

Power Electronics in Microgrids Short-Course Outline

1. Introduction to state of the art microgrids (**Kevin Meagher**)
 - a. Types of microgrids; motivation for setting up a microgrid; what were the drivers behind this. (this is the emphasis; needs to give a good overview of what are the driver and functionalities)
 - b. Commercial: data centers, hospitals, universities
 - c. Review of implementations; types of implementations.
 - d. Examples of actual implementations (requires publication review)
2. Fundamentals of components resources in microgrids (**Len White**)
 - a. PV, storage, wind,
 - b. Gensets (SM basics); Len has some practical information as well
 - c. Power electronics interfaces to renewables
3. Protection (**Mesut Baran**)
 - a. Basics of protection challenges and issues
4. Primary and secondary control of microgrids (**Srdjan Lukic, Iqbal Husain**)
 - a. Part 1 current practices
 - i. Primary Control: voltage and current control mode;
 - ii. Droop control; Secondary Control for stabilizing voltage/frequency in islanded mode;
 - b. Advanced concepts
 - i. Islanding transitions
 - ii. Advanced control modes: Synthetic inertia, oscillator control
 - iii. Advanced concepts: FREEDM
5. Energy management in microgrids (**Ning Lu**)
 - a. Overview
 - b. Strategies
 - c. Use cases:
 - i. Off grid energy management
 - ii. Providing grid services
 - iii. Minimizing energy payment

FREEDM



SYSTEMS CENTER

6. Cost benefit analysis (**David Lubkeman**)
 - a. Methodology of how to do cost benefit study
 - b. Example: FREEDM cost benefit
 - c. Sample cases -- showing operation of the microgrid and it changes with assets and microgrid formation
 - d. Introduction of HOMER and demo different scenarios

7. Field Implementation of Microgrid (**Aleks Vukojevic**)
 - a. Engineering lessons learned from the field associated with Microgrid planning, design, commissioning and implementation of control schemes

8. Forward Looking Implementation (**Kevin Meagher**)
 - a. High tech implementation/product of a microgrid: renewable energy group; an ABB person – integration group; battery energy storage person.

9. Lab sessions
 - a. GEH or Multi SST lab: LV SST Lab -- grid connected and islanding?? Mode.
 - b. Distributed Control Microgrid Lab
 - c. Central Control Microgrid Lab + Energy Management Demo (**Ning Lu**)
 - d. Power Analytics Demo (**Kevin Meagher**)