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DEVELOPMENT OF A PLANNING TOOL FOR NETWORK ANCILLARY SERVICES USING CUSTOMER-OWNED SOLAR AND BATTERY STORAGE

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Renewable energy generators, in particular solar photovoltaic (PV), are in most cases intermittent. In order to reach the targets recently set by European and Australian energy directives of 20% of grid generation from renewables by 2020 [3][4], it will be necessary to ensure adequate electricity storage is available to smooth this intermittency. The rapidly declining prices and higher capacities of electric batteries make this technology a good prospect [5].

An imbalance between generation and consumption of energy in the network can disrupt power flows and cause a displacement of frequency from its nominal regulated value. Conventional primary frequency regulation requires the adjustment of large centralized generators or switching of substation devices that can take seconds to be deployed or is difficult to do in a smooth granular way. Previous studies [6][7] have demonstrated the advantage of using batteries, not only for smoothing of intermittent generation but also as an energy reserve for cost-effective fast frequency regulation and local ancillary services. However, to be an asset the network operator can rely upon it will be important that they have visibility of the stored potential and can plan for future control actions.

This paper presents a practical method for estimate the state of charge (SoC) of customer-owned solar PV and battery assets on a site-by-site basis in real-time. Starting from the assumption that there is a preceding agreement between customers and network operator, the tool makes a day-ahead estimation of the SoC of the battery. This considers the local PV generation and consumption of the customer and assumes the system is operating to optimize performance with regards to tariffs and operating costs and the agreed network agreement. A model-based observer is used to predict SoC 24 hours ahead. The model considers customer consumption and PV production which are separately forecasted and used to estimate the SoC of the battery one day ahead. Since the forecasts are uncertain, a Monte Carlo approach has been considered in order to estimate an upper and lower bound of the SoC over time.

With this information the utility can make its choices on Ancillary Services resources allocation one day ahead.

Simulation results are presented using input data from a real system.

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