2016 Delaware State Report

July 2017
1. Planning
   • Generation Portfolio Analysis
   • Transmission Analysis
   • Load Forecast

2. Markets
   • Capacity Market Results
   • Market Analysis

3. Operations
   • Emissions Data
• **Existing Capacity:** Natural gas represents approximately 62 percent of the total installed capacity in Delaware while oil represents approximately 25 percent, and coal 13 percent. This differs from PJM where natural gas and coal are relatively even at 35 and 34 percent respectively.

• **Interconnection Requests:** Natural gas represents more than 75 percent of new interconnection requests in Delaware.

• **Deactivations:** No generation units retired in Delaware in 2016. This compares to 392 MW of capacity retirements PJM-wide in 2016.

• **RTEP 2016:** Delaware had no 2016 RTEP baseline or network projects.

• **Load Forecast:** Delaware load growth is nearly flat, averaging between -0.1 and 0.2 percent per year over the next 10 years. This aligns with PJM RTO load growth projections.
• **2020/21 Capacity Market:** Compared to the PJM footprint, Delaware’s distribution of generation, demand response, and energy efficiency is similar.

• **6/1/2014 – 5/31/2017 Market Performance:** Delaware’s average daily locational marginal prices were consistent with the PJM average daily LMPs. Natural Gas resources represented 53 percent of generation used in Delaware while imports averaged 28 percent.

• **Emissions:** 2016 carbon dioxide emissions are slightly down from 2015; sulfur dioxides and nitrogen oxides continue to hold flat from 2015.
PJM Service Area – Delaware

Legend
- Substation
  - 500 kV
  - 345 kV
- Transmission Lines
  - 345 kV
  - 500 kV
- Substations ≤ 345 kV
- Transmission Lines ≤ 345 kV

Substations and Transmission Lines in Delaware:
- Peach Bottom
- Delta York
- Rock Springs
- Conesville
- Bexcom
- New Freedom
- Salem
- Hope Creek
- Red Lion
- Orchard
- Calvert Cliffs
- Burches Hill
- Weigh Chapel
- Chalk Point
- PePCO
- Dix
- Livingston Park
- Maryland
- Pennsylvania
- New Jersey
- Delaware
Planning
Generation Portfolio Analysis
Summary:
Natural gas represents approximately 62 percent of the total installed capacity in Delaware while coal represents approximately 13 percent.

Overall in PJM, natural gas and coal are relatively even at 35 percent and 34 percent respectively.

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* Gas Contains

<table>
<thead>
<tr>
<th>Source</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Natural Gas</td>
<td>2,039 MW</td>
</tr>
<tr>
<td>Other Gas</td>
<td>8 MW</td>
</tr>
</tbody>
</table>

---
In PJM, natural gas and coal make up nearly 70 percent total installed capacity.

<table>
<thead>
<tr>
<th>* Gas Contains</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Natural Gas</td>
<td>62,941 MW</td>
</tr>
<tr>
<td>Other Gas</td>
<td>405 MW</td>
</tr>
</tbody>
</table>

- Gas, 63,347 MW
- Coal, 59,679 MW
- Waste, 922 MW
- Nuclear, 33,932 MW
- Oil, 9,839 MW
- Solar, 262 MW
- Hydro, 8,358 MW
- Wind, 1,005 MW
Natural gas represents more than 75 percent of new interconnection requests in Delaware.

Total MW Capacity by Fuel Type

- **Natural Gas, 749 MW**
- **Solar, 108 MW** (Nameplate Energy = 226 MW)
- **Wind, 130 MW** (Nameplate Energy = 500 MW)
- **Biomass, 12 MW**

**Fuel as a Percentage of Projects in Queue**

- **Active**: 701 MW, 13 projects
- **Under Construction**: 7 MW, 1 project
- **Suspended**: 291 MW, 1 project
- **Total**: 999 MW, 15 projects
## Delaware – Interconnection Requests

