Effects of 4/25/06 FERC RSG Order on Convergence of MISO markets

October 6, 2006
Agenda

• Executive Summary

• Background

• Hypothesis 1: Impact on Virtual Supply-Demand Ratio

• Hypothesis 2: Impact on DA-RT Power Price Premium

• Hypothesis 3: Impact on absolute DA-RT Power Price Divergence

• Backup
  — Theoretical Post-RSG-Order Equilibrium
  — Convergence in Other ISO Markets
Executive Summary
– Effects of 4/25/06 FERC RSG Order –

• FERC order on 4/25/06 subjects virtual supply bids (INCs) to a new and significant incremental transaction charge (RSG). This has materially impacted the DA market by drastically reducing the number of cleared INC (~50% decrease) and DEC transactions (~40% decrease).

• Has this new charge hurt the efficiency of the market? We examine this question by testing three hypothesis.
  — Hypothesis 1: The ratio of cleared INC to cleared DEC transactions has significantly declined, resulting in excessive plant dispatch in the day ahead market
  — Hypothesis 2: The average premium (bias) of the DA market to the RT market has significantly increased, thus raising costs for consumers of power
  — Hypothesis 3: The hourly absolute DA to RT market divergence has increased significantly, thus impairing the efficiency of plant dispatch

• Analysis of Market Data from 4/27/06 to 8/14/06 shows strong support for all three hypotheses
  — INC/DEC ratio has clearly decreased since FERC order (99.9% confidence level)
  — DA premium over RT prices has clearly increased (99.9% confidence level for Cinergy Hub; 89-99% confidence for tests at other 3 hubs); impact is greater than $2/mwh
  — Hourly absolute DA to RT divergence has increased (92% confidence level) based on a comprehensive (all nodes, all hours) measure of divergence

• Bottom-line impact: Among other negative effects, a $2 increase in DA premium implies $400M in additional costs since the imposition of the FERC RSG order…(annualized impact > $1B)
Hypothesis testing confirms that the MISO market has been harmed

Data Analysis: MISO DA-RT Market Convergence

Hypothesis Significance (using raw data)

Hypothesis 1
The ratio of cleared INC to cleared DEC transactions has declined

- YES
  - >99% Confidence Interval for whole market

Hypothesis 2
The average premium (bias) of the DA market to the RT market has increased

- YES
  - >99% Confidence Interval at Cinergy Hub

Hypothesis 3
The hourly absolute DA to RT market divergence has increased

- YES
  - >99% Confidence Interval for all nodes

Hypothesis Significance (adjusting for temporal correlation)

- YES
  - >99% Confidence Interval for whole market

- YES
  - >99% Confidence Interval at Cinergy Hub

- LIKELY YES
  - ~92% Confidence Interval for all nodes
Why RSG charges to INC transactions can cause an increase in bias and divergence

**Logic Tree: RSG Impact on Convergence**

- **Risk of RSG charges to INC Transactions**
  - Fewer INC Transactions Clear in DA Market
    - The DA-RT Premium Increases
      - Fewer DEC Transactions Clear in DA Market
        - Fewer Total Virtual Transactions Clear in DA Market
          - Greater Hourly Absolute DA-RT Divergence

INC transactions arbitrage high DA prices
DA Premium makes DEC transactions less profitable
Not only is a DA premium bad for the market and consumers, so too is poor DA-RT convergence.

### Why Convergence is Good

- **Reduces risk premium, i.e., the market price to insure against volatility**
  - Generally means lower prices for consumers

- **More efficient dispatch**
  - Generally means lower energy prices for consumers

- **Incent generation to bid competitively into the DA market**
  - No need to discount chances of receiving a fair price
  - Generally means lower energy prices for consumers

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*Annual impact to consumers is likely to be greater than the $1B driven directly by the DA premium increase (these effects are more difficult to measure, but real nonetheless)*
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Virtual energy transactions are an integral part of a two-settlement wholesale electricity markets

