Transmission Expansion Advisory Committee (TEAC) Recommendations to the PJM Board

PJM Staff Whitepaper
October 2015

EXECUTIVE SUMMARY

The PJM Board of Managers previously approved changes to the Regional Transmission Expansion Plan (RTEP) on July 28, 2015. Those changes totaled $295.13 million, and were primarily to resolve the Artificial Island operational performance issue.

Since that time PJM identified additional baseline reliability criteria violations within the planning horizon as part of the 2015 RTEP. Transmission upgrades were identified to resolve these reliability criteria violations. The total increase to the RTEP to include these baseline project additions is $580.53 million. In addition, there were a number of changes to previously approved baseline projects. The cost and scope of some projects changed and in some instances the upgrades are no longer needed and their removal from the RTEP was recommended. The total increase to the RTEP associated with these changes to previously approved baseline projects is $47.67 million. The net change to the RTEP to include the new baseline reliability upgrades and changes to previously approved baseline projects is an increase of $628.2 million.

In addition to the upgrades to address baseline reliability issues PJM staff also recommended several projects to address expected congestion on the system. These market efficiency projects, which were solicited through the 2014/15 long-term RTEP proposal window, have an estimated cost of $59.3 million and are expected to mitigate $815 million in energy market congestion over the next 15 years.

As part of the 2015 RTEP PJM staff also completed 155 new interconnection queue impact studies and 157 projects were withdrawn from the interconnection queue. The impact of these changes to the interconnection queue was a net increase in the RTEP of $595.40 million.

The total change in the RTEP to include the new reliability and market efficiency baseline projects, incorporate the changes to previously approved baseline projects, and include the changes associated with the interconnection projects is a net increase of $1,282.9 million. With these changes, the RTEP includes over $27,788.76 million of transmission additions and upgrades since the first plan was approved by the Board in 2000.

On October 15, 2015, the elements of the 2015 RTEP for the 155 interconnection queue impact studies and additional baseline upgrades and were presented for the Board Reliability Committee's (BRC) consideration and for recommendation to the PJM Board for approval and inclusion in the RTEP. The PJM Board approved the changes as summarized below.

SUMMARY OF UPGRADES

2015 Baseline Transmission Upgrades Changes and Additions

One aspect of the development of the Regional Transmission Expansion Planning Process is an evaluation of the "baseline" system, i.e. the transmission system without any of the generation interconnection requests included in the current planning cycle. This baseline analysis determines the compliance of the existing system with reliability criteria and standards. Transmission upgrades required to maintain a reliable system are identified and reviewed with the Transmission Expansion Advisory Committee (TEAC). The cost of transmission upgrades to mitigate such criteria violations are the responsibility of the PJM transmission owners.

In 2012 PJM filed proposed changes to the Operating Agreement in compliance with FERC Order 1000. Those changes were approved by the FERC and were implemented for the first time as part of the 2014 RTEP. Consistent with the changes to the Operating Agreement, PJM administered the first Long Term Market Efficiency proposal window in addition to two 30 day near-term proposal windows in 2015.

Long-Term Market Efficiency Proposal Window:

PJM opened the first Order 1000 Long Term Market Efficiency proposal window from October 30, 2014 through February 27, 2015 to solicit proposals to address future simulated congestion.

Market Efficiency Analysis is a part of the overall Regional Transmission Planning Process (RTEP) to accomplish the following objectives:

1. Determine which reliability upgrades, if any, have an economic benefit if accelerated or modified.
2. Identify new transmission upgrades that may result in economic benefits.
3. Identify economic benefits associated with "hybrid" transmission upgrades. Hybrid transmission upgrades include proposed solutions which encompass modification to reliability-based enhancements already included in RTEP that when modified would relieve one or more economic constraints. Such hybrid upgrades resolve reliability issues but are intentionally designed in a more robust manner to provide economic benefits in addition to resolving those reliability issues.

Market Efficiency analysis is conducted using a market simulation tool which models the hourly security-constrained commitment and dispatch of generation over a future annual period. Economic benefits of transmission upgrades are determined by comparing results of simulations which include the study upgrade to results of simulations which do not include the study upgrade. Projects are measured using two Tariff/Operating Agreement criteria. First, the project must address congestion as simulated in the Market Efficiency analysis. Second, the project benefits must exceed the costs by at least 25 percent. Project

benefits are measured by comparing the benefits in the form of net load payments and/or production costs with and without the proposed project for a 15-year study period.

To date, the PJM RTEP only has a handful of projects that were specifically added to address Market Efficiency. With the implementation of PJM's Order 1000 compliant planning process, 93 proposals were submitted through an open solicitation window to address market efficiency issues.

PJM staff provided entities with a list of facilities, along with simulated congestion dollars, to solicit proposals during the Order 1000 Long-Term Market Efficiency Proposal Window. The list of these facilities along with the simulated congestion for study years 2019 and 2022 is shown in Table 1. In the Market Efficiency Proposal Window, PJM received a number of project proposals to address facilities in which congestion may be alleviated with lower cost incremental upgrades to the facilities. PJM staff is recommending a number of these projects as further described below. PJM staff is also in the process of assessing a number of regional facilities associated with PJM IROL (Interconnected Reliability Operating Limit) Reactive interfaces. Evaluation of these projects is ongoing and completion of the evaluation is anticipated later this year or in early 2016.

Table 1. Facilities Recommended for Project Proposals and Simulated Congestion

Facility Name	AREA	TYPE	2019 Congestion Frequency (Hours)	2019 Market Congestion ($ Millions)	2022 Congestion Frequency (Hours)	2022 Market Congestion ($ Millions)
AP SOUTH L/O BED-BLA	PJM	Interface	1,799	$110.2	1,503	$130.6
Miami Fort to Willey 138 kV	DEO&K	Line	331	$22.5	282	$36.7
Brunner Island to Yorkana 230 kV	ME - PPL	Line	1,073	$36.7	937	$39.0
AEP-DOM L/O BED-BLA	PJM	Interface	527	$22.7	575	$34.2
Worcester to Ocean Pines (I) 69 kV	DP&L	Line	112	$23.9	116	$27.0
Safe Harbor to Graceton 230 kV	PPL - BGE	Line	357	$7.9	237	$5.2
Taneytown to Carroll 138 kV	AP	Line	2,163	$33.4	1,668	$20.3
Cordova to Nelson 345 kV	CE	Line	414	$9.5	329	$12.9
Lorreto to Wilton CTR 345 kV*	CE	Line	52	$2.9	113	$8.2
Fieldale to Thornton 138 kV	AEP	Line	91	$2.2	186	$9.0
Dravosburg to West Mifflin 138 kV	DLCO	Line	567	$4.7	589	$7.1
Woodville to 15USAP 138 kV	DLCO	Line	131	$1.7	218	$4.7

*Project studies under evaluation to address RPM COMED binding LDA.

