

Master Thesis Opportunity

Flexibility Technology Options for Switzerland

Supervisors: Prof. Dr. Volker Hoffmann, Dr. Alejandro Nuñez-Jimenez

As Switzerland transforms its energy system to achieve net-zero emissions by 2050, technologies that provide flexibility will become essential tools to manage variations in energy supply and demand.¹ In the near future, the Swiss energy system will require flexibility to handle expected variations like seasonal energy fluctuations and unexpected ones like demand surges at different time scales. Different technologies can provide flexibility and enable system operators to adjust energy supply, conversion, demand, storage, and imports and exports, but which technologies could contribute most effectively to the Swiss energy transition remains unclear.

Flexibility technology options vary widely, making it difficult to compare their potential to contribute to the Swiss energy transition. For example, some flexibility technologies, such as battery storage, are part of the electricity sector, while others couple different sectors, such as electric vehicles. Another important difference is that some flexibility technology options are mature technologies available on a large scale, like pumped hydropower. In contrast, others, like hydrogen electrolyzers, have only recently started to be deployed at scale. In addition, some flexibility technology options could be easily deployed in Switzerland thanks to existing infrastructure and value chains, while others may have little potential, face significant barriers, and require entirely new value chains.

This master's thesis addresses the question: What flexibility technology options could contribute most effectively to the Swiss energy transition? To answer this question, a thorough mapping of technologies that can provide flexibility to the energy system will be carried out, and their potential to contribute to the Swiss energy transition will be assessed. The student's main tasks will be:

- Review current literature on flexibility technologies,
- Develop an assessment framework for flexibility technology options,
- Collect data on existing and potential flexibility technology options in Switzerland,
- Analyze the set of identified flexibility technology options, and
- Derive implications and formulate recommendations.

The main contribution of this master thesis will be to provide a coherent and comprehensive overview of flexibility technology options for the Swiss energy transition. If completed successfully, the thesis will provide the basis for a report publication as part of a Swiss Energy Research for the Energy Transition (SWEET) project by the Swiss Federal Office of Energy.

If you are interested in writing this thesis, don't hesitate to contact us.

Please send your motivation letter, CV and transcript of records to anunez-jimenez@ethz.ch

¹ SWEET PATHFINDER consortium. (2023). Flexibility and Sector Coupling in Energy Systems: Definitions and Metrics. <https://doi.org/https://doi.org/10.3929/ethz-b-000641177>