Figure 3.18 Map of real-time generation, less real-time load, by zone: January through September, 2018
Figure 3-46 Real-time, load-weighted, average LMP: January through September, 2018
Figure 11-4 Location of the top 10 constraints by PJM day-ahead congestion costs: January through September, 2018
Table 11-4 Zonal and PJM real-time, load-weighted average LMP components (Dollars per MWh): January through September, 2017 and 2018

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<tr>
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<th>2017 (Jan - Sep)</th>
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<th></th>
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## Area Based and Constraint Based Total Day Ahead and Total Balancing Congestion by Zone (Dollars (Millions)): January through September, 2018

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<th>Constraint Based Balancing</th>
<th>Total</th>
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## Area Based and Constraint Based Total Day Ahead and Total Balancing Congestion by Zone (Dollars (Millions)): January through September, 2017

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</table>
System Example

A
Load: 800
Gen: 900
LMP = $5

B
Load: 400
Gen: 650
LMP = $15

C
Load: 400
Gen: 50
LMP = $15

<table>
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<tr>
<th>Type</th>
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<tr>
<td>Gen</td>
<td>1,600</td>
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</tbody>
</table>

<table>
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<th>Constraint</th>
<th>B</th>
<th>C</th>
</tr>
</thead>
<tbody>
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<td>$15</td>
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<tr>
<td>SMP</td>
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<tr>
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<td>----&gt;</td>
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Shadow price of constraint = $10
System Example

A  LMP = $5
Load: 800
Gen: 900

B  LMP = $15
Load: 400
Gen: 650

C  LMP = $15
Load: 400
Gen: 50

Congestion = The difference between total charges to load and total payments to generation caused by binding transmission constraints.

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<tr>
<td>Gen</td>
<td>1,600</td>
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Shadow price of constraint = $10
Total congestion = $10 x 100 MW
Total congestion = $1,000
System Example

A
Load: 800
Gen: 900
LMP = $5

B
Load: 400
Gen: 650
LMP = $15

C
Load: 400
Gen: 50
LMP = $15

<table>
<thead>
<tr>
<th>Type</th>
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<td>Gen</td>
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<table>
<thead>
<tr>
<th>Constraint</th>
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<th>C</th>
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<tbody>
<tr>
<td>LMP</td>
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<td>$15</td>
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<tr>
<td>SMP</td>
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<table>
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<th>Load Weighted Reference Bus</th>
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<th>Zone Based B</th>
<th>Zone Based C</th>
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</tr>
<tr>
<td>900</td>
<td>650</td>
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<table>
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<th>Zone Based B</th>
<th>Zone Based C</th>
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Total Zone Congestion (Area Method) For B and C
$500

Total Congestion for system
$1,000
Load is paying more for energy than gen is being paid for energy due to constraints.

Load downstream of constraints pay congestion.
System Example

A

Load: 800
Gen: 900

LMP = $5

<table>
<thead>
<tr>
<th>Type</th>
<th>Total MW</th>
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</thead>
<tbody>
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<tr>
<td>Gen</td>
<td>1,600</td>
</tr>
</tbody>
</table>

100 MW

B

Load: 400
Gen: 650

LMP = $15

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C

Load: 400
Gen: 50

LMP = $15

- LMP $5
- SMP $10
- CLMP $5

Load MW 800
Load Weighted Reference Bus 400

Gen MW 900
650
50

Total Congestion for system $1,000

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