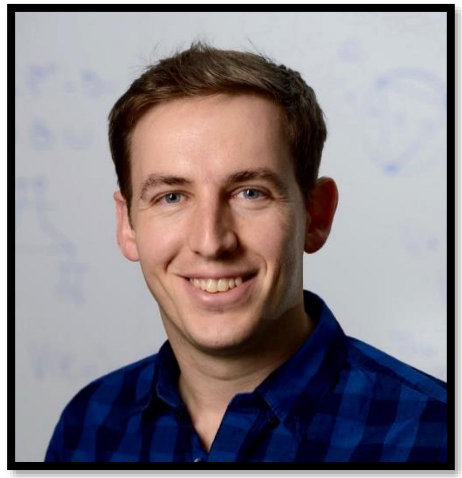
EPSTEIN INSTITUTE SEMINAR ▪ ISE 651

Incentive Analysis and Coordination Design for Multi-Timescale Electricity Markets

ABSTRACT - This talk discusses incentives and coordination requirements that arise when heterogeneous participants bid in electricity markets that operate at different timescales. First, we consider the conventional timescales of market clearing, spanning 5 minutes to several hours ahead, and investigate the incentives for price manipulation that market participants (generators and loads) have in a two-stage settlement market. Our analysis unveils the importance of accounting for both generators' and loads' strategic behavior in two-stage markets, even when the consumers' demand is inelastic! Precisely, we show that loads can exploit generators' strategic bidding and maintain a systematic difference between the forward and spot prices, the latter being higher than the former. Such a strategy does bring down demand-side payments and undermines supply-side market power. Second, we consider the problem of co-optimizing generation resources with different timescale characteristics. To that end, we frame and study a joint problem that optimizes both slowtimescale economic dispatch resources and fast-timescale frequency regulation resources. We provide sufficient conditions to optimally decompose the joint problem into slow and fast timescale problems. These slow and fast timescale problems have appealing interpretations as the economic dispatch and frequency regulation problems, respectively. We further provide a market implementation for the fast-timescale problem. In this implementation, participants receive prices and dispatch and dynamically update their bids according to either a dynamic gradient play or best response. Under price-taking assumptions, our market implementation is guaranteed to converge to the optimal (efficient) allocation even in the presence of generator dynamics. A by-product of this solution is that frequency restoration and thermal limits are automatically guaranteed.



Dr. Enrique Mallada
Assistant Professor
Dept. of Electrical and Computer Engineering, Johns Hopkins University

SPEAKER BIO – Enrique Mallada is an Assistant Professor of Electrical and Computer Engineering at Johns Hopkins University since 2016. Before joining Hopkins, he was a post-doctoral fellow at the Center for the Mathematics of Information at the California Institute of Technology from 2014 to 2016. He received his ingeniero en telecomunicaciones (telecommunications engineering) degree from Universidad ORT, Uruguay, in 2005 and his Ph.D. degree in electrical and computer engineering with a minor in applied mathematics from Cornell University in 2014. Dr. Mallada was awarded the Catalyst Award and Discovery Award from Johns Hopkins in 2020 and 2019, the NSF CAREER award in 2018, the ECE Director's Ph.D. Thesis Research Award for his dissertation in 2014, the Cornell University's Jacobs Fellowship in 2011, and the Organization of American States scholarship from 2008 to 2010. His research interests lie in the areas of control, dynamical systems, and optimization, with applications to engineering networks, including power grids, and the Internet.

USC Viterbi
School of Engineering
Daniel J. Epstein Department of Industrial and Systems Engineering

TUESDAY, APRIL 13, 2021
3:30 PM – 4:50 PM
ZOOM/ONLINE *PLEASE EMAIL OWH@USC.EDU FOR PASSWORD*