As noted above there were 93 proposals submitted during the Long Term window that closed in February of 2015. Proposals submitted ranged in costs from $0.1 to $432 million and included Transmission Owner upgrades and Greenfield projects from incumbent transmission owners and non-incumbent entities. The breakdown of project proposals by area is shown in Table 2.

Table 2. Proposals by Area

AREA of Proposal	Number of Proposals	Greenfield Proposals	TO Upgrade Proposals
AEP	3	1	2
APS	5	3	2
APSOUTH and/or AEP-DOM Area	41	37	4
ATSI	4	0	4
BGE/PPL	4	0	4
ComEd	15	4	11
DEOK	8	8	
DPL	1	0	1
DUQ	4	3	1
PECO	5	0	5
PSEG	3	2	1
Grand Total	93	58	35

PJM staff conducted an extensive analysis on the proposals to determine which projects satisfy the Market Efficiency criteria of having a Benefit/Cost ratio >1.25, through reduction or elimination of the congestion as simulated and shown in Table 1, and are economically justified.

PJM staff also completed additional sensitivity analyses using updated assumptions for Natural gas prices, future load, and any significant generation or transmission network changes to ensure that the proposals would still satisfy the B/C using these updated assumptions.

The projects shown in Table 3 satisfy the B/C ratio and were recommended to the Board for approval for inclusion into the RTEP. These projects are all upgrades to existing equipment and will be designated to the incumbent transmission owners. Taken as a group, the Benefit/Cost ratio for all of the projects combined was equal to 15.6, which far exceeds the required 1.25 threshold.

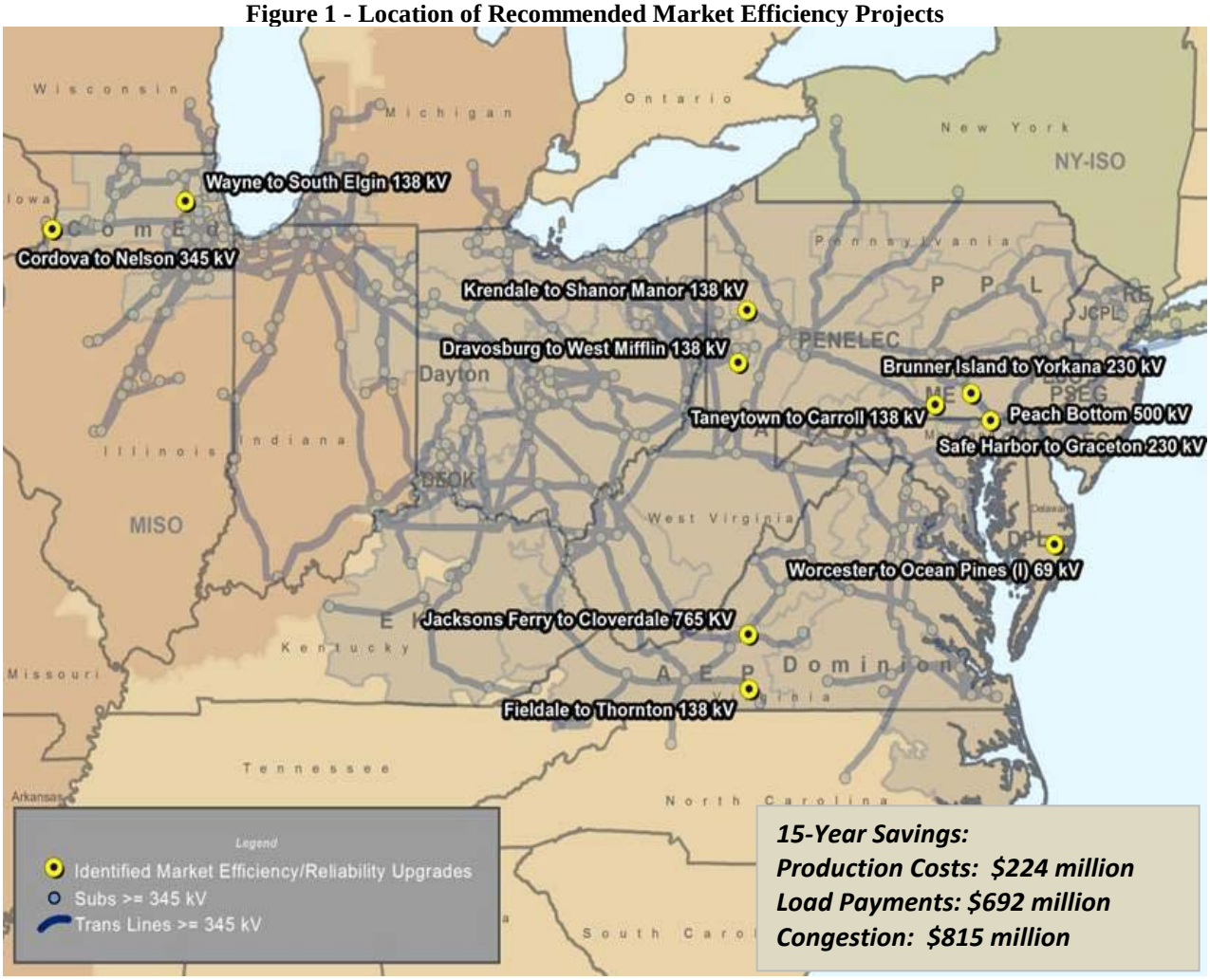
Table 3. Recommended Market Efficiency Projects

