Disconnected PNode Information for April and May 2009

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**Introduction**

In this report we provide some data on the number of occurrences in which the Day-Ahead Market encountered disconnected PNodes as well as some further analysis of a couple of sample hours during which we analyze the effect that the zero dollar Marginal Congestion Component had on the Trading Hub price.

**Disconnected PNode Occurrences**

The tables below show a summary of the number of instances in the Day-Ahead Market when there were disconnected pnodes in April and May:

<table>
<thead>
<tr>
<th>Month</th>
<th>Max</th>
<th>Min</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>April</td>
<td>93</td>
<td>47</td>
<td>66.6</td>
</tr>
<tr>
<td>May</td>
<td>78</td>
<td>26</td>
<td>40.4</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Month</th>
<th>Max</th>
<th>Min</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>April</td>
<td>13</td>
<td>2</td>
<td>6.4</td>
</tr>
<tr>
<td>May</td>
<td>16</td>
<td>1</td>
<td>4.6</td>
</tr>
</tbody>
</table>

In Figure 1 below, the graph reflects the hourly fluctuation in the number of disconnected PNodes for the month of April.

![Figure 1: Number of disconnected PNode in April for each hour](image-url)
In Figure 2 below, the graph reflects the hourly fluctuation in the number of disconnected PNodes for the month of May.

Figure 2: Number of disconnected PNodes in May for each hour

In Figure 3 below, the graph reflects the hourly fluctuation of the number of disconnected PNodes related to a trading hub for the month of April.

Figure 3: Number of disconnected PNodes related to a trading hub in April for each hour
In Figure 4 below, the graph reflects the hourly fluctuation of the number of disconnected PNodes related to a trading hub for the month of May.

Figure 4: Number of disconnected PNodes related to a trading hub in May for each hour

Case Studies Related to Trading Hub Price
In the case studies listed below we have taken a couple of hours to describe the impact of the replacement of a substitute PNode MCC for those disconnected PNodes associated with a Trading Hub.

Case study I
In this case study we used the data for May 12, 2009 HE10 from the Day-Ahead Market as a sample period during which there were several disconnected PNodes. We identified the disconnected PNodes then used a program to determine the closest electrically connected PNode. If the program had to go more than 7 busses from the disconnected PNode and still could not find a PNode that was electrically connected then we did a manual search. Of the PNodes that we used in our example only one could not find a substitute PNode using the program and the substitute had to be found manually. During the running of the Day-Ahead Market for May 12, 2009 HE10 the system had the most disconnected trading hub related PNodes during April and May.

Table 3 below reflects the mapping from the disconnected PNode to the substitute PNode for the date and hour referenced. Table 4 takes the allocation factor for the disconnected PNode and applies this to the substitute MCC to arrive at the Trading Hub impact.
Table 3. Disconnected PNode Mapping