**Virtual Energy Transactions**

- **Introduction**

- Most LMP markets have a two-settlement system that combines a short term forward (day-ahead) market with a spot (real-time or balancing) market
  - All electricity markets must have a real-time (RT) market to ensure that instantaneous supply and demand are matched or balanced
  - The day-ahead (DA) market serves as a financial hedge against spot price volatility enabling participants to gain price certainty; it provides a market-based forecast of the real-time market; and it enables ISO to secure majority of generation ahead of time (reliability benefit)
    - PJM started its LMP market with a real-time settlement in 1998, the day-ahead market was introduced in June 2000
    - NYISO started its LMP market in 1999, followed by NE in March 2003, and MISO in April 2005

- Given that they both describe the same commodity, the prices in the day-ahead and real-time markets ought to converge; financial, or virtual, energy transactions were developed to encourage this convergence
  - Financial energy transactions consist of increment (INC) offers to sell power in the day-ahead market and decrement (DEC) bids to buy power in the day-ahead market
  - These transactions are purely financial, they automatically close out in the Real-Time market and there is no physical obligation to take or provide power
There are essentially four components to the MISO energy market: physical and financial supply and demand.

**Energy Market Components**

### Supply
- **Physical**
  - Generator offer to sell power into the market
    - DA and RT bids
    - 3-part offer (start-up, no-load, incremental energy)
    - Accepted if market clearing price is above incremental energy offer

### Demand
- **Physical**
  - Load-serving entities place bids for power into the market
    - DA and RT bids
    - Can be flexible (price-sensitive) or fixed
    - Fixed bids always accepted; price-sensitive accepted if market clearing price is below the bid

### Financial
- **Physical**
  - Virtual offer to sell power into the DA market if market clearing price is greater than offer (also called an "INC")
    - If accepted, the volume cleared is treated just like any other offer in the DA market but the participant must buy back power in RT market to cover committed supply
    - Typically placed when expectation is that DA LMP will be higher than RT LMP

- **Financial**
  - Virtual bid to buy power in the DA market if market clearing price is less than bid (also called a "DEC")
    - If accepted, the volume cleared is treated just like any other bid in the DA market, but the participant must sell this power in RT to offload committed demand
    - Typically placed when expectation is that DA LMP will be lower than RT LMP
In the DA energy market, both physical and financial bids are part of the market solution.
Virtual transactions provide numerous benefits to the energy markets

Benefits of Virtual Transactions

- **DA/RT market convergence**
  - Because financial participants seek to arbitrage the difference between the DA and RT markets, the effect is to bring them closer together

- **Liquidity**
  - Ensures that market clears at a fair price even in absence of physical participants

- **Granularity**
  - Physical bids are governed by physical parameters, so there may be price gaps on the stack – but virtuals can be priced anywhere (e.g., if 50/50 chance that $60 plant needed in addition to $40 plant, then the appropriate price is $50 -- which virtuals can provide)

- **Reduces the ability of large participants to exercise market power**
  - Virtual participation means increased overall participation (and hence competition) in the market

- **Risk mitigation**
  - Enables participants to hedge other physical and financial positions (physical example: generators can submit DECs to hedge some of the risk if their unit trips offline unexpectedly)
Definition of Revenue Sufficiency Guarantee (RSG)

- **Layman’s definition:** MISO pays generators a “make whole” payment to cover any revenue insufficiencies in the real time market. These amounts equal the difference between their total production “cost” (incremental energy + no-load + start-up bids) and real time energy revenues.

- **Allocation:** RSG has historically been allocated to generators, load, and exports (physical transactions) in proportion to their deviations from the Day Ahead Market, except that load/exports are allocated RSG only for Real-Time purchases that exceed Day-Ahead levels. The logic being that since these deviations generally cause RSG, they should pay for it.
RSG is often paid to generators who set the marginal clearing price, as LMP alone will not cover start-up and no-load costs.

**Market Solution**

- **Price**
  - Ex: $50 / Mwh

- **Generation Dispatched**

- **Instantaneous Demand**

- **Supply (based on marginal cost)**

**Generator A Economics**

**Costs (@ 100MW)**
- Incremental Energy: $5K
- No-load: $1K
- Start-up: $1K

**Revenues (@ 100MW)**
- LMP: $5K

$2K shortfall, so MISO provides a Revenue Sufficiency Guarantee (RSG) make-whole payment of $2K.
RSG is also often paid to generators committed for reliability / reserve purposes. In these cases LMP does not even cover incremental costs.

