Advancing Wind Power in Illinois Conference 2011

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IIT Wind Consortium Project
Plenary Session

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Illinois Institute of Technology

IIT MICROGRID
A NEW HUB IN EENERGY INFRUSTRUCTURE

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The Interconnection

Edison designed the entire electrical system down to the wall outlet, and in 1881 established the first electric power company.

In the 1930s, isolated power systems melded into interconnected systems.

In the 1950s and 1960s, isolated systems were converted to large regional pools.

- bulk delivery over long distances
- originated at large generating plants

With economies of scale, prices declined and demands increased.

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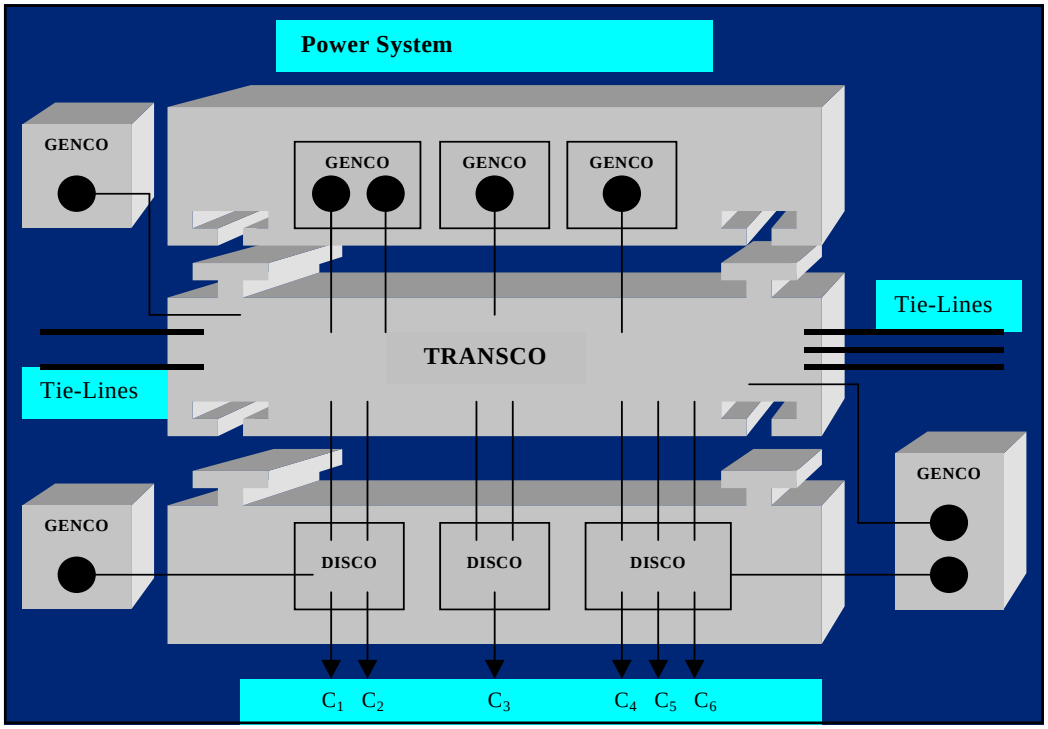


Electricity Infrastructure

Supply Adequacy and Economics: Applications of renewable energy, storage technologies for enhancing the security, coordination of renewable and storage supplies, carbon footprints

Transmission Expansion and Security: Expansion planning of transmission facilities, coordination of energy infrastructures, superconductors, HVDC, physical and cyber security, wide area measurements, PMUs

Smart Grid: Energy efficiency, price response, peak load reduction, distribution automation, new building technologies, smart metering, sensors, communication and control techniques

What is a Smart Grid?

