

SCUC and SCD Software for Fully Coordinated Regional Power Markets

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Presentation Outline

- About CES
- Regional Markets Coordination Opportunities
- Current Regional Markets Operation, Software and Issues
- Proposal for a Single Software for Multiple Regional Markets
- Benefits of the Proposed Structure and Software

About CES

- Cambridge Energy Solutions is a software company with a mission to develop software tools for participants in deregulated electric power markets.
- CES-US provides information and tools to assist market participants in analyzing the electricity markets on a locational basis, forecast and value transmission congestion, and to understand the fundamental drivers of short- and long-term prices.
- CES-US staff are experts on market structures in the US, system operation and related information technology

Regional Markets Coordination Opportunities

- Transmission Congestion Management
- Transmission Losses Management; Calculation and Pricing
- Operating Reserves Sharing and Clearing Mechanisms
- Economic Interchange Schedules and Storage

Current Regional Markets Coordination: Software and Issues

- Currently regional wholesale electric power markets in the US are loosely coordinated with significant operational inefficiencies
- There are some processes, initiatives, proposals and plans to address and resolve these, but these are ad hoc initiatives that remain short of a fully coordinated operation.

Software Issues

- Currently, each regional market clears the Day Ahead markets using its own SCUC and SCD software with its own market rules, system model, and assumptions on neighboring systems with little or no exchange of data on the expected operation of the other systems and markets, and/or with inconsistent assumptions
- There are some ISOs sharing partial information and utilizing this for better RT congestion management and coordination, or shared operating reserves

Regional Model's Differences, Inconsistencies, and Inefficiencies

- Each ISO has its own transmission model with equivalent representation of neighboring markets and assumptions
 - Shift factors and static Loop Flows with equivalent models, but those depend on:
 - Generation and demand
 - Transmission and generation outages
 - Static, Temperature-based, and Dynamic ratings
 - Special protection schemes and post contingency corrective actions



Regional Model's Differences, Inconsistencies, and Inefficiencies

- Each regional market optimizes its assets for its own least cost, which is different than the global least cost
 - Phase shifters model and optimization
 - DC links schedule optimization
 - Pump storage optimization
- The importance of the above controls becomes more with increased renewables and increased price responsive demand

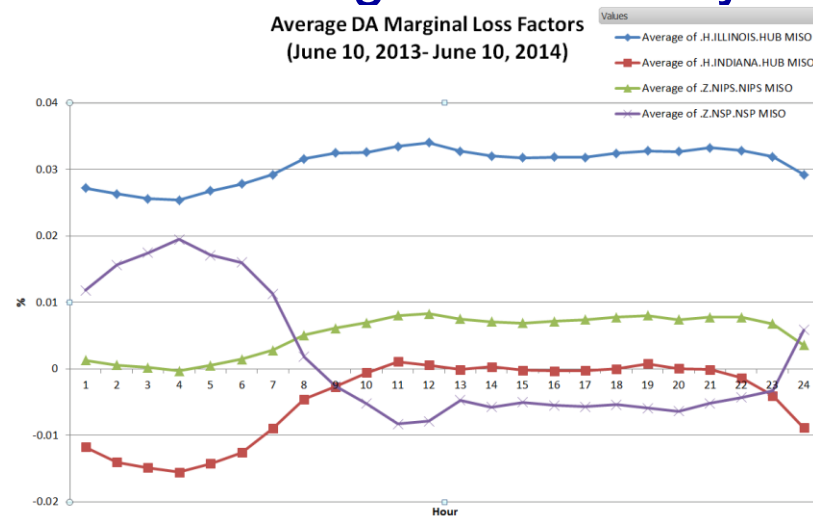
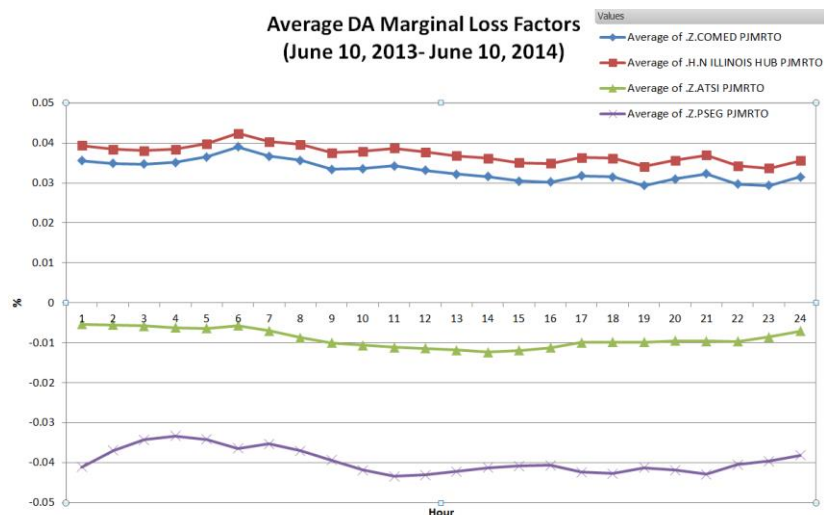


