CARIS – BENCHMARK UPDATE

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ESPWG Meeting
NYISO
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Benchmark Update

- Topics:
  - *Introduction*
  - *Benchmark Plan*
  - *Benchmark Deliverables*
  - *Benchmark Expectations*
  - *Annual Benchmark Status*
  - *Annual Benchmark Drafts Results*
  - *Peak Week Deep Dive Analysis*
  - *Sample Study*
  - *Benchmark Recommendation*

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Introduction

- Market Simulations at NYISO
- Analysis Tools
  - *PROBE – Historic Congestion Analysis*
    - Multiple-Pass SCUC and SCED with Actual DAM load and supply bids (including virtual)
    - Neighbors' model - PROXY busses
    - Co-optimized energy and reserve
  - *GE MAPS and ABB GridView – Planning tools*
    - Single Pass SCUC and SCED based on forecasted load, generating units heat rates and fuel prices
    - Neighbor model – full transmission, generation and load
- Results include LBMPs and LBMPs based metrics

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Benchmark Plan

- Simulations conducted for 2007
- Perform simulation across all 8760 hours on a zonal basis monitoring results across the list of metrics
- Perform deep dive simulations across all 168 hours on a zonal basis for the peak load week in 2007 monitoring results across the list of metrics
- Select a constrained element for a sample study analysis
- Simulate impact on results from alleviating the sample element with potential solutions (Generation, Transmission, and Demand)
- Compare results of each tool from the deep dive and sample study across the list of specified Benchmarking metrics
- Recommendation for tool selection reviewed with ESPWG in March

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Benchmark Deliverables

- 2007 Annual Benchmark
  - *Compare the Models behavior, hourly and annual metrics (Constrained & Unconstrained Simulations)*
- 2007 Peak Week Benchmark
  - *Closer coupling of MAPS, GridView and PROBE inputs*
- Sample Study
  - *Select a constrained element*
  - *Evaluate impact of the relieving the element from potential solutions (Generation, Transmission, Demand)*
- Compare results from the deep dive on the Peak Week and Sample Study across the list of specified Benchmarking metrics
- Recommendation for tool selection to perform the 2009 CARIS studies

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Benchmark Expectations

Simulation Tools Description

Data Type	PROBE	GridView	MAPS
Hourly Energy MWh	DAM Bids, include Virtual Bids	Zonal Actual	Zonal Actual
Generation	DAM Bids, includes Virtual Bids	Heat Rate Model, Fuel Prices	Heat Rate Model, Fuel Prices
Market Simulation	Single Pool, Multi-Pass SCUC and SCED Energy & Reserve Co-optimization	Multi-Pool, Single Pass SCUC and SCED	Multi-Pool, Single Pass SCUC and SCED
Neighboring Pools	PROXY Busses	HQ –PROXY Bus PJM, IESO, ISO-NE full representation	HQ-PROXY BUS PJM, IESO, ISO-NE full representation
Results	Zonal LBMPs, LBMPs metrics, etc…	Zonal LBMPs, LBMPs metrics, etc…	Zonal LBMPs, LBMPs metrics, etc…

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Benchmark Expectations

- Simulations conducted across NYCA for a historical period
- Input data per Benchmarking matrix presented at the Jan 8th ESPWG meeting
- Utilize available information from actual PROBE Analysis and grid performance
- Simulations performed for Constrained and Unconstrained conditions
- Models will be configured and compared against the 2007 actual results
- Results will be analyzed across a list of Benchmarking metrics presented at the Jan 8th ESPWG meeting
- Results from each tool will be analyzed for magnitude and response against actuals on several metrics
- Results from simulation tools are expected to be different from actual given operational configuration conditions (transmission, outages, etc…) over the course of the year – based on result magnitudes and response
- Results expected to trend in the anticipated cause and effect direction but are not expected to correlate with absolute magnitudes due intrinsic modeling differences (market bids vs. cost based bids, network operational configuration influence, virtual bidding, external proxy bus vs. actual external system representation, etc.).