Smart grid is a response to economic, security, and environmental mandates placed on energy supply and delivery

Smart grid provides access points that can be identified, much like computer devices, with an IP address on the internet

Smart grid uses the internet protocol to shuttle information back and forth between the utility and customers

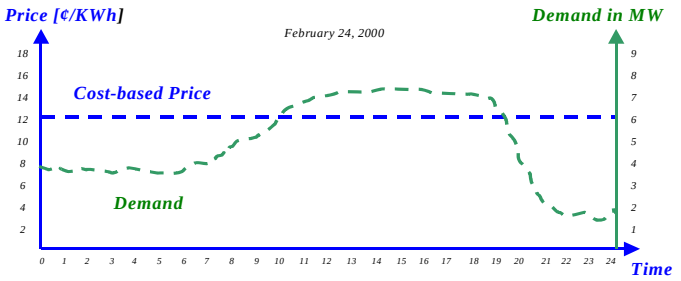
With two-way communications between consumers and suppliers, both parties can get far more control over the grid consumption, and physical and cyber security

Consumer's Dilemma

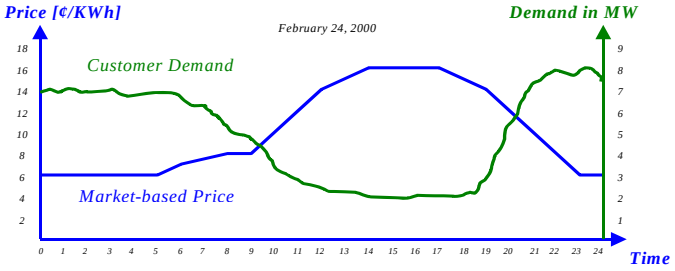
Today, most consumers know little about costs that show up on their electricity bills except that they are higher during hot and cold months

Few consumers realize that the true price of electricity varies continuously in response to supply and demand, and that electricity bills are mostly calculated based on average prices

Since consumers do not adjust energy use in response to high prices, they are likely to use electricity at peak hours more than what they need to — and thus pay more than what they would have to



Behavior of a Demand in a Vertically integrated Power Market



Response of a Demand to Price Signals

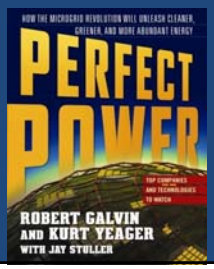
Microgrid at Illinois Institute of Technology

Funded by the U.S. Department of Energy ($12M)

Located at Illinois Institute of Technology (IIT)

Involves the entire campus

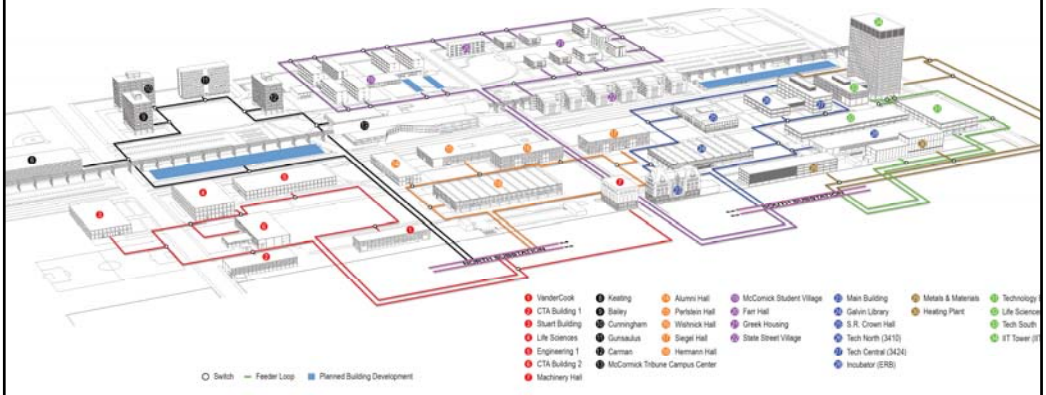
Partners: IIT, Exelon, S&C, Schweitzer, Endurant, Siemens, Eaton



"The perfect power system will ensure absolute and universal availability of energy in the quantity and quality necessary to meet every consumer's needs. It is a system that never fails the consumer." Bob Galvin

Perfect Power at Illinois Institute of Technology

In 2008, Illinois Institute of Technology (IIT) entered into a $12 million partnership with the Department of Energy to build the first-ever Perfect Power microgrid.



