographical work, this internship expects to propose principles for distributing national consumption data over regions and localities according to criteria to be defined and justified.

In addition to this breakdown, depending on desire and time, other tasks related to energy system modeling may be carried out, to play with prospective energy scenarios on a European scale.

References

1. Allard, S.; Mima, S.; Debusschere, V.; Tran, Q. T.; Criqui, P. & Hadjsaid, N.; European transmission grid expansion as a flexibility option in a scenario of large scale variable renewable energies integration; Energy Economics, 2020
2. Allard, S.; Debusschere, V.; Mima, S.; Tran, Q. T.; Hadjsaid, N. & Criqui, P.; Considering distribution grids and local flexibilities in the prospective development of the European power system by 2050; Applied Energy, 2020, 207

Profile and competencies

This internship requires curiosity, autonomy, and versatility.

The profile sought for this work is that of a student with energy systems modeling skills. Proficiency in data processing and display software is a plus.

- Technical competencies:
  - Data analysis, online search and statistics;
  - Modeling
  - Optimization (not directly in the internship)
- Transversal competencies:
  - Integrate and interact within a research team
  - Communicate work effectively and rigorously, both orally and in writing
  - Communicate in English in writing.

NB: this list of skills corresponds to those ideally sought in a candidate (who will probably not have all of them).

To apply

Please send an email to Vincent Debusschere (vincent.debusschere@grenoble-inp.fr), Rémy Rigo-Mariani (remy.rigo-mariani@grenoble-inp.fr), and Corentin Jacquier (corentin.jacquier@grenoble-inp.fr), with a short CV and if possible recent grades.