## 14.1: Delaware/Delmarva Peninsula RTEP Overview

PJM operates the Bulk Electric System (BES) transmission facilities (and others monitored at lower voltages), on the Delmarva Peninsula shown on Map 14.2, including those of Delmarva Power & Light (DPL) and Old Dominion Electric Cooperative (ODEC), transmission owners on the peninsula.

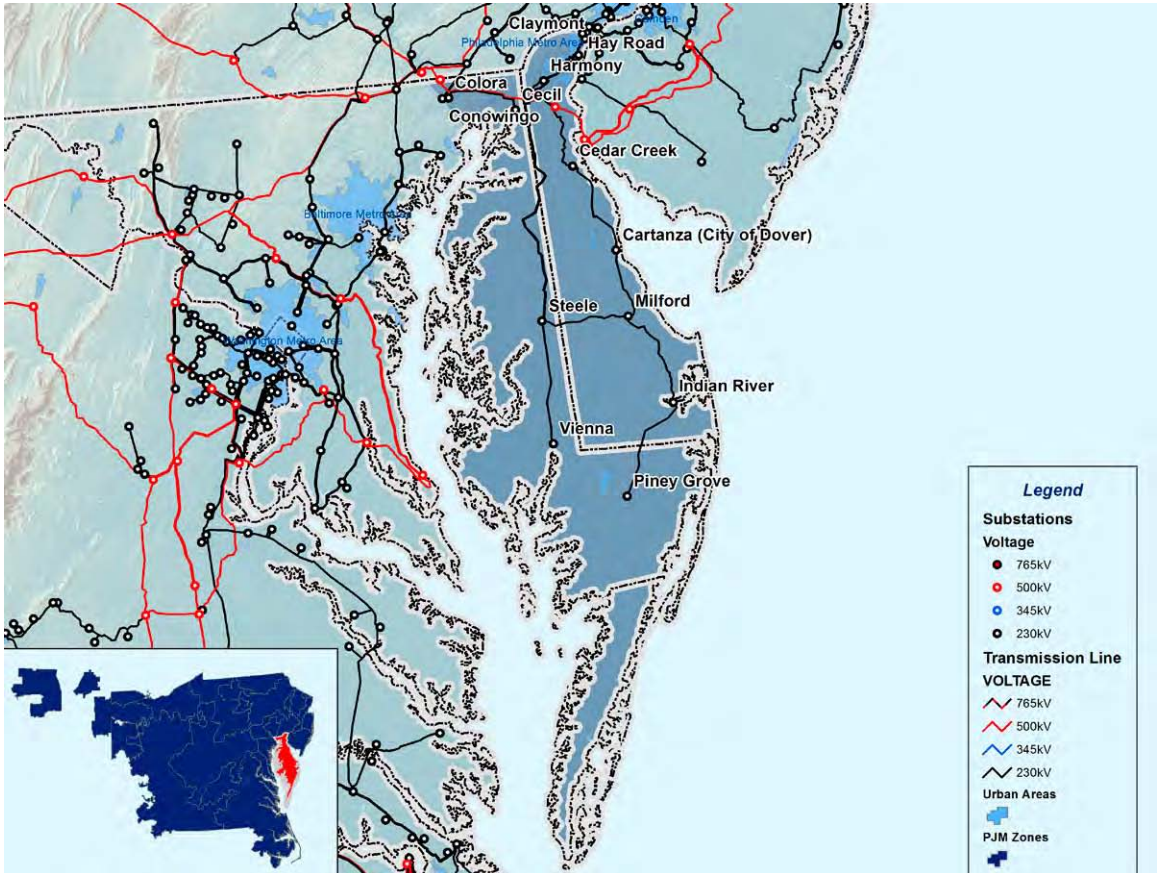
The transmission system on the Delmarva Peninsula delivers power to customers in Delaware, Maryland's eastern shore of the Chesapeake and a portion of Virginia at the south end of the peninsula. These customers are served by local generation and power transfers across tie-line facilities onto the peninsula from sources in other parts of PJM and beyond.

### *Critical Regional Transmission Expansion Plan (RTEP) Issues and Upgrades*

PJM's annual RTEP process assesses transmission facilities on the Delmarva Peninsula for compliance with NERC reliability criteria violations. In order to solve identified violations PJM determines necessary baseline upgrades as well as network upgrades necessary for the interconnection of new generation and merchant transmission facilities.

No one state within the PJM footprint acts in isolation. Understanding system conditions throughout PJM is key to understanding impacts on the Delmarva Peninsula. Thus, while this report provides summaries on a state-by-state basis, RTEP analysis is based on the aggregate requirements of the entire PJM system. **Section 16** provides a topical index of RTEP results, issues and challenges discussed in this report.

**Map 14.2:** PJM Service Area on the Delmarva Peninsula



### 14.1.1 – Load Growth and Existing Generation

***Internal Load Growth***

Delmarva Peninsula load is served primarily over the Delmarva Power & Light and Old Dominion Electric Cooperative transmission systems. Load growth for summer and winter periods is shown in **Section 14.0.2.** Peak summer load growth is expected to average 1.4 percent per year over the 10-year period through 2020. Peak winter load growth is expected to average 1.0 percent per year over the 10-year period through 2019/20.

