

Introduction to Electricity Markets

National Conference of State Legislatures
Electricity Markets and State Challenges Workshop

Douglas J. Gotham
Director, State Utility Forecasting Group

June 27, 2018

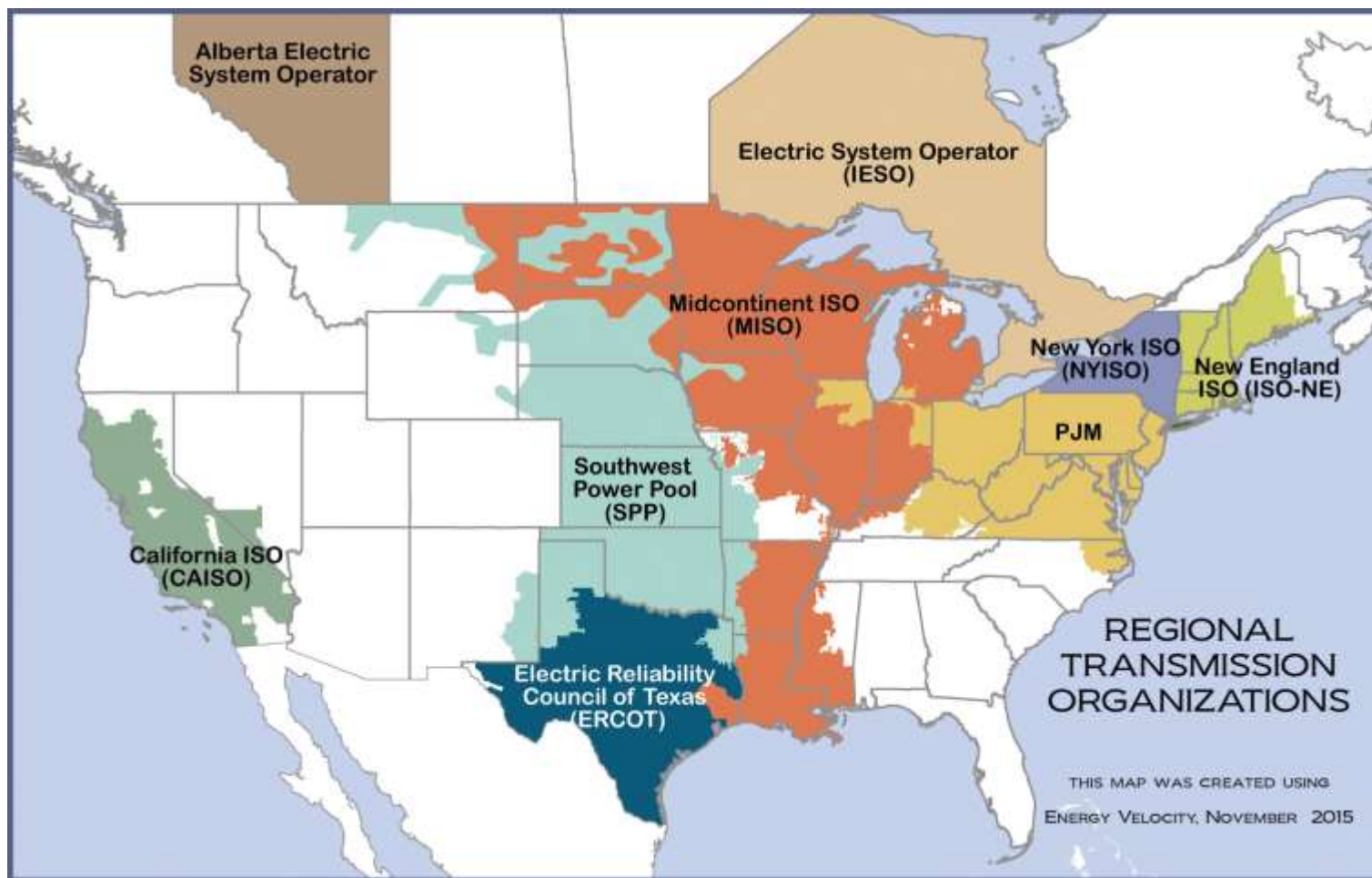
State Utility Forecasting Group

- Independent research and analysis group at Purdue University
- Established by Indiana General Assembly in 1985
- Performs economic and policy analysis, provides assistance to state policymakers

Market Structures

- Does the utility operate within a wholesale market operated by a regional transmission organization (RTO) or independent system operator (ISO)?
- Is it a traditional vertically-integrated utility or is it under retail choice (aka deregulation)?

RTOs/ISOs



Source: Federal Energy Regulatory Commission

Short-term Energy w/o RTO

- Utilities dispatch their own resources to minimize the cost of meeting the load
- They may enter into contracts to buy or sell with other entities
- They perform both unit commitment (for next day or two) and economic dispatch (now)

