Deadline Differentiated Pricing of Intermittent Supply

Rhodes Hall 310: August 30, 2012 @ 12:00PM

ISN Seminar Speaker:
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Abstract

As the penetration of wind and solar energy into the electric grid continues to grow, there will be an increasing need to evolve demand-side solutions capable of compensating the inherent variability in power supply from such resources. Today, demand is largely treated as inelastic. However, the power requirements of many commercial and residential loads are such that a fraction of power demand at any given moment is inherently deferrable in time subject to a deadline constraint on the total energy supplied. In this talk, I'll discuss some limitations of spot pricing mechanisms (e.g., real-time pricing) as a means of inducing responsive demand and suggest a novel forward contracting mechanism for deadline-differentiated pricing of deferrable energy to alleviate these difficulties. Essentially, consumers who are willing to defer their consumption further in time will receive a more favorable per-unit price for energy. The supply side is modeled stochastically to capture variability in renewable power supply. Using a general model for consumer preferences to capture the effect of consumption deferral on utility, we prove the existence of a competitive equilibrium and provide a characterization of deadline-differentiated prices yielding such an equilibrium. I'll also discuss provably optimal online scheduling algorithms to dynamically allocate the variable supply to a bundle of deadline-differentiated energy tasks.

Biography

Eilyan Bitar is currently an Assistant Professor in the School of Electrical and Computer Engineering at Cornell University. Prior to joining Cornell in the Fall 2012, he was engaged as a Postdoctoral Fellow in the department of Computing + Mathematical Science (CMS) at the California Institute of Technology [hosted by Steven Low] and at the University of California, Berkeley in Electrical Engineering and Computer Science [hosted by Kameshwar Poolla] during the 2011-12 academic year. A native Californian, He received both his Ph.D. [2011] and B.S. [2006] from the University of California, Berkeley in Mechanical Engineering. His current research interests include stochastic optimization and control theory and their applications to the economics, operation, and protection of the electricity grid with large-scale penetration of variable renewable energy resources.