

VSoE Research Innovation Fund (RIF) Report

The 2011 Distinguished Speaker Series on *Innovation in Energy Informatics*

Viktor K. Prasanna and Yogesh Simmhan

Summary

Energy sustainability is a critical, global mission that has economic, social and security implications. This process is occurring through a combination of consumer behavior, improved flexibility of utilities in power management, and favorable government policies. Achieving sustainability and leadership in the energy economy poses challenges for research in diverse areas. While these are obvious for engineering disciplines, the rapid rollout of smart grids makes information collection, integration, management, analysis and control of energy assets of vital importance. This area of Energy Informatics research, spearheaded by the *USC Center for Energy Informatics (CEI)*, applies novel IT practices for complex problems in the energy domain. One of its landmark projects is investigating software architectures for demand response in the DOE-sponsored Los Angeles Smart Grid project, one of the largest of its kind.

A distinguished speaker series, sponsored by a VSoE RIF award, was hosted by CEI to accelerate innovation in this inter-disciplinary space by creating opportunities for interaction between leaders in the domain, members of the center as well as faculty in various departments of the School. The series invited six high-profile leaders, three from academia, two from industry and one from a national lab, during the course of the 2011 calendar year. Their expertise cut across computer science research, smart grid operations, and theoretical energy models. RIF funds were used towards travel, boarding and lodging expenses of the speakers, and for refreshments at the venue. The list of speakers and the abstracts of their talk are posted on cei.usc.edu/news, and briefly summarized here.

Series Speakers and New Outcome

Prof. K. Mani Chandy, Professor, California Institute of Technology (February 25, 2011)

Prof. Chandy is the Simon Ramo Professor and Deputy Chair of Engineering and Applied Sciences at the California Institute of Technology in Pasadena, California. His talk on “*Uncertain, Intermittent Power: Hurdles in reaching President Obama’s Goal of 80% Renewable Energy by 2035*” explored the challenges posed in reaching an energy economy based primarily on wind and solar power due to intermittent power and uncertainty in predictions.

Dr. Tariq Samad, Corporate Fellow, Honeywell Automation and Control Solutions (March 9, 2011)

Dr. Samad is a Corporate Fellow with Honeywell and represents Honeywell on the Global Carbon Capture and Storage Institute, and the Governing Board of the U.S. Smart Grid Interoperability Panel. His talk on “*Technology Developments and R&D Challenges for Smart Grid Applications in Homes, Buildings, and Industry*” discussed the value of end-use sectors to achieve the promised benefits of smart grids, including reduction of electricity consumption, load shifting, and improved grid reliability.

Dr. Michael Chertkov, Los Alamos National Lab (April 5)

Dr. Chertkov joined LANL as a J.R. Oppenheimer Fellow in the Theoretical Division, with interests in theoretical problems in power systems, statistical and mathematical physics and

information theory. His talk on “Models, Optimization and Control of Collective Phenomena in Power Grids” reviewed the basics of power flows, and outlined several new problems in modeling, optimization and control theory for smart grids beyond the scope of the traditional power engineering.

Prof. Satoshi Matsuoka, Professor, Tokyo Institute of Technology (May 23, 2011)

Prof. Matsuoka is a full Professor at the Computing Center of Tokyo Institute of Technology, and leader of TSUBAME supercomputers, the 4th fastest and “Greenest Production Supercomputer in the World”. His talk on “*TSUBAME2.0 – Hybrid Petascale Computing in Practice*” investigated unique features of HPC research that went into its construction, especially for improving bandwidth scalability, fault tolerance, and green-ness, using latest hardware like GPU and SSD.

Dr. Dan Reed, Corporate Vice President, Microsoft (September 14, 2011)

As corporate vice president of the Technology Policy Group, Dr. Reed helps shape Microsoft’s long-term vision for technology innovations and the company’s associated policy engagement with governments and institutions around the world. His talk on the “*The 21st Century Energy Ecosystem*” explored our transition to an exciting new world of more nimble energy management, intelligent transportation systems, and computing systems whose loads follow the sun and wind, with a survey some of our opportunities and challenges.

Prof. Jack Dongarra, University of Tennessee, Oak Ridge National Laboratory, and University of Manchester (March 19, 2012)

Prof. Dongarra specializes in numerical algorithms in linear algebra, parallel computing, use of advanced-computer architectures, programming methodology, and tools for parallel computers. His talk on “*On the Future of High Performance Computing*” examines five areas of research that will help define thinking of software and algorithms for Peta and Exascale Computing: Redesign of software to fit multicore and hybrid architectures, Automatically tuned application software, Exploiting mixed precision for performance, The importance of fault tolerance, and Communication avoidance.

The series has helped the Viterbi community learn about the cutting-edge work in the energy informatics space and helped identify interdisciplinary research. The public nature of the seminars and wide publicity made them accessible to the broader USC community. Individual meetings between faculty and their graduate student research teams with the visitors have provided a discussion forum to showcase the research activities of the departments and the center. Dinner hosted select faculty have created opportunities to network, build collaborations and identify funding opportunities with the distinguished speakers, who would otherwise have been hard to bring to campus but for the RIF award.

New Directions and Continued Impact

We will continue this series through Fall 2012 and invite additional speakers to further broaden the theme to incorporate other facets of energy informatics such as system design, IT infrastructure and policy. We also plan to invite key program officers from NSF, DOE and DARPA to visit the campus given the heightened interest in energy efficiency and cyber physical systems. While we have seen active participation by and interactions with students, researchers and faculty in Civil and Environmental Engineering, Computer Science and Electrical Engineering, we will continue offer a broad base of speakers to encourage interactions with other departments including the School, HPC Center and ISI.