Preliminary Operation Results of Experimental Power Grid Facility

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Objective
To share the preliminary experimental results and key functionalities of the Experimental Power Grid Facility (EPGF) for different grid configurations and operation modes.

Introduction
The Experimental Power Grid Center (EPGC) was set up as a research programme by the Agency for Science, Technology and Research (A*STAR) [Singapore] to carry out research in the area of intelligent and decentralized power distribution, interconnection and utilization. EPGC works with its research partners from Industry, Universities and Public Agencies on projects that range from analysis, modeling and simulation to technology demonstrations. EPGC has a 3 MW low voltage (LV) distribution network that can be configured in radial, loop, series or as three independent networks. It can be operated in grid connected mode or as an islanded grid. It has generation assets such as Diesel Generators and Photovoltaic (PV) Arrays with scope for further expansion. In addition, it has storage in form of Batteries and Ultracapacitors. Emulators for Wind Turbine and PV are available that can be programmed to simulate different weather conditions. A Power Grid Emulator can also be used to emulate the LV grid characteristics. The whole facility is controlled using central controllers. The controllers can be programmed to operate the LV grid in grid connected mode or islanded mode. In summary, the facility offers a flexible platform to carry out research and development in the areas of renewable integration, DER and Microgrid control systems.

EPGF configured as three Independent Microgrids operating simultaneously

**Microgrid-A: Connected with Singapore Utility Grid**

The Graph shows Microgrid-A operation in automatic control mode with target PCC power set equal to zero. As shown in the above figure, power at PCC is maintained at zero. The change in load at point-1 & 2 is immediately compensated by the Lead Acid Battery (operating in local following mode) and then by DG-2.

**Microgrid-B: Connected with Power Grid Emulator (PGE)**

Graph shows the Microgrid-B operation in PGE connected mode and configured by MGC-4. PGE emulates the utility grid characteristics.

**Microgrid-C: Islanded Grid**

The Graph shows Microgrid-C intentional islanding at point-1 & 2 and re-synchronization at point-2 with the utility grid. At the time of islanding (point-1,3) about 40kW power is being imported and compensated by DG-2 after islanding.

**EPGF Configured as a Single Microgrid**

Microgrid is configured with all assets operating in connection with新加坡 utility grid and controlled by MGC-1. Microgrid represents the radial configuration and divided into two sub-zones using line impedance emulator (LC).

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