PJM Baseline ID	PJM Window Project ID	Project Description	Transmission Zone	Constraint Project Addresses	Project Cost ($M)	ISD	B/C Ratio	B/C Ratio Sensitivity Run
b2688	201415_1-18G	Upgrade terminal equipment on the Lincoln - Carroll 115/138 kV path.	APS	Taneytown to Carroll 138 kV	$5.2	2019	55.7	90.1
b2689	201415_1-12A	Reconductor approximately 7 miles of the Woodville-Peters (Z-117) 138 kV circuit, reconfigure the West Mifflin-USS Clairton (Z-15) 138 kV circuit to establish the Dravosburg-USS Clairton (Z-14) 138 kV circuit and the West Mifflin-Wilson (Z-15) 138 kV circuit	DUQ	Dravosburg to West Mifflin 138 kV	$11.2	2018	5.8	2.0
b2690	201415_1-2A	Reconductor two spans of the Graceton-Safe Harbor 230 kV transmission line. Includes termination point upgrades	PPL	Safe Harbor to Graceton 230 kV	$1.1	2019	4.3	14.4
b2691	201415_1-2B	Reconductor three spans limiting the Brunner Island - Yorkana 230 kV line, add 2 breakers to Brunner Island Switchyard, upgrade associated terminal equipment	PPL	Brunner Island to Yorkana 230 kV	$3.1	2019	73.3	22.2
b2692	201415_1-10J	Replace station equipment at three stations and upgrade conductor rating of three lines by re-conductoring and mitigating sag limitations.	COMED	Cordova to Nelson 345 kV	$24.6	2019	1.7	1.9
b2693	201415_1-10B	Replace L7815 B phase line trap at Wayne substation	COMED	Wayne to South Elgin 138 kV	$0.1	2019	7.2	6.4
b2694	201415_1-11H	Increase ratings of Peach Bottom 500-230 kV transformer to 1479 MVA normal / 1839 MVA emergency	PECO	Peach Bottom 500 kV	$9.7	2019	2.6	3.0
b2695	201415_1-13E	Rebuild Worcester - Ocean Pine 60 kV ckt 1 to 1400A capability summer emergency	DPL	Worcester to Ocean Pines (I) 69 kV	$2.4	2019	82.7	65.3
b2696	201415_1-18I	Upgrade 138 kV substation equipment at Butler, Shanor Manor, and Krendale substations. New rating of the line will be 353 MVA summer normal and 422 MVA	APS	Krendale to Shanor Manor 138 kV	$0.6	2019	35.8	123.4

		summer emergency						
b2697	201415_1-4I	Mitigate all violations identified by the sag study to operate the Fieldale - Thornton - Franklin overhead 138 kV line conductor at its maximum operating temperature. Preliminary study results have identified 6 potential distribution/utility line crossings to be addressed. Also, replace terminal equipment at AEP's Danville and East Danville substations to improve the thermal capacity of Danville - East Danville 138 kV circuit.	AEP	Fieldale to Thornton 138 kV	$0.8	2019	114.2	101.2
b2698	201415_1-4J	Replace relays at AEP's Cloverdale and Jackson's Ferry substation to improve the thermal capacity of Cloverdale - Jackson's Ferry 765 kV line	AEP	Jacksons Ferry to Cloverdale 765 KV	$0.5	2019	15.8	62.0

The recommended projects will provide major benefits to the RTO. These benefits include savings in congestion, production costs, and load payments as well as a more reliable network. The map in Figure 1 shows the location of the recommended projects. These projects are located throughout different areas of PJM. The projects, assuming no other RTEP upgrades, are estimated to provide production cost savings of $224 million in a 15-year period. The congestion and load payment savings are estimated to be $815 million and $692 million, respectively. The cost allocation for these projects is provided in Appendix A and B of this document.

