

Battery and energy management system for vanadium redox flow battery: A critical review and recommendations

Hao Wang, S. Ali Pourmousavi, Wen L. Soong, [Xinan Zhang](#), Nesimi Ertugrul

[Electrical, Electronic and Computer Engineering](#)

Research output: Contribution to journal › Review article › peer-review

Abstract

As one of the most promising large-scale energy storage technologies, vanadium redox flow battery (VRFB) has been installed globally and integrated with microgrids (MGs), renewable power plants and residential applications. To ensure the safety and durability of VRFBs and the economic operation of energy systems, a battery management system (BMS) and an energy management system (EMS) are inevitable parts of a VRFB-based power system. In particular, BMSs are essential to conducting efficient monitoring, control and diagnosis/prognosis functions with the help of a feasible and comprehensive battery model. Considering the application of a VRFB is normally integrated within a grid-level system, an EMS is required to operate the entire system in coordination with the BMS optimally. Several papers have reviewed the design and modelling of VRFB recently. However, the BMS and EMS in VRFB applications have received limited attention in the literature. This review article introduces the principles, applications, and merits of VRFBs and presents a critical review of the state-of-art VRFB modelling techniques related to BMS and EMS operation. More importantly, the state-of-the-art BMS for VRFBs is reviewed by taking the unique design of the VRFB systems into account, and recommendations are given for future development. Finally, several VRFB EMSs are discussed to illustrate their importance in improving the stability and reliability of grid-level power systems.

Original language	English
Article number	106384
Number of pages	21
Journal	Journal of Energy Storage
Volume	58
Publication status	Published - Feb 2023