

Next-generation Energy Systems Integration

Session co-chairs: Jennifer Kurtz, National Renewable Energy Laboratory, and Javad Lavaei, University of California, Berkeley

Energy impacts many aspects of our lives and has seen many transformations in recent history. The energy system, including electrical, fuels, and thermal sub-systems, has been essential to economic, industrial, and societal growth. The next-generation energy system must also be clean and adaptable to growing demand and new technologies. Our energy system is large and complex, includes more than electricity, and spans generation, distribution, and end use. Highly variable generation technologies in the energy system have increased in both number, location, and scale; along with decreasing costs. Many states and industries have aggressive targets for renewable generation and sustainability because these targets are needed to address climate change as well as business needs such as economics, sourcing, and resiliency. While these advancements and goals have many of us excited about the progress, our current energy system and operation are not able to flex and evolve enough to meet the goals without new vision and innovation. Some of these challenges with the current energy system are reliability, intermittency, variability, growth, emissions, and storage. Many of the renewable technologies support and/or address individual challenges, there is not one technology that meet all the requirements. Based on the studies by the Federal Energy Regulatory Commission, system operators resort to several heuristic methods to handle the complexity of the operation of the grid, which waste billions of dollars annually in the US. This session will discuss four main challenges for the next-generation integrated energy system:

- What solutions are needed in order to realize our greenhouse gas reduction goals? What policy and strategy are needed to enable, highly impactful integrated energy systems?
- How can technologies and operation strategies be integrated with highly variable generation without sacrificing grid reliability or resiliency?
- How can the new advances in optimization, computation, control, and artificial intelligence be used to make power grids more efficient, robust, resilient, and sustainable?
- How can energy be made affordable and accessible for remote communities?
- How does the energy-water dependency affect the design of future energy systems?

Speakers

Enabling the Operation of Future Grids Using New Tools in Control Theory and AI

Johanna Mathieu, University of Michigan

Powerful Water and Thirsty Energy: A Systems Challenge

Noel Bakhtian, Lawrence Berkeley National Laboratory

Enabling Impactful Residential-scale Energy Systems for Native American Communities

Suzanne Singer, Native Renewables