Figure 1 - Location of Recommended Market Efficiency Projects

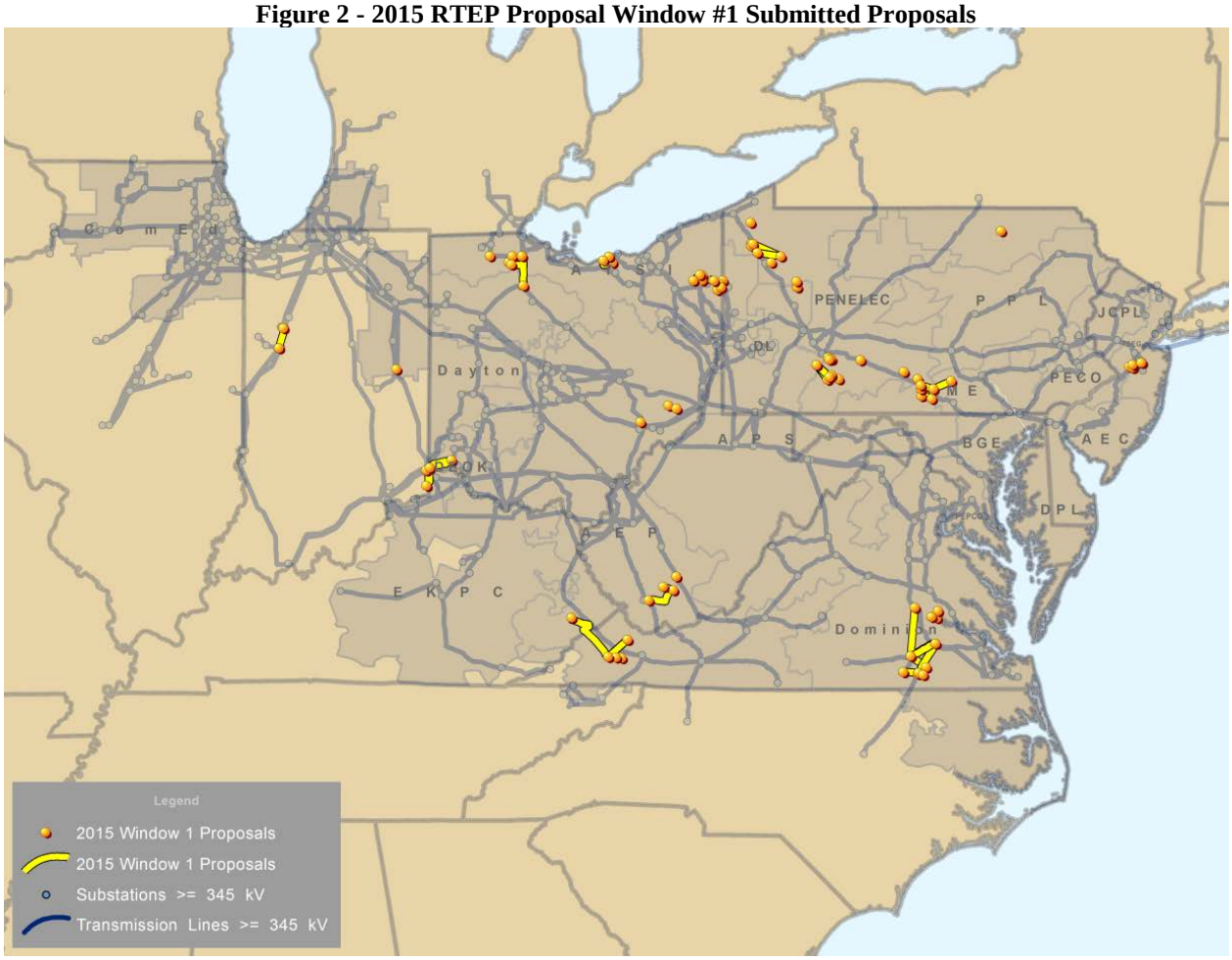


Baseline Reliability:

In June of this year PJM opened a 30-day proposal window, which was administered as the PJM RTEP Proposal Window #1, to solicit solutions to a number of reliability criteria violations that were identified as part of the 2015 RTEP. The associated reliability test procedures included basecase N-1 thermal, basecase N-1 voltage, Generator Deliverability, Load Deliverability thermal and voltage, and the N-1-1 thermal and voltage tests. PJM staff identified potential reliability criteria violations associated with 292 flowgates (transmission facility and contingency/outage pairs). Thermal reliability criteria violations were identified for approximately 30 individual transmission line facilities due to one or more test procedures. Voltage reliability criteria violations were identified for approximately 60 facilities.

In response to the 2015 RTEP Proposal Window #1, PJM received 91 baseline upgrade proposals to address these reliability criteria violations. The Window produced a wide range of proposals, from 9 different entities including incumbent transmission owners and their affiliates as well as non-incumbent transmission developers. Notably, several affiliates of PJM Transmission Owners proposed “Greenfield Projects” (i.e. new facilities that are not upgrades to existing facilities) in other PJM Transmission Owner zones. The non-incumbent transmission developers included ITC Mid Atlantic, NextEra Energy Transmission, Northeast Transmission Development/LS Power, and Transource Energy. Of the 91 proposals, 26 were Transmission Owner Upgrades and 64 were Greenfield Projects. The locations of the various proposals are shown on the map below in Figure 2.

Figure 2 - 2015 RTEP Proposal Window #1 Submitted Proposals



PJM staff reviewed all of the proposals and our evaluation of the effectiveness of each of the proposals with stakeholders through the Transmission Expansion Advisory Committee (TEAC). PJM staff recommended 19 of the 91 proposals to resolve reliability criteria violations. The 19 recommended proposals resolve all of the reliability criteria violations identified in proposal window #1 except for several voltage violations and a thermal violation on the 138kV system in the AEP transmission zone. There are several solution alternatives that are still under evaluation for these thermal and voltage violations in the AEP Transmission zone. The 19 proposals that are being recommended include several bus replacements, line reconductor projects, installation of additional transformers, switch and wave trap replacements, upgrades to terminal equipment, sag studies, rebuilds of existing circuits, capacitor installations, breaker installations, and relay upgrades. All of the 19 recommended projects are Transmission Owner Upgrades. Additional information about the recommended projects is included in this white paper.

In addition to the 19 recommended reliability project proposals that went through the 2015 PJM window process, there are an additional 2 projects that were recommended from the 2014 Proposal Window #2. Also, 36 projects were recommended for immediate need baseline reliability. The immediate need

baseline reliability projects include transmission enhancements with a need date of 3 years or less. Due to the critical timing of immediate need projects, PJM did not have time to administer a proposal window to solicit alternative solutions from PJM stakeholders for the associated reliability drivers.

The reliability criteria drivers for the immediate need projects include short circuit fault duty to which the only solution is a Transmission Owner upgrade of the associated breaker, Dominion local Transmission Owner criteria for "End of Life" facilities where the associated facilities have already reached their end of life, upgrades associated with generation deactivation within the three year horizon, and several PJM operational performance issues.

A summary of the more significant baseline projects with expected costs greater than $5 million are detailed below. A complete listing of all of the projects that were recommended to address baseline reliability is attached as Attachment A and B to this white paper. The projects that cost less than $5 million include removal of substations, relay replacements, metering equipment replacement, upgrades to or installation of capacitors, line reconductor projects, line rebuilds, bus replacements, wave trap replacements, installation of an additional transformer, circuit breaker upgrades or replacements to address short circuit problems, and other terminal equipment upgrades to increase the ratings of transmission lines to address thermal violations.

Mid-Atlantic Region System Upgrade

- ME Transmission Zone
  - Convert Middletown Junction 230 kV substation to nine bay double breaker configuration - $15.50 M

- PENELEC Transmission Zone
  - Convert the East Towanda 115 kV substation to breaker and half configuration - $1 M

Western Region System Upgrades

- AEP Transmission Zone
  - Reconductor Dequine to Meadow Lake 345 kV circuit #1 utilizing dual 954 ACSR 54/7 cardinal conductor - $5.10 M
  - Install a second 345/138 kV transformer at Desoto - $10.60 M
  - Replace/upgrade/add terminal equipment at Bradley, Mullensville, Pinnacle Creek, Itmann, and Tams Mountain 138 kV substations. Sag study on Mullens – Wyoming and Mullens – Tams Mt. 138 kV circuits - $5.36 M

- APS Transmission Zone
  - Yukon 138 kV Breaker Replacements - $11.50 M

- ATSI Transmission Zone

- Rebuild the existing double circuit tower line section from Beaver substation to Brownhelm Jct. approx. 2.8 miles - $5.10 M