<table>
<thead>
<tr>
<th>Time</th>
<th>HE</th>
<th>Disconnected PNode Name</th>
<th>TOU</th>
<th>Substitute PNode Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>12MAY2009</td>
<td>10</td>
<td>BEARDSLY_7_B1</td>
<td>ON</td>
<td>RTRACK_1_N001</td>
</tr>
<tr>
<td>12MAY2009</td>
<td>10</td>
<td>CHSTN_7_B1</td>
<td>ON</td>
<td>RTRACK_1_N001</td>
</tr>
<tr>
<td>12MAY2009</td>
<td>10</td>
<td>COTTLE_7_N002</td>
<td>ON</td>
<td>WARNERVL_2_B1</td>
</tr>
<tr>
<td>12MAY2009</td>
<td>10</td>
<td>CURTISS_1_N010</td>
<td>ON</td>
<td>RTRACK_1_N001</td>
</tr>
<tr>
<td>12MAY2009</td>
<td>10</td>
<td>DONNELLS_7_B1</td>
<td>ON</td>
<td>RTRACK_1_N001</td>
</tr>
<tr>
<td>12MAY2009</td>
<td>10</td>
<td>FBERBORD_1_N001</td>
<td>ON</td>
<td>RTRACK_1_N001</td>
</tr>
<tr>
<td>12MAY2009</td>
<td>10</td>
<td>FULTON_1_B1</td>
<td>ON</td>
<td>FULTON_1_N020</td>
</tr>
<tr>
<td>12MAY2009</td>
<td>10</td>
<td>NEWCJ1_1_B1</td>
<td>ON</td>
<td>NEWCSTLE_7_B1</td>
</tr>
<tr>
<td>12MAY2009</td>
<td>10</td>
<td>PHOENIX_7_N001</td>
<td>ON</td>
<td>RTRACK_1_N001</td>
</tr>
<tr>
<td>12MAY2009</td>
<td>10</td>
<td>SNDBRJT_1_B1</td>
<td>ON</td>
<td>RTRACK_1_N001</td>
</tr>
<tr>
<td>12MAY2009</td>
<td>10</td>
<td>SPRNGGP_7_B1</td>
<td>ON</td>
<td>RTRACK_1_N001</td>
</tr>
<tr>
<td>12MAY2009</td>
<td>10</td>
<td>VACA-DIX_1_N014</td>
<td>ON</td>
<td>VACA-DIX_1_N001</td>
</tr>
<tr>
<td>12MAY2009</td>
<td>10</td>
<td>VINCENT_2_N100</td>
<td>ON</td>
<td>VINCENT_5_B1</td>
</tr>
<tr>
<td>12MAY2009</td>
<td>10</td>
<td>VINCENT_2_N101</td>
<td>ON</td>
<td>VINCENT_5_B1</td>
</tr>
<tr>
<td>12MAY2009</td>
<td>10</td>
<td>WARNE1_7_B1</td>
<td>ON</td>
<td>PASTORIA_2_B1</td>
</tr>
<tr>
<td>12MAY2009</td>
<td>10</td>
<td>WARNE2_7_B1</td>
<td>ON</td>
<td>PASTORIA_2_B1</td>
</tr>
</tbody>
</table>

Table 4. Allocation factors and price

<table>
<thead>
<tr>
<th>Disconnected PNode</th>
<th>Mapping</th>
<th>AF</th>
<th>Substitute MCC</th>
<th>Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>BEARDSLY_7_B1</td>
<td>RTRACK_1_N001</td>
<td>0.000351</td>
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<tr>
<td>CHSTN_7_B1</td>
<td>RTRACK_1_N001</td>
<td>0.001563</td>
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<tr>
<td>COTTLE_7_N002</td>
<td>WARNERVL_2_B1</td>
<td>0.000413</td>
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<td>0</td>
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<td>CURTISS_1_N010</td>
<td>RTRACK_1_N001</td>
<td>4.22E-05</td>
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<tr>
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<td>0.005392</td>
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<td>FULTON_1_B1</td>
<td>FULTON_1_N020</td>
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<tr>
<td>NEWCJ1_1_B1</td>
<td>NEWCSTLE_7_B1</td>
<td>0.000334</td>
<td>6.24272</td>
<td>0.002086</td>
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<tr>
<td>PHOENIX_7_N001</td>
<td>RTRACK_1_N001</td>
<td>0.000147</td>
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<tr>
<td>SNDBRJT_1_B1</td>
<td>RTRACK_1_N001</td>
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<td>RTRACK_1_N001</td>
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<tr>
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<td>VACA-DIX_1_N001</td>
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<td>0</td>
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<tr>
<td>VINCENT_2_N100</td>
<td>VINCENT_5_B1</td>
<td>0.011236</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>VINCENT_2_N101</td>
<td>VINCENT_5_B1</td>
<td>0.00317</td>
<td>0</td>
<td>0</td>
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<tr>
<td>WARNE1_7_B1</td>
<td>PASTORIA_2_B1</td>
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<tr>
<td>WARNE2_7_B1</td>
<td>PASTORIA_2_B1</td>
<td>0.003561</td>
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</tbody>
</table>

In case study I, above, although 16 PNodes are disconnected, the effect is less than one cent. For a CRR with a source or sink at NEWCJ1_1_B1 the effect would be more substantial.
Case study II

In case study II we used the data for May 19, 2009 HE11 from the Day-Ahead Market as a sample period during which there were several disconnected PNodes associated with a Trading Hub. As noted above we identified the disconnected PNodes then used a program to determine the closest electrically connected PNode and used the MCC from the substitute PNode to calculate the impact to the Trading Hub MCC price.