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Annual Benchmark Status

- 2007 MAPS and GridView Database Completed
  - *Load, Transmission, Generation, Fuel Prices*
- Database Tuning in progress
  - *Known 2007 Maintenance Schedules Posted on Website*
  - *Base Load Generation*
- Tuning necessary to re-create boundary conditions, congestion and LBMPs

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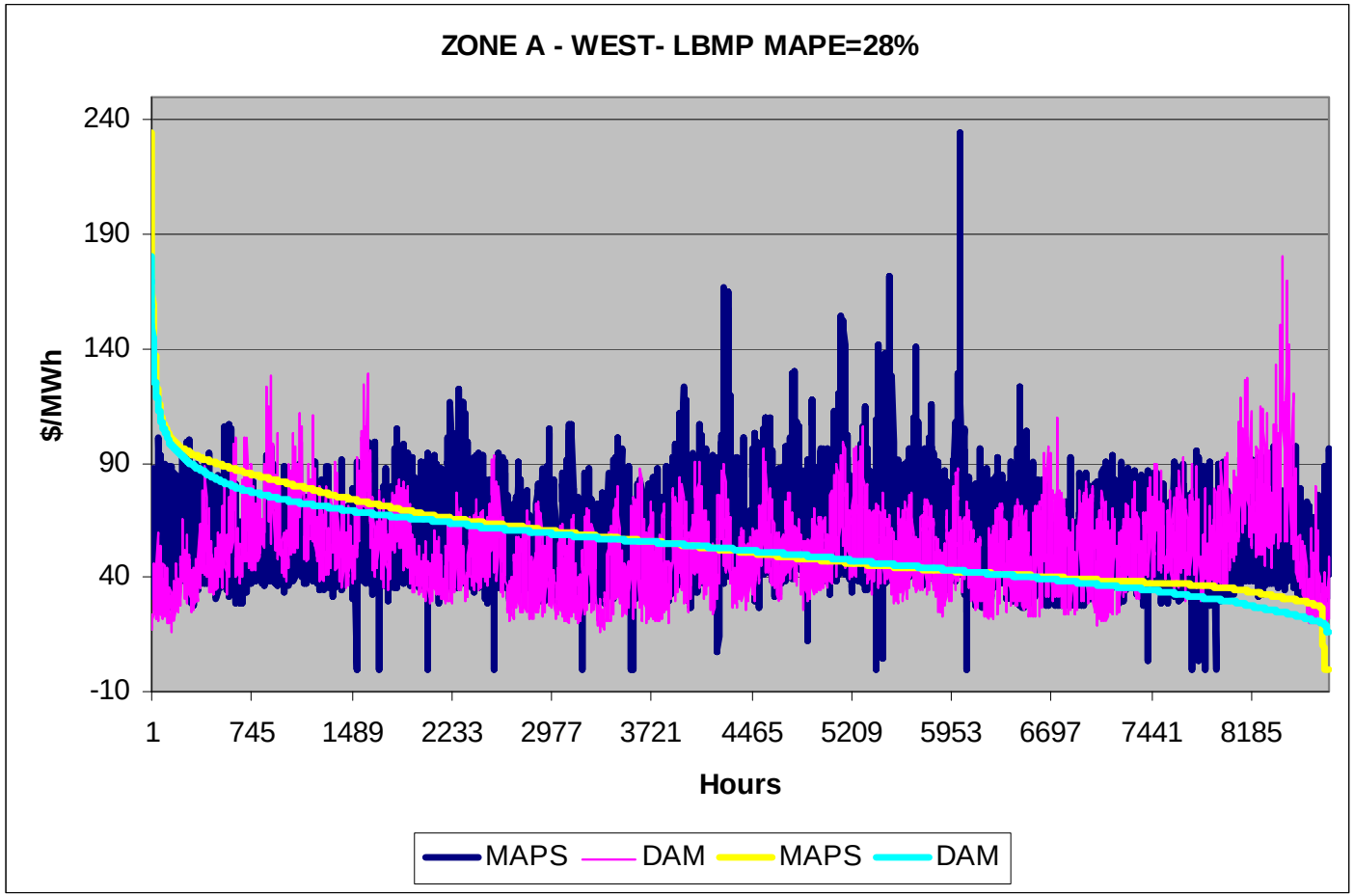
ANNUAL BENCHMARK RESULTS
DAM Zonal vs. Simulation LBMPs



