



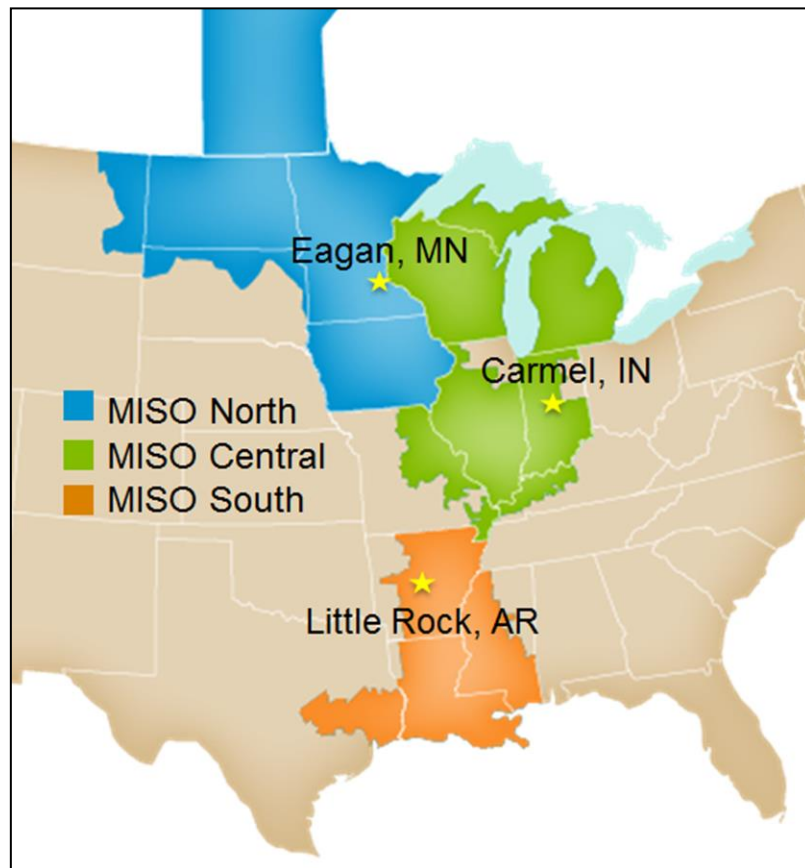
# ESIG 2020 Meteorology & Market Design for Grid Services Workshop