Example: Path 26 Shift Factors

	Path 26	
	CA ISO Model	WECC Model
Southern CA Edison	0	-0.0604
San Diego Gas & Electric	0	-0.0372
Pacific Gas & Electric	1	0.7835
Bonneville Power Admin (CAPTJACK)	1	0.6411
Sierra Pacific Power (Summit)	1	0.3702
PSC of Colorado (?)	0	0.2648
Idaho Power Company (?)	0	0.5097
Reference bus is Palo Verde		

Marginal Losses

- Only a few regional markets include marginal losses in SCUC and SCD, and out of those, only a few use the true marginal losses in the DA market.
- DA and RT markets can use the true marginal loss factors, and those can be coordinated to achieve higher efficiency



Operating Reserves

- Some regions have transparent markets for operating reserves with bids for each reserve type, and joint optimization of reserves and energy, while other regions do not.
- There are differences in bidding, allocation and pricing of reserves across different regions (ORDC, etc...)

Proposed Software – Objective

- Single software that clears multiple regional markets simultaneously in order to
 - Allow for full coordination among regions with or without regional operators or ISOs
 - Address and resolves all model differences and inconsistencies
 - Allow for higher operational efficiencies by integrating regional markets
- This software can be administered and maintained by a third party, with proper agreements with each regional entity.



Proposed Software

- The software uses the combined transmission system models and generation system data, as provided by each corresponding regional entity (including bid data and schedules)
 - ❑ the most accurate representation of the transmission and generation systems
 - ❑ with consistent information on generation and transmission outages,
 - ❑ Solves the global SCUC and SCD for the true power flows on lines, true congestion and marginal losses, and regional reserves



Proposed Software – Flexibility and Optionality

- ❑ Provides flexibility for each ISO to retain its own rules and procedures for its own systems
- ❑ Provides optionality to optimize resources across regions and allow market participants in all regional markets to participate and share the benefits from higher economic efficiency

Proposed Software

- ISOs regional operators need not participate in the market (buy and sell energy from each other) but rather allow (and facilitate) market participants in neighboring markets to be part of all regional coordinated markets
- Solves a single joint optimization of all regional markets involved, treats all scheduled economic transactions across ISOs as virtual transactions, with ex-post accounting to distribute any access revenues to load

PJM MISO Joint model

- The current state of the art in software algorithms allows for solving very large MIP problems in relatively short period of time
- We currently have a model for the PJM and MISO markets combined, the optimization can be solved with different focus: PJM market, MISO market and joint operation
- Can be easily extended to add additional regional markets like SPP...

Summary and Next Steps

- The proposed solution is technically feasible, but adds complexity to information sharing, solving the SCUC and SCD, and then the ex post processing of results (clearing prices back to each participating ISO).
- If the complete solution is difficult to achieve in the short term, then maybe partial solutions on sharing system and market information can be developed, for example, CA ISO use of the full WECC transmission model