Forecasted summer loads are modeled in power flow studies used into PJM's 2010 RTEP studies. PJM's RTEP includes baseline transmission upgrades on the Delmarva Peninsula to meet expected near-term 2015 peak load conditions. RTEP studies also assess anticipated needs for additional transmission expansion plans to meet long-term load growth out through 2025 as well.

***Existing Generating Capability***

Figure 14.4 provides a snapshot of the existing installed capacity by fuel type on the Delmarva Peninsula.

Figure 14.5 provides a snapshot of the existing installed capacity by fuel type for the state of Delaware alone.

**NOTE**

Values presented in these figures comprise installed capacity as of December 31, 2010 that is located within the PJM RTO and eligible to participate in Reliability Pricing Model (RPM) auctions. Nominal ratings of wind-powered facilities are typically many times larger than installed capacity values, as discussed and presented in **Section 2.3.4**.

**Figure 14.4:** Existing Installed Capacity on the Delmarva Peninsula (MW)

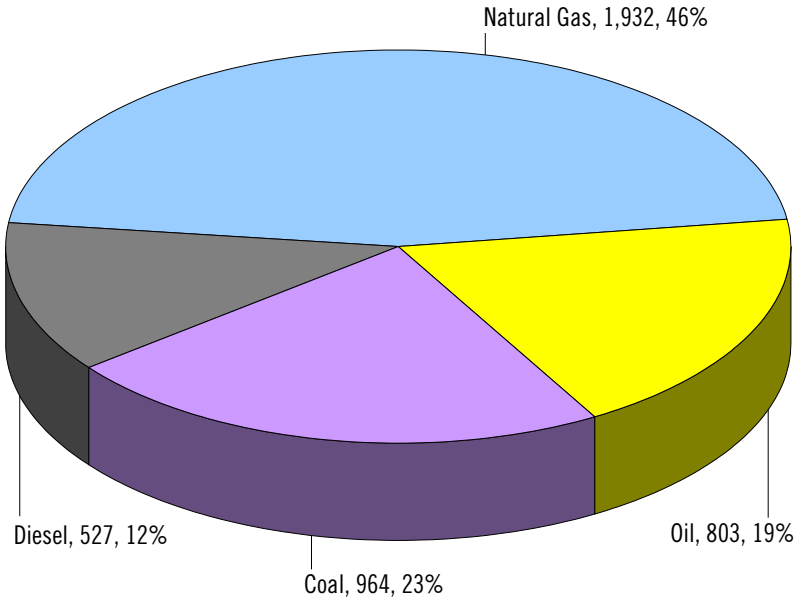
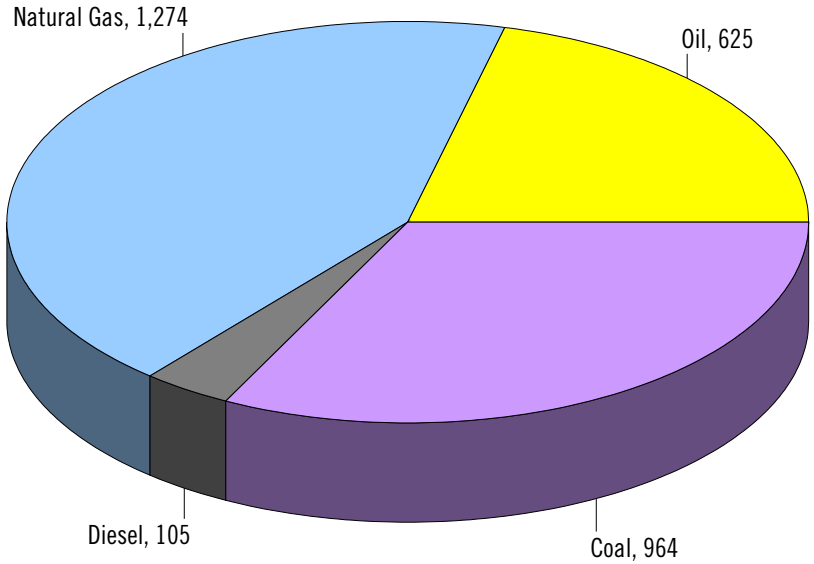



**Figure 14.5:** Existing Installed Capacity in the State of Delaware (MW)



### 14.1.2 – Generation Interconnection Requests

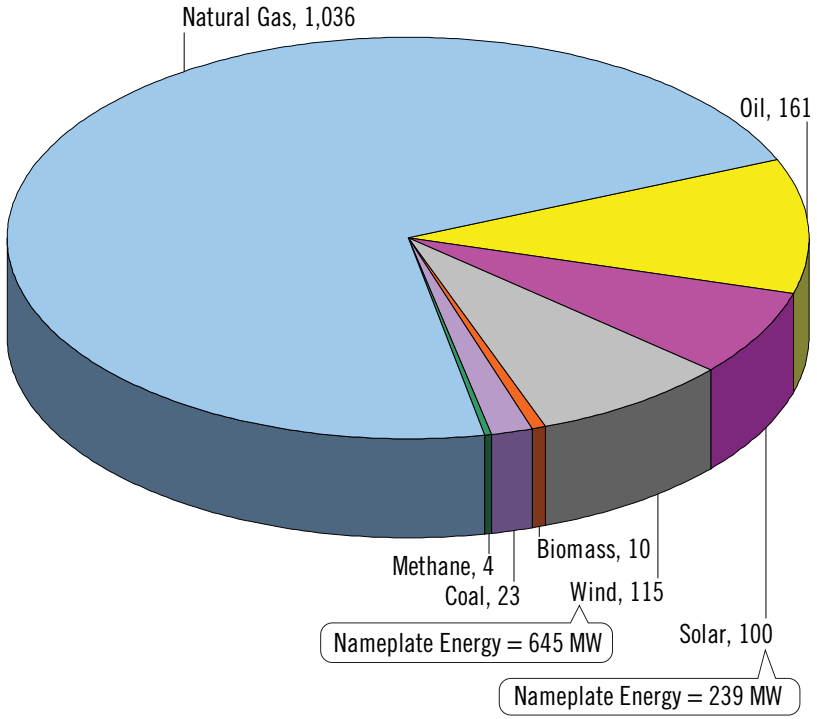
PJM has received interconnection requests for 85 new generating resources or incremental additions to existing resources on the Delmarva Peninsula since 1999, summarized in the Table below.

