

The incident on 8 January revealed no issue in relation to generation adequacy or high shares of renewables having an impact. The in-depth analysis has shown that the large pan-European electric power flows and the low stability margins in the system played a crucial role in the incident, which reveals an illuminating view on future power system conditions in Europe.

After the incident which on 8 January separated the Continental Europe synchronous area in two for one hour, and in accordance with the System Operation Guideline and the Incident Classification Scale Methodology, an expert panel composed of representatives of the affected transmission system operators (TSOs), ENTSO-E, regional security coordinators (RSCs), national regulators and ACER, was set up on 4 March 2021 to carry out an investigation.

After several months of intensive and close collaboration of all parties involved, the expert panel issues its final report which yields a comprehensive analytical overview of the incident - the causes and the consequences - and proposes 22 recommendations to prevent and mitigate the consequences of similar events in the future.

The expert panel's analysis has shown that the separation of the Continental European power system in two asynchronous areas led to significant frequency deviations in both areas. The impacts of the separation were visible in both areas through voltage and power oscillations. Primarily, due to the fast and coordinated activation of stabilizing measures, such as the activation of frequency re-serves, the contractually agreed interruption of industrial consumers, and the support from other synchronous areas, frequency degradation was automatically stabilized.

Further manual measures then brought the frequencies in the two areas back to the nominal value of 50 Hz soon after the incident, so that the resynchronization could take place over a duration of about one hour after the separation. In that time span, only a very small number of private and industrial loads could not be supplied, meaning that, overall, the incident had no major impact on the security of supply of European consumers.

In general, the incident was handled in a better and more efficient manner than the split in November 2006, which is also due to the lessons learned from that system separation and the consequent development of the binding legal framework at the EU level. The ENTSO-E Awareness System (EAS), which allows European TSOs to exchange information in real-time and which was introduced right after the 2006 event, allowed the TSOs to be aware of the overall system states. Coordinated measures of the TSO's electricity defense plans were activated quickly, which also allowed for the fast resynchronization of the two asynchronous areas.

With the ongoing energy transition, large and long-ranging power flows on the pan-European level will further increase in size and occurrence. In this regard, power system operation must become sufficiently resilient to cope with unexpected disturbances and

faults to guarantee unchanged high security of supply of European customers. Therefore, highly accurate security calculations and a continued commitment by the Member States for their TSOs to cooperate at regional and European levels to guarantee reliable energy supply is essential. This will help each jurisdiction to cope with sudden changes, drawing on stability contributors when needed. Grid resilience and maintaining security of supply together is an enabler of Europe's clean energy transition. The expert panel makes 22 recommendations for further assessments and corresponding implementation. These cover topics such as operational security calculations, frequency analysis and support, as well as TSOs' communication and coordination. The panel calls for ENTSO-E/TSOs and ACER/national regulators to follow up on the implementation of these recommendations to prevent and mitigate the consequences of similar incidents in the future.