<table>
<thead>
<tr>
<th>Resource</th>
<th>Active MW</th>
<th># of Projects</th>
<th># of Projects</th>
<th>Suspended MW</th>
<th># of Projects</th>
<th>Under Construction MW</th>
<th># of Projects</th>
<th>Withdrawn MW</th>
<th># of Projects</th>
<th>Total Sum MW</th>
<th># of Projects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biomass</td>
<td>12.0</td>
<td>2</td>
<td>0.0</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td>12.0</td>
<td>2</td>
<td>24.0</td>
<td>5</td>
</tr>
<tr>
<td>Coal</td>
<td>23.0</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>630.0</td>
<td>1</td>
<td>653.0</td>
<td>3</td>
</tr>
<tr>
<td>Methane</td>
<td>9.0</td>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>9.0</td>
<td>4</td>
<td>3.0</td>
<td>6</td>
</tr>
<tr>
<td>Natural Gas</td>
<td>451.0</td>
<td>1</td>
<td>1,088.1</td>
<td>18</td>
<td>291.0</td>
<td>1</td>
<td>7.0</td>
<td>1</td>
<td>5,265.4</td>
<td>18</td>
<td>7,102.5</td>
</tr>
<tr>
<td>Oil</td>
<td>168.2</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1.0</td>
<td>1</td>
<td>169.2</td>
<td>6</td>
</tr>
<tr>
<td>Solar</td>
<td>108.4</td>
<td>8</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>160.2</td>
<td>12</td>
<td>268.6</td>
<td>20</td>
</tr>
<tr>
<td>Storage</td>
<td>45.0</td>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>45.0</td>
<td>4</td>
<td>45.0</td>
<td>4</td>
</tr>
<tr>
<td>Other</td>
<td>30.0</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>30.0</td>
<td>2</td>
<td>30.0</td>
<td>2</td>
</tr>
<tr>
<td>Wind</td>
<td>129.8</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>290.0</td>
<td>3</td>
<td>419.8</td>
<td>5</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>701.2</td>
<td>13</td>
<td>1,318.3</td>
<td>32</td>
<td>291.0</td>
<td>1</td>
<td>7.0</td>
<td>1</td>
<td>6,403.6</td>
<td>41</td>
<td>8,721.1</td>
</tr>
</tbody>
</table>
Following Final Agreement execution 142 MW of capacity withdrew from PJM's interconnection process. Another 291 MW have executed agreements but were not in service as of December 31, 2015 (Suspended or Under Construction). Overall, 17% of requested capacity in Delaware reaches commercial operation.
Delaware – 2016 Actual Generation Deactivations
(Capacity, As of December 31, 2016)

Summary:

- No generating units in Delaware deactivated in 2016
- Across PJM, 11 generating units totaling 392 MW of capacity deactivated in 2016

<table>
<thead>
<tr>
<th>Unit</th>
<th>MW Capacity</th>
<th>TO Zone</th>
<th>Age</th>
<th>Actual Deactivation Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>none</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## Delaware – 2016 Generation Deactivations

(Capacity, As of December 31, 2016)

<table>
<thead>
<tr>
<th>Unit</th>
<th>MW Capacity</th>
<th>TO Zone</th>
<th>Age</th>
<th>Actual Deactivation Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>none</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Summary:**

- No Delaware generators submitted generator deactivation notifications in 2016.
- Across PJM, 23 PJM generating units submitted deactivation notification, ranging in date from 2016 - 2020.
Planning
Transmission Infrastructure Analysis
### Delaware – RTEP Baseline Projects

#### Delaware Baseline Project Driver

<table>
<thead>
<tr>
<th>Project ID</th>
<th>Project</th>
<th>Map ID</th>
<th>Baseline Load Growth/ Deliverability &amp; Reliability</th>
<th>Congestion Relief - Economic</th>
<th>Operational Performance</th>
<th>Generator Deactivation</th>
<th>TO Criteria Violation</th>
<th>Required Date</th>
<th>Cost ($M)</th>
<th>Designated Entity*</th>
<th>2016 TEAC Review</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td>None</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: Baseline upgrades are those that resolve a system reliability criteria violation.
<table>
<thead>
<tr>
<th>Map ID</th>
<th>Project ID</th>
<th>Project</th>
<th>Delaware Network Project Drivers</th>
<th>Required Date</th>
<th>Cost ($M)</th>
<th>TO Zone(s)</th>
<th>2016 TEAC Review</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>None</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: Network upgrades are new or upgraded facilities required primarily to eliminate reliability criteria violations caused by proposed generation, merchant transmission or long term firm transmission service requests.
### Delaware – TO Supplemental Projects