| | MW | # of Projects |
|---|---|---|
| Active | 1,475.54 | 26 |
| In Service | 1533 | 26 |
| Under Construction | 513.9 | 8 |
| Withdrawn | 5,912.4 | 25 |
| Total | 9,434.84 | 85 |

Table 14.3 includes generating resource interconnection requests located on the Delmarva Peninsula, shown on Map 14.3, received by PJM through the close of Queue W4 on January 31, 2011.

Figure 14.6 shows the fuel mix of queued generation interconnection requests in the Delmarva peninsula that have requested capacity injection rights through the close of Queue W4 on January 31, 2011, excluding projects that are in-service and those that have withdrawn. **Section 2.3** earlier in this report describes how generation interconnection requests are modeled in RTEP studies.

**Figure 14.6:** Queued Generation Interconnection Requests on the Delmarva Peninsula



For the sake of reporting, generating resources that are fully in-service (designated "IS") are included in the summary tabulation above but are NOT separately enumerated in Table 14.3.

A status code of "IS-NC" (in-service, no capacity) indicates a generator that is in-service for energy only. Such units have not requested consideration for capacity status.

A status code of "ISP" (in-service, partial) denotes a generating resource that is only partially in-service and has not reached full capacity status. A generating unit is ineligible for full capacity status until all transmission upgrades needed to ensure deliverability are completed. Only then will PJM grant capacity status designation.

**NOTE**

In this table the MW and MWC columns represent two different values:

The MW column represents the total site nameplate capacity of the generators including the existing generation as well as the requested up rate.

The MWC column represents the installed capacity portion of the upgrade. For renewable projects the installed capacity portion of the project varies as described in **Section 2**.

**Table 14.3:** Queued Generation Interconnection Requests on the Delmarva Peninsula

| Queue | Project Name | MW | MWC | Status | Schedule | TO | Fuel Type |
|---|---|---|---|---|---|---|---|
| G44 | Dupont Seaford 69 kV | 30 | 10 | IS - NC | 6/1/2002 | DPL | Natural Gas |
| H12 | Edgemoor 230 kV | 189 | 10 | ISP | 12/1/2005 | DPL | Natural Gas |
| N34 | Motiva | 250 | 142 | ISP | 12/31/2005 | DPL | Oil |
| R36 | Bethany 138 kV | 450 | 90 | UC | 6/1/2015 | DPL | Wind |
| R72 | Indian River 230 kV | 438 | 18 | UC | 6/1/2008 | DPL | Coal |
| R73 | Indian River 138 kV | 170 | 5 | UC | 6/1/2008 | DPL | Coal |
| T12 | Kent - Harrington 69 kV | 4.25 | 4 | ISP | 8/14/2007 | DPL | Methane |
| T67 | West | 20.3 | 5.3 | UC | 4/1/2009 | DPL | Oil |
| T68 | Edgemoor | 18.2 | 5.2 | UC | 4/1/2009 | DPL | Oil |
| T56 | Christiana | 53.4 | 8.4 | UC | 4/1/2009 | DPL | Oil |
| T52 | Red Lion 500 kV | 565 | 20 | UC | 5/1/2008 | DPL | Natural Gas |
| T144 | Pocomoke | 19.8 | 10 | Active | 1/1/2010 | DPL | Biomass |
| U3 - 003 | Mt. Olive 69 kV | 2 | 0 | UC | 6/1/2012 | DPL | Methane |
| U3 - 004 | Cecil | 2 | 0 | Active | 9/1/2009 | DPL | Methane |
| V2 - 028 | Vienna | 6 | 2.28 | Active | 12/31/2010 | DPL | Solar |
| V4 - 039 | Church | 9 | 3.4 | Active | 6/1/2011 | DPL | Solar |
| W1 - 003 | Oak Hall | 20 | 7.6 | Active | 12/1/2011 | DPL | Solar |
| W1 - 004 | Oak Hall | 20 | 7.6 | Active | 12/1/2011 | DPL | Solar |
| W1 - 005 | Oak Hall | 20 | 7.6 | Active | 12/1/2011 | DPL | Solar |
| W1 - 006 | Oak Hall | 20 | 7.6 | Active | 12/1/2011 | DPL | Solar |
| W1 - 062 | Clayton 138 kV | 115 | 67 | Active | 6/1/2011 | DPL | Natural Gas |
| W1 - 070 | Laurel 69 kV | 20 | 7.6 | Active | 5/31/2011 | DPL | Solar |
| W2 - 099 | Kenney 69 kV | 20 | 7.6 | Active | 6/1/2012 | DPL | Solar |
| W3 - 032A | Cartanza 230 kV | 309.2 | 309.2 | Active | 6/1/2014 | DPL | Natural Gas |
| W3 - 036 | Pemberton 12 kV | 5 | 1.9 | Active | 3/1/2012 | DPL | Solar |
| W3 - 037 | Delmar 12 kV | 20 | 7.6 | Active | 3/1/2012 | DPL | Solar |
| W3 - 054A | Oak Hall 138 kV | 95 | 12.35 | Active | 6/1/2013 | DPL | Wind |
| W3 - 061 | Church 69 kV | 20 | 7.6 | Active | 5/31/2011 | DPL | Solar |
| W3 - 071 | Worcester 25 kV | 12.54 | 4.77 | Active | 6/1/2012 | DPL | Solar |
| W3 - 086 | Townsend 138 kV | 10 | 3.8 | Active | 12/31/2011 | DPL | Solar |
| W3 - 087 | Cartanza 230 kV | 15 | 5.7 | Active | 12/31/2011 | DPL | Solar |
| W3 - 160 | Worcester 25 kV | 10 | 3.8 | Active | 3/31/2011 | DPL | Solar |