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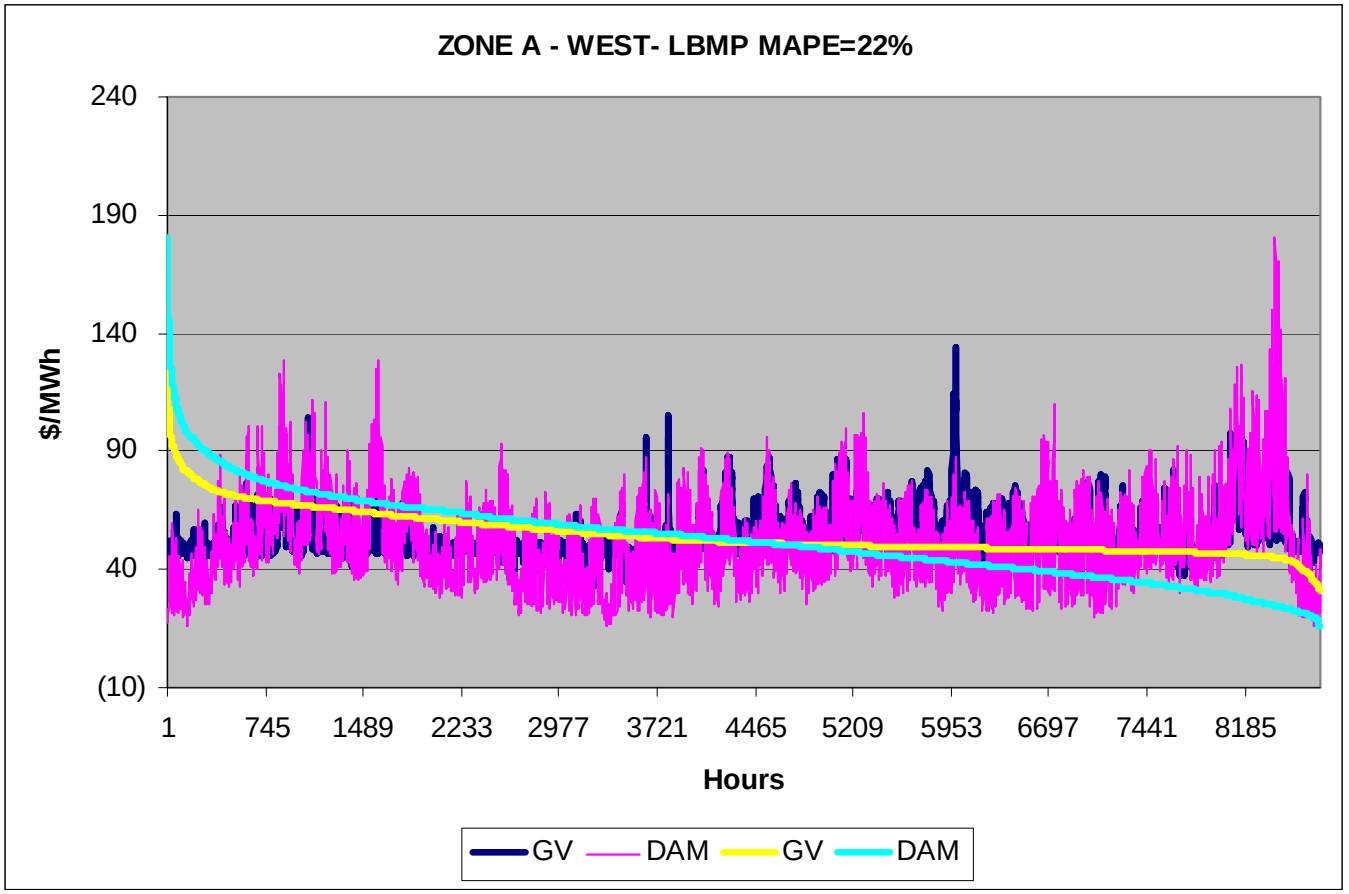

