New Guidance for Planning of Rural Networks with High Penetration of Renewable Energy

The transition process of the German power system faces new challenges. On one hand, the number and thus the installed capacity of distributed generators (DG) with a fluctuating supply of electrical energy are continuously increasing. On the other hand, the current distribution network has no suitable network configuration to take the increasing number of distributed generators. The increasing penetration of DG is already today one reason why distribution networks – and especially rural ones - are reaching their technical limits. In addition to the overload of electrical equipment due to high currents, the feed-in from photovoltaic and wind power causes voltage range deviations in the lower voltage grids. Hence the network dimensioning should be more and more aligned with the maximum in-feed scenario but moreover huge investment needs are necessary. However, the network expansion at optimal costs according to the new requirements is a cornerstone for the further integration of DG.

For this reason Siemens PTI and Bergische Universität Wuppertal initiated a research project (PuBVerteilung – which stands for Planning and Operation of Rural Distribution Grids) in cooperation with two large distribution network operators in Germany to examine the possibilities of an optimal network planning approach with the application of innovative technologies and methods.

The research project, which was funded by the German Federal Ministry for Economic Affairs and Energy, was completed this summer with the publication of a guideline for rural distribution operators including new planning and operational principles for rural distribution networks covering standardized concepts for the integration of DG.
These principles do not only consider conventional planning methods, moreover they focus on innovative concepts like on-load voltage controlled transformers or active power control too, with the objective to apply already available as well as to-be market-ready technologies in the distribution networks. The project has shown that the application of network automation and digitalization combined with long-term strategic network planning show an extensive technical and economic benefit across all voltage levels. In practice, the network expansion cost could be reduced significantly by using innovative technologies compared to a sole conventional expansion.

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