**Table 14.3:** Queued Generation Interconnection Requests on the Delmarva Peninsula (Continued)

| Queue | Project Name | MW | MWC | Status | Schedule | TO | Fuel Type |
|---|---|---|---|---|---|---|---|
| W3 - 172 | Hay Road 230 kV #1 | 402 | 402 | Active | 6/1/2013 | DPL | Natural Gas |
| W3 - 173 | Hay Road 230 kV #2 | 218 | 218 | Active | 6/1/2015 | DPL | Natural Gas |
| W3 - 121 | Queen Anne County 25 kV | 6 | 2.28 | Active | 6/1/2013 | DPL | Solar |
| W4 - 017 | Kings Creek - Crisfield 69 kV | 100 | 13 | Active | 12/1/2013 | DPL | Wind |
| W4 - 078 | Todd 25 kV | 20 | 7.6 | Active | 6/1/2013 | DPL | Solar |
| W4 - 096 | Piney Grove 25 kV | 10 | 3.8 | Active | 3/31/2013 | DPL | Solar |

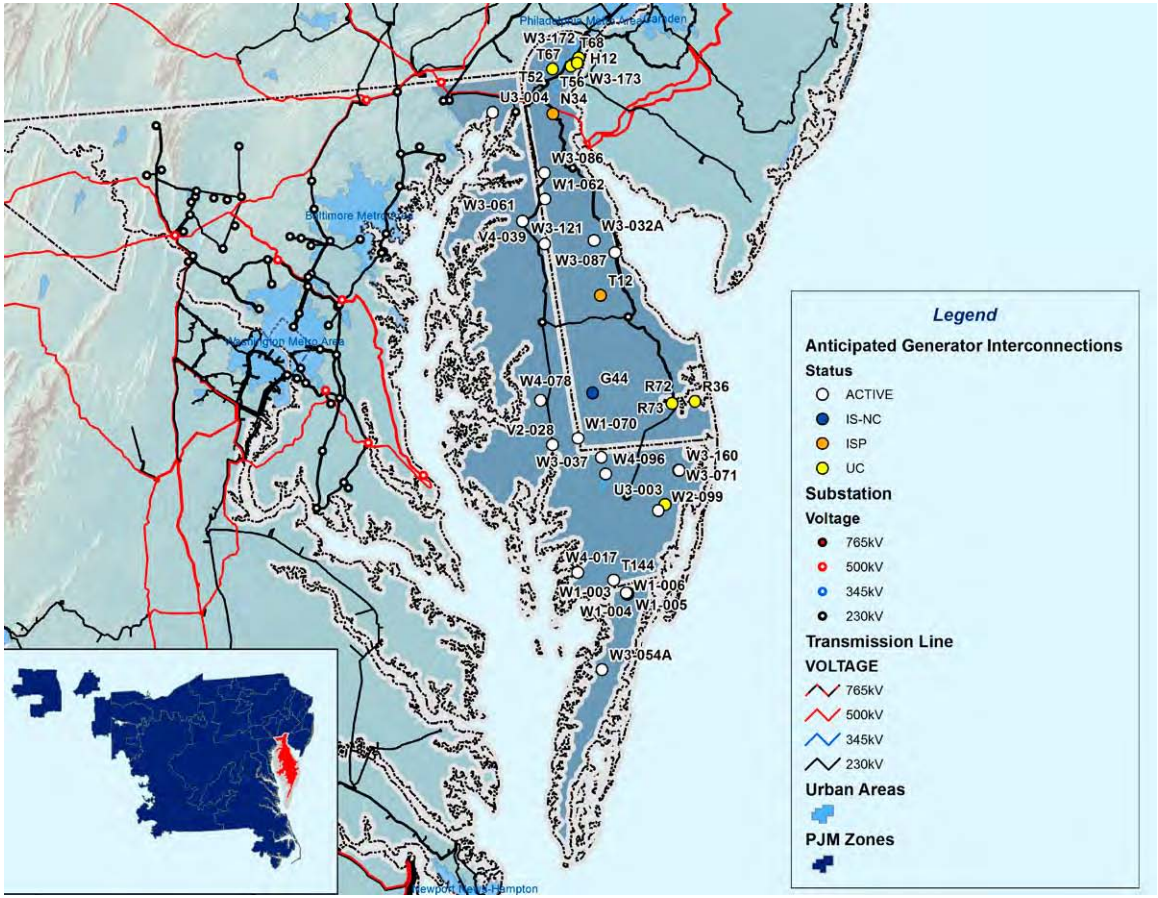
**NOTE**

In this table the MW and MWC columns represent two different values:

The MW column represents the total site nameplate capacity of the generators including the existing generation as well as the requested up rate.

