Benefits of Intelligent Power Grid Design Tools

Study commissioned by CurrENT

Executive Summary

01 June 2021

consentec

Study on Smart Transmission Technologies

The demand for long-distance transmission of electrical energy has increased significantly over the past decades and is expected to increase further in the foreseeable future. This development is driven by the rapidly growing share of renewable energy power generation which is often installed at long distances from load centres as well as the increasing desire for domestic and cross-border electricity exchange to reduce the costs of electricity and foster security of supply.

It is widely recognized that transmission systems need reinforcement and expansion to cope with increasing demand. This is also reflected in European (TYNDP) and national network development plans. Nevertheless, grid expansion has for some time been falling behind what is needed to achieve ambitious targets for the transformation of the electricity system (an inevitable component of the EU Green Deal). The huge cost of proposed investments in grid expansion – as well as broader public acceptance issues – weigh heavily in the minds of regulatory authorities and policy makers.

While some grid expansion will be required, reducing congestion on already existing infrastructure can be one of the major opportunities of the energy transition. We can look to highly advanced and innovative proven technologies to use existing grids more efficiently than ever before.

Whereas most grid expansion projects continue to rely on traditional technologies, especially simply installing new and bigger lines, the potential for proven smart grid technologies to optimize the operation of transmission systems has been generally recognized for some years now. Germany, for example, requires TSOs to consider optimization and reinforcement measures before planning new lines. Under the “NOVA principle”, regulators have approved adjustment of the capacity ratings for new and existing lines based on ambient conditions as well as the use of phase-shifting transformers for load-flow control.

currENT, the recently founded European industry association of providers of grid enhancing technologies, endorses such approaches but also sees room for improvement. Broad application

of technologies such as Dynamic Line Rating (relying on sensor-based monitoring of actual line conditions and especially the cooling effect of wind), modular Smart Valve technology for load flow control, and superconducting lines could not only allow for a better utilization of the existing transmission system, but also reduce costs and enhance both operational flexibility and reliability for TSOs.

currENT has commissioned Consentec, a boutique consultancy with long-standing experience in energy system analysis, to undertake a study to examine the technical and economic potential of these technologies to significantly reduce congestion and its associated costs in European transmission systems. The study will also examine how the different approaches to mitigate congestion can complement one another. In addition to more qualitative analysis of the opportunities afforded by such technologies, the assessment will be based on quantitative energy system modeling for a 2030 scenario including dispatch, load flow, and remedial action simulation. The geographic scope of the study will cover the Central West Europe region together with Denmark West. Results of the study will be available during early fall of 2021.