ASSESSING FLEXIBILITY DEMAND AND SUPPLY IN THE AUSTRIAN ELECTRICITY MARKET BY 2020/2030

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Overview

The optimal use of flexibility is one of the core aspects of future electricity supply in order to drive the future expansion of renewable energies. As flexibility can be provided by generation as well as by consumption and by storage and affects the different markets and grids, the analysis of flexibility covers a large part of the energy system. This paper analyzes how high the demand for flexibility will be within Austria by 2030 and which options for covering flexibility are of great importance. Generation technologies, import and export, heat pumps and boilers, e-mobility, industry, commerce, hydrogen and electricity storage technologies were analyzed as options for meeting the demand for flexibility.

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Methods

A central initial part of the overall study was to assess flexibility supply today (2020) and in future (2030). This was done in a comprehensive manner as outlined in detail in [1]. Thus, the focal point of this paper is however on the demand side, i.e. the future demand for power system flexibility, as well as on the interplay with flexibility supply options. As part of this study, the status quo (2020) of the need for flexibility in the Austrian electricity market was initially evaluated on the basis of ENTSO-E transparency data [2]. The comprehensive analysis of the year 2030 was model-based using the European electricity market model HiREPS/Market/Flow. The scenarios developed provide information about the need for flexibility for the short-term energy markets (day-ahead, intraday) in 2030, taking into account supra-regional effects (neighboring countries) and sector coupling effects. Different weather influences, specifically a scenario "normal year 2030" and a scenario "extreme year 2030", accompanied by a sensitivity analysis of the influence of the future CO2 price and the market-technical availability of large batteries, were considered. To evaluate the flexibility requirement, a flexibility requirement derived from the residual load (RL) for different time scales was the focus of a scenario comparison. The modeling also shows how the flexibility demand is covered by using the different supply and demand-side flexibility options that will be available in Austria in 2030 according to the survey carried out as part of the study.

Results

A look at the identified need for flexibility, i.e. the demand for flexibility, (see Figure 1) shows an increase of 30% to 33% by 2030 in the short term, i.e. with regard to the hourly fluctuations compared to the daily average. In the medium term shows a similar pattern, while in the long term a significant increase in flexibility demand can be observed - by 37% to 81% compared to today (2020). As can be seen from Figure 1 (right), a comparison of the residual load today and tomorrow in the annual balance shows a significant decrease in the annual residual load. This reflects the anticipated change in the electricity system, i.e. the massive expansion of renewable energies envisaged according to the UBA-WAM/NEKP scenario [3].

In summary, it can be stated that the modeling for the year 2030 shows an increase in the variability of the demand flexibility compared to today, while the annual average demand for flexibility decreases significantly as a result of the planned expansion of renewables.

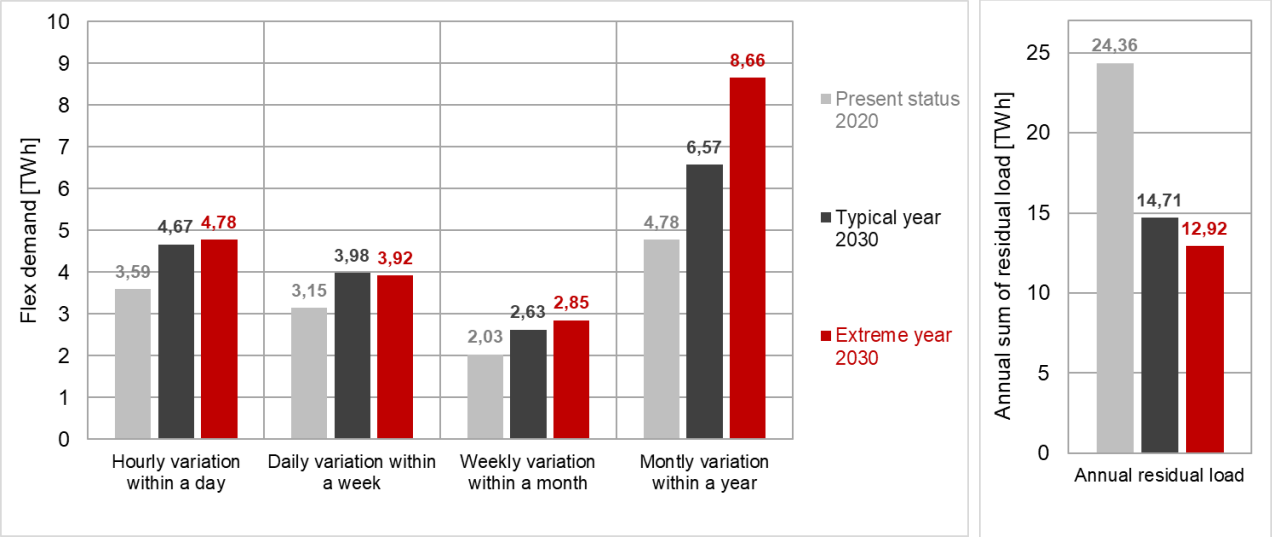

Figure 1: Status quo (2020) and comparison of scenarios (2030) of the variability of flexibility demand for at different time scales (left) and annual aerage flexibility demand (right)

There are different flexibility options available to cover the flexibility demand. According to the modeling, the following usage pattern emerges:

- Consumer options (load shifting in households, commerce and industry, e-mobility, hydrogen generation, etc.) contribute to balancing short-term fluctuations in the residual load but make (almost) no contribution to seasonal balancing in the long term.
- Large-scale batteries, if available in the 2030 electricity market, would contribute to meeting demand in the short term in a form comparable to flexible consumers.
- Storage and pumped-storage power plants allow flexible use in all time ranges. Based on real deployment patterns, their contribution is usually higher in the short and medium term as well as for covering the residual load over the entire year, i.e., in terms of providing the annual sum of the residual load. In general, it should be noted that (pumped-)storage hydropower is of central importance for meeting the demand for system flexibility in the austrian electricity market today - and this is also expected for tomorrow (2030).
- Thermal power plants tend to have their greatest contribution in the long term, i.e., for the seasonal balancing of monthly fluctuations compared to the annual average, and in the provision of the annual sum of the residual load.
- In the case of power exchange, the contribution to seasonal balancing, i.e., to covering the higher residual load in the winter months, is clearly the greatest, also in comparison to other options. In the short term, i.e., for balancing hourly fluctuations during the day, the opposite is true. Here, Austria exports short-term flexibility to neighbouring countries.

Conclusions

The well-structured flexibility assessment undertaken in this paper has proven useful in gaining relevant insights in the electricity system of tomorrow and on identifying needs stemming from its transition. From a perspective of policy-making, an increase of the use of all possible flexibility options seems vital. This requires to remove regulatory barriers and that market signals are provided to all possilbe actors. Mobilizing flexibility options well in time will contribute to safeguard electricity supply in times of rapid energy system transformation.

References

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