RSG Overview (continued)
– Units committed for reliability / reserve purposes –

RAC Process to manage for reliability

Generator B Economics

Costs (@ 25 MW – Eco Min Output)
- Incremental Energy $1.5K
- No-load $1.5K
- Start-up $2K

Revenues (@ 25MW)
- LMP $1.25K

MISO pays this generator (committed for reliability) $3.75K Revenue Sufficiency Guarantee (R&G) make-whole payment
(Total RSG for Generators A and B is $5.75k)
A FERC order on 4/25/06 suggested at least some portion of virtual offers will be charged RSG

**FERC RSG Order Description**

- Since the first day of MISO market operations (4/1/05), MISO made it clear to market participants (via business practice manuals, training sessions, and actual settlement bills) that virtual offers were not subject to RSG charges

- MISO TEMT (energy market tariff), however, contained ambiguous wording regarding allocation of RSG charges to virtual offers, so MISO sought to clarify tariff wording to match intent (and filed changes with FERC)

- On April 25, 2006, FERC ruled that a subset of virtual transactions should be allocated RSG charges according to the letter of the law (in particular, those of participants who also withdraw energy in real-time)

- INC (Virtual offer) volume (and DEC volume to a lesser extent) subsequently declined dramatically (>50%)
  - DA market premium increased

- MISO requested a stay of implementation; some ambiguity still remains over which virtual offers will be charged, as well as how much they will be charged
The steady state in an “INC RSG” world is one with a reduction in DECs, an even greater reduction in INCs, and a moderate DA premium.

**Post-RSG-Order Equilibrium Assessment**

– Example Case: RSG = $6 –

- **Limiting Case (Unstable)**
  - INCs Reduced, DECs Unchanged, No DA Prem.

- **Equilibrium**
  - DECs Reduced, INCs Reduced Further, Moderate DA Premium

- **Limiting Case (Untenable)**
  - INCs & DECs Equally Reduced, High DA Prem.

**DA Premium Distribution**

- **DECs Attractive**
  - Expected RSG Charge

**STEADY STATE**

- **DA-RT Premium ($)**

- **Expected RSG Charge**

The supply demand imbalance will naturally push the DA-RT distribution to the right (positive) side.

The balance of supply and demand will naturally push the DA-RT distribution back towards zero.
Looking at actual data, we do indeed see a moderate post-order DA premium that is somewhat less than the average RSG charge.
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Prior to the FERC RSG order, average daily INC/DEC volume ratio was about 0.95, with a standard deviation of 0.10
The post-RSG mean ratio is nine standard deviations away from where the simulated mean should be using pre-RSG data.

Expected Distribution of the Mean of the INC/DEC Ratios Post-RSG Order
– 4/27/06 to 8/14/06 (raw data) –

Actual post-RSG
Mean = 0.86

Cleared INC/DEC Volume Ratio

Sample size = 110 days
Mean = 0.95
Std. Dev. = 0.10/(110^{0.5}) = 0.01

The actual post-RSG outcome is “off-the-charts” relative to what would have been expected in a pre-RSG world. The market has clearly been impacted.
However, the cleared INC/DEC ratio displays significant daily correlation which could artificially raise confidence intervals.

Temporal Correlation Assessment of INC/DEC Ratios
– 8/1/05 to 4/26/06 –

Suggests a temporal correlation factor, $TCF = 1 - 0.28 = 0.72$
(midway between perfect & independent)
Adjusting for correlation, the post-RSG mean ratio is still more than three standard deviations from the pre-RSG distribution.

