

## IPUMSU

MICHIGAN STATE UNIVERSITY | INSTITUTE OF PUBLIC UTILITIES Regulatory Research and Education  
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# IPU Power Grid School 2019

April 29-May 1, 2019

*IPU Power Grid School covers the engineering and economics of the modernization and transformation of electric utility systems across the supply chain for power, from generation to transmission to distribution.*

## Program Agenda

### Sunday

1:00-5:00 pm **Introduction to Public Utility Regulation [Beecher]**  
240 min.  
Kellogg Center – Riverside Room (downstairs)  
Optional preconference program (separate registration is required).  
Recommended for those relatively new to public utility regulation.

### Monday

7:30-8:30 am **Registration and Breakfast**  
A full breakfast is provided daily at 7:30 am in the Riverside Room (downstairs).  
Daily networking breaks are at 10:00 am and 3:00 pm.

8:15-8:30 am **Welcome and Introductions [Beecher]**  
15 min.  
Kellogg Center – Riverside Room – all sessions

8:30-10:00 am **Fundamentals of Power Systems and Grid Infrastructure Part 1 [Mitra]**  
90 min.  
Characteristics of electric power components and systems. Transmission and distribution systems; distributed resources and microgrids. Interconnected systems and balancing authorities. Interconnection standards and interoperability. Island systems. Line losses.








10:30 -12:15 pm **Fundamentals of Electricity Markets, Economics, & Regulation Part 1 [Rose]**  
105 min.  
Wholesale market structure, operation, economics, and pricing. Role of private, nonprofit, and public power. Regulatory jurisdiction and coordination for generation, transmission, and distribution. FERC regulation and key rulings. Grid access and the Public Utility Regulatory Policies Act (PURPA). Climate change and carbon regulation.

12:15-1:30 pm Lunch at the Brody Hall Cafeteria (voucher provided)

1:30-3:00 pm **Fundamentals of Electricity Markets, Economics, & Regulation Part 2 [Rose]**  
90 min.  
Energy, capacity, and ancillary services markets and allocation rules. Renewable Energy Certificates (RECs). Regional transmission organizations (RTOs). Aligning wholesale and retail markets. Market performance and oversight. Impact of changing marginal costs. Choice and default service. Path dependence and sunk costs. Market and policy uncertainty.

3:30-5:15 pm 105 min.	<b>Fundamentals of Power Systems and Grid Infrastructure Part 2 [Mitra]</b> Grid congestion, abnormalities, and vulnerabilities. NERC and other standards for quality, reliability, and security. Supply-side capacity, efficiency, and expansion. Grid modernization and intelligence (smart grids).
5:30-6:30 pm	<b>Welcome Reception</b> (Corniche Room)
<b>Tuesday</b>	
8:30-10:00 am 90 min.	<b>Grid Integration and Modeling for Distributed and Variable Resources [Mills]</b> Engineering properties and efficiency of energy resources. Changing fuel mix. Relevance of scale. Value, costs, and benefits of renewable energy resources. Locational marginal pricing (LMP). Aggregation, bidding, and dispatching. Energy resource mapping tools. Modeling capacity expansion.
10:30-12:15 pm 105 min.	<b>Grid integration and Modeling (continued)</b>
12:15-1:30 pm	Lunch at the Brody Hall Cafeteria (voucher provided)
1:30-3:00 pm 90 min.	<b>Integrated Resource and Transmission Grid Planning [Bloom]</b> Modernizing integrated resource and transmission planning. Technological uncertainty and flexibility. Portfolio diversity and grid neutrality. Resource variability and spatial distribution. Challenges in forecasting supply and demand. Advanced tools, methods, and data for modeling and evaluation. Impact of developments in distribution on transmission. Regional planning and coordination. Findings of a national scale study of interconnection seams.
3:30-5:15 pm 105 min.	<b>Distribution System Optimization, Management, and Planning [Murray]</b> Increasing challenges for distribution systems. Beyond advanced metering infrastructure. Policy-driven metrics for innovation and optimization. Efficiency, flexibility, and cost criteria. Operating platforms. Distributed energy resource management systems (DERMS). Distribution management systems (DMS/ADMS). Volt-VAR Optimization. Investment and deferrals. Non-wires alternatives. Energy efficiency and demand response. Investing on both sides of the meter.
<b>Wednesday</b>	
8:30-10:00 am 90 min.	<b>Power Grid Interdependency, Vulnerability, and Security [Ten]</b> Transmission and distribution grid vulnerabilities. Hardware and software solutions. Cyber-security assessment and protection. Utilities, big data, and cloud storage. Data security and privacy. Evolving threats to reliability and resilience.
10:30-12:15 pm 105 min.	<b>Grid Architecture and Technologies for Ensuring Reliability and Resilience [Murray]</b> Problem definition. Evaluating options. SCADA systems. Distribution automation. Fault Location Isolation and Supply Restoration (FLISR). Automatic circuit reclosers. Utility-scale and distributed storage. Microgrids. Grid-edge technologies and innovation. Autonomous power systems and virtual power plants. Next generation smart grids. Practical solution sets. Experiments and pilots.
12:30-2:00 pm 90 min.	<b>Working Lunch and Discussion of the Future of Electricity Grids, Business Models, and Regulation [Beecher, et al.]</b> Trends in electrification (NREL, EPRI). Incentives for innovation and modernization. Disruption, defection, and the death spiral. Competing energy futures and business models. Alternative regulatory policies. Political, cultural, and leadership issues.

## IPU Power Grid School 2019: Program Faculty

	<p>Janice BEECHER (beecher@msu.edu)                  Director, Institute of Public Utilities, Michigan State University                  Ph.D., Political Science, Northwestern University  <a href="http://www.linkedin.com/in/janice-beecher-33a61810">www.linkedin.com/in/janice-beecher-33a61810</a></p>
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## IPU Power Grid School 2019

April 29-May 1, 2019 | Kellogg Center, MSU

### Program Information

#### Internet access

Free internet access is available throughout the Kellogg Center using the login MSUnet Guest.

#### Accessing program materials

Presentations and supplemental materials are available to all attendees. Please navigate to the attendee link on the program web page and enter the program password: \_\_\_\_\_.

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