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Abstract

The compressed air storage powerplant in Huntorf (Lower Saxony, Germany – A.K.A. "Neuenhuntorf"), consists of a gas turbine powerplant fed by two underground salt caverns for storing compressed air in order generate electricity on an industrial scale. The plant was commissioned in 1978 with the aim of peak-shaving (storing energy at off-peak times and producing electricity at peak times).

As a response to climate change and related politics, an energy transition has been happening in Germany over the past several years. The expansion of renewable energy systems and the reduction of nuclear and fossil energy capacities are leading to bottlenecks in the electrical transmission and distribution grids, which need to be balanced by flexible powerplants and storage facilities. A considerable capacity increase in energy storage is required to cover peak loads, assuming coal or gas-fired powerplants are no longer available as a reserve in the so-called "Dunkelflaute" (a period, mostly in winter when there is neither enough sunlight nor wind to power renewables) and if only renewables are to be used to generate electricity.

These conditions require the powerplant to adapt its use case from exclusively peak shaving with a short reserve capacity for a few operating hours per year to a commercially managed energy storage facility with significant operating times in residual load use. Residual load refers to the electrical load demand on the electricity grid that is to be provided by the remaining powerplants (gas, coal and nuclear powerplants as well as storage powerplants) after deducting the share of volatile providers such as wind and solar energy. The flexibility of this type of powerplant will be fully utilized by customers, which leads to new challenges regarding plant operation. One such challenge comes in the form of more frequent usage of the plant, which entails a significantly higher number of start-up processes as well as longer runtimes per usage, summing up to increased yearly operation time.

This situation demands the existing system be updated. Initial considerations to retrofit the plant for increased compressed air cavern capacity and improved output and process efficiency of the existing plant have been tabled in favour of the expansion of the site by (at least one) new storage cavern and the construction of a new state-of-the-art powerplant. The possibility of hydrogen being introduced in the combustion process instead of natural gas is being considered as well.

The presentation will cover the development of the compressed air storage powerplant at Huntorf, including the current expansion plans.

Key words: compressed air, Huntorf, gas turbine, salt caverns, peak-shaving, energy transition, renewable energy, residual load, hydrogen