Jessica Harrison

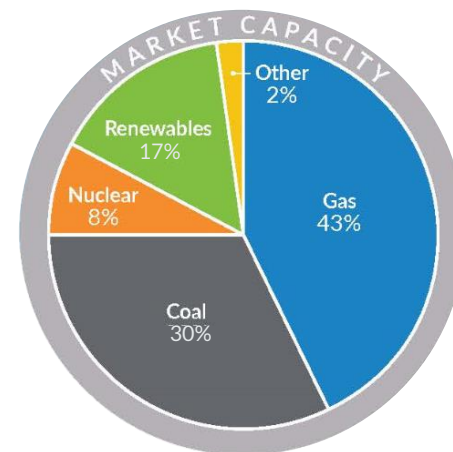
June 16, 2020

# MISO drives value creation through efficient and reliable markets, operations and planning

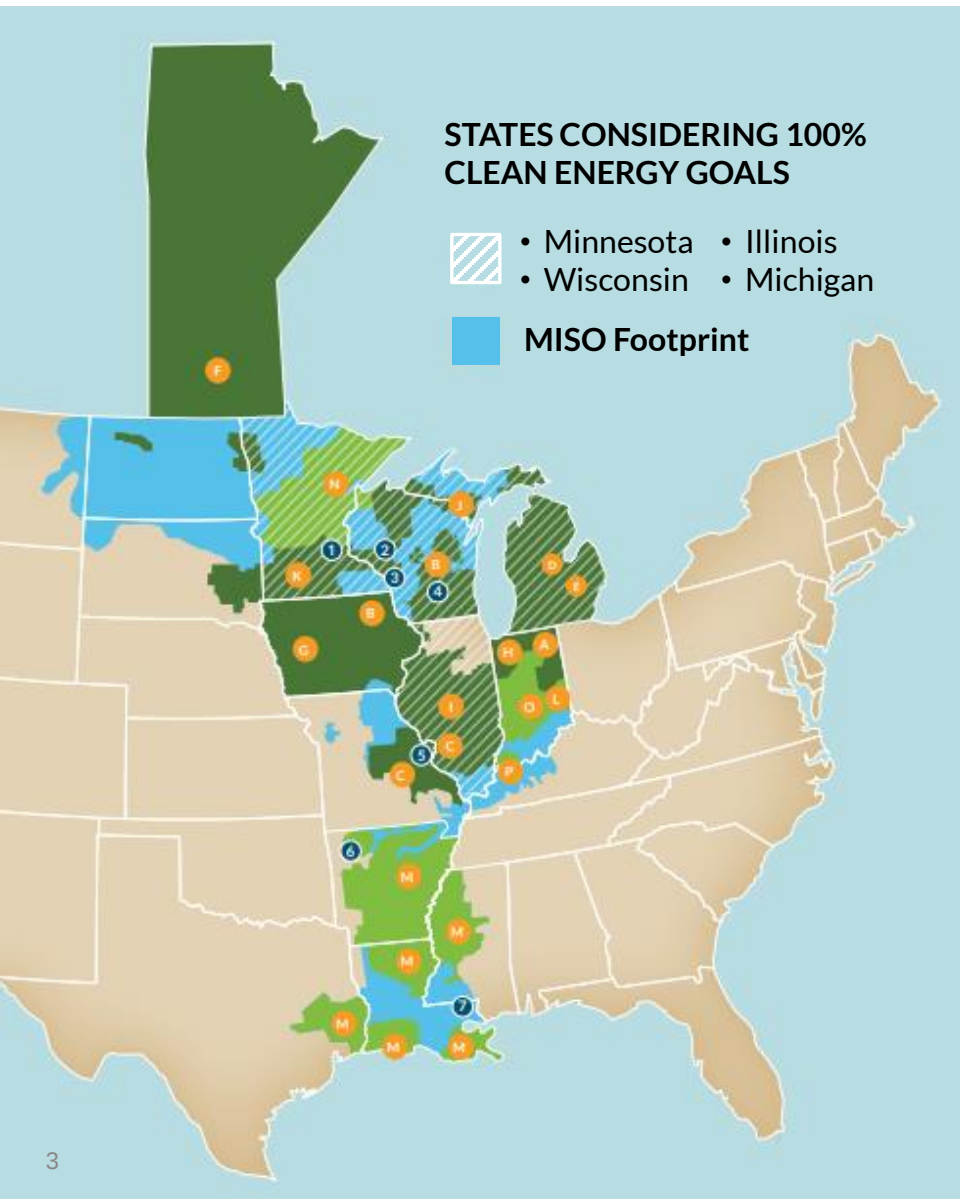
**MISO's vision: Be the most reliable, value-creating RTO**



| MISO by-the-numbers       |              |
|---------------------------|--------------|
| Transmission              | 71,800 miles |
| Generation Capacity       | 177,760 MW   |
| Peak Summer System Demand | 127,125 MW   |
| Customers Served          | 42 Million   |



# Large portions of the MISO footprint have set high decarbonization or clean energy goals



## MISO States, Cities and Utilities with Decarbonization or Clean Energy Goals

### CITIES WITH 100% CLEAN ENERGY GOALS

- |                      |                      |
|----------------------|----------------------|
| 1 Minneapolis, Minn. | 5 St. Louis, Mo.     |
| 2 Eau Claire, Wis.   | 6 Fayetteville, Ark. |
| 3 La Crosse, Wis.    | 7 Abita Springs, La. |
| 4 Madison, Wis.      |                      |

### **UTILITIES WITH 80%+ TARGETS**

- A. [AEP](#)
- B. [Alliant](#)
- C. [Ameren](#)
- D. [Consumers](#)
- E. [DTE](#)
- F. [Manitoba Hydro \(achieved, not a target\)](#)
- G. [MidAmerican](#)
- H. [Northern Indiana Public Service](#)
- I. [Vistra](#)
- J. [WEC Energy Group](#)
- K. [Xcel](#)

