

Optimal investment in smart MV/LV substations to improve continuity of supply

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Abstract— Smart MV/LV substations will play a crucial role in the evolution towards a smarter distribution grid. The implementation of smart MV/LV substations can provide a significant improvement of continuity of supply. However, a large investment is required, so the optimal level of implementation must be found. This paper aims to provide a methodology to determine the optimal degree of automation comparing the costs of increasing automation to the benefits derived from the improvement of continuity of supply achieved. First, the impact of different degrees of implementation of smart MV/LV substations on continuity of supply is quantified using a reference network model (RNM). Then, an economic analysis is performed to assess automation costs and supply interruptions costs from two different perspectives, considering non supplied energy for network users and alternatively regulatory incentives for distribution companies. Finally, the optimal degree of automation is identified by comparing marginal costs. Furthermore, the methodology proposed is applied to two large scale test cases of an urban and a semi-urban network. The results obtained highlight the need to compare costs and benefits showing that there is indeed an optimal degree of automation different from the complete automation of the distribution system.

Index Terms— Continuity of supply; Distribution network; Smart grid; Smart MV/LV substation

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