THE DEPARTMENT OF CHEMICAL ENGINEERING presents the

SPECIAL SEMINAR

AUGUST 10, 2015
DR. KODY POWELL
1:30 P.M. 3291 MEB
(CHE CONFERENCE ROOM)

Energy Optimization in a Smart Grid Environment

Abstract:

Widespread adoption of intermittent renewable energy technologies, predominantly solar and wind, require large-scale energy storage technologies so that disturbances in the energy source can be sufficiently buffered and that energy can be delivered to consumers on demand. In addition to providing power dispatchability to a system, energy storage gives a system enhanced flexibility, which can be exploited using optimization by taking advantage of the added degrees of freedom that storage provides. This requires a systems-level model including each component of the energy system in addition to an accurate and robust forecast of energy supply and/or demand so that a dynamic optimization problem can be solved, which minimizes energy consumption or total operating cost. This concept is applied to two types of systems using thermal energy storage: solar thermal and distributed energy generation. For solar thermal systems, several novel concepts are introduced: dynamic optimization subject to a forecast of solar irradiance, dual source heat generation, and optimal solar heat collection, storage, and delivery. The concept of dynamic optimization with forecasts is also applied to a distributed energy system where electricity, cooling, and heat are centrally generated and delivered by networks to buildings in the system. Solving these problems has led to several novel modeling and optimization developments including: adaptive grid modeling to track temperature gradients in a thermal energy storage system, flexible hybrid operation of a solar thermal/natural gas fired power plant, and a hierarchical decomposition of the dynamic optimization problem, which removes much of the problem's non-convexity and combinatorial complexity resulting in an orders of magnitude reduction in solution times.

Short Biography:

Kody Powell specializes in smart energy and manufacturing systems, which use real-time data, combined with detailed systems-level models to enhance system performance through automation, abnormal event detection, and enhanced understanding of the process through simulation.

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