Expected Distribution of the Mean of the INC/DEC Ratios Post-RSG Order

– 4/27/06 to 8/14/06 (temporal correlation factor = 0.72) –

The RSG order caused a shift to a more DEC-heavy market; the natural implication is that the DA-RT premium should increase.
The ratio of INC to DEC has radically decreased post RSG

## Summary of INC/DEC Volume Ratio Analysis

– 8/1/05 to 8/14/06 –

<table>
<thead>
<tr>
<th>INC-DEC Ratio</th>
<th>Pre-RSG (8/1/05 - 4/26/06)</th>
<th>Post-RSG (4/27/06 - 8/14/06)</th>
</tr>
</thead>
<tbody>
<tr>
<td># days</td>
<td>269</td>
<td>110</td>
</tr>
<tr>
<td>μ</td>
<td>0.95</td>
<td>0.86</td>
</tr>
<tr>
<td>σ</td>
<td>0.10</td>
<td>0.29</td>
</tr>
</tbody>
</table>

| Post-RSG decrease in μ | 0.09 |

<table>
<thead>
<tr>
<th>TCF</th>
<th>Post-RSG expected σ</th>
<th>Post-RSG decrease in μ (as multiple of σ)</th>
<th>Confidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.50</td>
<td>0.01</td>
<td>9.30</td>
<td>100.00%</td>
</tr>
<tr>
<td>0.72</td>
<td>0.03</td>
<td>3.34</td>
<td>99.96%</td>
</tr>
</tbody>
</table>

TCF = Total Cost of Funds


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Looking at monthly averages suggests that the DA premium has risen, although one cannot quantitatively test the hypothesis that it has risen.
However, we can perform another statistical assessment – this time of the average daily DA-RT premium.
Statistical analysis again shows that the post-RSG world is different than before: the $2.80 increase in the DA premium is significant.

**Expected Distribution of the Mean of the DA Premium Post-RSG Order**
– Cinergy Hub, 4/27/06 to 8/14/06 (complete independence assumed)

Note: The average RT price was actually lower in the post-RSG period than the pre-RSG period, which makes the significance even greater than it appears.
The average daily DA-RT market premium is not correlated from one day to the next at the Cinergy Hub.

Temporal Correlation Assessment of DA-RT Premium
– Cinergy Hub, 4/1/05 to 4/26/06 –

A lack of daily correlation suggests that the statistical significance of the analysis need not be adjusted.
Expanding this analysis to the other major MISO hubs shows the same general result.

### DA-RT Premium for Four Major Hubs
- **4/1/05 to 4/26/06**

<table>
<thead>
<tr>
<th>Hub</th>
<th># days</th>
<th>µ</th>
<th>σ</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-RSG (4/1/05 - 4/26/06)</td>
<td>391</td>
<td>1.11</td>
<td>9.23</td>
</tr>
<tr>
<td></td>
<td>391</td>
<td>1.23</td>
<td>9.69</td>
</tr>
<tr>
<td></td>
<td>391</td>
<td>0.95</td>
<td>10.03</td>
</tr>
<tr>
<td></td>
<td>391</td>
<td>1.62</td>
<td>14.79</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Hub</th>
<th># days</th>
<th>µ</th>
<th>σ</th>
</tr>
</thead>
<tbody>
<tr>
<td>Post-RSG (4/27/06 - 8/14/06)</td>
<td>110</td>
<td>3.90</td>
<td>9.34</td>
</tr>
<tr>
<td></td>
<td>110</td>
<td>2.39</td>
<td>14.23</td>
</tr>
<tr>
<td></td>
<td>110</td>
<td>3.27</td>
<td>11.27</td>
</tr>
<tr>
<td></td>
<td>110</td>
<td>3.92</td>
<td>19.85</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Hub</th>
<th>Post-RSG increase in µ ($)</th>
<th>Post-RSG expected σ</th>
<th>Post-RSG increase in µ (as multiple of σ)</th>
<th>Confidence</th>
<th>Computed TCF</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$ 2.80</td>
<td>0.88</td>
<td>3.18</td>
<td>99.93%</td>
<td>0.50</td>
</tr>
<tr>
<td></td>
<td>$ 1.16</td>
<td>0.92</td>
<td>1.25</td>
<td>89.50%</td>
<td>0.49</td>
</tr>
<tr>
<td></td>
<td>$ 2.31</td>
<td>0.96</td>
<td>2.42</td>
<td>99.22%</td>
<td>0.52</td>
</tr>
<tr>
<td></td>
<td>$ 2.30</td>
<td>1.41</td>
<td>1.63</td>
<td>94.84%</td>
<td>0.56</td>
</tr>
</tbody>
</table>