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ANNUAL BENCHMARK RESULTS
Payment Metrics

2007 Annual Delta: Unconstrained Less Constrained

DELTA [$ millions]	Load Pay			Gen Pay			Prod Cost		
	PROBE	GV	MAPS	PROBE	GV	MAPS	PROBE	GV	MAPS
ZONE A	$91	$20	$22	$211	$67	$81	$30	$0	$15
ZONE B	$67	$27	($53)	$63	$16	$113	$7	$1	$36
ZONE C	$61	$62	$160	$258	$286	$520	$123	$146	$56
ZONE D	$32	$16	($177)	$56	$68	($29)	$2	$3	($53)
ZONE E	$30	($7)	$57	$37	$0	$48	$19	$0	$13
ZONE F	($13)	($25)	$49	($4)	($98)	$109	($16)	($86)	$16
ZONE G	($23)	($19)	$13	($54)	($25)	$30	($39)	($15)	$1
ZONE H	($11)	($6)	($3)	($38)	($39)	$18	$0	$0	$0
ZONE I	($21)	($14)	($1)	($1)	$0	$0	$0	$0	$0
ZONE J	($375)	($132)	($169)	($269)	($175)	($220)	($156)	($148)	($254)
ZONE K	($374)	($51)	($17)	($424)	($200)	($118)	($227)	($219)	($175)
TOTAL NYSIO	($536)	($129)	($119)	($165)	($100)	$552	($257)	($318)	($345)

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Annual Benchmark Summary

- Models have been configured and tuning winding down
- Both models show preliminary results that are expected across all 8760 hours
- Further tuning to account for operational conditions would be extremely time consuming
- Results from the Annual analysis provide a solid basis to perform a deep dive over an abbreviated period (peak load week)

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Peak Week Deep Dive Analysis

- Deep dive analysis and comparison to be performed across an abbreviated period
- Calendar week (Aug. 8th) selected as the week in which the coincident NYISO peak occurred in 2007
- Provide 100% alignment of all inputs across all three models
- Report results across the specified Benchmarking metrics
- Results combined with those from the Sample Study will provide the basis for tool selection

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Peak Week Benchmark Draft Results

2007 Peak Week: Constrained vs Unconstrained

Subtotal NYISO Delta (1) **Total Delta (2)**	**PROBE (million$)**	**GridView (million$)**	**MAPS (million$)**
Load Payment			
Generation Payment			
Production Cost			

(1) NYISO Delta include NYCA zones only

(2) Total Delta included both internal and external zones

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Sample Study

- 2007 Peak Week Benchmark
  - *Select three methods to reduce congestion on a selected element*
  - *Generation, Transmission and Demand*
- Report across all specified Benchmarking metrics
- Purpose is to test models behave rationally

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Benchmark Recommendation

- Evaluate MAPS & GridView performance
  - *2007 Benchmark Metrics*
  - *Peak Week Analysis Metrics*
  - *Sample Study Results*
- Tool Selection Decision
  - *Performance across specified metrics*
  - *Tool Capability*
  - *Future Support*

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The New York Independent System Operator (NYISO) is a not-for-profit corporation that began operations in 1999. The NYISO operates New York's bulk electricity grid, administers the state's wholesale electricity markets, and provides comprehensive reliability planning for state's bulk electricity system.

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