



TRANSFORMING GRID OPERATION AND PLANNING

Future Power Grid Initiative Newsletter

June 2013

This Newsletter brings you an update on the FPGI Annual Review and the panel discussion with FPGI Advisors that took place in Richland on May 7. Also, VOLTRON™ was presented at the AAMAS conference.

EXPERT PANEL DISCUSSED FUTURE POWER GRID AT PNNL

Eight leaders of the energy field discussed their visions for the power grid of the future during a panel discussion hosted by PNNL's **Future Power Grid Initiative** (FPGI). The panelists are all members of the advisory committee for FPGI, PNNL's internally funded drive to develop next-generation concepts and tools for grid operation and planning to ensure a more secure, efficient and reliable future power grid.

The panel, consisting of leading experts from PJM, Alstom Grid, AEP, WSU, UW, North Carolina State University, and PNNL, addressed the emerging structure of today's power grid and talked about research needs to fulfill the promise of a smart and resilient future grid. Technology had come a long way, but the deployment of millions of new devices also brought new challenges to the grid. "We need to come up with a new control system that combines the emerging local system with its distributed generation, storage and new loads and the existing centralized system," said Jianzhong Tong, Senior Strategist at PJM. Commenting on the increasingly large and complex network, characterized by the merging of information technology and grid infrastructure and operation, Tong called for new control paradigms that reflected the changing grid with its growing amount of distributed generation and dispatchable loads.

Another challenge the panel discussed was the current state of regulation. PNNL's Electricity Market Sector Manager Carl Imhoff illustrated that with high transmission congestion costs and the inability to recoup costs through real time pricing, ISOs were having a harder time managing the grid in this constrained environment. What was needed were additional mechanisms, such as transactive control, that could relieve the grid in times of peak demand and work in both regulated and deregulated markets.



FPGI Advisory Committee members Scott Moore (AEP), David Sun (Alstom Grid), Chen-Ching Liu (WSU), Jianzhong Tong (PJM), and Frank Mueller (NCSSU)

Yet the power system community was also in an incredible sweet spot, commented Chen-Ching Liu, Boeing Distinguished Professor of Electrical Engineering at Washington State University. He emphasized the importance of self-healing capabilities for our future power grids. After decades of neglect, the nation was now paying close attention to a safe, secure and efficient power grid. Although there is a concern that the Recovery Act funding was drying up, encouraging changes could be seen in several fields, such as higher student enrollment in power engineering at universities.

With an eye towards the future, the panel discussed drivers of innovation. Scott Moore, AEP's Vice President of Transmission Engineering & Project Services, noted that as loads were declining, R&D that usually is tied to grid operators' bottom line was reduced as well. Moreover, as FERC rule 1000 was implemented, increased competition on the transmission side would further drive down costs, which could increase the reductions in R&D spending. On the distribution side, however, Moore was cautiously optimistic, since new FERC rules allowed cost recovery for specific resiliency related projects. David Sun, Chief Scientist at Alstom Grid, sees the driver of innovation in the end user of the technology. "We have spent a lot of time making devices smarter. But let's not forget that the key to smart grid innovation will not come from new devices, but come from its users- the consumers. Just like with cell phones, consumers will drive the direction where the market is going."

On a more technical level, Frank Mueller, Professor for Computer Science, at North Carolina State University's Center for Embedded Systems Research and High Performance Simulations, described how computer networks needed to follow the microgrid and islanding model to prevent loss of connection, and loss of power to infrastructure. Distributed grid intelligence could be achieved by embedding devices across the network; from inexpensive switches to smart commodities plugs.

The panel concluded that in times of uncertain research funding, industry, academia and national laboratories needed to closely collaborate to ensure that resources were spent wisely. Only then could the promise of a grid evolution leading to a highly resilient, flexible and green future grid will be fulfilled.

VOLTTRON™ PRESENTATION AT THE AAMAS CONFERENCE

FPGI Focus Area one's Jereme Haack and Brandon Carpenter presented **VOLTTRON**, FPGI's platform for deploying intelligent agents to do decentralized cooperative decision making, at **2013 Autonomous Agents and Multiagent Systems conference (AAMAS)** in Saint Paul, Minnesota. Haack and Carpenter successfully demonstrated the capabilities of **VOLTTRON** throughout the conference, which is considered the flagship conference on agents. The team is also testing **VOLTTRON** to conduct EV charging experiments at the **PNNL Lab Homes**, two custom factory-built energy research homes on the PNNL campus.

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 Harold Kirkham (harold.kirkham@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:** David Callahan (david.callahan@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 Lead:** Paul Whitney (paul.whitney@pnnl.gov), and Jodi Obradovich (jodi.obradovich@pnnl.gov)

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.

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