Smart Grids

Renewables integration

Energy Management

Development of an Advanced Microgrid Controller

Issue

Microgrids are becoming increasingly attractive because of their active role in achieving a sustainable energy system. Microgrids are promising in providing efficient, low-cost and clean energy by integrating a large number of distributed energy sources, including solar photovoltaic (PV) and energy storage. A grid-connected microgrid is also able to provide ancillary energy services to the utility grid, such as frequency and voltage stability support during network faults. The global deployment of microgrids is expected to exceed 37 GW by 2024. To put this number into context, the maximum demand for the Qatar network in 2017 was 7.85 GW. Despite this anticipated growth, there are still many challenges to efficient microgrids operation in both grid-connected and islanded modes. These challenges are mainly related to microgrids control in terms of achieving optimal power-sharing and dispatch of the distributed units or achieving a seamless mode transfer between microgrids operating modes, as well as the ancillary services provision by grid-connected microgrids. Extensive research activities are thus ongoing to tackle these issues.

Solution

Offering microgrid control as a universal, plug and play, product that integrates a bundle of predefined control blocks residing in off-the-shelf products is the ideal path to speed up microgrids deployment rate in distribution networks. To this end, Iberdrola Innovation ME lab is equipped with a state of the art microgrid setup that is managed by a flexible control platform. This allows developing and testing the different components of a microgrid control system from the device level (primary voltage and current control) up to integrated energy management systems (distributed units dispatch) to achieve the plug-and-play functionality. Ultimately resulting in developing a universal controller that is compatible with isolated and grid-connected microgrids, and able to achieve a smooth transition between both modes while also supporting the grid through its complex ancillary services algorithms.



Impact

Microgrid control is currently provided by most vendors as a solution (utilising proprietary platforms) rather than a set of microgrid control products (off-the-shelf) which can be applied to a project by the system owner's engineers. This approach could introduce many challenges such as high service costs, difficulty in modifying and extending the system without the vendor's involvement. Therefore, the targeted plug-and-play universal microgrid controller has a significant impact on facilitating the microgrids' adoption. This impact extends to utility operators in terms of maintaining system stability during energy exchange with microgrids at their points of common coupling. In addition, isolated microgrids are becoming an increasingly adopted trend such as in; Australian mines, Qatari food farms and Brazilian rural communities. The universal microgrid controller is also able to coordinate sustainable energy management for these isolated areas.



