UNIVERSITY of WASHINGTON

ISE Graduate Seminar Series

Risk-Averse Optimization Techniques to Improve Virtual Power Plant Scheduling and Flexibility

William Yang

BIO

William Yang is a PhD candidate in the Industrial and Systems Engineering Department at the University of Washington. His research interests include data-driven optimization methods to improve the operations of energy systems and renewable energy.

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Location: MEB 234

ABSTRACT

We have seen a trend of increased renewable energy generation for the past several decades, which allows the power grid to rely less on coal generation. Therefore, increasing renewable energy generation is necessary for reducing the global carbon footprint and combating climate change. However, it is difficult for smaller solar and wind farms to participate in the wholesale energy market. A Virtual Power Plant (VPP) is an entity that aggregates smaller solar and wind farms with other heterogeneous distributed energy resources (DERs), to increase their visibility to Independent System Operators (ISOs) and allow them to participate in the energy market. There are several challenges associated with operating a VPP effectively, however. Due to the heterogeneity of the system and the presence of variable renewable resources, it is difficult to schedule VPP operations in a reliable and cost-effective manner. We present a multi-stage distributionally robust optimization (MSDRO) approach to tackle the dynamic coordination of heterogeneous DERs with intermittent renewable energy output. Another challenge that arises from increased renewable energy penetration is maintaining the VPP's flexibility. The uncertainty brought by renewable energy makes it harder to balance energy supply and demand, and failing to do so can result in expensive renewable energy curtailment or blackouts. We present a robust uncertainty-set optimization method to maximize the amount of net load deviation the system can tolerate, which is comprehensive, functional, and reliable.