

UNIFIED CONTROL AND OPERATION OF A 20KVA LABORATORY MICROGRID INCORPORATING FLYWHEEL ENERGY STORAGE

*Catherine Jones, Chris Fitzer, Mike Barnes**

** Corresponding author*

*School of Electrical and Electronic Engineering, University of Manchester,
room SSB/A6a, PO Box 88, Manchester, M60 1QD,
tel. +44 161 306 4798, fax. +44 161 306 4774, email: mike.barnes @ manchester.ac.uk
Paper not previously presented at conference*

Keywords: Microgrids, Energy Storage, Embedded Generation

ABSTRACT

‘Microgrids’ are small, semi-autonomous areas of the electrical power network which combine embedded generation, energy storage and ‘intelligent’ control with conventional loads. Control concepts for Microgrids are still at an early stage of development and little experimentally verified research has been published to date. The key to operating a Microgrid is the control of the energy storage unit, which must balance mismatches between loads and micro-sources when the Microgrid operates autonomously. The energy storage unit should also facilitate islanding from, and reconnection to, the main grid, with minimal disturbance. This paper discusses the limitations of existing control strategies. The paper presents a unified controller concept for energy unit storage units, one that encompasses grid connected, islanded, islanding and resynchronisation control, for Microgrids incorporating micro-sources which may use non-power electronic interfaces. This controller is validated in simulation and on a hardware test-platform. The test Microgrid system consists of a 4MJ energy storage flywheel unit with a 20kW power rating, along with a 22kW Motor-Generator set representing the micro-source generation and a 12kW load bank. Islanded and grid connection is shown, as is islanding and grid synchronisation with minimal voltage distortion. Simulation and experimental results show excellent agreement.