# Future Power Grid Initiative Newsletter

September 2011

The Future Power Grid Initiative (FPGI) was approved in September 2010. By November 2010, nine projects started, focusing on research in the three focus areas: Networking and Data Management; Grid Modeling, Simulation, and Analysis; and Visualization and Decision Support. With its first birthday approaching, the FPGI can look back at a very successful year filled with a number of achievements.
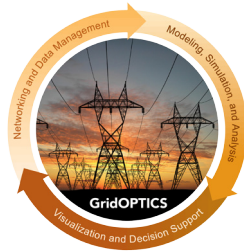
HIGHLIGHTS & NOTABLE ACHIEVEMENTS

In 2011, FPGI

- Receiving $535K in funds from the Department of Energy's Office for Electricity Delivery and Energy (DOE-OE) as a result of the work done by principle investigator Shuai Lu and his team on an FPGI LDRD project "Modeling of Distributed Energy Resources in the Smart Grid". The funds will support the Smart Grid R&D program and will be available October 2012.

- Filed one patent application on Load Sequencing, Renewables Forecasting and Goal-based Demand Response in the Electric Power System using Distributed Software Agents, plus three invention reports.

- Launched powerNET lab, a research laboratory and test-bed for power grid data networking, equipment, and technology.

- Launched the development of the gridOPTICS software architecture, an integrated capabilities tool suite that is able to securely collect data in real time, use data to drive modeling and simulation, and convert large volumes of data to actionable information.

- Launched an external website, **gridoptics.pnnl.gov**

- Engaged 15 potential key industry partners and 2 potential federal clients – DOE-OE and ASCR.

Papers

- Yan Liu, Ian Gorton, Yousu Chen and Shuangshuang Jin. 2011. "Designing a Distributed Systems Architecture Testbed for Real-Time Power Grid Systems." In *Proceedings of the Twenty-Third International Conference on Software Engineering and Knowledge Engineering (SEKE 2011)*, pp 268 - 271.

- Thomas Ferryman, Francis Tuffner, Ning Zhou, and Guang Lin, 2011 "Initial Study on the Predictability of Real Power on the Grid based on PMU Data," *2011 IEEE PES Power Systems Conference & Exposition*, March 20 - 23, 2011, Phoenix, Arizona, USA.

- Shuai Lu, Marcelo Elizondo, Nader Samaan, Karanjit Kalsi, Ebony Mayhorn, Ruisheng Diao, Chunlian Jin, and Yu Zhang, "Control Strategies for Distributed Energy Resources to Maximize the Use of Wind Power in Rural Microgrids", invited paper, *IEEE Power and Energy Society General Meeting 2011*, Detroit, Michigan, July 24-29, 2011.

- Guang Lin, Ning Zhou, Thomas Ferryman, Francis Tuffner, 2011 "Uncertainty Quantification in State Estimation using the Probabilistic Collocation Method," *2011 IEEE PES Power Systems Conference & Exposition*, March 20 - 23, 2011, Phoenix, Arizona, USA.

- B. Akyol, J. Haack, C. Tews, B. Carpenter, A. Kulkarni, P. Craig, "An Intelligent Sensor Framework for the Power Grid," *Presented at the 2011 ES Fuel Cell Conference*, Washington, DC.

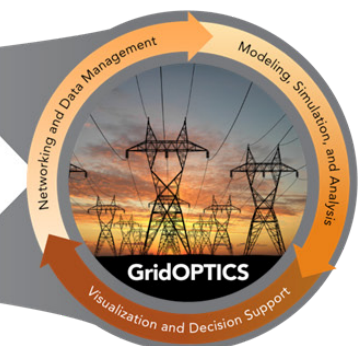Outcomes — Networking Lab and Test-Bed — TIME — Data Mgmt and Simulation — TIME — Grid Viz with Large-Scale Sim — TIME — Demo with Actual Data — TIME

Upcoming Papers

- T. Gibson, A. Kulkarni, K. Kleese van Dam, T. Critchlow, "The Feasibility of Moving PMU Data in the Future Power Grid", *Submitted to the 2011 CIGRE Canada Conference on Power Systems*, Sept. 2011, PNNL-SA-80268

- K.Kalsi, F. Chassin and D. Chassin, "Aggregated Modeling of Thermostatic Loads in Demand Response: A Systems and Control Perspective", *IEEE Conf. Decision and Control*, Orlando, FL, Dec. 2011, accepted.

- K.Kalsi, M. Elizondo, J. Fuller, S. Lu and D. Chassin, "Aggregated Thermostatically Controlled Load Models for Demand Response", submitted to *HICSS*, Jan. 2012, accepted.

FPGI FOCUS AREAS

Focus Area One addresses data networking and management issues, and enables the digital infrastructure for the future grid. This focus area will address the gaps in networking and real-time data management by developing advanced algorithms and software tools and techniques. **Focus Area Leads**: Bora Akyol (bora@pnnl.gov) and Phil Craig (philip.craig@pnnl.gov)

Focus Area Two targets research in the areas of advanced mathematical models, next-generation simulation and analytics capabilities for the power grid. Projects in Focus Area Two will use high-throughput data streams produced by projects in Focus Area One and integrate them with sophisticated mathematical models to conduct large-scale power grid simulation and analysis. Focus Area Two strives to advance the state-of-the-art in modeling and simulation in order to achieve much higher fidelity situational awareness and global comprehension for power grid stability, efficiency and flexibility. **Focus Area Leads**: Daniel Chavarria (daniel.chavarria@pnnl.gov), Tom Ferryman (tom.ferryman@pnnl.gov), and Ning Zhou (ning.zhou@pnnl.gov)

Focus Area Three aims to convert large amounts of model and sensor data into information and knowledge to support decisions in grid operation, planning, and policymaking. This area concentrates on the development of coordinated visualization interfaces and decision support capabilities in a modular, extensible software environment that can be used for both real-time grid operations as well as long-term planning. **Focus Area Leads**: Bill Pike (william.pike@pnnl.gov) and Paul Whitney (paul.whitney@pnnl.gov)

UPCOMING EVENTS

The FPGI is hosting an International Workshop on High Performance Computing, Networking and Analytics for the Power Grid at the SC11 conference in Seattle, Wash. on November 13, 2011.

ABOUT FPGI

The Future Power Grid Initiative (FPGI) will deliver next-generation concepts and tools for grid operation and planning and ensure a more secure, efficient and reliable future grid. Building on the Electricity Infrastructure Operations Center (EIOC), the Pacific Northwest National Laboratory's (PNNL) national electric grid research facility, the FPGI will advance the science and develop the technologies necessary for meeting the nation's expectations for a highly reliable and efficient electric grid, reducing carbon emissions and our dependence on foreign oil.

Contact

For more information, please visit the FPGI website **gridoptics.pnnl.gov**.

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