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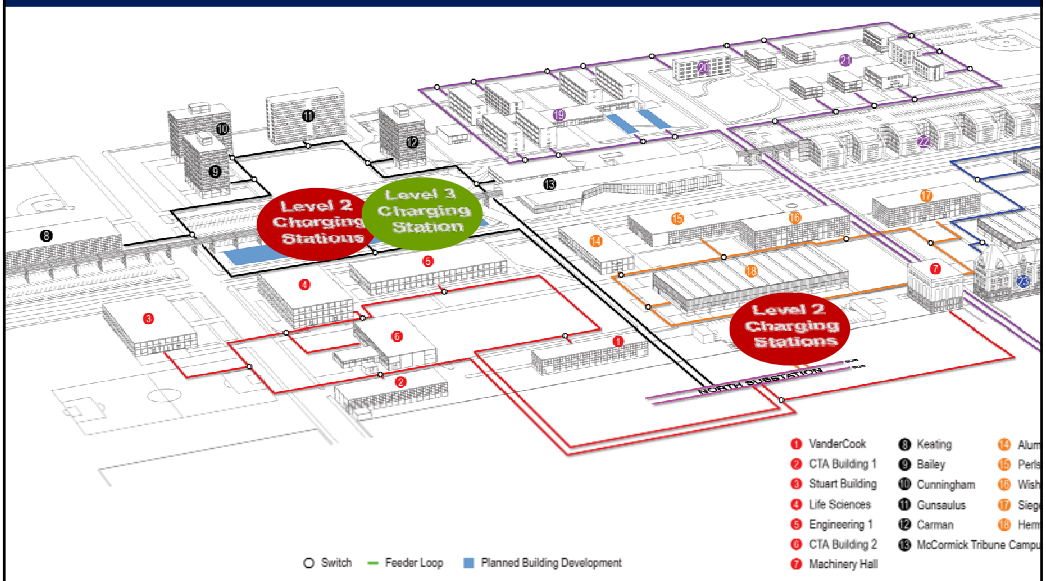
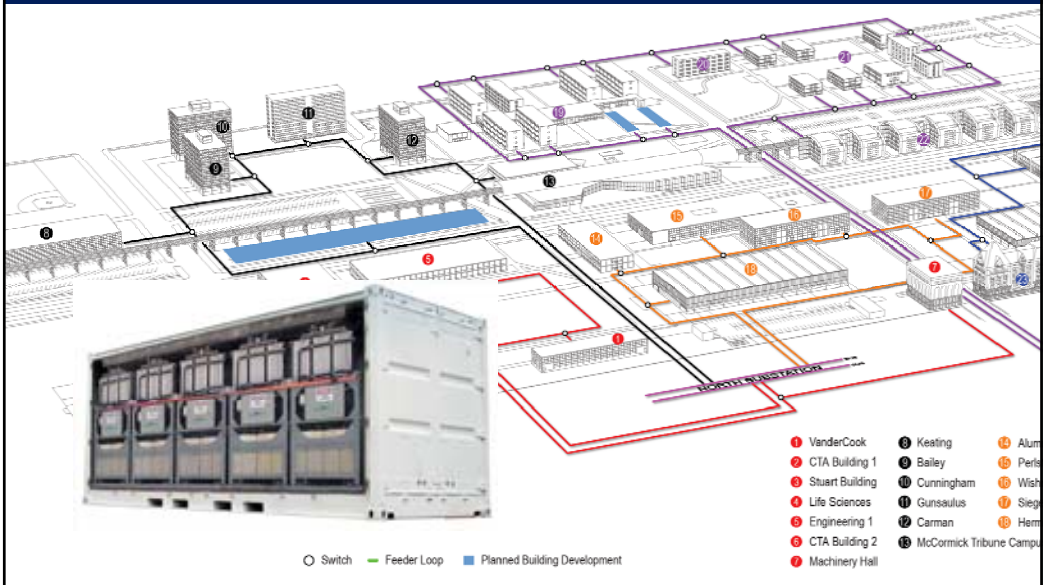
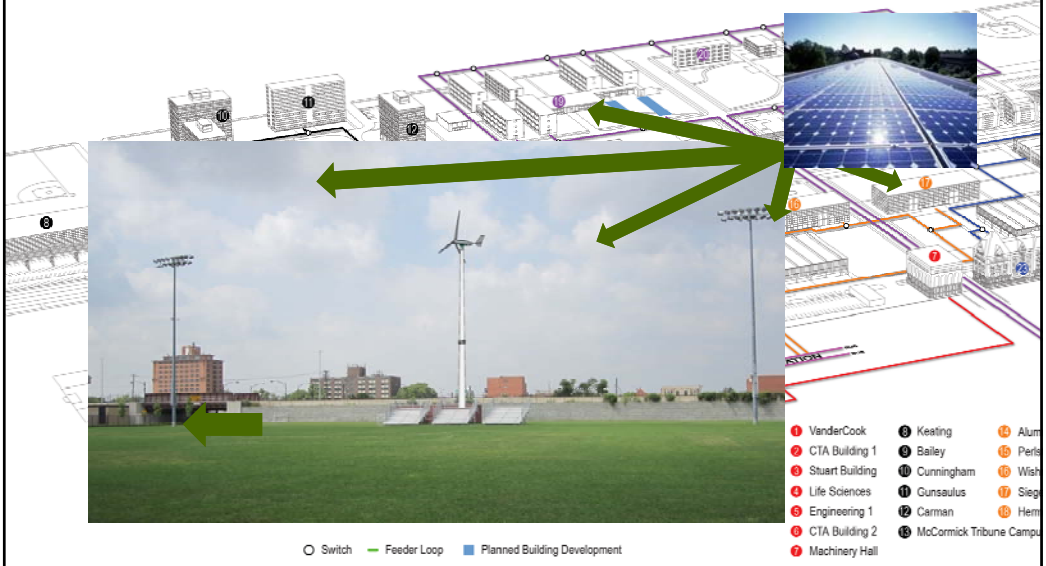
Microgrid | Electric Vehicle Charging Stations



