

The overvoltage-driven blackout of the Iberian Peninsula on 28th April 2025

L. Rouco Rodríguez; F.M. Echavarren Cerezo; E. Lobato Miguélez

Abstract-

The Iberian Peninsula blackout on 28th April 2025 occurred due to cascading disconnection of renewable generation with power factor control, triggered by overvoltage generation protections. This paper describes a conceptual model to explain the primary phenomenon that occurred, which we have called an overvoltage-driven blackout. While the phenomenon of voltage collapse, or more precisely undervoltage collapse, is widely discussed in the scientific literature, the phenomenon of an overvoltage-driven blackout is new. An illustrative 3-bus small-scale power system is provided to better understand the evolution of bus voltages in an overvoltage-driven blackout, identifying the critical factors that can lead a power system to a blackout caused by overvoltage. The conceptual model is applied to the state of the Iberian Peninsula electricity system at 12:30 on 28th April 2025, preceding the blackout. The paper will show how, with the loss of renewable generation, the growth of bus voltages exhibits the same pattern as the one identified in the 3-bus small-scale system. A new safety metric (margin to overvoltage-driven blackout) is defined and computed. The paper will demonstrate how the system operated with an insufficient safety margin, leading to an overvoltage-driven blackout, due to a lack of sufficient synchronous reactive power absorption capacity in the central and southern parts of Spain, as well as the low-loaded transmission grid in those regions.

Index Terms- Voltage collapse; Voltage control; Ancillary services

Due to copyright restriction we cannot distribute this content on the web. However, clicking on the next link, authors will be able to distribute to you the full version of the paper:

[Request full paper to the authors](#)

If your institution has an electronic subscription to Sustainable Energy, Grids and Networks, you can download the paper from the journal website:

[Access to the Journal website](#)

Citation:

Rouco, L.; Echavarren, F.M.; Lobato, E. "The overvoltage-driven blackout of the Iberian Peninsula on 28th April 2025", Sustainable Energy, Grids and Networks, vol.45, pp.102125-1-102125-9, March, 2026.