The MWC column represents the installed capacity portion of the upgrade. For renewable projects the installed capacity portion of the project varies as described in **Section 2**.

**Map 14.3 - 1:** Queued Generation Interconnection Requests on the Delmarva Peninsula



### 14.1.3 – Anticipated Generation Deactivations

Generating unit deactivation requests on the Delmarva Peninsula are summarized in Table 14.4 and shown on Map 14.4. A full list of all generation deactivation information is accessible on PJM's website at URL: http://pjm.com/planning/generation-retirements/gr-summaries.aspx.

### 14.1.4 – Merchant Transmission Interconnection Requests

PJM's interconnection queues does not contain any requests for merchant transmission interconnection on the Delmarva Peninsula.

**Map 14.4:** Generation Deactivation Requests on the Delmarva Peninsula

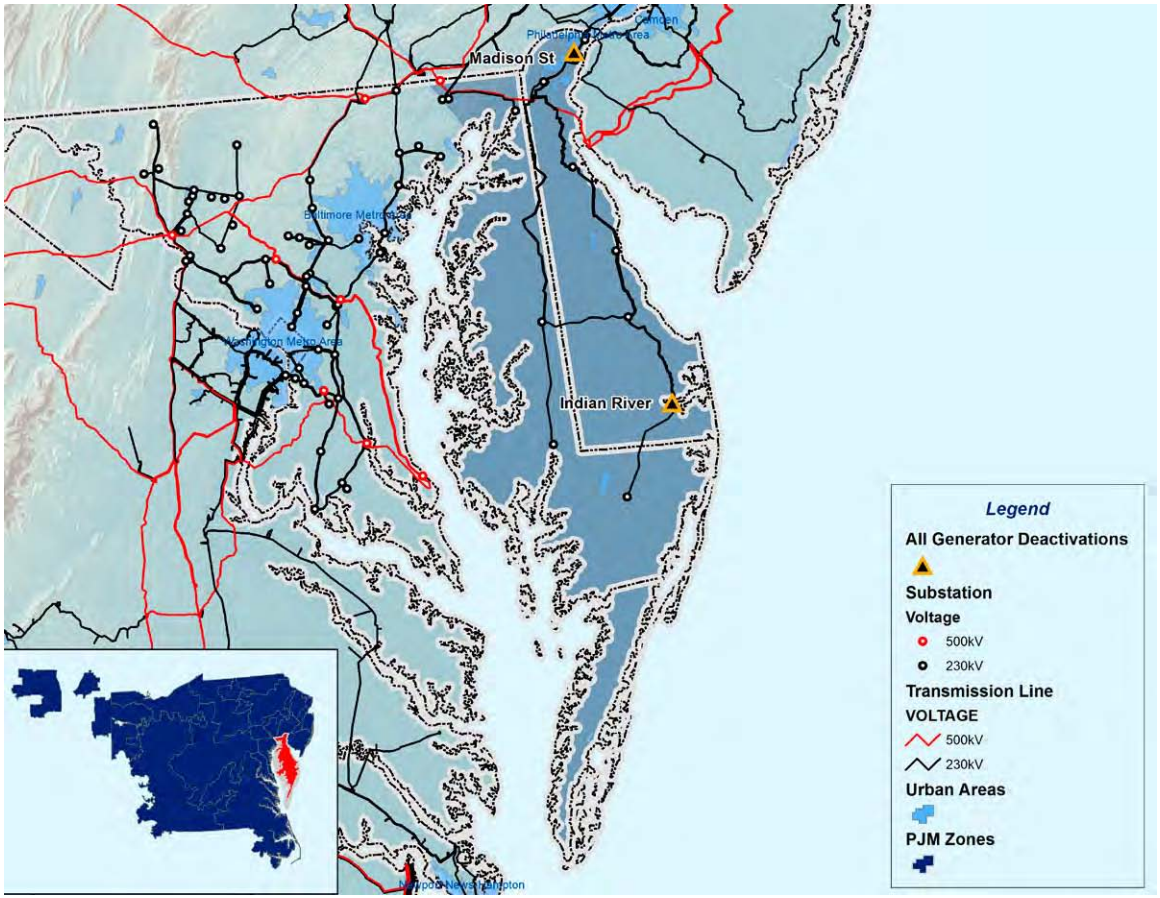



**Table 14.4:** Generation Deactivation Requests on the Delmarva Peninsula

| Retirement Date | Generator | TO | Capacity (MW) | Status |
|---|---|---|---|---|
| Jan-05 | Madison St. CT | DPL | 10 | No Reliability Issues |
| May-10 | Indian River #2 | DPL | 89 | Reliability issue identified and resolved |
| May-11 | Indian River #1 | DPL | 90 | Reliability issues identified and expected to be resolved by 5/1/2011 |
| Dec-13 | Indian River Unit #3 | DPL | 169.7 | Reliability Analysis complete - reliability impact identified and expected to be completed before deactivation of unit |

### 14.1.5 –Transmission Expansion Plans on the Delmarva Peninsula

Table 14.5 summarizes new RTEP planned transmission upgrades greater than $5 million on the Delmarva Peninsula as approved by the PJM Board during 2010. Map 14.5 shows the location of upgrades enumerated in Table 14.5.

