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Electrical and Computer Engineering at Illinois Institute of Technology

Engineering Outlook

New Faces in the ECE Field

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ALSO IN THIS ISSUE:

- Coordinating Renewable Resources
- Urban Crisis Management Through Wireless Networks
- Implantable Safety Devices for Active Seniors
- Exacting Sports Stats and Smart Skin for Aircraft

Coordinating Renewable Resources
Wind, Hydro, and Gas Working Together for More Affordable Power and Better Security

THE ELECTRIC POWER INDUSTRY IS A MAJOR CONTRIBUTOR TO CARBON DIOXIDE (CO_2) PRODUCTION, WHICH FUELS GLOBAL WARMING. AS A COUNTRY, WE KNOW WE NEED TO INCREASE PRODUCTION OF LOW-EMISSION OR EMISSION-FREE ENERGY TO REDUCE CO_2, BUT THE QUESTION REMAINS, WHAT IS THE BEST WAY TO DO IT?

Most renewable energies are abundant, but only wind energy is currently economical and easy to harness. Wind energy is safe, clean, and has demonstrated a prosperous future of development. The addition of renewable wind energy into the electricity systems would enhance the social sustainability of the nation's energy infrastructure.


Zuyi Li

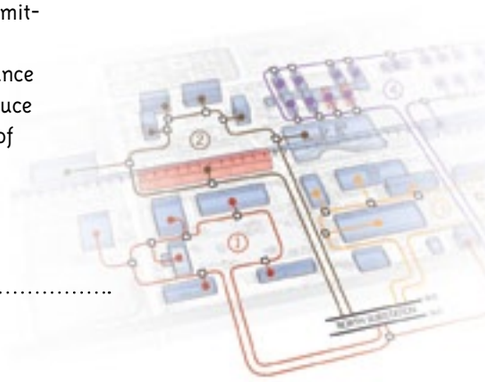
However, wind energy is considered a "non-firm" resource because of its intermittency, meaning it is not available continuously throughout the day, and because of its volatility, meaning when it is available it may only last a few minutes or stay steady for hours. The intermittent and volatile nature of wind power generation could impact power system voltage and frequency, so more reserves must be allocated to guarantee the operational reliability of the system. The combined effect of intermittency and volatility of wind could also increase security risks in the United States electricity infrastructure.

Electrical and computer engineering professors Mohammad Shahidehpour and Zuyi Li are developing an efficient way of "firming up" wind power generation through hydro-wind-gas coordination in hydrothermal power systems. This means coordinating the schedule of wind power units with nearby hydro-generating units, including conventional and pumped-storage units, and natural gas-fired combined-cycle generating units.

When water is available, hydro-generating resources will be the first to coordinate with wind power generation due to its low cost, fast response, and emission-free features. More water will be discharged when the wind blows slowly and less water will be discharged when the wind blows fast. When water is not readily available, gas-fired units with their fast response and low-emission features provide an indispensable complement to wind power generation. With proper placement and configuration, gas-fired units can operate flexibly to follow the wind pattern and firm up the aggregated power output.

The electric power grid [upper] and the natural gas grid [lower] can be cross referenced to pinpoint the best locations for coordinating renewable resources.

The outcome of this federally funded initiative could be applicable to other renewable intermittent and volatile energy forms, such as solar energy. Implementation will ultimately enhance the operation of stressed power systems, reduce the chance of blackouts, lower the emission of greenhouse gases, and improve the nation's overall energy security and sustainability.



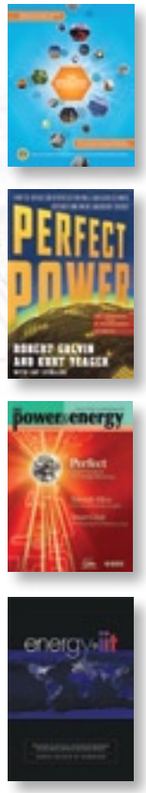
Perfect Power **Update**

Illinois Institute of Technology's Department of Electrical and Computer Engineering hosted the Perfect Power opening ceremony in November 2008, marking the first of the improvements to be made during the next five years. IIT partnered with the Galvin Electricity Initiative to convert IIT Main Campus into the flagship Perfect Power system in the United States. The Department of Energy (DOE) has also joined the effort, providing a $7 million grant to be paired with IIT's $5 million investment, totaling $12 million to fund the project. ECE Department Chair Mohammad Shahidehpour, professors Alex Flueck, Zuyi Li, and Chi Zhou, and more than 60 independent experts are building the system at IIT.

IIT was featured in *The Smart Grid: An Introduction*, a U.S. Department of Energy publication available online at www.oe.energy.gov/1165.htm.

Siegel Hall, home to the ECE department at IIT, was featured in the book *Perfect Power* by Bob Galvin and Kurt Yeager.

Several articles in the November/December 2008 issue of *IEEE Power & Energy Magazine* featured Perfect Power at IIT.



More information on ECE energy initiatives including Perfect Power is available in the *energy@iit* online magazine at **www.ece.iit.edu.**