- DEOK Transmission Zone
  - Convert Miami Fort 345 kV substation to a ring bus terminating Feeder 4504, TB 9 and TB10 in separate ring positions - $6.80 M

Southern Region System Upgrades

- Dominion Transmission Zone
  - Wreck and rebuild existing Remington CT - Warrrenton 230 kV (approx. 12 miles) as a double-circuit 230 kV line - $105.00 M
  - Install three 230 kV bus breakers and 230 kV, 100 MVAR Variable Shunt Reactor at Dahlgren to provide line protection during maintenance, remove the operational hazard and provide voltage reduction during light load conditions - $6.70 M
  - Rebuild Boydton Plank Rd - Kerr Dam 115 kV Line #38 (8.3 miles) to current standards with summer emergency rating of 353 MVA at 115 kV - $12.50 M
  - Rebuild Carolina - Kerr Dam 115 kV Line #90 (38.7 miles) to current standards with summer emergency rating of 353 MVA at 115 kV - $58.00 M
  - Rebuild Clubhouse - Carolina 115 kV Line #130 (17.8 miles) to current standards with summer emergency rating of 353 MVA at 115 kV - $26.70 M
  - Rebuild Twittys Creek - Pamplin 115 kV Line #154 (17.8 miles) to current standards with summer emergency rating of 353 MVA at 115 kV - $25.70 M
  - Rebuild Buggs Island - Plywood 115 kV Line #127 (25.8 miles) to current standards with summer emergency rating of 353 MVA at 115 kV. The line should be rebuilt for 230 kV and operated at 115 kV - $38.70 M
  - Rebuild Greatbridge - Hickory 115 kV Line #16 and Greatbridge - Chesapeak E.C. to current standard with summer emergency rating of 353 MVA at 115 kV - $21.70 M
  - Build 20 mile 115 kV line from Pantego to Trowbridge with summer emergency rating of 262 MVA - $35.00 M
  - Build 15 mile 115 kV line from Scotland Neck to S Justice Branch with summer emergency rating of 353 MVA. New line will be routed to allow HEMC to convert Dawson's Crossroads RP from 34.5 kV to 115 kV - $33.00 M
  - Pratts Area Improvement - $103.70 M

Following is a more detailed description of the larger scope upgrades that were recommended to the PJM Board for their consideration. A description of the criteria driving the need for the upgrade as well as the required in-service date is provided.

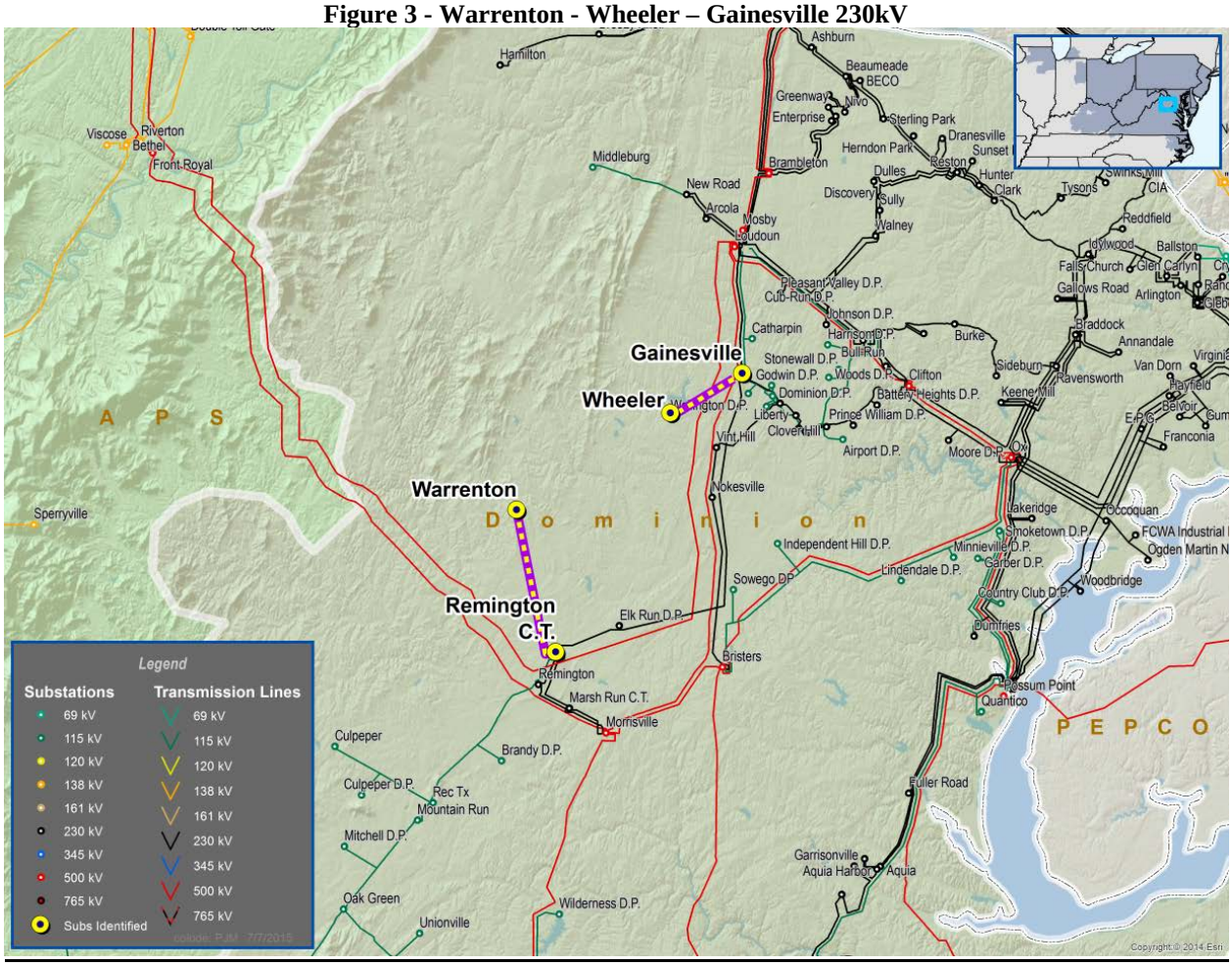
Baseline Project B2461 – Warrenton - Wheeler – Gainesville 230kV