A complete listing and status of all system reinforcements approved by the PJM Board can be found on PJM's website via the following URL: http://www.pjm.com/planning/rtep-upgrades-status.aspx.

The extent to which Mid-Atlantic PJM continues to rely on transfers into the area to meet load-serving needs also has a quantifiable, negative impact on the high voltage backbone transmission system west of the Delmarva Peninsula. In addition to the TrAIL project already under construction, 2015 baseline analysis indicated that the PATH project and MAPP project would be needed to resolve identified reliability criteria violations, as discussed in **Sections 5** and **6**. Regulatory activities for each line continued to unfold throughout 2010, having a significant bearing on PJM's 2011 RTEP cycle of analyses.

***Possum Point-Indian River (MAPP) 500kV Line***

Based on 2010 RTEP baseline analysis, as described in **Sections 6.2** through **6.5**, PJM confirmed the need in 2015 for the MAPP Project. The MAPP project was confirmed by the PJM Board with a required in-service date of June 1, 2015. The MAPP project proved more effective than alternatives at resolving violations considering the estimated costs and time to complete each project.

In summary, the 2010 RTEP baseline analysis PJM identified numerous voltage violations of NERC Reliability Standards, including multiple voltage collapse conditions for the contingency loss of certain 500 kV facilities. Load deliverability tests identified 12 voltage drop violations, six voltage magnitude violations and five voltage collapse violations beginning in June 2015.

In certain cases, voltage collapse occurred before the required Capacity Emergency Transfer Objective (CETO) was reached. Specifically, the Keeney to Rock Springs 500 kV line contingency is projected to cause a precipitous voltage collapse with little or no warning to system operators. Unlike other identified violations the voltage collapse result was not preceded by other voltage violations. This type of system scenario is among the most difficult to predict and control from an operational perspective.

Each of the identified voltage violations is resolved by the MAPP Project as discussed in **Section 6**.

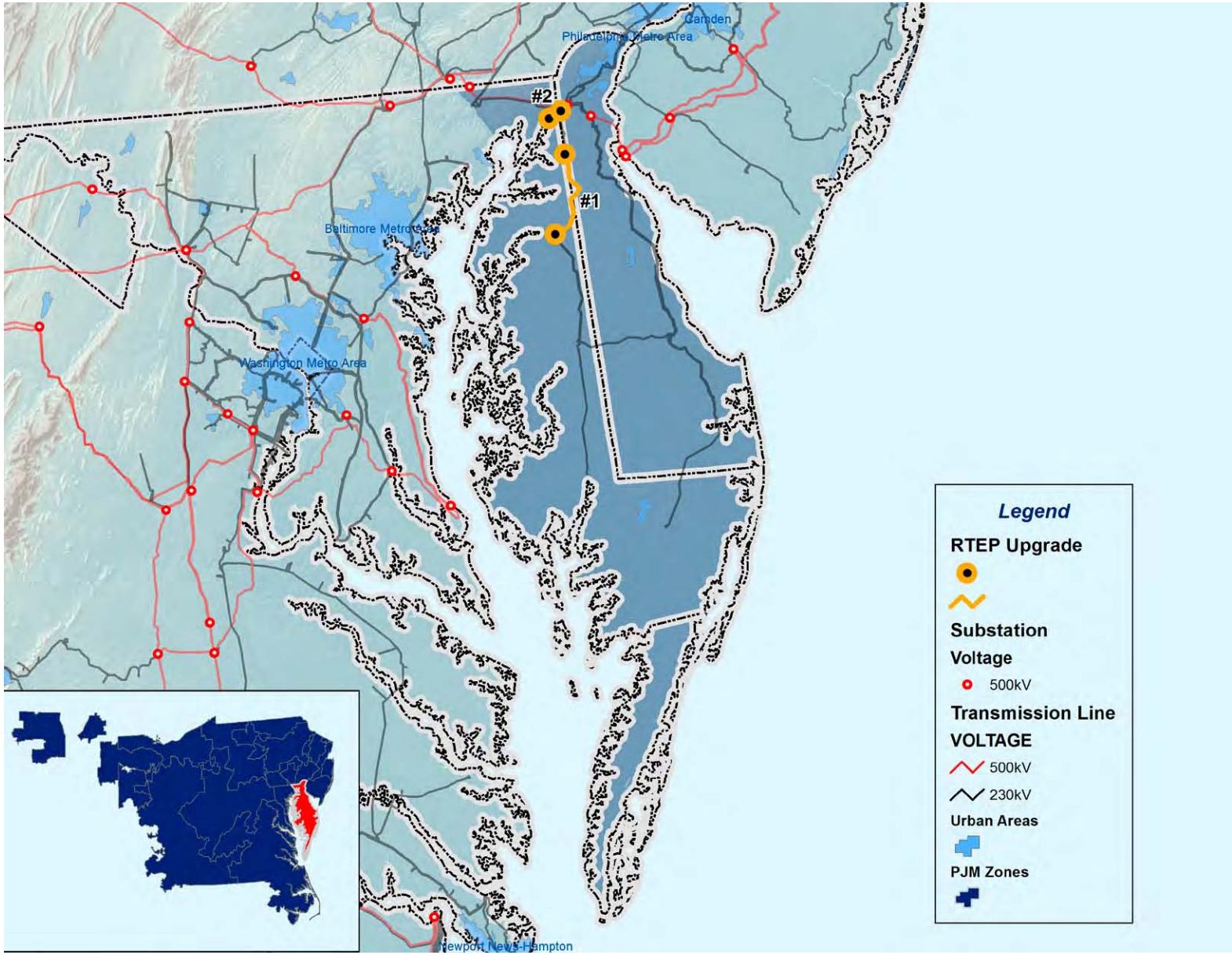
The use of Direct Current (DC) technology for the portion of the MAPP Project under the Chesapeake Bay improves reliability into the eastern Mid-Atlantic and allows for higher energy flows from the southwest onto the Delmarva Peninsula than previously observed using Alternating Current technology. DC technology also provides controllability for improved operational performance. This further enhances reliability in the Mid-Atlantic region by reducing energy flows on critical 500 kV transmission facilities on the PJM eastern and central interfaces and has the ability to facilitate the integration of off-shore renewable generation resources.

