



TRANSFORMING GRID OPERATION AND PLANNING

Future Power Grid Initiative Newsletter

February 2015

FPGI: LIFE BEYOND 2015

As Initiative Winds Down, Efforts Increase to Position GridOPTICS™ for Future Success

The Future Power Grid Initiative (FPGI), now in its final year as a Pacific Northwest National Laboratory (PNNL)-funded research effort, will officially conclude in September. However, in many ways, the work to fully realize the initiative's potential is just beginning.

“FPGI has made excellent progress on its objectives. Since the initiative's launch in 2011, our team has performed groundbreaking research and delivered new grid tools. Much of our core product, the GridOPTICS™ capability suite, has been completed,” says **Henry Huang**, initiative co-lead. “In addition to wrapping up our remaining research projects this year, we are incorporating a stronger external focus that will help move GridOPTICS™ from the laboratory to the marketplace and broader use.”

Toward this purpose, initiative leadership has formulated and now is implementing a transition plan, led by FPGI's **Jennifer Hodas**.

“We're currently identifying potential new partnerships, funding opportunities and other approaches that will help us

achieve our goal of advancing the use of GridOPTICS™ tools in research organizations and industry,” Jennifer explains. “We're convinced the capabilities we've developed through FPGI will improve grid operations and planning for the nation.”

The transition, she notes, also will include an increased emphasis on community building, communications and marketing. The community building aspect involves formation of a group of GridOPTICS™ users and advocates to move the capability suite to broader use and promote post-FPGI development.

To date, FPGI has completed 14 research projects, with four remaining. The initiative has successfully created novel technologies—including open-source software—that have been used in a variety of government and industry projects. FPGI also has sponsored prominent grid analytics workshops designed to advance community building and technology in the field.

Interested parties who want to learn more about opportunities to engage with FPGI can contact **Henry** or **Jennifer**. For more information on FPGI milestones and accomplishments, see the [At a Glance flier, 2014 GridOPTICS™ brochure](#), and the [FPGI-GridOPTICS™ web page](#).



FPGI has successfully conducted several demonstrations that show how GridOPTICS™ tools can be integrated to improve grid operations and planning. Moving GridOPTICS™ toward broader use is a key objective in 2015.

VOLTTRON™ SUPPORTS TRANSACTIVE CONTROL PROJECT

Technology Serves as Platform in Effort to Enhance Future Smart Grid Research and Pilots

FPGI's VOLTTRON™, a distributed control and sensing software platform, is at the heart of a project that's advancing transactive control, a key element of a smart grid.

In the project, QualityLogic, an Idaho-based firm, is applying the transactive control technology that initially was developed and implemented in the Battelle-led Pacific Northwest Smart Grid Demonstration Project (PNW-SGDP). The PNW-SGDP is a U.S. Department of Energy-sponsored

regional endeavor that tested smart grid technologies and concepts and will conclude later this year.

Transactive control enables users and suppliers of electricity to effectively negotiate electricity cost and consumption, a dynamic that helps improve overall grid operation, reliability, and cost-effectiveness.

In this update project, QualityLogic is using VOLTTRON™ as the underlying platform to implement a transactive control "node" based on the PNW-SGDP design. Nodes are locations on the grid at which power flow, consumption and/or constraints can be managed. Essentially, VOLTTRON™'s role in the

project is to supply virtual "agents" to carry out specific tasks within the node.

The new implementation will provide industry with a common platform for transactive energy research and pilots. It reflects improvements learned from the demonstration project, as well as QualityLogic's longstanding experience in using smart grid standards for incentive and load information exchange and asset control.

The project is expected to be completed later this spring.

More information on [VOLTTRON™](#).

UPDATED GridPACK™ OFFERS NEW FEATURES

Additions Expand Software Framework's Capabilities

Version 2.0 of GridPACK™ has been released.

GridPACK™ stands for Grid Parallel Advanced Computational Kernels. It's an open source software framework that takes advantage of advanced computing and simplifies the development of power grid simulation programs.

