DEVELOPING A ROBUST ELECTRICITY MIX

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Overview

The electricity sector is experiencing increased uncertainty. The context is challenging: evolving market regulation, changes in policy and innovation that is reshaping the energy system. They all generate gradual as well as abrupt changes that impact projections. The probability of occurrence of a specific scenario and its impact cannot be identified without ambiguity, especially in a system with growing complexity. Unfortunately, the energy infrastructure is strongly path-dependent. Due to its long lifetime and high capital cost, current decisions affect the set of future solutions.

Decision-makers should develop robust solutions in order to cope with large technical and undesirable socio-economic events. As asserted by Trutnevyte et al. (2016, p.326), ”rather than focus on uncertainty in model parameters, greater reflection on structural uncertainties, such as shifts in energy governance, is also required”. My goal is to identify a robust electricity mix and quantify the impact of choosing a robustness criterion rather than an optimal one.

Methods

I am developing an open source model to manage uncertainty in the electric sector. It integrates various problem-solving tools: operational research, uncertainty simulations, and real option analysis. However uncertainty management demands significant computational capacity. I must simulate a comprehensive set of states of the world and identify the robustness of each solution. In an attempt to tackle this issue, I am currently integrating machine learning tools into my energy model.

Results

The research is still in progress. By the end of September, I should be able to present the techno-economic energy model which integrates a machine learning module. It aims to efficiently select a feasible mix. I should also be able to present preliminary findings on the long-term management of the electricity mix.

The model is tested within a Swiss context, however the conclusion will be more general. Firstly, anyone could use my model as open access will be provided in the near future. Secondly, scientists could be interested in discussing the impact of robust decision-making approach in determining an electric mix.

Conclusions

Uncertainty is recognized as a major challenge in energy models. New approaches must be developed in order to support decision makers. My research contributes to the effort, by integrating an energy model with a machine learning approach.

References

E. Trutnevyte, W. McDowall, J. Tomei, and I. Keppo, “Energy scenario choices : Insights from a retrospective review of UK energy futures,” Renewable and Sustainable Energy Reviews, vol. 55, pp. 326 – 337, 2016.