Microgrid | Energy Storage



Microgrid | Renewable Generation



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Microgrid | Distributed Roof-top Solar

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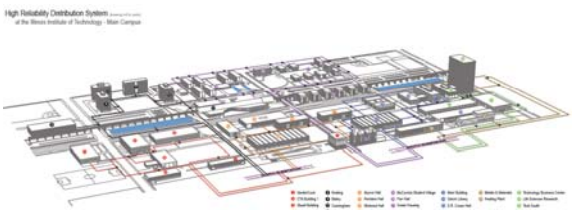
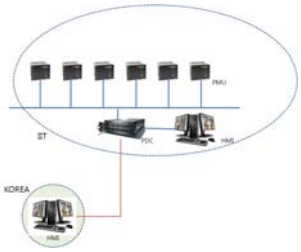
Microgrid | Local Area Monitoring System

Campus Microgrid
Illinois Institute of Technology



Smart PMU



- PMU Demonstration for microgrid application
- LAMS for Campus Microgrid field test
- Enlarge PMU application field & Enhance microgrid technology

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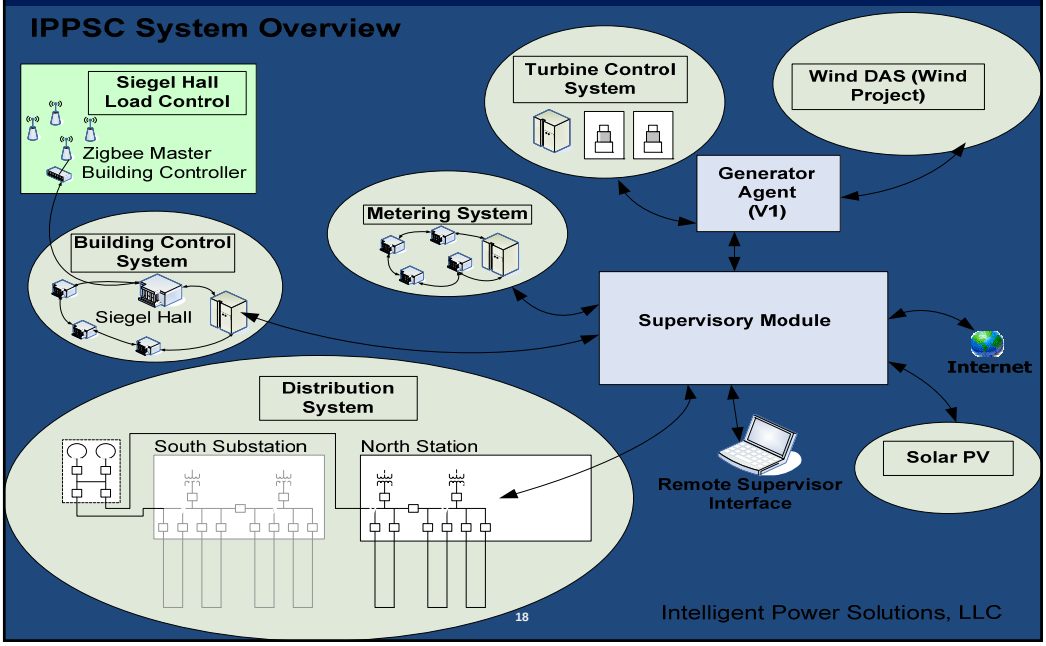
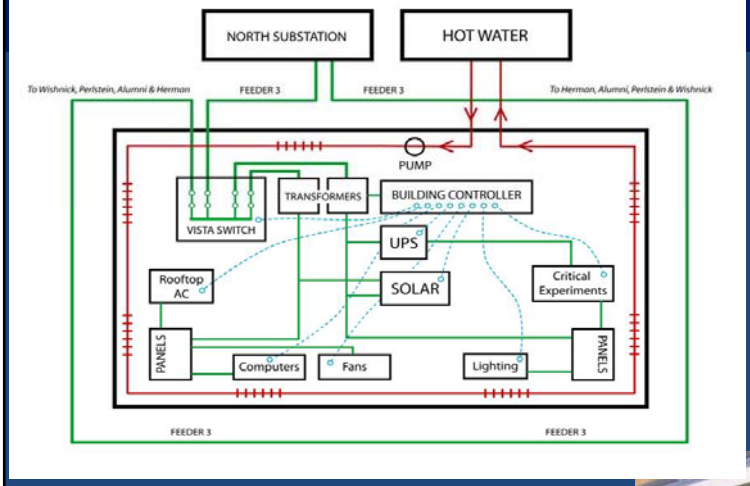
Microgrid | Intelligent Perfect Power System Controller





Why would IIT Need a Microgrid?

At least three power outages per year

- Costs = up to $500,000 annually in restoration costs, lost productivity and ruined experiments