Table 5 below reflects the mapping from the disconnected PNode to the substitute PNode for the date and hour referenced. Table 6 takes the allocation factor for the disconnected PNode and applies this to the substitute MCC to arrive at the Trading Hub impact.

Table 5. Disconnected PNode Mapping

<table>
<thead>
<tr>
<th>Market</th>
<th>HE</th>
<th>Disconnected PNode Name</th>
<th>TOU</th>
<th>Substitute PNode Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>19MAY2009</td>
<td>11</td>
<td>MESAHGTS_6_N011</td>
<td>ON</td>
<td>MESAHGTS_6_N001</td>
</tr>
<tr>
<td>19MAY2009</td>
<td>11</td>
<td>NEWCJ1_1_B1</td>
<td>ON</td>
<td>NEWCASTLE_7_B1</td>
</tr>
<tr>
<td>19MAY2009</td>
<td>11</td>
<td>PITSBRG_2_B1</td>
<td>ON</td>
<td>DECPENSBG_2_N001</td>
</tr>
<tr>
<td>19MAY2009</td>
<td>11</td>
<td>SOUTHBGT_7_B1</td>
<td>ON</td>
<td>SOUTHBAY_6_B1</td>
</tr>
<tr>
<td>19MAY2009</td>
<td>11</td>
<td>VACA-DIX_1_N014</td>
<td>ON</td>
<td>VACA-DIX_1_N001</td>
</tr>
<tr>
<td>19MAY2009</td>
<td>11</td>
<td>VINCENT_2_N100</td>
<td>ON</td>
<td>VINCENT_5_B2</td>
</tr>
<tr>
<td>19MAY2009</td>
<td>11</td>
<td>VINCENT_2_N101</td>
<td>ON</td>
<td>VINCENT_5_B2</td>
</tr>
</tbody>
</table>

Table 6. Allocation factors and price

<table>
<thead>
<tr>
<th>Disconnected PNode Name</th>
<th>Substitute PNode Name</th>
<th>AF</th>
<th>Substitute MCC</th>
<th>Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>MESAHGTS_6_N011</td>
<td>MESAHGTS_6_N001</td>
<td>0.00319</td>
<td>0.71191</td>
<td>0.000227</td>
</tr>
<tr>
<td>NEWCJ1_1_B1</td>
<td>NEWCASTLE_7_B1</td>
<td>0.000334</td>
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<td>0</td>
</tr>
<tr>
<td>PITSBRG_2_B1</td>
<td>DECPENSBG_2_N001</td>
<td>0.074623</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>SOUTHBGT_7_B1</td>
<td>SOUTHBAY_6_B1</td>
<td>4.14E-06</td>
<td>0.7653</td>
<td>3.17E-06</td>
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<td>VACA-DIX_1_N014</td>
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<tr>
<td>VINCENT_2_N100</td>
<td>VINCENT_5_B2</td>
<td>0.011236</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>VINCENT_2_N101</td>
<td>VINCENT_5_B2</td>
<td>0.00317</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

As with case study I the results from case study II still show the effect on the trading hub price to be less than one cent.

Conclusion

Overall this analysis shows two things. Firstly it shows that the effect of the zero dollar MCC on the trading hub prices is negligible. This is due to the fact that the allocation factors are small and although the MCC is zero in the LMP the Marginal Energy Cost (MEC) is non-zero, as is the loss component (MLC). In addition if there is little congestion then sometimes even the MCC that is substituted is still zero. Thus a very small fraction of a small amount is a fraction of a cent. Secondly; the CAISO realizes that the main effect is on CRR holders that hold CRRs with sources or sinks at these disconnected points. These entities will be aware of their own positions, and the CAISO has not performed this analysis at the Scheduling Coordinator (SC) level. Clearly some SCs benefit and some do not.