**Assuming Independence (TCF = 0.5)**

<table>
<thead>
<tr>
<th>Hub</th>
<th>Post-RSG expected σ</th>
<th>Post-RSG increase in µ (as multiple of σ)</th>
<th>Confidence</th>
<th>Computed TCF</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0.86</td>
<td>3.25</td>
<td>99.94%</td>
<td>0.58</td>
</tr>
<tr>
<td></td>
<td>0.90</td>
<td>1.29</td>
<td>90.12%</td>
<td>0.57</td>
</tr>
<tr>
<td></td>
<td>1.04</td>
<td>2.23</td>
<td>98.71%</td>
<td>0.58</td>
</tr>
<tr>
<td></td>
<td>1.86</td>
<td>2.24</td>
<td>89.22%</td>
<td>0.57</td>
</tr>
</tbody>
</table>

**Using Computed TCFs**

The average increase in the DA premium for the four hubs is $2.14.
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Average absolute hourly DA-RT power price divergence has a log-normal distribution, with a 30% pre-RSG mean vs. 36% post-RSG.
If the previous distribution is normalized using a log function, it is easier to observe the post-RSG shift in the mean.

**Distribution of Log. of Average Absolute DA-RT Power Price Divergence**

- All nodes, 1/1/06 to 8/14/06

**Pre-RSG (1/1/06 - 4/26/06)**

- # hours: 2762
- $\mu$: -0.63
- $\sigma$: 0.31

**Post-RSG (4/27/06 - 8/14/06)**

- # hours: 2586
- $\mu$: -0.56
- $\sigma$: 0.34

Logarithm of Abs. Avg. DA-RT Div. as % of Avg. RT LMP
Adjusting for hourly correlation lowers the confidence that the post-RSG change in the mean divergence, but it is still statistically significant.

**Hourly Correlation and Statistical Significance**  
– All nodes, 1/1/06 to 8/14/06 –

### Temporal Correlation Assessment  
– 1/1/06 to 4/26/06 –

![Graph showing the relationship between number of consecutive hours and standard deviation of mean, with the equation $y = 0.3082x^{0.2547}$.

### Statistical Assessment

<table>
<thead>
<tr>
<th></th>
<th>Pre-RSG (1/1/06 - 4/26/06)</th>
<th>Post-RSG (4/27/06 - 8/14/06)</th>
</tr>
</thead>
<tbody>
<tr>
<td># hours</td>
<td>2762</td>
<td>2586</td>
</tr>
<tr>
<td>$\mu$</td>
<td>-0.63</td>
<td>-0.56</td>
</tr>
<tr>
<td>$\sigma$</td>
<td>0.31</td>
<td>0.34</td>
</tr>
<tr>
<td>Post-RSG increase in $\mu$</td>
<td>0.06</td>
<td></td>
</tr>
</tbody>
</table>

**Assuming independence (TCF = 0.5)**

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Post-RSG expected $\sigma$</td>
<td>0.01</td>
<td></td>
</tr>
<tr>
<td>Post-RSG decrease in $\mu$ (as multiple of $\sigma$)</td>
<td>10.46</td>
<td></td>
</tr>
<tr>
<td>Confidence</td>
<td>100.00%</td>
<td></td>
</tr>
</tbody>
</table>

**Using actual TCF = 0.75**

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Post-RSG expected $\sigma$</td>
<td>0.05</td>
<td></td>
</tr>
<tr>
<td>Post-RSG decrease in $\mu$ (as multiple of $\sigma$)</td>
<td>1.40</td>
<td></td>
</tr>
<tr>
<td>Confidence</td>
<td>91.98%</td>
<td></td>
</tr>
</tbody>
</table>
A top-level approach using raw absolute deviation also confirms that the post-RSG divergence is higher than it was in 2005 and pre-RSG 2006.