Although created by FPGI, GridPACK™ has garnered funding for its ongoing development from the DOE Office of Electricity Delivery and Energy Reliability's Advanced Grid Modeling program. GridPACK™'s initial release was in November 2013.

Version 2.0's features include:

- » an interface that accommodates the popular Fortran programming language, broadening the base of potential users
- » two additional applications that demonstrate how GridPACK™ can be used to create parallel power grid simulations. These include a massive contingency analysis code that can assess the effect of different failures in the system, and a state estimation program (an assessment of how the grid is operating at any point in time, which informs operation decisions)

- » modules and performance enhancements that support new types of calculations.

Continued investment by DOE in GridPACK™ over the next three years will support collaboration among other national laboratories to make additional high-performance libraries and algorithms available to the broader power grid community.

See the [GridPACK™](#) page for more information.

NEW FPGI FLIER OUTLINES INITIATIVE PROGRESS

Visual Approach Offers “By the Numbers” View of Outcomes

A new flier, “Future Power Grid Initiative At A Glance,” offers a quick overview of FPGI progress and accomplishments. The document was completed in January and is [posted](#) on the FPGI website.

In addition to a brief history of the initiative and timeline, the flier provides a variety of “by the numbers” factoids and statistics. These include a listing of initiative publications and presentations, summaries of FPGI open source software, intellectual property statistics and an overview of external collaborations and support for FPGI activities.

“Our objective with the flier was to create a medium for a wide range of audiences that quickly and succinctly communicates the accomplishments of FPGI, the progress that has been made in establishing GridOPTICS™, and new technologies that are available to the grid community,” says Jennifer Hodas, FPGI’s commercialization manager.

Future Power Grid Initiative At A Glance

OVERVIEW
 PNNL's Future Power Grid Initiative (FPGI) is developing data-driven solutions to manage the nation's increasingly complex power grid. Since 2011, FPGI research in data management, simulation and visualization has advanced new tools that help power system operators, planners and policy makers effectively comprehend and utilize the future grid. The initiative's family of tools is collectively known as GridOPTICS™ (Grid Operation and Planning Technology Integrated Capabilities Suite). GridOPTICS™ provides capabilities to address three "bottles" occurring today between grid and data networks; transmission and distribution networks; and operations and planning systems with markets.

HOW FPGI SHARES ITS RESEARCH

- 77 national and international presentations
- 38 publications/conference papers
- 3 technical reports
- 1 book chapter
- 3 videos

8 Workshops
 Attended by research, industry, and academia:
 3 Next-Generation Analytics Workshops
 3 High-Performance Computing Workshops
 2 Software-Engineering Challenges Workshops

Net Interchange Scheduling tool reduction of error in energy forecasts: **65%**

Year 1
 Three research focus areas defined: 1) Networking and Data Management, 2) Modeling, Simulation and Analysis, and 3) Visualization and Decision Support.
 Nine projects initiated in support of the three focus areas.

Year 2
 Four new projects initiated to address three power grid foci:
 - GridOPTICS™ tool suite concept framed
 - VOLTRON™ distributed control/sensing platform developed
 - powerNET power system communication testbed developed

Year 3
 Three new projects initiated in support of GridOPTICS™ development:
 - FPGI conducts two Next-Generation Grid Analytics workshops
 - Framework for Network Co-Simulation (FNCS) developed

Year 4
 - GridPAC™ software framework receives DOE funding
 - GridOPTICS™ Software System (GOSS) middleware developed
 - FPGI conducts third Next-Generation Grid Analytics workshop

Year 5
 Four ongoing projects:
 - Focus on efforts to transition GridOPTICS™ to broader use
 - GridPac 2.0 released

GRIDOPTICS™ SOFTWARE SYSTEM (GOSS)
 GOSS facilitates data exchange and enables interoperability for development and deployment of new applications for the future grid. <https://github.com/epri/GOSS>

FNCS
 The Framework for Network Co-Simulation (FNCS) is a federated co-simulation platform that merges communication simulator with distribution and transmission simulators. <https://github.com/epri/FNCS>

PROPERTY SNAPSHOT
 Shared Perspectives: When combined and demonstrated with other FPGI-developed tools, Shared Perspectives allows simultaneous and selective sharing of information between two different entities. This is expected to provide a key resource for effective communication, collaboration, and coordination among electric utilities.

