

Abstract

An autonomous smart battery is developed to incorporate storage on an isolated 12 V DC grid called the PeCo grid. The PeCo grid is a personal consumer grid aimed at electrification of rural areas with no existing electrical infrastructure. In order to develop the smart battery a 12 V lead-acid battery is combined with a Dual Active Bridge (DAB) bi-directional DC-DC converter. Using this combination with the relevant control algorithms the smart device achieves grid stabilisation, black starting and fault protection without the use of a dedicated communication network. These features are achieved through the usage of a decentralised control architecture that is solely based upon the grid voltage. The smart battery is able to seamlessly integrate into an existing system due to its plug and play nature. A working prototype of the smart battery is developed and experimentally validated on the distributed energy system.