**Average Absolute DA-RT Power Price Divergence**

– All nodes, 4/1/05 to 8/14/06 –

![Graph showing the effect of RSG Order on average absolute DA-RT power price divergence.](image)

<table>
<thead>
<tr>
<th></th>
<th>Pre-RSG (1/1/06-4/26/06)</th>
<th>Post-RSG (4/27/06-8/14/06)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Avg. Abs. Divergence</td>
<td>$12.80</td>
<td>$16.76</td>
</tr>
<tr>
<td>Avg. DA LMP</td>
<td>$40.89</td>
<td>$48.19</td>
</tr>
<tr>
<td>Avg. RT LMP</td>
<td>$41.45</td>
<td>$44.70</td>
</tr>
</tbody>
</table>

- Divergence as % of DA LMP: 31% to 35%
- Divergence as % of RT LMP: 31% to 37%
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The distribution of DA-RT deviations is roughly normal with a mean near zero -- which in a normally functioning market with no RSG means roughly equal opportunities for INCs (virtual supply) and DECs (virtual demand).
The introduction of a charge on INCs (Virtual Offers) makes some subset of those opportunities unattractive.

Immediate Effect of RSG Charge on Attractive Virtual Opportunities

INC RSG Charge (Assumption: $6)

No Attractive Opps

Attractive DEC Opportunities

Attractive INC Opportunities

DA-RT Premium ($)
As INCs (Virtual Offers) withdraw from the market, a DA premium develops…

**Impact of INC Withdrawal on DA Market**

<table>
<thead>
<tr>
<th>Original Supply</th>
<th>New Supply</th>
</tr>
</thead>
<tbody>
<tr>
<td>Decrease in Supply</td>
<td>Increase in Prices</td>
</tr>
</tbody>
</table>

Price $P_N$ $P_O$

Quantity
... and shifts the distribution of DA-RT deviations to the right (positive) side -- which means fewer DEC opportunities, and a modest rebound in INC opportunities (levels still below the DEC side)
Note that the distribution does not shift so much that the number of attractive INCs and DECs balance out. If this were the case, then there would be nothing left to support the DA-RT shift (as there would be no supply/demand imbalance).

**Example of Untenable DA-RT Distribution Shift**

- “Limiting Case” for DA Premium Increase –

Note: Implies a theoretical cap on the DA premium of half the RSG charge ($3 in this illustrative example where RSG has been assumed to be $6).
The steady state in an “INC RSG” world is one with a reduction in DECs, an even greater reduction in INCs, and a moderate DA premium.

Post-RSG-Order Equilibrium Assessment

Limiting Case (Unstable)
– INCs Reduced, DECs Unchanged, No DA Prem. –

Limiting Case (Untenable)
– INCs & DECs Equally Reduced, High DA Prem. –

Equilibrium
– DECs Reduced, INCs Reduced Further, Moderate DA Premium –

The supply demand imbalance will naturally push the DA-RT distribution to the right (positive) side.

STEAZY STATE

The balance of supply and demand will naturally push the DA-RT distribution back towards zero.
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A simple metric suggests that convergence has improved substantially over time, with disruptions during the assimilation of new geographies.

Convergence Metric: PJM Example

- Ratio of Avg. Abs. Spread to Avg. DA Price (1 Yr Lookback)

Average Hourly Absolute Nodal Spread as Percent of Average DA Power Price

1 Data set starts 06/01/00 and ends 9/11/05. Not scaled with load. All nodes are considered with equal weighting.
Building the Energy Markets of Tomorrow… Today

NYISO Price Convergence
DAM and Real Time LBMP - NYCA Wide

Values closer to zero indicate price convergence. In order to smooth day to day variations, a 28-Day Moving Average of \( \text{ABS}(\text{RT}/\text{DAM}) - 1 \) is used.
(Data through 8/6/2006)

For Discussion Only

September 6, 2006

DC ENERGY
The convergence metric is a simple aggregation of hourly divergence on a nodal basis.

**Convergence Metric Formula**

- The average absolute spread between the day-ahead and real-time market prices across all nodes was calculated using the following formula:

\[
\sum_{\text{All Hours}} \left( \frac{\sum_{\text{All Nodes}} |\text{DayAheadPrice} - \text{RealTimePrice}|}{\text{Total Nodes}} \right) \div \text{Total Hours}
\]

- The average price was calculated across all nodes using the following formula:

\[
\sum_{\text{All Hours}} \left( \frac{\sum_{\text{All Nodes}} \text{DayAheadPrice}}{\text{Total Nodes}} \right) \div \text{Total Hours}
\]