

## Cycling Performance and Efficiency of Vanadium Redox Flow Batteries

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Recently, Vanadium Redox Flow Battery (VRFB) has shown great promise as an efficient large scale energy storage system for a wide range of applications including uninterruptible power supply, stabilization of wind turbine output, and hybrid photovoltaic cells. Unlike other popular electrochemical energy storage systems such as lithium ion batteries, VRFB stores energy in electrolyte solutions rather than in electrodes. This setup could result in a considerable increase in life time due to low self discharge of the battery provided that the charged electrolyte solutions can be kept in stable conditions. The advantages of VRFB systems include high energy efficiency (> 75%), deep discharge ability, fast response, low self discharge, long life-time (> 10 yr), and most important, independent power and storage capacity. Cycle life of VRFB is influenced by various conditions. Therefore, VRFB cycling test were carried out under several conditions and the optimal conditions in VRFB were evaluated.