Sliding Pressure Unit
Frequency Response Requirement
Impacts

January 24, 2018
Comparison Basis

- Current Sliding Valve Operation and Heat Rate Vs. Proposed Fixed Pressure Operation and Heat Rate
- Modeling only includes the change in gross margin resulting from changed dispatch curves. It does not address lost or “out of money” output resulting from frequency response commands.
- Operational comparisons were made dispatching against market curves.
Merchant Impacts

• Fixed Pressure Operation results in higher average heat rates.
  – Slightly higher at full load and significantly higher at minimum load.
  – Due to the increased slope of the average heat rate, marginal heat rates within
    the operating range of the unit are lower for fixed pressure operation.

• Lower marginal heat rates result in a slight increase in generation if unit is on line.
  – These MWh have some gross margin value.

• Gross margin on additional MWh is more than offset by the increased fuel and consumables costs resulting from higher average heat rates on all generation.
  – Gross margin losses vary significantly based on price and relative position in
    the dispatch stack.
  – Preliminary estimates indicate annual losses in gross margin of $500k - $3.1 Million per unit and could go higher.
Sample high and low values taken from 5 years of data on multiple units. Costs structures and control technologies vary by unit. Each metric is individually ranged. High and low figures do not necessarily correlate to a single unit run.

<table>
<thead>
<tr>
<th>Delta Measure</th>
<th>Low</th>
<th>High</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gross Margin $000</td>
<td>-$500</td>
<td>-$3,100</td>
</tr>
<tr>
<td>Generation GWh</td>
<td>32</td>
<td>93</td>
</tr>
<tr>
<td>CO2 kTons</td>
<td>58</td>
<td>151</td>
</tr>
<tr>
<td>SO2 Tons</td>
<td>41</td>
<td>243</td>
</tr>
<tr>
<td>NOx Tons</td>
<td>6</td>
<td>58</td>
</tr>
<tr>
<td>Hg lbs</td>
<td>0.5</td>
<td>1.4</td>
</tr>
</tbody>
</table>
Other Impacts

• Incremental O&M expenditures that may be required to address wear and tear for rapid response operations are not included.
• Sample years do not include potential impacts of future emissions caps, possible carbon taxes or other regulations.