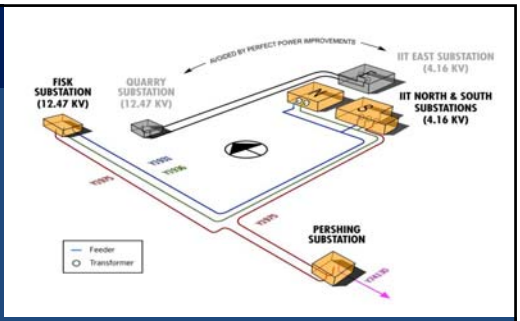
Addition of two new resident halls require more power

Campus electricity infrastructure would need to be upgraded

Electricity demand is growing with increased student population

Installation of additional building equipment adds to energy use

Benefits of IIT Microgrid



Efficiency in campus electricity use

- 50% peak demand reduction
- 20% permanent demand reduction

Improved resilience to disasters

- Demonstration of the value of perfect power
- Cost avoidance and savings in outage costs
- Deferral of planned substations

Replicable in larger cities and municipalities

Living Laboratory for the promotion of energy efficiency in cleaner cities

Reduced energy costs

Reduce carbon footprint

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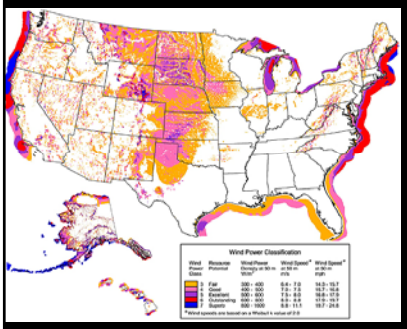
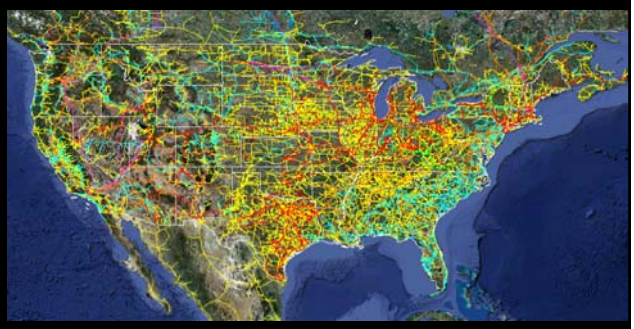
IIT | Consortium for Wind Energy Research & Education

