Optimization of Energy Systems: At the Interface of Data, Modeling, and Decision-Making

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Abstract:
The combination of data analysis, systems modeling, and computational optimization provides a powerful framework to tackle emerging challenges in energy systems. We discuss how the constantly evolving energy technology landscape as well as interdependencies between infrastructures is promoting the development of new decision-making paradigms, algorithmic techniques, and software tools to quickly assess the performance of different technologies under diverse weather and market conditions. In particular, we present new capabilities to make strategic decisions in the face of uncertainty, across multiple spatial and temporal scales, and in the presence of conflicting priorities among stakeholders. We discuss how to use these techniques to analyze the economic performance of concentrated solar power, wind power generation, and energy storage technologies. We also demonstrate how to use these capabilities to assess the impacts of coordination (or the lack thereof) between natural gas, communication, and electrical power infrastructures.