

Distributed Generation's Impact on Italian Defense Plan and Restoration

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Abstract

Renewable Energy Sources (RES) have more and more impact on security and reliability of the power system operation. In 20 years wind power capacity has grown from around 10 to 320 GW and photovoltaic (PV) from almost zero to 140 GW worldwide. Installed solar and wind power capacity in Italy is about 30 GW, with a power consumption ranging from a minimum of 20 GW to a peak load of 55 GW. Typically in the South of Italy, there are many problems connected to high percentage of volatile RES, such as bottlenecks and congestions management, load curtailment, increasing need for reserve margins and balancing capacity in pool markets, steep up/down power ramps to conventional plants, etc. To operate such a complex power system, researches and studies are needed to help operators to keep system reliability, especially in case of high penetration of RES. This turns into an increase of the detail and the accuracy of the dynamic models to be used. Equipment and protection models are briefly introduced, according to the Italian Grid Code guidelines on RES modeling.

Validation and improvements of Sardinia and Sicily Defense Plan on different scenarios (off peak and peak periods) are presented, using the above-mentioned models and taking into account the actual installed RES generation. One of the goals of the presented studies is the update of the lowest frequency/voltage thresholds of the Defense Plan in order to optimize the tripping of those feeders with a high percentage of Distributed Generation (DG) connected to. DG's impact is also relevant during restoration, as it needs a strong coordination between TSO and DSO to evaluate load forecasting on primary cabins (PC) hosting DG. This is because of the relevant differences of load values between connected and disconnected (i.e. after a blackout) PCs. Other effects are discussed, such as dynamic stability of power plants, grid code infractions, harmonic disturbances, etc. Particular attention is given to a real restoration field test on a portion of the Sardinia grid where the level of DG is notable.