<table>
<thead>
<tr>
<th>Map ID</th>
<th>Project ID</th>
<th>Project</th>
<th>Required Date</th>
<th>Cost ($M)</th>
<th>TO Zone(s)</th>
<th>2016 TEAC Review</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>None</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: Supplemental projects are transmission expansions or enhancements that are used as inputs to RTEP models, but are not required for reliability, economic efficiency or operational performance criteria, as determined by PJM.
## Delaware – Merchant Transmission Project Requests

<table>
<thead>
<tr>
<th>Queue</th>
<th>Project Name</th>
<th>MFO</th>
<th>Status</th>
<th>In Service Date</th>
<th>TO</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Planning
Load Forecast
### Delaware – 2017 Load Forecast Report

<table>
<thead>
<tr>
<th>Transmission Owner</th>
<th>Summer Peak (MW)</th>
<th>Winter Peak (MW)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2017</td>
<td>2027</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Growth Rate (%)</td>
</tr>
<tr>
<td></td>
<td>2016/17</td>
<td>2026/27</td>
</tr>
<tr>
<td></td>
<td>Growth Rate (%)</td>
<td></td>
</tr>
<tr>
<td>Delmarva Power and Light *</td>
<td>2,681</td>
<td>2,651</td>
</tr>
<tr>
<td>PJM RTO</td>
<td>152,999</td>
<td>155,773</td>
</tr>
</tbody>
</table>

*Delmarva Power and Light serves load other than in Delaware. The Summer Peak and Winter Peak MW values in this table each reflect the estimated amount of forecasted load to be served by Delmarva Power solely in Delaware. Estimated amounts were calculated based on the average share of Delmarva Power’s real-time summer and winter peak load located in Delaware over the past five years.*

*PJM’s 2017 forecast reflects methodology improvements implemented in 2016: variables to account for equipment and appliance saturation and efficiency, distributed solar generation adjustments and more refined treatment of weather data.*
Markets
Capacity Market Results
PJM 2020/21 Auction Clearing Prices
(May 23, 2017)

ComEd $188.12

RTO $76.53

Duke OH/KY $130.00

MAAC $86.04

EMAAC $187.87
## Delaware - Cleared Resources in 2020/21 Auction

*(May 23, 2017)*

<table>
<thead>
<tr>
<th></th>
<th>Cleared MW (Unforced Capacity)</th>
<th>Change from 2019/20 Auction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Generation</td>
<td>3,080</td>
<td>562</td>
</tr>
<tr>
<td>Demand Response</td>
<td>160</td>
<td>(119)</td>
</tr>
<tr>
<td>Energy Efficiency</td>
<td>36</td>
<td>19</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>3,276</strong></td>
<td><strong>462</strong></td>
</tr>
</tbody>
</table>

**EMMAC Locational Clearing Price**

$187.87
## PJM - Cleared Resources in 2020/21 Auction
(May 23, 2017)

<table>
<thead>
<tr>
<th></th>
<th>Cleared MW (Unforced Capacity)</th>
<th>Change from 2019/20 Auction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Generation</td>
<td>155,976</td>
<td>882</td>
</tr>
<tr>
<td>Demand Response</td>
<td>7,820</td>
<td>(2,528)</td>
</tr>
<tr>
<td>Energy Efficiency</td>
<td>1,710</td>
<td>195</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>165,506</strong></td>
<td><strong>(1,450)</strong></td>
</tr>
</tbody>
</table>
## Delaware – Offered and Cleared Resources in 2020/21 Auction
(May 23, 2017)

