Cloverdale-Lexington 500 KV Line Upgrade (MEP-B-11)
**MEP-B-11 Cost/Benefit Analysis**

**Project Description**
- Increase Operational Limit of Cloverdale – Lexington 500 kV Transmission Line
- Expected in-service date=2017

**Project Costs**
- Conservative estimate of $100 million
- Cumulative Net Present Value of project costs during first 15 years of Project life is $156 Million based on a carrying charge rate of 17.9%

**Project Benefits**
- Cumulative Net Present Value of project benefits during first 15 years of the Project life is $2.3 Billion based on discount rate of 7.7%.

\[
\Delta \text{Total Energy Market Benefit} = 0.7 \times PC + 0.3 \times NLP \\
\Delta \text{Total Energy Market Benefit} = 0.7 \times (1,601) + 0.3 \times (3,945) \\
\Delta \text{Total Energy Market Benefit} = 2.3 \text{ Billion}
\]

Benefit/Cost Ratio = $2.3 billion/$156 million
Benefit/Cost Ratio = 14.76

Benefit/Cost Ratio > 1.25  **PASSED**

**Annual Energy Market Benefit ($Millions)**

<table>
<thead>
<tr>
<th>Study Year</th>
<th>Net Load Payment Benefit</th>
<th>Production Costs Benefit</th>
<th>Energy Market Benefit</th>
</tr>
</thead>
<tbody>
<tr>
<td>2017</td>
<td>106.2</td>
<td>153.5</td>
<td>139.3</td>
</tr>
<tr>
<td>2018</td>
<td>200.3</td>
<td>147.9</td>
<td>163.6</td>
</tr>
<tr>
<td>2019</td>
<td>294.5</td>
<td>142.2</td>
<td>187.9</td>
</tr>
<tr>
<td>2020</td>
<td>388.6</td>
<td>136.5</td>
<td>212.2</td>
</tr>
<tr>
<td>2021</td>
<td>383.0</td>
<td>165.6</td>
<td>230.8</td>
</tr>
<tr>
<td>2022</td>
<td>430.3</td>
<td>175.4</td>
<td>251.9</td>
</tr>
<tr>
<td>2023</td>
<td>477.6</td>
<td>185.1</td>
<td>272.9</td>
</tr>
<tr>
<td>2024</td>
<td>524.9</td>
<td>194.9</td>
<td>293.9</td>
</tr>
<tr>
<td>2025</td>
<td>572.2</td>
<td>204.6</td>
<td>314.9</td>
</tr>
<tr>
<td>2026</td>
<td>619.6</td>
<td>214.4</td>
<td>335.9</td>
</tr>
<tr>
<td>2027</td>
<td>666.9</td>
<td>224.1</td>
<td>357.0</td>
</tr>
<tr>
<td>2028</td>
<td>714.2</td>
<td>233.9</td>
<td>378.0</td>
</tr>
<tr>
<td>2029</td>
<td>761.5</td>
<td>243.6</td>
<td>399.0</td>
</tr>
<tr>
<td>2030</td>
<td>808.8</td>
<td>253.4</td>
<td>420.0</td>
</tr>
<tr>
<td>2031</td>
<td>856.2</td>
<td>263.1</td>
<td>441.0</td>
</tr>
<tr>
<td><strong>Total NPV</strong></td>
<td>$3,945</td>
<td>$1,601.</td>
<td><strong>$2,304</strong></td>
</tr>
</tbody>
</table>
Trended Energy Market Benefit

2025 Simulation Energy Market Benefit

Actual Simulation Benefit
• Load Sensitivity
  – Modeled a 10% Increase and Decrease in load

• Gas Commodity Price Sensitivity
  – Modeled Upper and Lower Range of Ventyx Expected Commodity Price based on 12 month Distribution of Nymex Futures Henry Hub Traded Prices (2013 – 2023)
RTO Total Energy Demand (Thousands GWH’s)

- PJM Annual Energy + 10%
- PJM Annual Energy - Expected
- PJM Annual Energy - 10%

Energy Demand (Thousands GWHs)


+/- 10%
Ventyx Gas Commodity Forecast

$ Per MMBTU

- Ventyx Gas Commodity Forecast
- Sensitivity High Gas Forecast
- Sensitivity Low Gas Forecast

