Helping our members work together to keep the lights on... today and in the future
Topics

• Net Benefits Test Threshold
• Steps for Determining Net Benefits Test Threshold
• Results for May 2011 through May 2012
Net Benefits Threshold Price

- The Net Benefits Threshold Price is the price that corresponds to the point on the Supply Curve where the net benefit first exceeds the cost to Load (see accompanying Appendix for more details).

- Equivalently, Point on the Supply Curve where the
  - % Change in MWH Consumed < % Change in LIP
  - Elasticity of Supply < 1
Net Benefits Test Threshold Price

Aggregate Supply Curve

Elasticity < 1 for LIP ≥ $33

%ΔQ > %ΔP
Supply Elastic

%ΔQ < %ΔP
Supply Inelastic

LIP = $33/MWH is the Net Benefits Threshold Price
Net Benefits Test

• By the 15th on each month, SPP will post the NBT Threshold Price that will be in effect for the next month; for example, by June 15th, SPP needs to post the NBT Threshold Price for the month of July.

• Terminology
  ➢ Study Month – Month for which NBT Threshold Price applies
  ➢ Reference Month – Calendar month from the preceding year that corresponds to the Study Month.
  ➢ Example: July 2012 is the Study Month, July 2011 is the corresponding Reference Month
Net Benefits Test

- Step 1 – Retrieve Generator Offers for Reference Month
- Step 2 – Apply Fuel Cost Adjustment Factors to the Offers
- Step 3 – Aggregate Offers into Representative Supply Curve
- Step 4 – Apply Smoothing Methods to Obtain Smooth Supply Curve
- Step 5 – Compute the Price Elasticity of Supply
- Step 6 – Determine the Net Benefits Threshold Price
Net Benefits Test – Step 1

- Retrieve Generator Offers for Reference Month
  
  - For Resources in Available & Quick Start Status
  
  - For the hour corresponding to the Daily Peak for each day of the month (excluding weekends and holidays)
Net Benefits Test – Step 2

- Apply Fuel Cost Adjustment Factors to the Offers

- Adjustments made for Coal, Natural Gas, and Oil

- Fuel Adjustment Factor (FAF)
  
  \[ FAF = \frac{\text{Futures Price for Study Month}}{\text{Average Spot Price for Reference Month}} \]

- Fuel Adjusted Offer (FAO)
  
  \[ FAO = 10\% \times \text{Reference Month Offer Price} + 90\% \times FAF \times \text{Reference Month Offer Price} \]
Net Benefits Test – Step 3

- Form an Aggregate Supply Curve

JULY 2011 Study Month

MWH

$ / MWH

0 100 200 300 400 500 600

0 2000 4000 6000 8000 10000 12000 14000

Raw Supply
Net Benefits Test – Step 4

• Apply Smoothing Methods to Obtain Smooth Supply Curve

➤ We fit each representative supply curve to the following form:  \[ P(x) = A + Bx + Cx^2 + Dx^3 + e^{(Fx + G)} \]

where

➤ \( x \) represents MWH
➤ \( P(x) \) is the corresponding price on the Supply Curve
➤ A, B, C, D, F and G are coefficients determined by the a non-linear regression model
➤ \( e \approx 2.718281828 \) (the ‘natural’ exponential base)
Net Benefits Test – Step 4

JULY 2011 Study Month

- Raw Supply
- Smoothed Supply
Net Benefits Test – Step 5

• Compute the Supply Elasticity for the Smoothed Curve
  ➢ This is simple step once you have the smoothed supply function

Net Benefits Test – Step 6

• Determine the Price for which the Elasticity changes from greater than 1 to less than 1 (in other words, the price where supply changes from elastic to inelastic)
• This Price is the Net Benefits Test Threshold Price
## Net Benefit Test Results

<table>
<thead>
<tr>
<th>Reference Month</th>
<th>Study Month</th>
<th>Demand Reduction Threshold Price ($/MWH)</th>
</tr>
</thead>
<tbody>
<tr>
<td>May 2010</td>
<td>May 2011</td>
<td>43.62</td>
</tr>
<tr>
<td>June 2010</td>
<td>June 2011</td>
<td>42.83</td>
</tr>
<tr>
<td>July 2010</td>
<td>July 2011</td>
<td>42.61</td>
</tr>
<tr>
<td>August, 2010</td>
<td>August, 2011</td>
<td>33.73</td>
</tr>
<tr>
<td>September 2010</td>
<td>September 2011</td>
<td>34.30</td>
</tr>
<tr>
<td>October 2010</td>
<td>October 2011</td>
<td>33.41</td>
</tr>
<tr>
<td>November 2010</td>
<td>November 2011</td>
<td>28.18</td>
</tr>
<tr>
<td>December 2010</td>
<td>December 2011</td>
<td>28.90</td>
</tr>
<tr>
<td>January, 2011</td>
<td>January, 2012</td>
<td>27.59</td>
</tr>
<tr>
<td>February, 2011</td>
<td>February, 2012</td>
<td>25.94</td>
</tr>
<tr>
<td>March 2011</td>
<td>March 2012</td>
<td>24.18</td>
</tr>
<tr>
<td>April 2011</td>
<td>April 2012</td>
<td>20.64</td>
</tr>
<tr>
<td>May 2011</td>
<td>May 2012</td>
<td>20.01</td>
</tr>
</tbody>
</table>
Appendix