EXTERNAL SUPPORT FOR GRIDOPTICS™ TOOLS
 Non-FPGI funding, obtained from government and other clients, for use or development of GridOPTICS™ tools.

Key Partners:
 IncSys
 Lawrence Berkeley National Laboratory
 NERC Reliability Coordinator Working Group
 Northrop Grumman
 Oak Ridge National Laboratory
 PJM Interconnection
 South East European Research Centre
 The Ohio State University
 Transformative Wave
 University of Illinois at Urbana-Champaign
 Virginia Tech
 Washington State University
 Yale University

For more information, please visit the GridOPTICS™ website or contact:
 Henry Huang | zhenyu.huang@pnnl.gov or Jeff Dagle | jeff.dagle@pnnl.gov
gridoptics.gov

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VIDEOS HIGHLIGHT FNCS, GOSS

New informational videos for two GridOPTICS™ tools are now available on the FPGI web site.

“Introducing FNCS: Framework for Network Co-Simulation,” and “GridOPTICS™ Software System—A Middleware Framework for the Power Grid,” were completed in September 2014. The videos provide an overview of each technology, including basic information about architecture and features.

The two videos—and others—are available on the [FPGI Videos](#) web page.

PAPERS SOUGHT ON HPC APPLICATIONS FOR THE GRID

FPGI’s Henry Huang and the University of Toronto’s Zeb Tate will serve as Guest-Editors-in-Chief for a special issue of IEEE Transactions on Smart Grid focused on High Performance Computing (HPC) Applications for a More Resilient and Efficient Power Grid.

The publication provides a good opportunity to publish work relevant to HPC, which in this context is defined as parallel computers ranging from small

to medium to large scales of different kinds (shared memory, clusters, cloud computing, etc.).

The deadline for extended abstract submission is February 13. For information about relevant topics, the submission process and important dates, see the Call for Papers (<http://gridoptics.pnnl.gov/docs/CFP-TSG-HPC-Grid-Huang.pdf>). Questions may be directed to Henry or Zeb.

ABOUT FPGI AND GRIDOPTICS™

The **Future Power Grid Initiative** (FPGI) was established in 2011 by Pacific Northwest National Laboratory and is delivering next-generation concepts and tools for grid operation and planning to help ensure a more secure, efficient and reliable future grid. FPGI builds upon PNNL's pre-eminent grid expertise and resources such as the Electricity Infrastructure Operations Center (EIOC), a national electric grid research facility.

When the initiative concludes in 2015, its key product will be the **Grid Operation and Planning Technology Integrated Capabilities Suite** (GridOPTICS™), a set of tools that

will facilitate secure data collection and management in real time, use data to drive modeling and simulation, and convert large volumes of data to actionable information. The result will be the ability to show and analyze grid performance at an unprecedented speed, scale, and resolution, supporting operational and policy decision-making for the grid of the future. A primary emphasis of FPGI is on transitioning GridOPTICS™ tools to open-source status and creating a community of advocates that will promote use and further development.

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Past Newsletters

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Contact

For more information, please visit the FPGI website gridoptics.pnnl.gov or contact Initiative Leads

Henry Huang

Tel: (509) 372-6781

zhenyu.huang@pnnl.gov

Jeff Dagle

Tel: (509) 375-3629

jeff.dagle@pnnl.gov

Tim Ledbetter

Communication Lead

Tel: (509) 375-5953

tim.ledbetter@pnnl.gov

Pacific Northwest
National Laboratory
P.O. Box 999, K1-85
Richland, WA 99352

www.pnnl.gov

