SECURES: Securing Austria´s Electricity Supply in Times of Climate Change – Results and Conclusions from the Model-based Analysis

Energie-/Klimapolitik, Versorgungssicherheit

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Motivation

The transition of Austria’s electricity system towards a safe and sustainable future in times of climate change brings a broad range of challenges and opportunities into the policy debate where timely decisions on the way forward are of key relevance. To provide targeted support to Austrian policy makers for Austria´s future years, the project SECURES aims

* to define a suitable set of future trend scenarios for electricity sector and
* to conduct a comprehensive model-based scenario analysis of Austria’s future electricity sector, targeted to secure a reliable, sustainable and cost-efficient transition of Austria’s electricity sector in times of climate change.

This paper provides an outlook on the results and conclusions derived from the ongoing corresponding model-based analysis. It is intended to be part of a special session on the project SECURES within IEWT 2023.

# Method

Our overall analysis focusses on the assessment of how flexibility options contribute to meet the respective demand in Austria’s electricity sector of the future (2030, 2050). Building on the modelling of distinct scenarios as defined in [1], we thus analyze the influence of the ongoing energy transformation as well as climate impacts derived from an in-depth analysis of climate data.

The starting point for determining the need for flexibility is the analysis of the Residual Load (RL). In this study, RL expressed as an hourly power value in GW, represents the difference between the total electricity demand and the electricity infeed from variable renewables including run-of-river hydro, wind and photovoltaics. RL can be positive (temporary generation deficit), negative (temporary generation surplus), or, in individual cases, zero (generation and consumption balanced).

Based on the determination of RL, the calculation of the flexibility needs will then be performed according to the method proposed in [2]. This implies an analysis of the dynamics of RL on daily, weekly, monthly and yearly level. The identified flexibility needs identified within the respective timescales cannot be added, but they rather measure the variability of RL for the corresponding timescales. Additionally, we will then also express the yearly balance of RL to inform on the respective gap or surplus that may arise as well as extreme values of RL (in GW) and the hourly gradient/ramp (in GW/h).

Apart from flexibility needs, modelling will also inform on the contribution of available flexibility options (e.g. flexible generation and storage technologies, cross-border exchange, load shifting demand side options, etc.) for achieving a balance between supply and demand within every hour. We will thus show their contribution in accordance with the depiction of flexibility needs as described above.

# Results and Conclusions

Modelling is currently ongoing in the course of SECURES and final results are not yet derived. As a sort of appetizer, we show the outcomes of a former analysis in that topical context, undertaken on behalf of the Austrian Regulatory Authority E-Control in the project “Flexibility Supply and Demand in the Austrian Electricity System 2020/2030”, cf. [3]. Within that study the effects of the ongoing energy sector transformation within Austria were incorporated but possible impacts of climate change were neglected.



Figure 1: Status quo (2020) and comparison of scenarios (2030) of the temporally subdivided flexibility demand (left) incl. indication of the annual balance of the residual load (right)) (Source: [3])

A look at the identified flexibility needs (Figure 1) shows a moderate increase (30% to 33%) by 2030 compared to today in the short term, i.e. with regard to the hourly fluctuations compared to the daily average. In the medium term a similar pattern is applicable, while in the long term a significant increase in flexibility demand can be observed (37% to 81%). As can be seen from Figure 1 (right), a comparison of the residual load today and tomorrow in the yearly balance shows a significant decrease in the residual load. This reflects the anticipated change in the electricity system, i.e. the massive expansion of renewable energies envisaged within Austria’s according to policy targets for 2030.

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Literature

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[3] Suna, D., Totschnig, G., Schöniger, F., Resch, G., Spreitzhofer, J., Esterl, T., 2022. Assessment of Flexibility Needs and Options for a 100% Renewable Electricity System by 2030 in Austria. Smart Energy, 6 (2022), <https://doi.org/10.1016/j.segy.2022.100077>

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