2025 IERE-TPC Taipei Net-Zero Workshop
May 26–29, 2025

Micro Grid in Black Start and Seamless Technology

***Yi-Kuan, Ke[1], Wen-Ching, Chang [2], Chih-Han, Ko [3], Jia-Jing, Lin [3], Yi-Kai, Tseng [3], Hong-Jhih, Liu [3], Li-Quan, Xiao [3], Jen-Ming, Yang [3], Zhe-Hao, Chang [3], Kuei-Yen, Lee [3]**

[1]Director, EISBG, Advance II Department, Delta Electronics, Inc.
[2]Chief, EISBG, Advance II Department, Delta Electronics, Inc.
[3] Senior Design Engineer, EISBG, Advance II Department, Delta Electronics, Inc.

Keywords: *Micro Grid, Seamless, Black Start, Load Shedding, Micro Grid Energy Management System*

Abstract

With the growing adoption of renewable energy, microgrids are increasingly deployed to enhance energy management efficiency and economic benefits. However, the inherent intermittency of renewable generation poses challenges such as frequency and voltage deviations, potentially compromising system stability and leading to power failures under severe conditions. To improve system resilience, this demonstration implements key strategies, including seamless transition, black start procedures, virtual inertia, and automatic load shedding and recovery.

As an independent entity within the power system, a microgrid offers operational flexibility in managing distributed energy resources (DERs), whether in grid-connected or islanded mode. In this demonstration, DERs—including photovoltaic generation, battery energy storage systems, a diesel generator, and curtailable loads—are integrated into an adaptive control framework. In the event of a grid outage, the microgrid central controller (MGCC) autonomously disconnects from the main grid, triggering a seamless transition where power conditioning systems (PCS) shift from current source mode to voltage source mode, ensuring stable voltage and frequency regulation. This aligns with the IEEE 2030-7 standard and enhances system reliability.

This session will showcase the implementation of these resilience strategies, providing insights into their effectiveness in mitigating contingencies and ensuring a robust microgrid operation.