Stuart Field Looking West

IIT | Wind Integration and Infrastructure Planning





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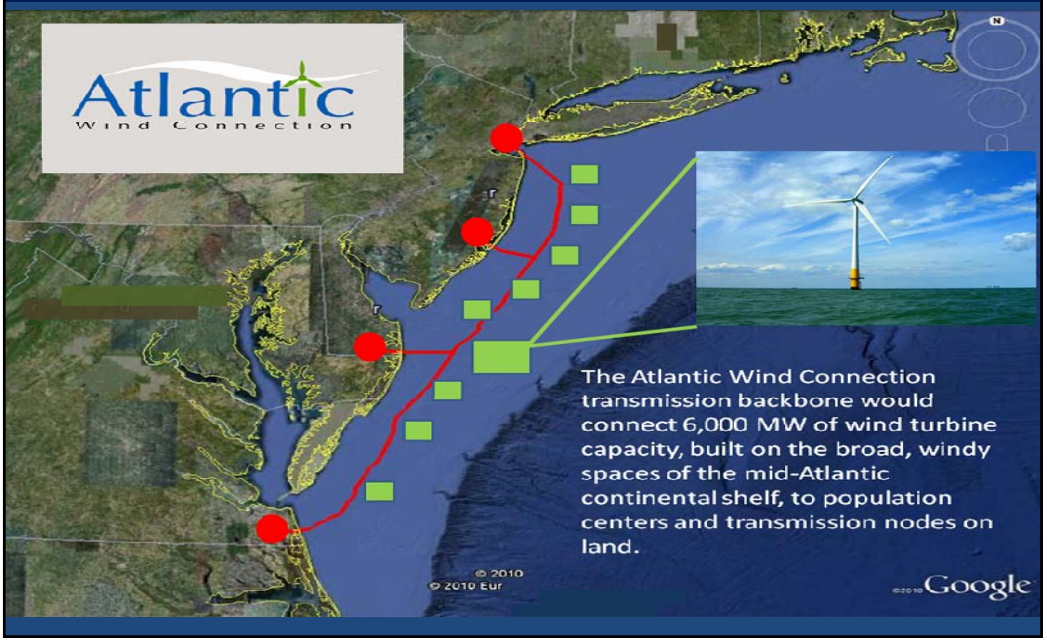
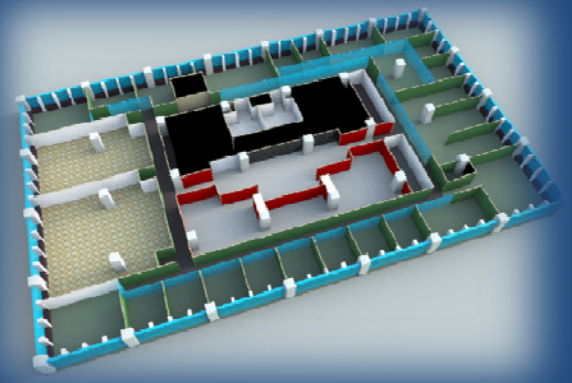
IIT | Offshore Wind Infrastructure Planning



IIT | Smart Grid Workforce Education and Training Center

A $12.6 million project at IIT , supported by the U.S. Department of Energy and the State of Illinois, to educate and train the nation's workforce to meet the global challenges and opportunities of the smart grid.



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Illinois Smart Grid Regional Innovation Cluster

IIT is helping lead the development of an innovation platform for Smart Grid technology that recently was awarded $600,000 from the Small Business Administration.

The Cluster will provide technical and business support to speed new Smart Grid technologies on the path to commercialization.

www.SmartGridCluster.com

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DoD Microgrid

Using its strong set of research, test-bed and technology innovation assets, the Center will serve DoD goals by:

1) Identifying, validating and certifying emerging, battlefield-ready micro grid technologies.
2) Accelerating new military micro grid technology development.
3) Providing sustainment training for DoD personnel.

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