Pursuant to schedule 6 of the Operating Agreement, PJM is obligated to evaluate the local transmission owner (TO) criteria in addition to the PJM, NERC and regional planning criteria. Dominion Virginia Power

(DVP) local transmission owner criteria states that loading on a single source radial transmission line is limited to 100 MW maximum and that an additional transmission source is required if loading exceeds 100 MW. Both PJM and DVP local TO criteria also limits the planned load loss to a maximum of 300 MW. Loss of the Gainesville Substation is projected to result in over 300 MW of load being dropped by summer 2017. The existing load on the DVP radial Remington CT – Warrenton 230 kV line is projected to exceed 100 MW by summer 2018. Also, the Northern Virginia Electric Cooperative (NOVEC) radial Gainesville – Wheeler 115 kV line presently exceeds 110 MW. Although not subject to the radial line loading criteria, NOVEC's Gainesville – Wheeler 115 kV line experiences operating issues associated with its high load and radial configuration.

To resolve the Remington CT – Warrenton 230 kV radial line load violation, the 300 MW load loss at Gainesville Substation and the operational issues with NOVEC's Gainesville – Wheeler 115 kV radial line, the recommended solution was to wreck and rebuild the existing Remington CT – Warrenton 230 kV circuit (approximately 12 miles) as a double circuit 230 kV line, construct a new 230 kV line from a new 230 kV switching station in the Vint Hill area to a new 230 kV switching station adjacent to NOVEC's Wheeler Substation (approximately 5.4 miles), convert the Gainesville – Wheeler 115 kV line to 230 kV, and terminate the converted Gainesville – Wheeler line at Gainesville to create a Vint Hill – Wheeler – Gainesville 230 kV networked line.

Figure 3 - Warrenton - Wheeler – Gainesville 230kV

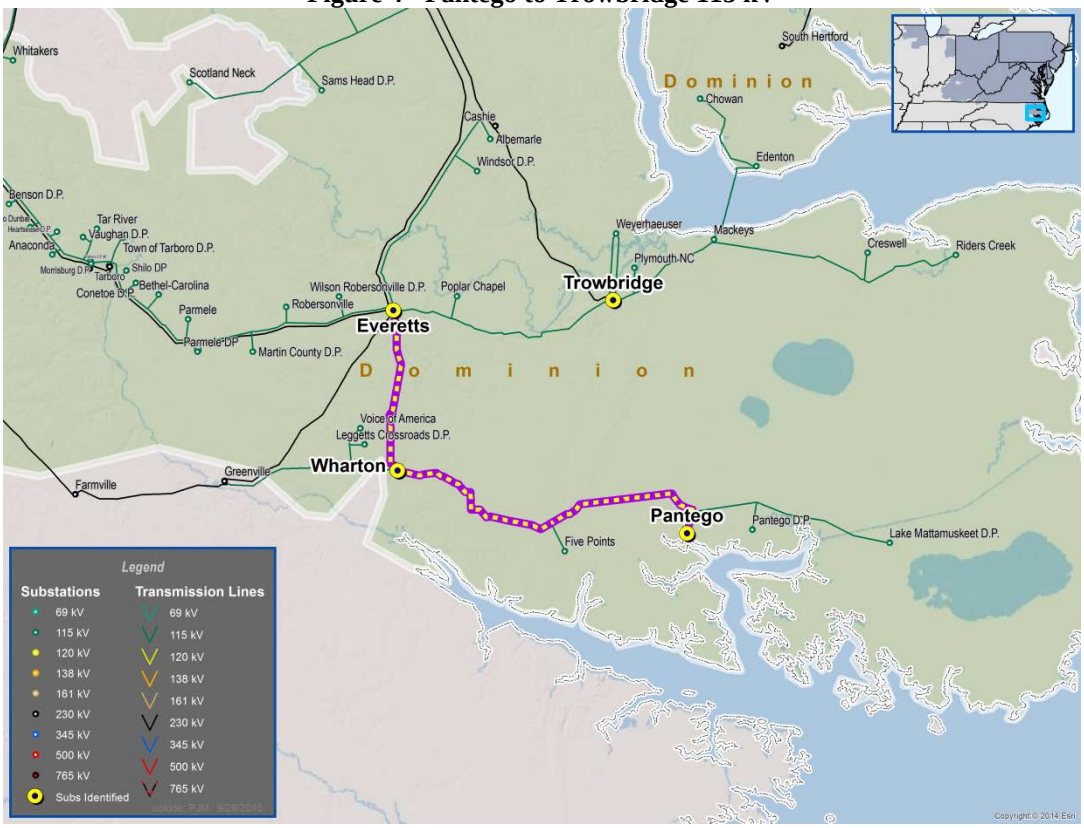


Baseline Projects to Resolve Dominion Radial Line Criteria Violations

In January 2015, Dominion added a radial line criteria to their Transmission Owner criteria. The criterion defines a radial transmission line as a single line that originates in a substation, serves load, and does not tie to any other transmission line or substation. The loading on a single source radial transmission line is limited to 100 MW maximum, and a 700 MW-Mile exposure (where MW-Mile equals the Peak MW multiplied by the radial ling length).