Preliminary 2011 PJM RTEP process analysis suggests that the need for the PATH line has moved several years beyond 2015. The outlook for a slower economic recovery – reflected in the reduced load growth rates in PJM's January 2011 published forecast – has led the PJM Board to direct transmission owners to suspend efforts on the PATH line pending a more complete analysis in 2011 of all RTEP upgrades, including MAPP. **Section 5** of this report discusses the PATH suspension.

**Table 14.5:** Major 2010 RTEP Plans on the Delmarva Peninsula

| | | System Upgrade Drivers | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Baseline Upgrades | | | | | Network Upgrades | | | Supplemental Upgrade | | | | |
| | Upgrade | Baseline Load Growth / Deliverability & Reliability | Congestion Relief - Economic | Operational Performance | Generator Deactivation | TO Criteria Violation | Generation Interconnection | Merchant Transmission Interconnection | Long - term Firm Transmission Service | Criteria Compliance other than for Baseline | Date | Cost (M) | TO Zone(s) | 2010 TEAC Review |
| 1 | Re-build the Townsend - Church 138 kV circuit | ▲ | | | | | | | | | June 2015 | 5.96 | DPL | 9/8/2010 |
| 2 | Re-build the Glasgow - Cecil 138 kV circuit | ▲ | | | | | | | | | June 2015 | 16 | DPL | 9/8/2010 |

**Map 14.5:** Major 2010 RTEP Plans on the Delmarva Peninsula



### 14.1.6 – Interconnection Requests for Generation Powered by Renewable Fuel Sources

PJM's RTEP process offers a structure that assures consistent, equal opportunity across fuel types while flexible enough to adapt to specific technical realities and market challenges. Presently, PJM's queues include interconnection requests on the Delmarva Peninsula for plants fueled by wind, hydro, methane and biomass, as listed in Table 14.6 and shown on Map 14.6.

While some renewable resources can operate in a manner similar to the traditional fossil fueled power plants, other renewable energy sources, such as wind, are recognized as intermittent resources. Their ability to generate power is directly determined by the immediate availability and/or magnitude of their specific fuel. For example, wind turbines can generate electricity only when wind speed is within a range consistent with the physical specifications of the related turbines. This presents challenges with respect to real-time operational dispatch and specific capacity value. To address the latter issue, PJM has established a set of business rules unique to intermittent resources that provide for the determination of capacity values sufficiently credible to represent capacity during the PJM summer peak period. These are described in PJM Manuals M21 (http://pjm.com/~/media/documents/manuals/m21.ashx) and M14A (http://pjm.com/~/media/documents/manuals/m14a.ashx).