### Unforced Capacity

<table>
<thead>
<tr>
<th>Generation</th>
<th>Offered MW</th>
<th>Cleared MW</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Generation</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Offered MW</td>
<td>3,080</td>
<td></td>
</tr>
<tr>
<td>Cleared MW</td>
<td>3,080</td>
<td></td>
</tr>
<tr>
<td><strong>Demand Response</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Offered MW</td>
<td>248</td>
<td></td>
</tr>
<tr>
<td>Cleared MW</td>
<td>160</td>
<td></td>
</tr>
<tr>
<td><strong>Energy Efficiency</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Offered MW</td>
<td>43</td>
<td></td>
</tr>
<tr>
<td>Cleared MW</td>
<td>36</td>
<td></td>
</tr>
<tr>
<td><strong>Total Offered MW</strong></td>
<td></td>
<td>3,371</td>
</tr>
<tr>
<td><strong>Total Cleared MW</strong></td>
<td></td>
<td>3,276</td>
</tr>
</tbody>
</table>

**NOTE:** Demand Response and Energy Efficiency are reported to PJM by Transmission Zone. The numbers above reflect the state’s pro-rata share of cross-state zones for illustrative purposes.
Markets
Market Analysis
Delaware’s average daily LMPs generally align with the PJM average daily LMP

<table>
<thead>
<tr>
<th>Date</th>
<th>DE Average Real-time LMP</th>
<th>PJM Average Real-time LMP</th>
<th>DE RT Average Load</th>
</tr>
</thead>
<tbody>
<tr>
<td>6/1/2014</td>
<td>75</td>
<td>100</td>
<td>1,000</td>
</tr>
<tr>
<td>12/1/2014</td>
<td>125</td>
<td>150</td>
<td>1,500</td>
</tr>
<tr>
<td>6/1/2015</td>
<td>150</td>
<td>175</td>
<td>1,750</td>
</tr>
<tr>
<td>12/1/2015</td>
<td>175</td>
<td>200</td>
<td>2,000</td>
</tr>
<tr>
<td>6/1/2016</td>
<td>200</td>
<td>225</td>
<td>2,250</td>
</tr>
<tr>
<td>12/1/2016</td>
<td>225</td>
<td>250</td>
<td>2,500</td>
</tr>
<tr>
<td>6/1/2017</td>
<td>250</td>
<td>275</td>
<td>2,750</td>
</tr>
</tbody>
</table>
Delaware’s hourly LMPs were similar to the PJM average.

Delaware – Hourly Average LMP and Load
(June 1, 2014 – May 31, 2017)
Amount of energy produced by Delaware generation

- Natural gas, 53%
- Imports, 28%
- Other Gas, 7%
- Coal, 8%
- Petroleum, 4%
- Misc., 0%
Operations
Emissions Data
PJM - Average Emissions (lbs/MWh)

(December 31, 2016)

PJM Average Emissions (lbs/MWh)

- **CO₂ (lbs/MWh)**
  - 2005: 1,350
  - 2006: 1,300
  - 2007: 1,250
  - 2008: 1,200
  - 2009: 1,150
  - 2010: 1,100
  - 2011: 1,050
  - 2012: 1,000
  - 2013: 950
  - 2014: 900
  - 2015: 850
  - 2016: 800

- **SO₂ and NOₓ (lbs/MWh)**
  - 2016: 9
  - 2015: 8
  - 2014: 7
  - 2013: 6
  - 2012: 5
  - 2011: 4
  - 2010: 3
  - 2009: 2
  - 2008: 1
  - 2007: 0

**Emissions Categories**
- Carbon Dioxide
- Nitrogen Oxides
- Sulfur Dioxides
Delaware - Average Emissions (lbs/MWh)

(December 31, 2016)

Delaware Average Emissions (lbs/MWh)

- **CO₂ (lbs/MWh)**
  - 2005: 1,900
  - 2006: 1,700
  - 2007: 1,500
  - 2008: 1,300
  - 2009: 1,100
  - 2010: 900
  - 2011: 700
  - 2012: 500
  - 2013: 300
  - 2014: 200
  - 2015: 100
  - 2016: 0

- **SO₂ and NOₓ (lbs/MWh)**
  - 2005: 12
  - 2006: 10
  - 2007: 8
  - 2008: 6
  - 2009: 4
  - 2010: 2
  - 2011: 0
  - 2012: 0
  - 2013: 0
  - 2014: 0
  - 2015: 0
  - 2016: 0

**Carbon Dioxide**

**Nitrogen Oxides**

**Sulfur Dioxides**