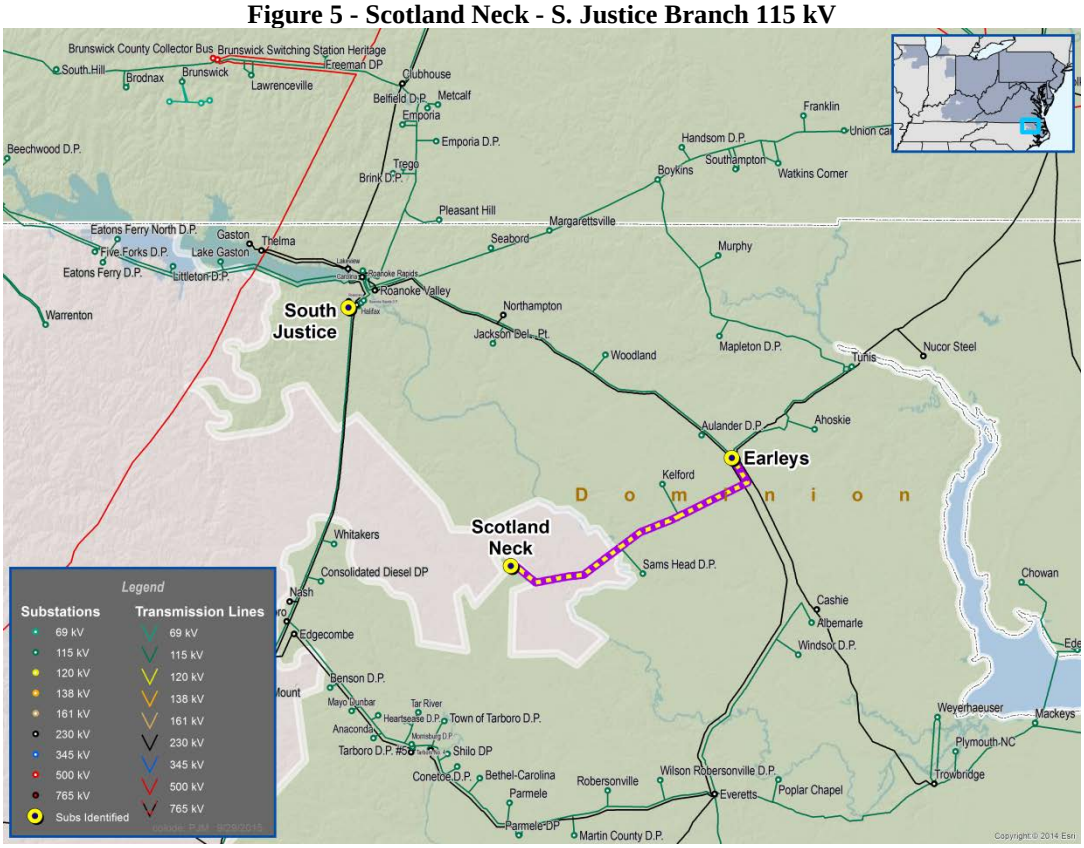
Several lines had been identified that did not meet the radial line criteria and resulted in PJM recommending immediate need solutions. One of the circuits identified through the radial line criterion is the 115 kV line #82 from Everetts – Wharton that feeds the radial line #189 from Wharton to Pantego. The MW-Miles for lines #82 and #189 are 2,156 and 1,419 MW-Miles respectively, which is a violation of the radial line criteria. The recommended solution is to network both lines by rebuilding a 20 mile 115 kV line from Pantego to Trowbridge with a summer emergency rating of 353 MVA, and install a 115 kV four breaker ring at Pantego and an additional 115 kV breaker at Trowbridge. The estimated cost for this work is $35.4 million and the projected in service date is June 1, 2018. This project is classified as immediate need due to the required date that is within three years.

Figure 4 - Pantego to Trowbridge 115 kV



Another line that was identified through the immediate need criterion is the #126 115 kV 25 mile radial line from Earleys – Scotland Neck on two pole wood H-frames that were originally built in the 1960s. The MW-Miles for this line is 775 MW-Miles which is a violation of the radial line criteria. The recommended solution was to network #126 by building a 15 mile 115 kV line from Scotland Neck – S. Justice Branch with a summer emergency rating of 262 MVA and installing a 115 kV three breaker ring at S. Justice Branch and a 115 kV breaker at Scotland Neck. The estimated cost for this new work is $33.3 million and the projected in service date is June 1, 2018. This project is classified as immediate need due to the required date that is within three years.

Figure 5 - Scotland Neck - S. Justice Branch 115 kV



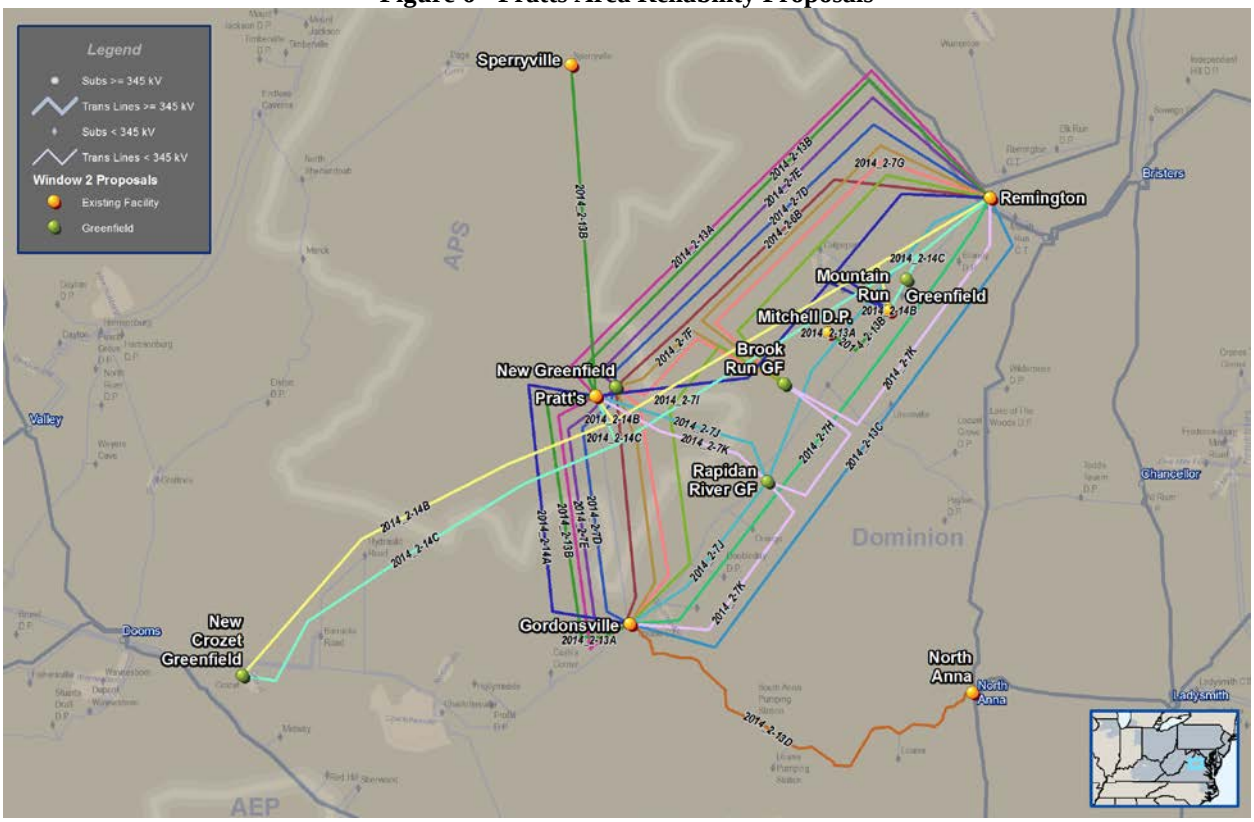
Baseline Project B2686 – Pratts Area Reliability Violations

