The Electric Power Systems Center aims to facilitate worldwide electrification in an economically efficient, equitable, secure, and low-carbon manner that helps to pave the way for the power system for the future.

The electric power sector is undergoing a seismic transformation. Major forces including the drive toward greater de-carbonization, increased decentralization, and digitization are reshaping the provision of electricity services. With these dynamics comes a host of opportunities and a range of challenges for stakeholders across the value chain.

The Electric Power Systems (EPS) Center, one of the MIT Energy Initiative’s Low-Carbon Energy Centers, has been established to accelerate an efficient transition toward a decarbonized power sector by leveraging and integrating MIT’s broad-ranging expertise.

Through quantitative analysis and member-motivated research, the Center studies the impacts and system level implications of emerging technologies, evolving business models, and regulatory and policy dynamics that are shaping the future of the sector. The Center examines both pragmatic and disruptive solutions ranging from development of new modeling tools to breakthrough digital, software, and hardware technologies. It is also developing a comprehensive framework that expands upon MIT’s interdisciplinary and integrative modeling capabilities and techno-economic analysis to help guide and inform members on an ongoing basis through this transition.

Understanding and shaping this transition requires a broad range of expertise in topics ranging from economics, power system regulation, and political science to sensors, control systems, and digital signal processing — areas of expertise that are central to the Electric Power Systems Center.”

— Professor Christopher Knittel
Co-Director, Electric Power Systems Center
Goals and approach

The Electric Power Systems Center applies the broad analysis and research capabilities of MIT faculty from across the Institute’s five schools and engages with EPS Center members to help them navigate the complex transition to tomorrow’s power system and support data-driven decision-making at the strategic, operational, and regulatory levels across the power sector. Members include traditional utilities, OEMs, digital service providers, system integrators, new energy service providers, NGOs, and regulatory and policy makers, among others.

Analysis and core competencies

Today’s power system is highly complex, with decisions being made continuously on timescales ranging from microseconds to decades. To function, it depends on the precise integration of hardware, operational coordination, and market and regulatory structures. Increasing deployment of distributed energy resources such as solar, storage, wind, and demand response, along with growing cyber threats concomitant with digitization, are further challenging the reliable planning and operations of the power system.

Addressing these challenges in an effective and efficient manner requires a multidisciplinary approach. MIT is uniquely positioned to meet the challenges within the electric power sector given its breadth of capabilities across a wide range of technical, social, and economic disciplines relevant to the power sector. These include:

- Policy, markets, and regulation
- Climate and carbon impact modeling
- Technical and economic power system modeling
- Customer engagement, behavioral economics, and business model evolution
- Digitization and its impact on planning and operations
- Power electronics, sensors, communications, and controls
- Application of machine learning and artificial intelligence
- Cybersecurity for the evolving power sector
- Electrification of the transportation sector
- Low-carbon generation technologies, including wind, advanced nuclear, nuclear fusion, and solar

Modeled global horizontal solar irradiance (top) and wind capacity factor (bottom) at tens of thousands of sites across the continental US at 1pm on 6/2/2011. Solar data are from the National Solar Radiation Database and wind data from the Wind Integration National Dataset Toolkit. Research in the EPS Center is using high-resolution publicly-available datasets to understand the prospects of solutions like long-distance transmission, resource complementarity, and energy storage to manage the intermittency of variable renewable energy resources.
A model-based approach to understanding the evolving power system

The Center develops state-of-the-art computational methods for power system modeling, simulation, and planning. Proprietary models core to the Center’s capabilities include:

- **GenX**: Wide area electricity resource capacity planning with distributed energy resources
- **Reference Network Model**: Large-scale distribution network planning tool enabling estimation of efficient distribution costs
- **D-Sim**: Distribution network power flow, locational pricing, and operational simulation with distributed energy resources
- **DR DRE**: End-user demand response and distributed resource economic decision model
- **SESAME**: High resolution energy systems technology assessment

To learn more about these modeling tools, visit: epscenter.mit.edu/modeling-tools

Example publications

Center researchers are exploring new areas that can advance the electric power system. Below are some representative publications by Center researchers.


For more publications, visit: epscenter.mit.edu/publications

“Our Center is not only distinguished by its unique quantitative analysis and modeling tools and the breadth of skills and knowledge it taps from across the MIT campus, but also by its strategic connection to the energy transition.”

— Dr. Robert Stoner
Co-Director, Electric Power Systems Center
Interested in joining us?

Membership benefits

- Semi-annual workshops with MIT faculty and researchers
- Member-only analysis and research presentations
- Insights from techno-economic analysis and decision support tools
- Member participation in formulating collaborative research programs with the faculty committee
- Access to a curated web-based library of relevant academic research with links to all MIT Center for Energy and Environment Policy Research (CEEPR) working papers
- Opportunities to develop important connections with MIT researchers, rising talent, and the MIT/Boston-area startup ecosystem
- Access to findings and perspectives from all of MITEI’s Low-Carbon Energy Centers via topical webinars and special events throughout the year

The Electric Power Systems Center is building on over a decade of thought leadership in the energy sector with quantitative analyses that shape and inform policy, technology development, and future research.

Co-Directors:
Christopher Knittel, George P. Shultz Professor of Applied Economics, MIT
Robert Stoner, Deputy Director for Science and Technology, MIT Energy Initiative

Executive Director:
Raanan Miller, MIT Energy Initiative

Asia Pacific Energy Partnership Program Director:
Wendy Duan, MIT Energy Initiative

For additional information or to join the Electric Power Systems Center, please contact:
Raanan Miller
Executive Director
ramiller@mit.edu
617-253-3441

To see a list of current members, visit:
epscenter.mit.edu/members

MIT ENERGY INITIATIVE
Massachusetts Institute of Technology
77 Massachusetts Avenue, E19-307
Cambridge, MA 02139-4307
energy.mit.edu