



Investigator: Wei Qiao

Position Title: Associate Professor

Department: Electrical & Computer Engineering

Email: wqiao3@unl.edu

Phone: (402) 472-9619

Webpage: <http://engineering.unl.edu/elec/wei-qiao/>

An Optimal Dynamic Operation Model for Participation in the Southwest Power Pool's Energy Market

Abstract.

The Southwest Power Pool (SPP) launched a new Integrated Marketplace on March 1, 2014. In this new energy market, the SPP becomes the central balancing authority operating energy and reserve across its entire footprint. Unlike the SPP's old Energy Imbalance Service (EIS) market which was just a centrally dispatched real-time market, the Integrated Marketplace revamps the EIS market by including an market for transmission congestion rights (TCRs) on an annual or monthly basis, an day-ahead market along with an operating reserve market on an hourly basis, and a real-time energy market on a continuous 5-minute basis. The *goal* of this project is to study the use of stochastic optimization principles, risk management, and game theory to develop a new dynamic operation model for energy producers, such as Nebraska Public Power District (NPPD), to maximize their profits in the SPP's new Integrated Marketplace. The approach is to: 1) develop a new integrated multistage optimal dynamic decision-making model to maximize the total profit of a market participant using stochastic optimization principles, 2) study the risk management in the dynamic decision-making process caused by uncertainties; and 3) study the influence of the behaviors of other market participants on the dynamic decision-making process using the game theory. The proposed model will be validated by numerical simulations using the operational data of the SPP energy market for a participating utility, such as NPPD. The proposed research covers multidisciplinary areas such as electricity market, electric grid operation, optimization, and economics. The project findings will help create a broader interdisciplinary research area covering communication, control, optimization, big data, economics, etc. to address the challenges in one of the nation's critical infrastructures, the electric grid. The project outcomes will help ensure electricity security, efficiency and sustainability. These will benefit various sectors of the nation's and local economies.