Years:
- 2011
- 2012
- 2013
- 2014
- 2015
- 2016
- 2017
- 2018
- 2019
- 2020
- 2021
- 2022
- 2023
- 2024
- 2025
- 2026
- 2027
- 2028
- 2029
- 2030
- 2031

Values:
- 0.00
- 2.00
- 4.00
- 6.00
- 8.00
- 10.00
- 12.00
- 14.00
- 16.00

Ventyx Gas Commodity Forecast visited on 6/26/2014
MEP-B-11 Sensitivity Results

Low Load Case
Lower Loading of Transmission System Results in Less congestion and cheaper means of re-dispatch.

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Benefit/Cost Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Base</td>
<td>14.76</td>
</tr>
<tr>
<td>Low Load</td>
<td>10.02</td>
</tr>
<tr>
<td>High Load</td>
<td>4.96</td>
</tr>
<tr>
<td>Low Gas</td>
<td>11.5</td>
</tr>
<tr>
<td>High Gas</td>
<td>16.1</td>
</tr>
</tbody>
</table>

High Load Case
By increasing the limits on Cloverdale - Lexington there are more West to East transfers, thus higher loading and congestion. In a high load case, congestion caused by West to East transfers are exacerbated whereas the benefits of the project do not grow as quickly.

Low Gas Case
More opportunities for gas units in the east to be committed results in less dependence on West to East Transfers.

High Gas Case
More dependence on generation in PJM West results in more West to East Transfers.
• Cloverdale-Lexington 500 KV Line Upgrade (MEP-B-11) summary

- Driver for project is for both Reliability and Markets
- Sensitivity analysis on results of Cloverdale-Lexington upgrade around key input assumptions show project still beneficial
- Year 2025 high level results match with trend
- Zonal summary results - Posted
- Recommendation to Board in December
Market Efficiency Projects

COMED AREA
COMED Area Proposed Projects – Update including Reliability Light Load upgrades

<table>
<thead>
<tr>
<th>Project Number</th>
<th>Description</th>
<th>Expected ISD</th>
<th>Voltage</th>
<th>Estimated Costs ($ millions)</th>
<th>Benefit/Cost</th>
<th>Updated Benefit/Cost*</th>
</tr>
</thead>
<tbody>
<tr>
<td>MEP-A-1</td>
<td>Byron-Cherry Valley-Pleasant Valley 345 KV</td>
<td>2016</td>
<td>345</td>
<td>112.5</td>
<td>0.75</td>
<td>N/A</td>
</tr>
<tr>
<td>MEP-A-2</td>
<td>Byron-Pleasant Valley 345 KV</td>
<td>2016</td>
<td>345</td>
<td>105</td>
<td>0.96</td>
<td>N/A</td>
</tr>
<tr>
<td>MEP-A-3</td>
<td>Cherry Valley - Pleasant Valley 345 KV</td>
<td>2016</td>
<td>345</td>
<td>67.5</td>
<td>2.74</td>
<td>1.1</td>
</tr>
<tr>
<td>MEP-A-4</td>
<td>Byron - Charter Grove- Wayne 345 KV, Charter Grove 345/138 KV TX.</td>
<td>2016</td>
<td>345</td>
<td>275</td>
<td>0.24</td>
<td>N/A</td>
</tr>
<tr>
<td>MEP-A-5</td>
<td>Byron - Wayne 345 KV</td>
<td>2016</td>
<td>345</td>
<td>175</td>
<td>0.41</td>
<td>N/A</td>
</tr>
</tbody>
</table>

* Updated Benefit/cost Ratio includes addition of upgrades associated with Reliability Light Load analysis identified at October 2011 TEAC.

- MEP-A-3 no longer passes 1.25 threshold and might create reliability issues.
- Not necessary to rerun other projects since Benefit/Cost would only get lower.
- No Projects in COMED AREA to be recommended for Market Efficiency
Market Efficiency Next Steps

- Update Base Results
  - Add Light Load Upgrades
  - Add Reactive Upgrades
    - Apply new Reactive Interface Ratings
  - Rerun appropriate cases

- Study new submitted projects