

Energy Systems Modeling including Hydrogen Deployment
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In the global effort to decarbonize energy systems, numerous studies indicate the beneficial—and sometimes necessary—role of integrating the power system with the broader energy sector via complementary end uses and energy intermediates. These include hydrogen and other means to couple multiple sectors (e.g., transport, industry, heating, etc.) to synergistically meet policy, economic, and reliability goals. Utilizing low-cost conventional and/or variable renewable energy (VRE) power to produce high-value hydrogen for a variety of applications is one potential use case, which provides additional flexibility benefits for the power system (e.g., long-duration storage) and a raw input for a wide range of downstream industrial and transportation applications. The importance of incorporating hydrogen into energy systems has become even more salient given recent policy and geopolitical developments impacting many parts of the world. To help assess the tradeoffs of various decarbonization options within these energy systems, planners and other decision makers often rely on computational modeling tools to explore policy, economic, reliability, and social justice considerations. These tools provide insights into what resources to deploy, how to design and operate them, and how changes in external drivers like policies and markets can impact the least-cost pathway. This presentation will provide a high-level overview of the opportunities and challenges associated with hydrogen supporting a decarbonized energy system. Examples from modeling-based research will be highlighted to demonstrate the complexity and remaining gaps for maximizing the value of hydrogen in these energy systems.