Optimal Design of Power Systems with Large Shares of Renewable Energy

SPEAKER: Matthias Fripp
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PLACE: Holmes Hall 389

ABSTRACT:
Renewable resources are an attractive source of electricity with minimal greenhouse gas emissions. However, wind, solar, geothermal and marine power cannot be turned on and off as needed, so it is unclear how large a role they should play in future power systems. In this seminar I will present two new tools for modeling power systems with large shares of renewable power, on both long and short time scales. The "Switch" planning optimization model identifies the least expensive combination of renewable and conventional generators and transmission capacity to add to a power system over a multi-decade period, to provide a reliable power supply while reducing greenhouse gas emissions. The "IGOR" model estimates the spinning reserves that are required to compensate for errors in short-term wind power forecasts, firming up the power supply to 99.999% reliability. My work with these models shows that existing technologies can be used to nearly eliminate greenhouse gas emissions at surprisingly modest cost. Both models also suggest that dynamic demand-response (e.g., "smart" charging of electric vehicles or adjustment of air conditioner setpoints) could significantly ease the integration of large-scale renewable power, making it possible to use more renewable energy, at a lower cost. I will finish with a brief discussion of future research on using high levels of renewable power with active demand response in Hawaii.

SPEAKER BIO:
Matthias Fripp is the NextEra Research Fellow in Renewable Energy at the University of Oxford, United Kingdom. His research focuses on modeling the technical and economic behavior of power systems with large shares of renewable energy. Dr. Fripp holds a Ph.D. and Master's degree from the Energy and Resources Group at the University of California, Berkeley, and a B.A. from Lewis & Clark College in Portland, Oregon. He has previously worked as a modeler and researcher at Lawrence Berkeley National Laboratory, Trexler Climate+Energy Services, Inc., and the Renewable Northwest Project.