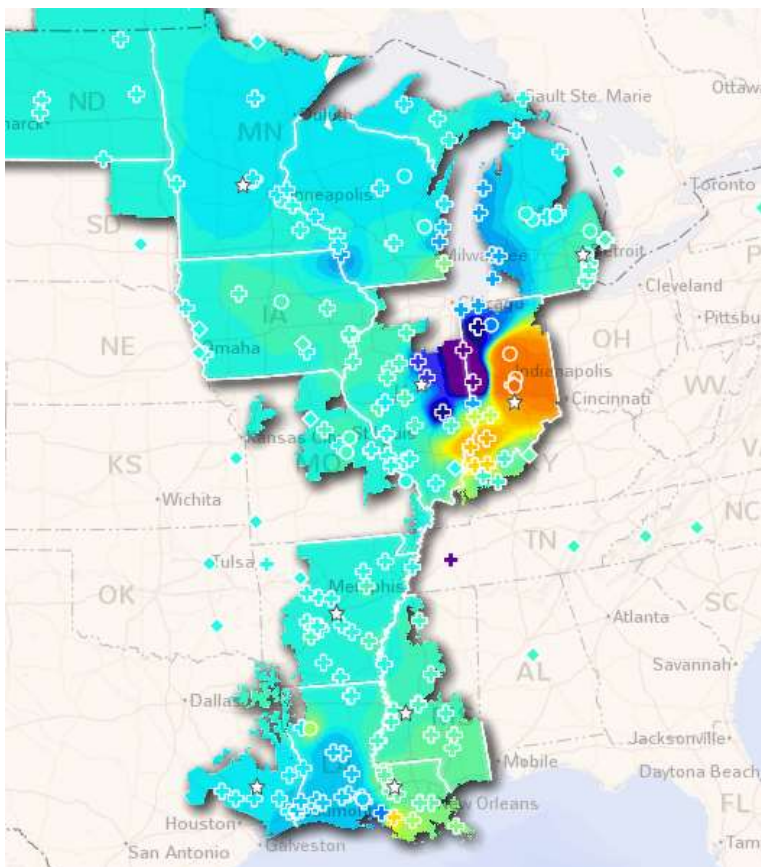
Short-term Energy w/ RTO

- Suppliers make offers to sell specific amounts of energy at specific prices
- Load is also bid at specific prices and quantities
- Market operator determines the least-cost method of supplying the load subject to transmission limitations

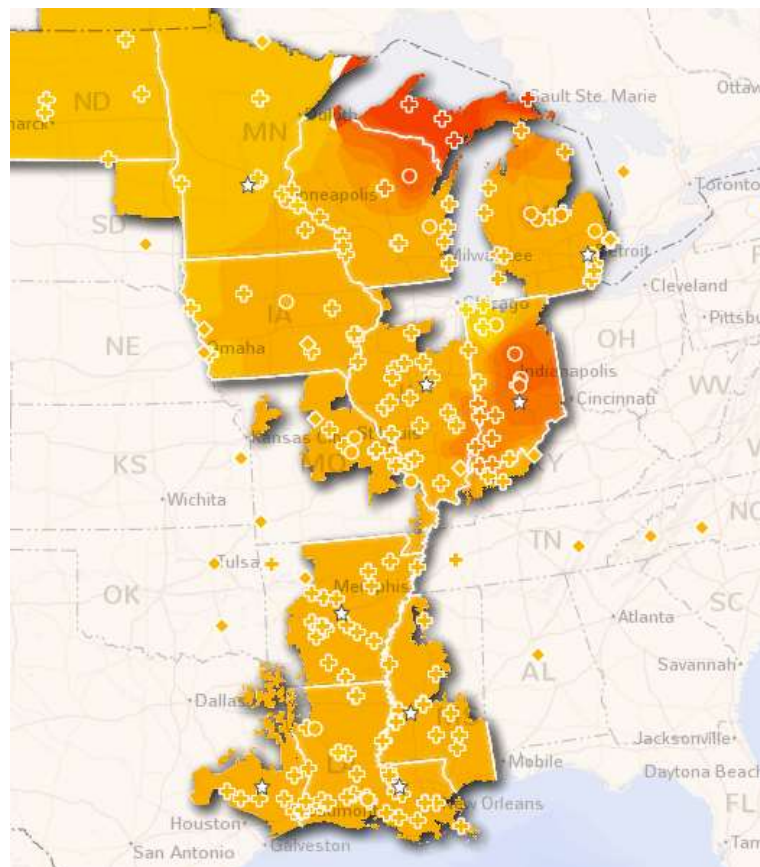
Locational Marginal Price (LMP)

- LMP represents the marginal cost of supplying the last increment of energy to a specific location in the network
- Loads pay the LMP for all energy consumed at their point in the network and suppliers are paid the LMP for all energy supplied at their network point
- LMPs differ across the network due to transmission limitations (congestion) and losses

MISO LMP Contour Map



6/19 3:30 pm



6/20 11:50 am

Day-ahead & Real-time Markets

- RTOs operate a day-ahead market based on expected load and generator availability
 - settles hourly
- Also operate a real-time market to balance deviations from the day-ahead market
 - load and/or generator availability may be different than expected
 - settles every five minutes
- Both day-ahead and real-time markets determine LMPs at which the market clears

Long-term Planning w/ Vertically Integrated Utilities

- Generally under state purview and often done through Integrated Resource Planning (IRP)
- IRPs are long-term (10-20 years) studies to determine the appropriate expected mix of future resources (both supply-side and demand-side)
- Generally done every 2-3 years
- Consider various factors like cost and risk

Long-term Planning w/ Retail Choice

- Usually less state overview
- Some states may have long-term filing requirements but most do not require IRPs
- Suppliers may be subject to RTO capacity requirements

RTO Capacity Markets

- Some RTOs have capacity markets that operate 1-3 years in advance to ensure sufficient resources in the future
- Load-serving entities must have sufficient resources available to meet their highest level of demand (aka peak demand) plus a reserve margin for unexpected contingencies

RTO Capacity Markets

- Capacity prices also serve as an indicator as to when new resources may be needed
- Entities in both restructured and traditional states are subject to their RTOs' capacity requirements

Further Information

- Doug Gotham
 - 765-494-0851
 - gotham@purdue.edu
- <https://www.purdue.edu/discoverypark/sufg/>