- The following slides explain the derivation of the NBT formula
Appendix* - Net Benefits Test Formula

- In formulaic terms, the net benefit is deemed to be realized at the price point on the supply curve where \((\text{Delta LIP} \times \text{MWh consumed}) > (\text{LIP}_\text{NEW} \times \text{CLR})\) where \(\text{LIP}_\text{NEW}\) is the market clearing price after the \(\text{CLR}\) is dispatched and \(\text{Delta LIP}\) is the price before \(\text{CLR}\) is dispatched minus the \(\text{LIP}_\text{NEW}\)

* The material in this appendix was originally presented at the April 2012 MWG meeting
Appendix - Billing Unit Effect Example 1

• Load without Demand Response (DR) is 90 MW and the LMP is $40/MWH
• Assume 5 MWH of DR will reduce LMP to $38/MWH
• Is the DR a Net Benefit or Cost?

<table>
<thead>
<tr>
<th></th>
<th>Calculation</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gens Paid</td>
<td>85 x $38 =</td>
<td>$3,230</td>
</tr>
<tr>
<td>DR Paid</td>
<td>5 x $38 =</td>
<td>190</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$3,420</td>
</tr>
<tr>
<td>Load after DR</td>
<td>85</td>
<td></td>
</tr>
<tr>
<td>Load Pays Total</td>
<td></td>
<td>$3,420</td>
</tr>
<tr>
<td>Load Pays $/MWH</td>
<td></td>
<td>$40.24</td>
</tr>
</tbody>
</table>

• Net Cost because $40.24 > $40
Appendix - Billing Unit Effect Example 2

• Load without Demand Response (DR) is 100 MW and the LMP is $50/MWH

• Assume 5 MWH of DR will reduce LMP to $45/MWH

• Is the DR a Net Benefit or Cost?

<table>
<thead>
<tr>
<th></th>
<th>Calculation</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gens Paid</td>
<td>95 x $45 =</td>
<td>$4,275</td>
</tr>
<tr>
<td>DR Paid</td>
<td>5 x $45 =</td>
<td>225</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$4,500</td>
</tr>
<tr>
<td>Load after DR</td>
<td></td>
<td>95</td>
</tr>
<tr>
<td>Load Pays Total</td>
<td></td>
<td>$4,500</td>
</tr>
<tr>
<td>Load Pays $/MWH</td>
<td></td>
<td>$47.37</td>
</tr>
</tbody>
</table>

• Net Benefit because $47.37 < $50
Appendix - Relate Example 2 to Protocol Language

- Net Benefit because $47.37 < $50

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Gens Paid</td>
<td>$4,275</td>
<td></td>
</tr>
<tr>
<td>DR Paid</td>
<td>225</td>
<td></td>
</tr>
<tr>
<td>Load after DR</td>
<td>95</td>
<td></td>
</tr>
<tr>
<td>Load Pays Total</td>
<td>$4,500</td>
<td></td>
</tr>
<tr>
<td>Load Pays $/MWH</td>
<td>$47.37</td>
<td></td>
</tr>
</tbody>
</table>

MWH Consumed x LIP_{NEW} + CLR x LIP_{NEW} = LIP_{NEW} + Delta LIP
Appendix - Net Benefits Test Formula

• Net Benefit if the following holds:

\[
\frac{\text{MWH Consumed} \times \text{LIP}_{\text{NEW}} + \text{CLR} \times \text{LIP}_{\text{NEW}}}{\text{MWH Consumed}} < \text{LIP}_{\text{NEW}} + \Delta \text{LIP}
\]

• Equivalently (after some algebra)

\[
\text{CLR} \times \text{LIP}_{\text{NEW}} < \Delta \text{LIP} \times \text{MWH Consumed}
\]
Appendix - Net Benefits Test Formula

• From Last Slide, Net Benefit if the following holds:

\[ \text{CLR} \times \text{LIP}_{\text{NEW}} < \text{Delta LIP} \times \text{MWH Consumed} \]

• Equivalently Stated as

\[ \% \text{ Change in MWH Consumed} < \% \text{ Change in LIP} \]

• And in terms of Elasticity

\[ (\% \text{ Change in MWH Consumed} / \% \text{ Change in LIP}) < 1 \]