Energy Management System Design for Cyber-Physical Microgrid Systems

Background Introduction: Currently, renewable energy source based distributed generations (RES-DGs) such as photovoltaic (PV) and wind DGs have been increasingly connected to power distribution networks. For instance, by the end of 2013, the total global wind capacity rises to 318.105 GW and the total global solar photovoltaic installation reaches almost 138.9 GW [1], [2]. As the penetration level of RES-DGs continues rising, the fluctuation of power generated from RES-DGs makes optimal energy management within microgrids really challenging. To address the this challenge, in this project, neural network based machine learning technologies will be used to predict generations from renewables, electricity consumptions from residential houses and optimally control the charging/discharging of energy storage systems.

Project Objectives:

- Build the following physical microgrids system, being familiar with Matlab/Simpower Programming is required

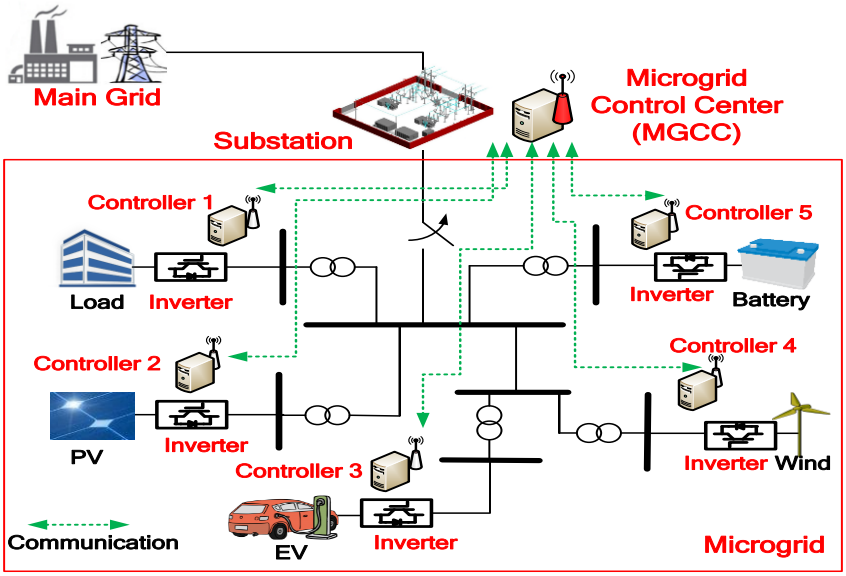

Fig. 1 Cyber-Physical Microgrid Structures

- Design neural network based renewable generations and electricity usage prediction modules;
- Design neural network based energy management scheme for energy storage systems;
- Interfacing physical microgrids in Matlab/Simpower and communication network modules in OPNET Modeler (Riverbed Tech)--C++ programming skills are required for Co-simulation

Number of Students: 5-6

References:

[1] G. Masson, S. Orlandi, and M. Rekinger, "Global market outlook: For photovoltaic 2014-2018," Eur. Photovoltaic Ind. Assoc., Brussels,Belgium, Tech. Rep., May 2014.

[2] S. Sawyer and K. Rave, "Global wind report 2013," Glob. Wind Energy Council, Brussels, Belgium, Tech. Rep., Apr. 2014.

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