

Limiting perfect foresight in energy systems modeling

As the world transitions its electricity generation away from traditional power plants to variable renewable energy (VRE), both to save on costs and to reduce emissions, new challenges are starting to appear. For example, the electricity system operator in Sweden (Svenska Kraftnät) is adding additional reserve markets for Fast Frequency Reserves to combat the increasing difficulty in managing faults in the system. At the same time, Ireland has set a cap on how much wind energy is allowed each hour to ensure a stable electricity grid. Both of these examples relate to the challenge of how to keep the grid stable as the VRE share increases.

Part of the energy system research being done at Chalmers is focused on investigating how to cost-efficiently ensure a stable grid in highly renewable electricity systems using energy system modeling. The model used considers several regions and sectors at a semi-hourly resolution for multiple years to give information on the cost-optimal generation capacity mix and dispatch. This research points to batteries as a vital technology for frequency control as the VRE share increases.

This project will be a case study on a single region to investigate how perfect foresight may have affected the aforementioned research. This will include all steps of a research project and give important understanding of the limitations, and possibilities, of optimization models for energy system analysis. There is published literature on limiting the foresight in these types of optimization models, which will come in use for this project, but none that apply it like will be done in this project.

Interested students, contact Jonathan Ullmark: jonathan.ullmark@chalmers.se and attach:

- A description of yourselves and what you are looking for in terms of thesis project and work afterwards, and
- A list of your courses and grades