International Journal of Distributed Energy Resources
Volume 1 Number 4 (2005) Pages 279-298
Manuscript received: 25. April 2005

TECHNOLOGY &SCIENCE

ELECTRICAL STABILITY OF LARGE SCALE INTEGRATION OF MICRO GENERATION INTO LOW VOLTAGE GRIDS

Xueguang Wu[1], Yibin Zhang[2,4], Atputharajah Arulampalam[3], Nick Jenkins[4]

[1]Simulation & Studies, PES, AREVA T&D
Lichfield Road, Stafford ST17 4LN, UK
Tel: +44 1875 274507,
Email: xueguang.wu@areva-td.com

[2]China Electric Power Research Institute
Qinghe, Beijing, 100085, P.R. China
Tel: +86 10 62913201, Email:
zhangyb@epri.ac.cn

[3]Dept of Electrical Engineering & Electronics, The University of Peradeniya
Peradeniya 20400, Sri Lanka
Tel: +94 24 2221294, Email:
atpu@ee.pdn.ac.uk

[4]School of Electrical and Electronic Engineering, The University of Manchester
PO Box 88, Manchester M60 1QD, UK
Tel: +44 161 200 4813
nick.jenkins@manchester.ac.uk

Keywords: stability, micro grid

ABSTRACT

With large-scale integration of micro generation into low voltage grids, stability becomes an important issue for a MicroGrid. The unique nature of the MicroGrid requires that the MicroGrid is stable in both grid-connected mode and islanded mode. In this paper, the major factors (such as control schemes of the flywheel energy storage system, types of load in the MicroGrid, location of the fault and inertia constants of motor load) influencing the stability of the MicroGrid are investigated. Three possible control strategies (PQ control, Droop control and Frequency/Voltage control) of the MicroGrid are described. Simulation results show how the flywheel uses PQ control only when the MicroGrid is operated in grid-connected mode. During islanded mode, the control scheme of the flywheel has to be switched from PQ control to Droop control or Frequency/Voltage. With fixed PQ load or impedance load in the MicroGrid there is no stability problem. However, motor loads have a significant influence on the transient stability of the MicroGrid. In the MicroGrid, no evidence of small signal instability has been found. Instability of the MicroGrid is likely to result in low voltages. Hence, the stability of the MicroGrid can be improved by using an undervoltage load shedding method on the less important motor loads in the MicroGrid.