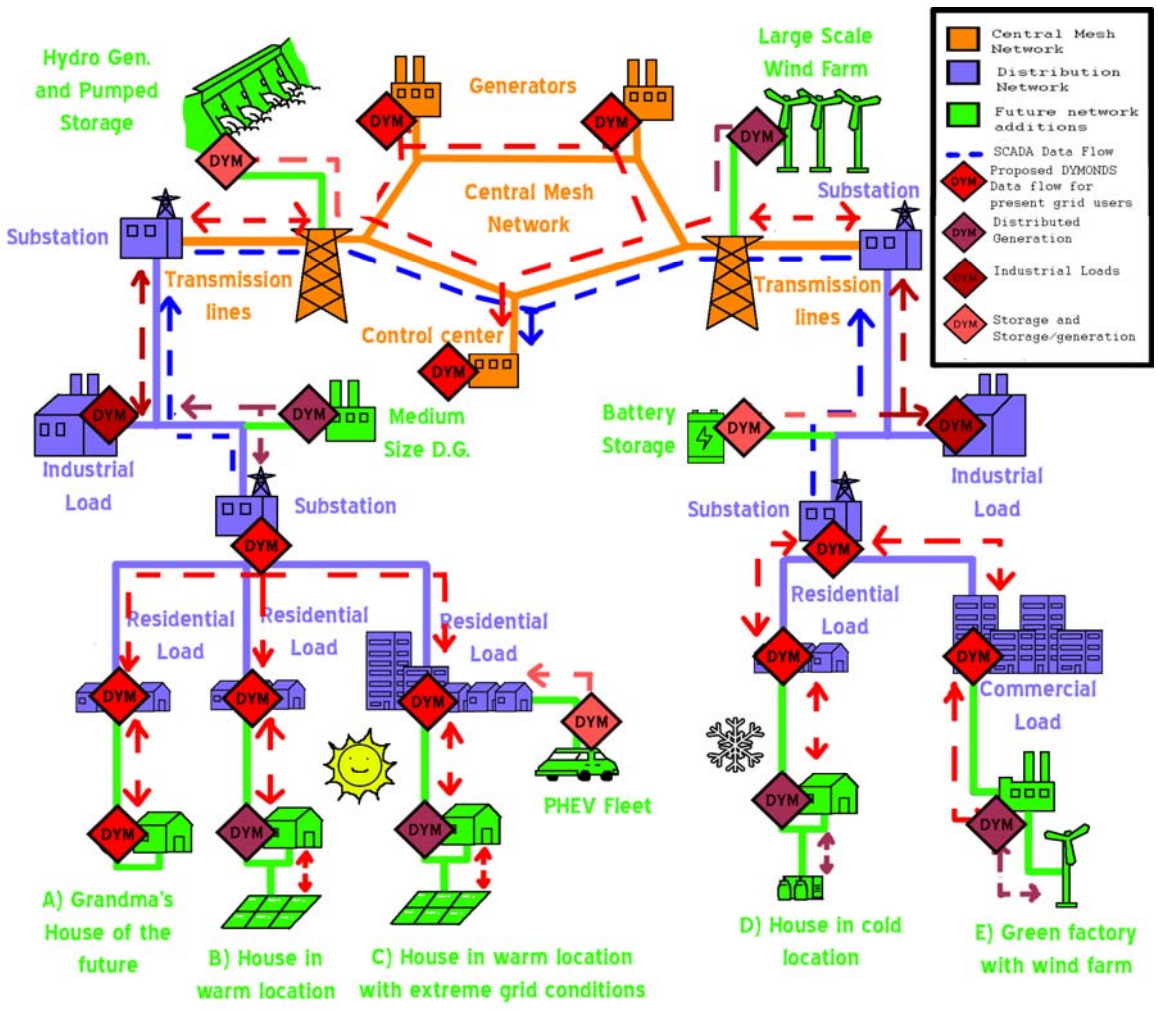
ECE/EPP COURSE (FALL 2014): *18-618/19-638*
Smart Grids and Future Electric Energy Systems

Instructor: Professor Marija Ilic, CMU ECE
milic@ece.cmu.edu

Prerequisite: Background in physics, circuits and ordinary differential equations.

****If you want to learn how to become software expert in cyber-physical systems this is the course for you! The course bridges EE and CE/CS tools in major ways. We learn what information needs to be sensed, communicated and processed by different embedded cyber systems into physical electric systems and for what purpose. Become a leader in using cyber for sustainable energy systems.*****

If you have time conflict with lectures, you can watch video-taped lectures and come to recitations!



DyMonDS (Dynamic Monitoring and Decision Decision Systems)--- Embedded Software for Cyber-Physical Systems!

The basic premise of this course is that much can be gained by introducing more automation in today's and future electric energy systems. Instead of over-designing, the basic idea is to rely on flexible responses by the smart electric power grids, energy sources and energy users for extracting often low-hanging fruits measured in terms of reliable, efficient and clean electric energy services. This course considers technical foundations necessary for transforming today's electric utility systems to the highly sensed and adjustable electric energy systems.

The course offers an advanced presentation of modern electric power systems, starting from a brief review of their structure and their physical components, through modeling, analysis, computation, sensing and control concepts. Great care is taken to avoid presenting "practical" techniques built on dubious theoretical foundations and also to avoid building elaborate "mathematical" models whose physical validity and relevance may be questionable. Mastering both principles and relevant models is important for those who wish to seriously understand how today's electric power grids work and their challenging technical issues. This prepares students for working on applying many novel information processing concepts for designing and operating more reliable, secure, and efficient electric energy systems. Students interested in both applied physics and signals and systems should consider taking this subject. Also, students interested in public policy analysis design are encouraged to master in-depth necessary technical concepts.

Once the fundamentals of today's power systems are understood, it becomes possible to consider the role of smart electric power grids in enabling evolution of future electric energy systems. Integration of intermittent energy resources into the existing grid by deploying distributed sensors and actuators at the key locations throughout the system (network, energy sources, consumers) and changes in today's Supervisory Control and Data Acquisition (SCADA) for better performance become well-posed problems of modeling, sensing and controlling complex dynamic systems. This opens opportunities to many innovations toward advanced sensing and actuation for enabling better physical performance. Modeling, sensing and control fundamentals for possible next generation SCADA in support of highly distributed operations and design are presented.
This course is a must for those doing research in electric energy systems, including optimization, control, estimation and communications methods for these systems. This course adds serious momentum to the area of Modern Energy Systems in ECE.