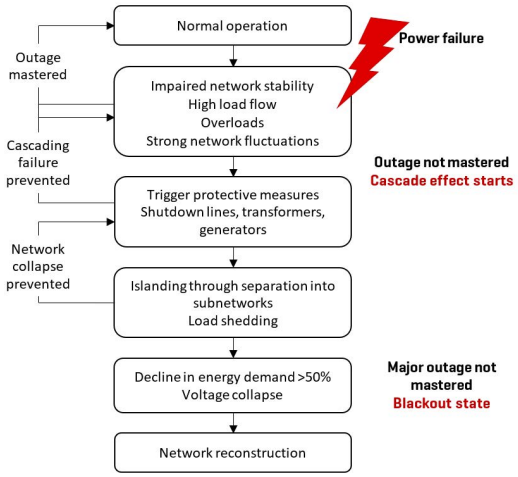
SECURE POWER SUPPLY IN THE ENERGY TRANSITION

IN BRIEF

- Security of supply in Austria is at a consistently high level.
- However, interdependencies in the power grid are increasing and influencing the stability of the entire system.
- In the medium term, climate change, digitalisation, and the energy transition will lead to more volatility in the power supply. This increases the risk of outages.
- Shaping the transition of the energy infrastructure in a constructive way requires suitable framework conditions.
- The central task of politics is to accompany this fundamental change by moderating and shaping it.

WHAT IS IT ABOUT?

A blackout is an unexpected and unforeseeable total collapse of the supraregional power supply network for an extended period (> 12 h). From a technical point of view, a blackout is a major disruption that can no longer be managed, causing severe damage. It is a so-called HILP event (High Impact Low Probability), i.e. an event with high potential for damage but very low probability of occurrence. In Austrian media, the topic of blackouts has been discussed time and again, yet there is no clear evidence of an increasing risk. Announcements of blackouts in certain time periods are not based on scientifically proven findings. A blackout is a major disruption with potentially serious damage, since the entire transmission network collapses in such an event. The extent of the damage depends on how long it takes to rebuild the grid. In Austria, experts assume a duration of ten to 30 hours. These estimates are based on exercises and simulations. However, in practice it is unknown whether the grid could actually be restored during this time as there has never been such a case in Austria.



Source: Own illustration based on Dickert/Schegner 2007

Typical course of major outages

The probability of a blackout strongly depends on the prevailing operating conditions in the power grid. Environmental influences or an increased imbalance of generation and consumption can create unfavourable conditions and become problematic when an incident occurs. Interaction of various negative factors (e.g. overload and simultaneous line failure) can lead to cascading effects (chain reactions) if a blackout cannot be resolved. Climate change, digitalisation, and the energy transition bring about many new challenges for a sustainable, stable power supply and security of supply. The associated increasing fluctuation margins (volatility) can increase the risk of cascading effects and thus also the risk of a blackout.

BASIC DATA

Project title: Sichere Stromversorgung und Blackout-Vorsorge in Österreich

Project team: **ITA:** Allhutter, D., Bettin, B., Kleinferchner, J., Krieger-Lamina, J., Nentwich, M., Ornetzeder, M., Strauß, S.
AIT: Brunner, H., Weber, M.

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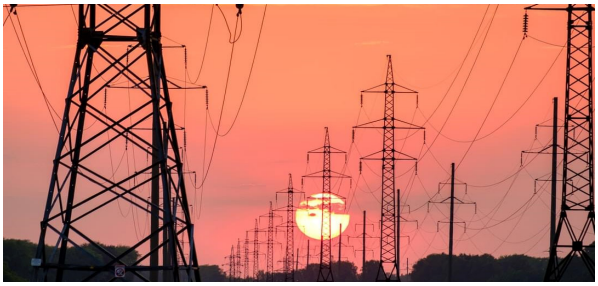
KEY RESULTS

Global warming and environmental changes favour extreme weather phenomena (e.g. heat, floods, massive storms). Due to an increase in heat waves and a switch to renewable energy sources (wind, solar), electricity consumption is becoming more weather-dependent than in the past. Additional heat waves can trigger seasonal electricity shortages in the medium term, which would have far-reaching consequences for the European transmission network. Digitalisation also involves technical, social, and structural changes. The global demand for energy is increasing as a result of a growing number of digital devices and novel phenomena such as trading in cryptocurrencies.



Climate change can strain the power grid's stability in the medium and longer term and increase the risk of major disruptions.

The integration of digital control systems can improve both control processes in load management as well as the ongoing monitoring of the power grid.
However, IT security problems can spill over into the power grid, increasing vulnerability to faults or targeted attacks on the power supply. A central challenge in the energy sector is the energy transition. By 2030, up to 100 % of the total electricity consumption is to be covered by renewable energy sources. Moreover, all economic sectors in Austria are to be climate-neutral by 2040. In addition to industry, other sectors such as mobility and heat supply are increasingly being electrified. The massive expansion of renewable generation capacities also requires the expansion and conversion of infrastructure. If society's energy needs are to be met from renewable resources in the future, electricity will play a central role. Sufficiently available reserve capacity is essential for security of supply to meet the demand for energy and compensate for fluctuations. Fluctuations can become particularly critical when hydropower, wind energy, and photovoltaics prove inadequate during high demand.

WHAT TO DO?

These challenges are to be addressed even more strongly through precautionary and institutional measures at various levels:

- Coordinated expansion of generation capacity from renewable energy sources and the expansion and conversion of the electricity grid (in accordance with the 2030 expansion plan).
- Evaluation of the need for balancing power and reserves with regard to the energy transition.
- Evaluation of the need to expand cross-border balancing power markets and analysis of the required additional framework conditions.
- Greater attention to progressive environmental changes in systematic monitoring of the electricity infrastructure with the involvement of climate experts.
- Precautionary measures against rising dependence on environmental conditions with the help of flexible solutions (e.g. demand-side management) and various storage solutions.
- Training of specialists with combined electrical engineering and IT expertise to compensate for the prevailing shortage and to create awareness for dependency issues related to digitalisation.
- Strengthening inter- and transdisciplinary knowledge transfer between research and stakeholders in the energy sector.
- Risk analyses with a stronger focus on climate-related major disruptions and relevant exchange of knowledge and experience in Europe.
  Governance of the energy transition for a sustainable, secure power supply.

FURTHER READING

Allhutter, D. et al. (2022). Sichere Stromversorgung und Blackout-Vorsorge in Österreich. Entwicklungen, Risiken und mögliche Schutzmaßnahmen (Endbericht) (130 p.) (in German). ITA: Vienna.
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