REDUCING DISTRIBUTED GENERATORS CONNECTION REQUESTS QUEUE ON THE DISTRIBUTION NETWORK THROUGH CONDITIONAL AGREEMENTS

Federico De Santi: JRC Ispra & KU Leuven Department of Mechanical Engineering,
Via Enrico Fermi, 2749 9500 Ispra (VA) Italy,
Phone: +39 3450422207, e-mail: federico.de-santi@ec.europa.eu
Leonardo Meeus: Florence School of Regulation
Erik Delarue: KU Leuven Department of Mechanical Engineering

Overview

The transition towards a decarbonized electricity system heavily relies on the adoption of Renewable Energy Sources (RES) at the distribution level. However, this transition poses a significant challenge for Distribution System Operators (DSOs) as they face an increasing number of connection requests from Distributed Generators (DG) at the Medium Voltage (MV) level. Traditionally, grid reinforcement investment has been the primary approach used by DSOs to cope with the surge in connection requests. Nevertheless, while the benefits of this approach can only be realized in the long-term, it may lead to grid overbooking in the short-term not being able to accommodate all connection requests, exposing the DSO to further challenges. By exploiting DG flexibility services, DSOs can offer connection conditional agreements to the applicant for relieving the connection queue while guaranteeing the system to keep working under a safe and reliable operating condition.

Method

The main aim of this study is to propose a short-term approach for accepting new DG connection requests through conditional agreements as an alternative to network reinforcements. Typically, the percentage of network reinforcement costs to be paid by the generator company, if necessary, differs among countries, while the entire cost of connection is borne by the generator company. Whereas this investment ensures a secure connection for the generator, it can become a significant expense, particularly if reinforcement costs are not shared among other generators, thus leading to connection queues and hindering new connection requests.

The significance of this study lies in the utilization of Optimal AC Power Flow for the assessment of new connection requests by the DSO, with the objective of minimizing energy curtailment. As an alternative to firm connections, offering non-firm connection agreements, namely solidarity and non-solidarity in this study, can grant connection for the applicant without the need of reinforcement works. However, determining how generators get curtailed during periods of network congestion is yet a challenge to be determined by regulators.

The proposed approach is tested on three synthetic network topologies (urban, semi-urban and rural) developed on the basis of real data coming from European DSOs by the Joint Research Centre (JRC), which allows for observation of the influence of network characteristics.

Results

The primary goal of this study is to assess the feasibility and acceptability of new RES generators by utilizing a novel approach that leverages DG flexibility. Specifically, this study aims to analyze and compare different types of conditional agreements, solidarity vs non-solidarity, and evaluates their impact on the acceptance of connection requests. The proposed solidarity conditional agreement involves all generators contributing to alleviate the network constraint, with the generators most sensitive to the network constraint being curtailed the most. In contrast, the non-solidarity approach involves each generator's curtailment contribution being different and based on the amount agreed upon in the contract.

Conclusions

The study presented highlights the strengths and weaknesses of the conditional agreements under study. The study suggests that while identifying the optimal connection point in the network (i.e., the one that yields the lowest energy curtailment) is the primary objective for applicants under the solidarity scheme, the same cannot be said for generators under the non-solidarity regime. These generators are primarily interested in connecting first before the grid becomes saturated, thereby obtaining the most beneficial contracts.

Overall, these results suggest that policymakers and regulators should carefully consider the trade-offs between energy curtailment and timely grid access when designing conditional agreements for new generator connections.

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