

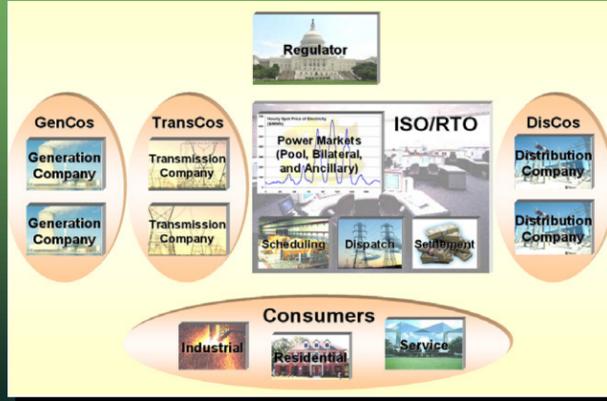


EMCAS: New Agent-Based Model Simulates Competitive Electricity Markets

EMCAS Capabilities

- Combines detailed engineering modeling techniques with quantitative market analysis.
- Represents multiple market participants and agents with individual company-level, decision-making capabilities.
- Incorporates agent learning and adaptation based on past performance and changing conditions.
- Makes available a wide range of market strategies to different agents (from risk-averse to risk-prone).
- Models various markets, including energy spot markets, bilateral markets, and ancillary services markets.

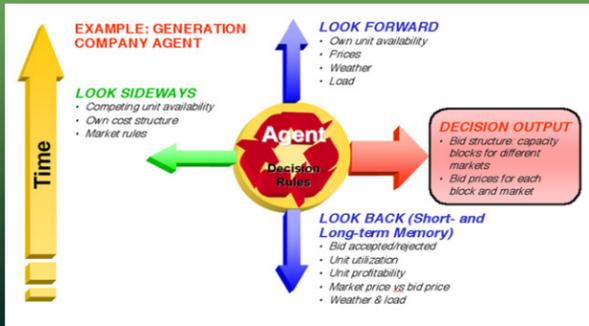
Electricity Markets Complex Adaptive Systems (EMCAS)



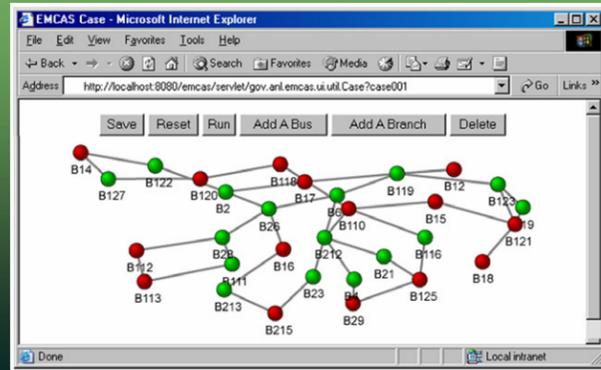
EMCAS Capabilities

- Each company agent has a set of corporate objectives, such as profit, risk exposure, market share, etc.
- Multiple objectives are combined into a "corporate utility function."
- Each agent seeks to maximize its own utility.
- User-specified market rules affect the behavior of both individual agents and the system.
- Market behavior emerges from agent interactions.
- AC and DC load flow models simulate the actual operation of the physical system configuration.
- Generators and transmission nodes are represented at the individual bus-level; transmission lines are represented as individual branches.

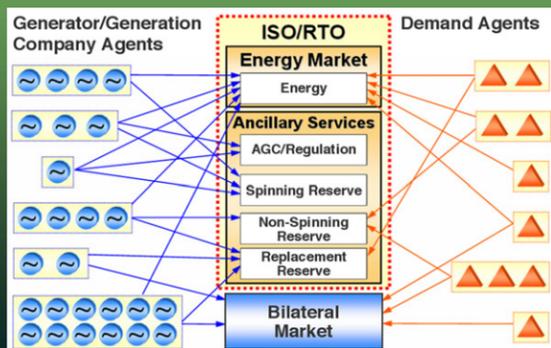
- Agents go through a complex evaluation process to prepare bids or solicitations.
- In the decision-making process, agents rely on historical and projected information as well as information on competitors.
- Agents have individual forecasting capabilities.



- The EMCAS interface is designed to easily construct and manipulate power market configurations and access model results.
- The web-based EMCAS model is developed in Java for ultimate portability.



- Individual generators and generation company agents can bid their generation capacity into any of the energy, bilateral, or ancillary services markets, subject to technical and physical constraints.
- Demand agents can satisfy their loads by bidding into the energy and bilateral markets; demand agents can bid the curtailment of interruptible loads into the ancillary services market as non-spinning reserve.
- All bids must specify the delivery and/or receiving points.



- Typically, zonal or locational marginal prices closely follow the load pattern.
- Adaptation and learning allow agents to raise market prices during recurring events, such as capacity shortages.