### **UTILITIES WITH 50%+ TARGETS**

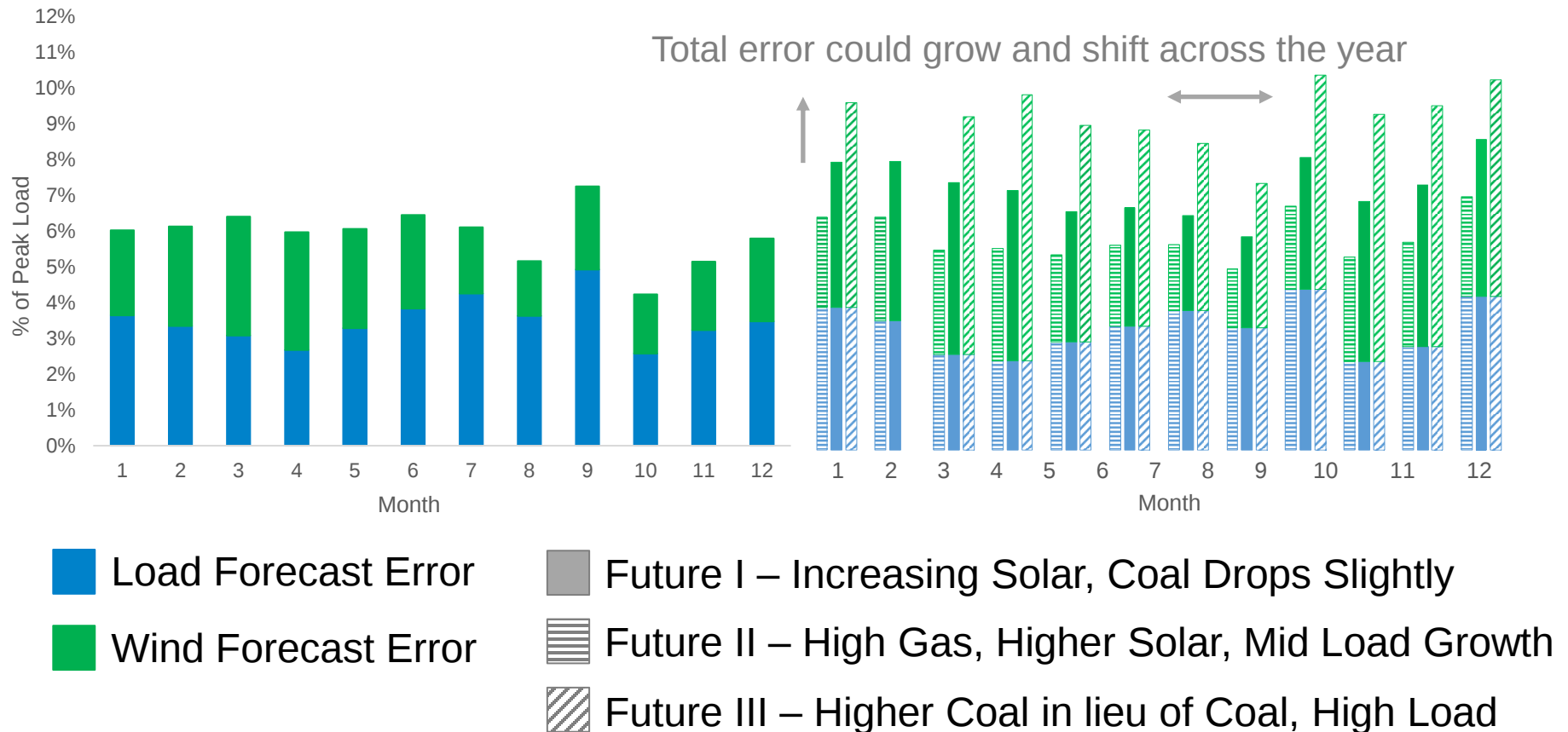
- L. [Duke](#)
- M. [Entergy](#)
- N. [Great River Energy](#)
- O. [Indianapolis Power and Light](#)
- P. [Vectren/SIGE](#)

# Uncertainty profiles are likely to change, growing in magnitude and shifting across the year

## Monthly Average Aggregate Forecast Error \*

### 3-year Historical

### Future Scenarios



# Grid operators manage margins to ensure reliability

- The margin between supply resources and obligations is an indicator of how close the system is to emergency or loss of load.\*
- It is influenced by a number of factors, some of which are highly variable and uncertain
  - Outages
  - Intermittent generation
  - Net scheduled interchange