**Map 14.6:** Generator Interconnection Requests, on the Delmarva Penninsula, by Renewable Fuel Sources

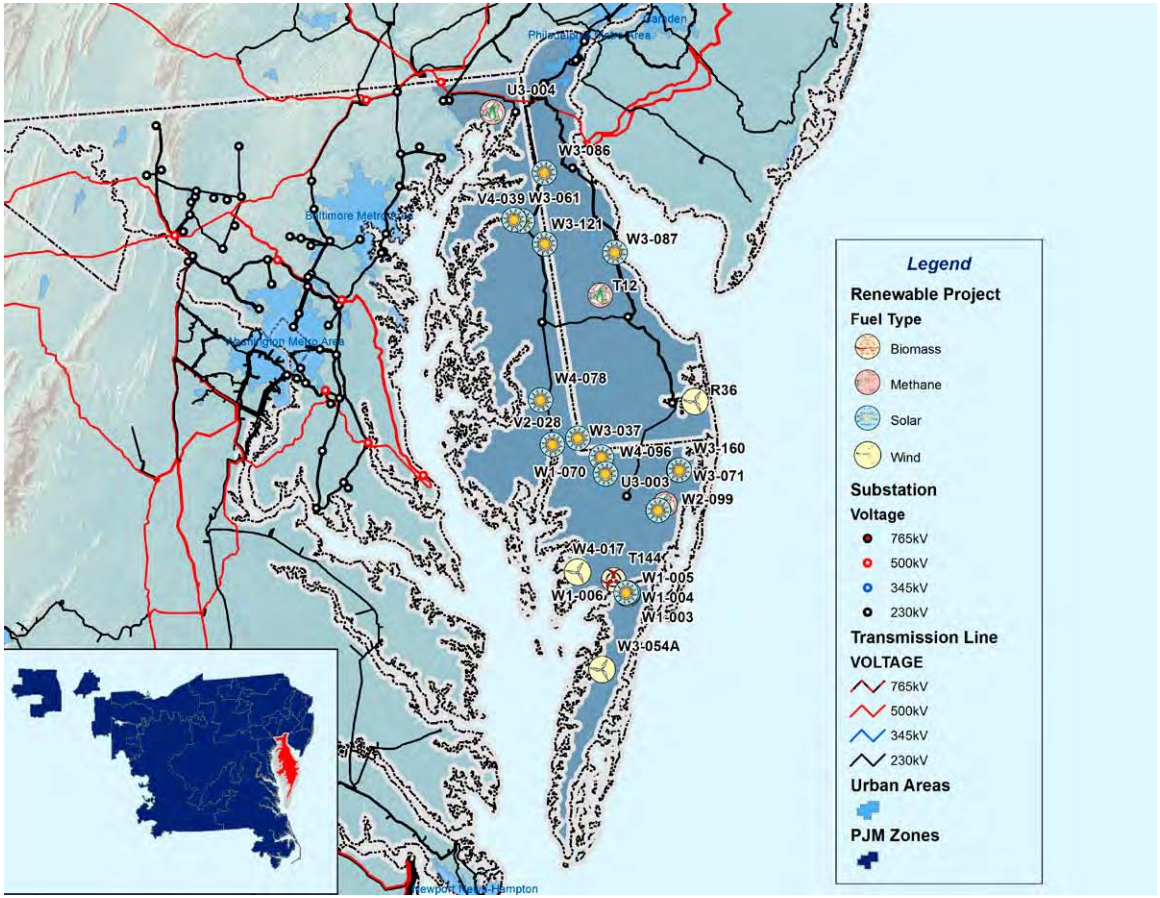


**Table 14.6:** Interconnection Requests by Renewable Fuel Type

| Queue | Project Name | MW | MWC | Status | Schedule | TO | Fuel Type |
|---|---|---|---|---|---|---|---|
| R36 | Bethany 138 kV | 450 | 90 | UC | 6/1/2015 | DPL | Wind |
| T12 | Kent - Harrington 69 kV | 4.25 | 4 | ISP | 8/14/2007 | DPL | Methane |
| T144 | Pocomoke | 19.8 | 10 | Active | 1/1/2010 | DPL | Biomass |
| U3 - 003 | Mt. Olive 69 kV | 2 | 0 | UC | 6/1/2012 | DPL | Methane |
| U3 - 004 | Cecil | 2 | 0 | Active | 9/1/2009 | DPL | Methane |
| V2 - 028 | Vienna | 6 | 2.28 | Active | 12/31/2010 | DPL | Solar |
| V4 - 039 | Church | 9 | 3.4 | Active | 6/1/2011 | DPL | Solar |
| W1 - 003 | Oak Hall | 20 | 7.6 | Active | 12/1/2011 | DPL | Solar |
| W1 - 004 | Oak Hall | 20 | 7.6 | Active | 12/1/2011 | DPL | Solar |
| W1 - 005 | Oak Hall | 20 | 7.6 | Active | 12/1/2011 | DPL | Solar |
| W1 - 006 | Oak Hall | 20 | 7.6 | Active | 12/1/2011 | DPL | Solar |
| W1 - 070 | Laurel 69 kV | 20 | 7.6 | Active | 5/31/2011 | DPL | Solar |
| W2 - 099 | Kenney 69 kV | 20 | 7.6 | Active | 6/1/2012 | DPL | Solar |
| W3 - 036 | Pemberton 12 kV | 5 | 1.9 | Active | 3/1/2012 | DPL | Solar |
| W3 - 037 | Delmar 12 kV | 20 | 7.6 | Active | 3/1/2012 | DPL | Solar |
| W3 - 054A | Oak Hall 138 kV | 95 | 12.35 | Active | 6/1/2013 | DPL | Wind |
| W3 - 061 | Church 69 kV | 20 | 7.6 | Active | 5/31/2011 | DPL | Solar |
| W3 - 071 | Worcester 25 kV | 12.54 | 4.77 | Active | 6/1/2012 | DPL | Solar |
| W3 - 086 | Townsend 138 kV | 10 | 3.8 | Active | 12/31/2011 | DPL | Solar |
| W3 - 087 | Cartanza 230 kV | 15 | 5.7 | Active | 12/31/2011 | DPL | Solar |
| W3 - 160 | Worcester 25 kV | 10 | 3.8 | Active | 3/31/2011 | DPL | Solar |
| W3 - 121 | Queen Anne County 25 kV | 6 | 2.28 | Active | 6/1/2013 | DPL | Solar |
| W4 - 017 | Kings Creek - Crisfield 69 kV | 100 | 13 | Active | 12/1/2013 | DPL | Wind |
| W4 - 078 | Todd 25 kV | 20 | 7.6 | Active | 6/1/2013 | DPL | Solar |
| W4 - 096 | Piney Grove 25 kV | 10 | 3.8 | Active | 3/31/2013 | DPL | Solar |

**NOTE**

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The MWC column represents the installed capacity portion of the upgrade. For renewable projects the installed capacity portion of the project varies as described in **Section 2**.