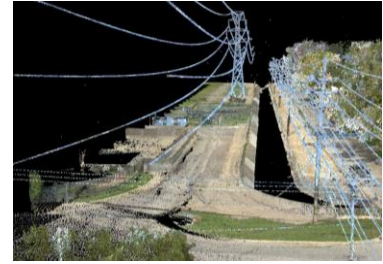


IPU GRID SCHOOL 2017

Understanding the Engineering, Economics, Regulation, and Transformation of the Supply Chain for Power
March 27-30, 2017 | Kellogg Center, MSU



About Grid School

IPU Grid School is designed to improve regulatory capacity for grid-related policy development and decision-making at all government levels in support of innovation, efficiency, and environmental goals. Grid School is open to the public and private sectors, including economic and environmental regulators. The program provides an intensive, interdisciplinary, and interactive educational and professional networking experience. Grid School is objective and rigorous, taught by knowledgeable and independent experts. This program considers the integral role of electricity grids in the energy supply chain and is designed to be responsive to new mandates and infrastructure investments associated with federal and states policies. IPU Grid School is sponsored by the Institute of Public Utilities in collaboration with MSU's College of Engineering and Argonne National Laboratory.

IPU Grid School is **open to everyone** and designed for members of the federal and state regulatory policy community, including commissioners and staff members of the public utility commissions, energy and environmental agency staff, legislative staff, consumer advocates, utility personnel (public and private), engineers, planners, investors, analysts, consultants, attorneys, and others interested in learning about the electricity grid. Attendees receive a certificate of participation and credit toward a Certificate of Continuing Regulatory Education (currently available only to public-sector and nonprofit employees). IPU also can help arrange continuing education credits (for engineers, accountants, attorneys, and others).

Topics Covered

- Fundamentals of power systems and grid infrastructure
- Fundamentals of electricity markets and economics
- Intersection of wholesale and retail markets
- Grid integration for variable energy resources
- Resource modeling, planning, and mapping
- Energy storage and emerging technologies
- Integrated resource planning policy and practices
- Demand-side energy resources and their evaluation
- Distributed energy resources and their impacts
- Rate design and net metering
- Natural gas trends and role in the power sector
- Interdependency, security, resiliency, and big data
- Emerging utility and regulatory models
- Future of electricity and grids

IPU also offers a Sunday preconference program on **Introduction to Public Utility Regulation and Ratemaking** (1:00 to 6:00 pm).

For program details and registration information, please visit www.ipu.msu.edu.
For accommodations, please visit <https://kelloggcenter.com>.
Space is limited – please register today!

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Preliminary Agenda

Sunday

1:00-6:00 pm **Introduction to Public Utility Regulation and Ratemaking** [Beecher]
270 min. Optional preconference educational program (separate registration required)

MONDAY

7:00-8:00 am **Registration & Continental Breakfast** (*provided each morning*)

8:00-8:15 am **Welcome to Grid School!** [Beecher].

8:15-10:00 am **Fundamentals of Power Systems and Grid Infrastructure 1** [Mitra].
105 min. Characteristics of electrical power. Supergrids, transmission, distribution grids, and microgrids. Infrastructure components, interconnection, interoperability, and balancing.

10:00-10:15 am Networking Break

10:15-12:00 pm **Fundamentals of Electricity Markets and Economics 1** [Rose]. Wholesale market structure, operation, economics, and pricing. Role of private, nonprofit, and public power. Federal, state, and local governance of generation, transmission, and distribution. FERC regulation and key rulings. Fragmentation and coordination.

12:00-1:15 pm Lunch at Brody Hall (on your own)

1:15-3:00 pm **Fundamentals of Power Systems and Grid Infrastructure 2** [Mitra].
105 min. Congestion, abnormalities, and vulnerabilities. NERC and other standards for quality, reliability, and security. Supply-side capacity, efficiency, and expansion. Grid modernization and intelligence. Smart-grid capabilities.

3:00-3:15 pm Networking Break

3:15-5:00 pm **Fundamentals of Electricity Markets and Economics 2** [Rose]. Energy, capacity, and ancillary services markets. Regional transmission organizations (RTOs). Distribution system organizations (DSOs). Retail markets. Transactive energy.

5:00-5:30 **Bonus: State Oversight of the RTOs** [Paslowski].

5:30-7:00 Welcome Reception

Tuesday

- 8:15-10:00 am** **Intersection of Wholesale and Retail Markets** [Rose]. Market behavior and monitoring. Environmental regulation. PURPA and avoided cost. Wholesale price signals. Renewable Energy Certificate (REC) markets. Demand response.
105 min.
- 10:00-10:15 am Networking Break
- 10:15-12:00 pm** **Grid Integration for Variable Energy Resources** [Veselka]. Engineering properties and efficiency of energy resource alternatives. Costs and benefits of renewable resources. Locational marginal pricing (LMP).
105 min.
- 12:00-1:15 pm Lunch at Brody Hall (on your own)
- 1:15-2:15 pm** **Grid Integration for Variable Energy Resources** [Veselka]. Case studies
60 min.
- 2:15-2:45 pm Networking Break
- 2:45-4:00 pm** **Resource Modeling, Planning, and Mapping** [Koritarov]. Methodological evolution and accepted practices in planning and forecasting. Modeling generation capacity expansion investment decisions. Regional planning, management, and coordination. Energy Zones Mapping Tool.
75 min.
- 4:00-4:15 pm Networking Break
- 4:15-5:00** **Energy Storage Technologies** [Koritarov]. Centralized and distributed energy storage. Pumped storage. Fuel cells. Electric vehicles. Emerging technologies.
45 min.
- 5:00-5:30** **Bonus: Renewable Portfolio Standards** [Barbose].

Wednesday

- 8:15-10:00 am** **Integrated Resource Planning** [Wilson]. Regulatory requirements, practices, and processes. Resource and grid neutrality. IRP modeling methods.
105 min.
- 10:00-10:15 am Networking Break
- 10:15-12:00 pm** **Demand-side Energy Resources** [Levin]. Energy efficiency technologies. Dynamic pricing and demand response. Data security and privacy. Aggregation, bidding, and dispatching. Behavioral issues. Program evaluation.
105 min.
- 12:00-1:15 pm Lunch at Brody Hall (on your own)
- 1:15-3:00 pm** **Distributed Energy Resources** [Barbose]. Trends in electricity revenues, expenditures, and prices. Rate design and net metering. Grid defection. Impacts on grids, utilities, and customers.
105 min.
- 3:00-3:15 pm Networking Break

3:15-5:00 pm **Natural Gas Trends and Role in the Power Sector** [Dismukes]. Interaction of gas and electricity markets. Gas in the generation portfolio. Resource interdependency.
105 min.

5:00-5:30 **Bonus 1: Overview of International Case Studies** [Levin].
30 min. **Bonus 2: Integrated Resource Planning in Michigan** [Proudfoot].

Thursday

8:15-10:00 am **Infrastructure Interdependency and Cyber-security** [Ten]. Transmission and distribution grid vulnerabilities. Cyber-security assessment and protection. Recovery and resilience. Utilities and big data.
105 min.

10:00-10:15 am Networking Break

10:15-Noon **Roundtable on the Future of Electricity Grids: Evolution or Extinction?**
105 min. [Beecher, et al.] Regulatory compact. Nature and social value of networks. Disruptive change and uncertainty. Myth and reality of the death spiral. Competing energy goals and futures.


Noon Adjourn









MICHIGAN STATE

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