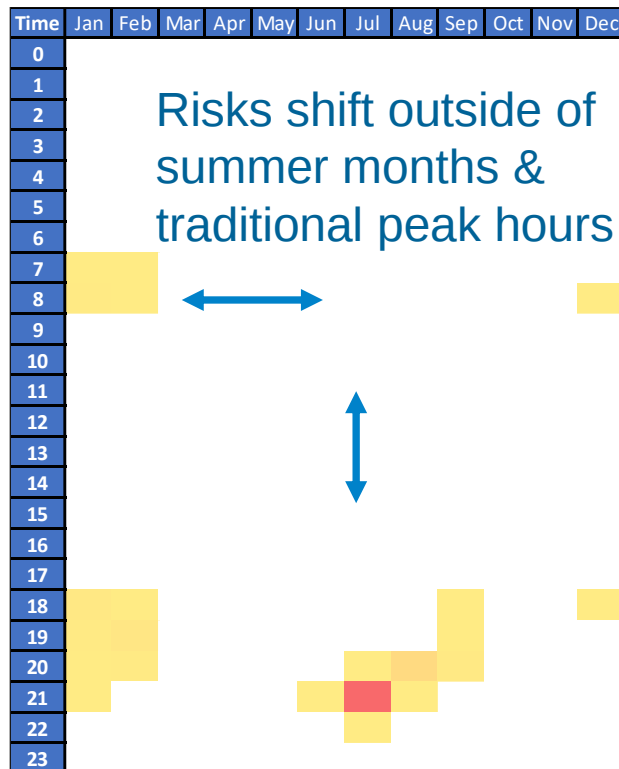
Margin = Available non-intermittent generation + intermittent generation +  
RDT limit + Net Scheduled Interchange + Load Resources  
(BTMG + LMR + EDR) - Load - Operating Reserve

\* Emergencies include alerts through to load shed

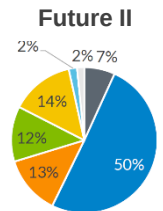
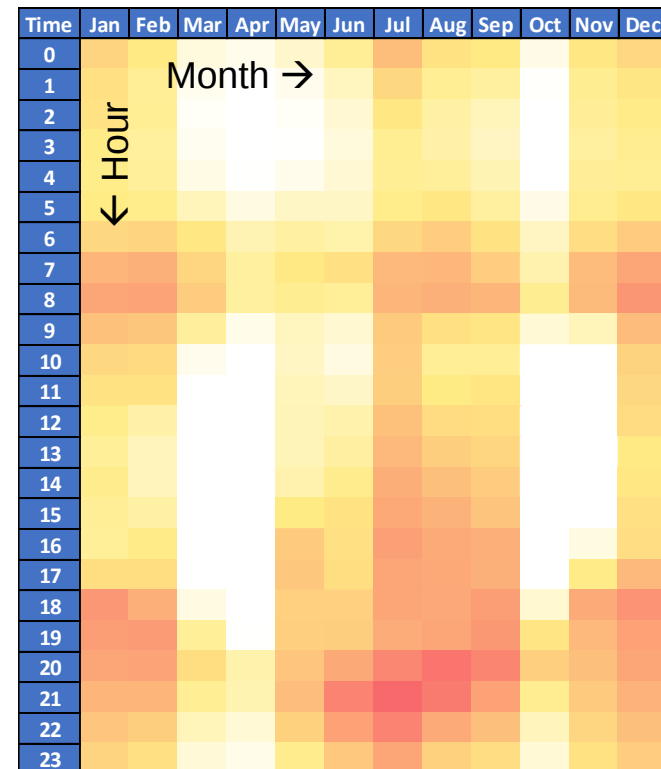
# Future resource evolution and total capacity shape patterns of need

