SMART GRID

Organizers:
Dr. Ning Lu, *Pacific Northwest National Laboratory*, (ning.lu@pnl.gov)
Dr. Masahiro Ishiyama, *Toshiba Corporation*, (masahiro@isl.rdc.toshiba.co.jp)

This session focuses on presenting the latest technology developments in smart electric power distribution grids. Electric power distribution systems typically encompass the power delivery systems with voltage levels from 115 kV and below. These systems include the branches, nodes, and components up to the meter outside of customer buildings. Important features of a smart distribution power grid include the deployment of two-way communication networks, alternative energy resources (renewable generation and energy storage), and smart devices (smart switches and appliances).

The smart grid technologies are enablers to schedule loads at the consumer level to save energy, reduce cost, and help grid operation. In the next few years, millions of smart meters, sensors, and automatic control devices will be deployed in electric power distribution grids down to residential and commercial buildings via two-way communication networks. Retail pricing schemes, such as real-time pricing (RTP), time-of-use (TOU), and critical peak pricing (CPP), are being designed by utilities to bring retail electricity prices to end-use devices to provide incentives for consumers to actively participate in energy efficiency or demand response (DR) programs. Furthermore, it is possible to control and monitor the on/off, cycling, or mode switching of appliances wirelessly with a home energy management system by developing smart appliances and deploying home area networks (HANs). Under these circumstances, it is beyond question that cyber security and privacy become exceedingly important issues.

Historically, there have been strict assumptions with respect to network topology and network power flows. Consequently, physical design and construction have followed suit. Now, with the desire to integrate large numbers and large amounts of alternative energy sources, the power distribution system itself has become a limiting factor. Professor Miu will open the session by presenting the challenges of system analysis and control for planning and operating a smart grid. To push beyond the limits, enabling technologies for system operations are needed. These include not only new components such as automated switches, voltage controls, etc., but also integrated, distribution, energy-management systems with advanced distribution analysis and automation techniques. Some current efforts addressing these issues will also be presented. Next, Dr. Venkatakrishnan will present the latest technology development on smart appliances and household energy management systems that allow consumers to actively participate in grid operation to save energy, lower costs, and defer investment on the distribution grid. After that, Prof. Tan will present the home network area, the testbed for an energy management system, and the home network standard. In the end, Dr. Kiuchi will present the cyber security issues raised by the smart grid. She will present the threat analysis (threat and its countermeasure) for smart grid IT networks in a broad context.

During Q&A, the speakers will address questions from the audience, covering issues such as privacy and security in the smart grid implementations.