*Draft results*

## 0.1 Loss of Load Expectation



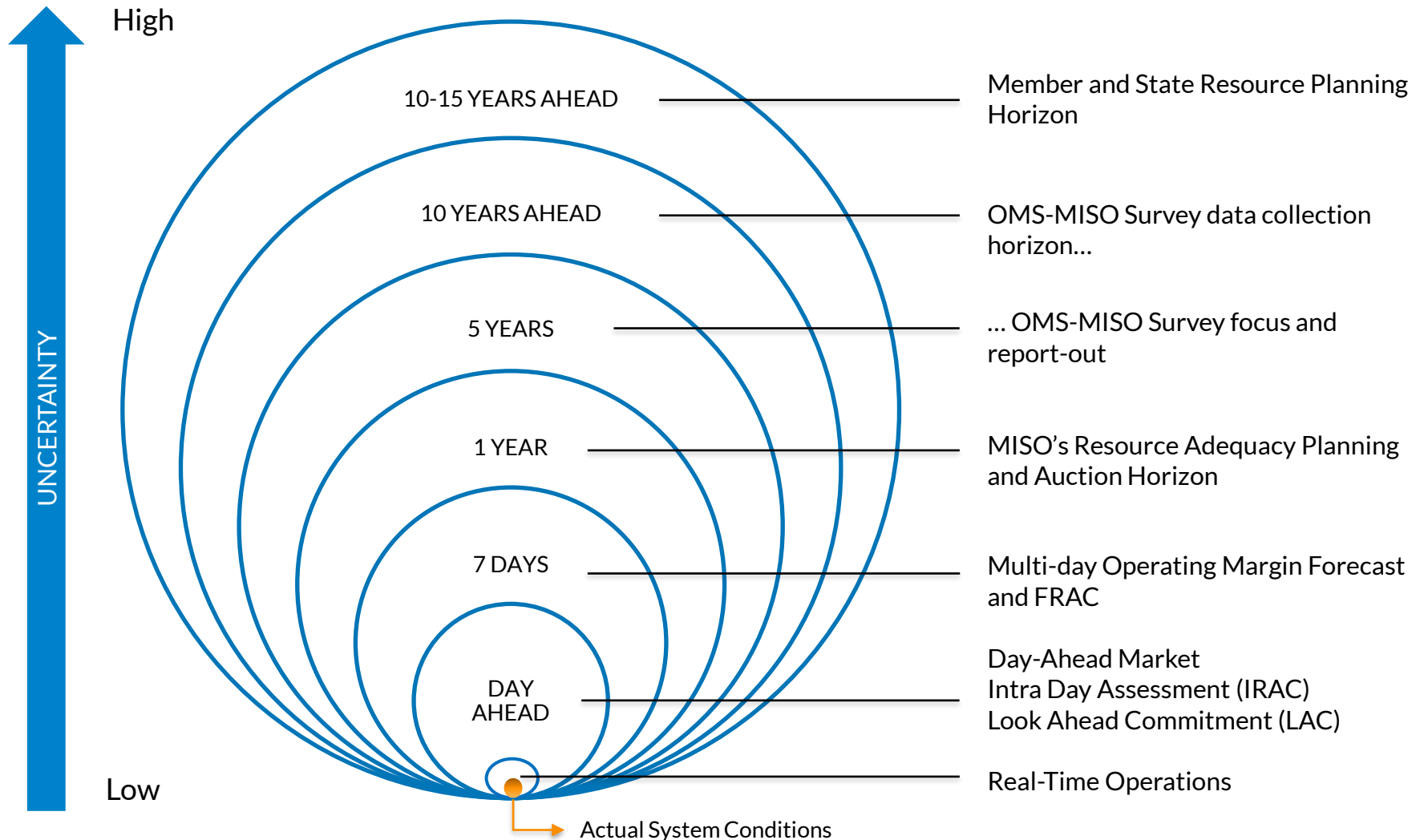
## Proxy Operator Experience\*



\* 0.6 LOLE Target

□ No risk    □ Moderate Risk    □ High Risk

# MISO and its members prepare from years to minutes ahead to be ready to balance supply and obligations



# The 2020 focus is on near-term steps that will address both current and longer-term needs

|                   | Identify Reliability Needs                                                                                                           | Planning Horizon                                                                              | Operating Horizon                                                                                       |
|-------------------|--------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------|
| <b>Needs</b>      | <p>Develop analytic methods to define reliability criteria</p> <p>Identify system reliability needs in addition to peak hour MWs</p> | <p>Define planning constructs that complement state and member roles in Resource Adequacy</p> | <p>Improve pricing for existing products</p> <p>Develop necessary new processes, tools and products</p> |
| <b>Importance</b> | <p>Current analysis (LOLE) does not address 24/7 risk with portfolio evolution</p>                                                   | <p>Stakeholders require better information to inform planning and investment decisions</p>    | <p>Market prices must better reflect underlying system conditions</p>                                   |
| <b>2020 Focus</b> | <p>Define system reliability needs and capabilities</p>                                                                              | <p>Develop sub-annual planning + PRA reform</p> <p>Enhance resource accreditation</p>         | <p>Propose scarcity pricing reforms</p>                                                                 |

# MISO has already taken some actions to date and is also planning further work

## Uncertainty and Risk Management

- Forecasting Enhancements
- Net Scheduled Interchange (researching needs)
- Research Stochastic Approaches
  - ARPA-E PERFORM Risk Adjusted Market Clearing (Georgia Tech et al)
  - ARPA-E PERFORM Stochastic Nodal Adequacy Pricing (Tabors Caramanis Rudkevich et al)
  - ARPA-E Stochastic Look-Ahead Commitment (University of Arizona et al)

## Additional Market Products and Pricing

- Short Term Reserves
- Enhanced Price Formation (e.g., ELMP)
- Additional Product Enhancements

## Resource Models

- Enhanced Combined Cycle
- Energy Storage Resource
- Pumped Hydro (prototyping)
- Hybrid Plants (researching)
- Distributed Energy Resource Aggregations (researching needs)