During the 2014 RTEP, several reliability criteria violations were identified in the vicinity of the Gordonsville and Remington substations in the Dominion Transmission Zone and also the Pratts 115 kV substation in the FirstEnergy/Allegheny Power Transmission Zone. The reliability criteria violations included a number of voltage drop and voltage magnitude violations on the 115 kV and 230kV Dominion transmission system. Also, PJM observed voltage magnitude and voltage drop violations at Pratts 115 kV. There is also an N-1-1 thermal violation of Mitchell – Mountain Run 115 kV facility in Dominion.

PJM requested solution alternatives to the Pratts area reliability violations as part of the 2014 RTEP Proposal Window #2. In response, PJM received a total of 16 proposals from 4 entities. Three entities were non PJM transmission owners and the fourth entity was a joint effort between two PJM transmission Owners, Dominion and FirstEnergy.

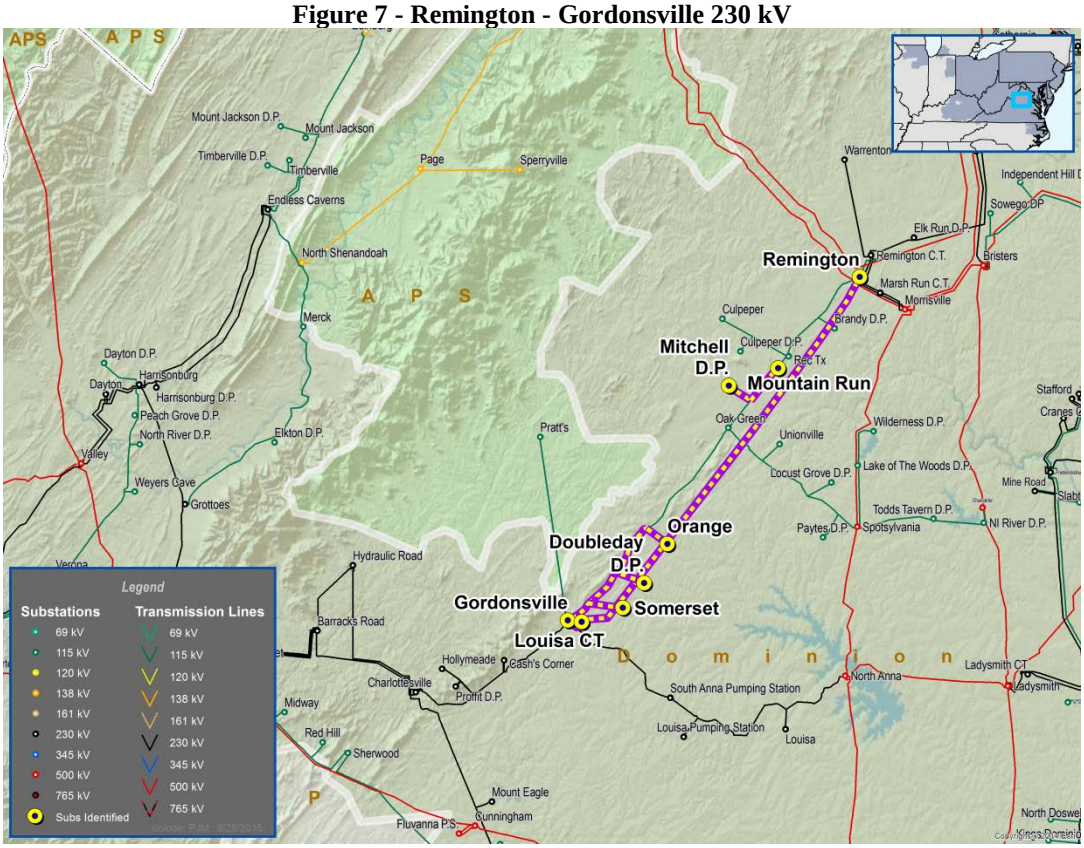
Most of the 16 proposals focused on transmission between the existing Gordonsville, Pratts and Remington station locations. Out of the 16 proposals, 8 projects focused on an approach to build new or rebuild transmission between Gordonsville and Pratts and also to build new transmission between Pratts and Remington. Out of the remaining 8 proposals, 6 projects focused on an approach to build new transmission between Gordonsville and Remington. Additionally, 2 other projects were proposed with alternate routes to connect Remington, Pratts or Gordonsville with new transmission.

Figure 6 - Pratts Area Reliability Proposals



The performance of all 16 proposals was evaluated by PJM. PJM also reviewed the overall project feasibility, cost and risk. PJM also considered the Virginia State Commission Corporation (SCC) siting codes that prefer existing ROW as the priority location for additions to the transmission system. PJM staff considered the importance of minimizing new Right of Way (ROW) in the project implementation due to the sensitivity of the historic and protected land in the area. Considering all of these issues, PJM staff recommended a proposal that satisfies the performance criteria, is among the lowest cost and does not require significant new ROW. PJM understands that minimal widening of an existing ROW corridor may be required to accommodate the design requirements of a modern transmission tower. Every other alternative proposal required significant new ROW. The recommended solution is to build a 230 kV line from Remington Substation to Gordonsville Substation using existing ROW. The overall estimated project cost for this work is $103.7M and the anticipated in-service date is 6/1/2018.

Figure 7 - Remington - Gordonsville 230 kV



Baseline Projects to Resolve Dominion End of Life Criteria Violations

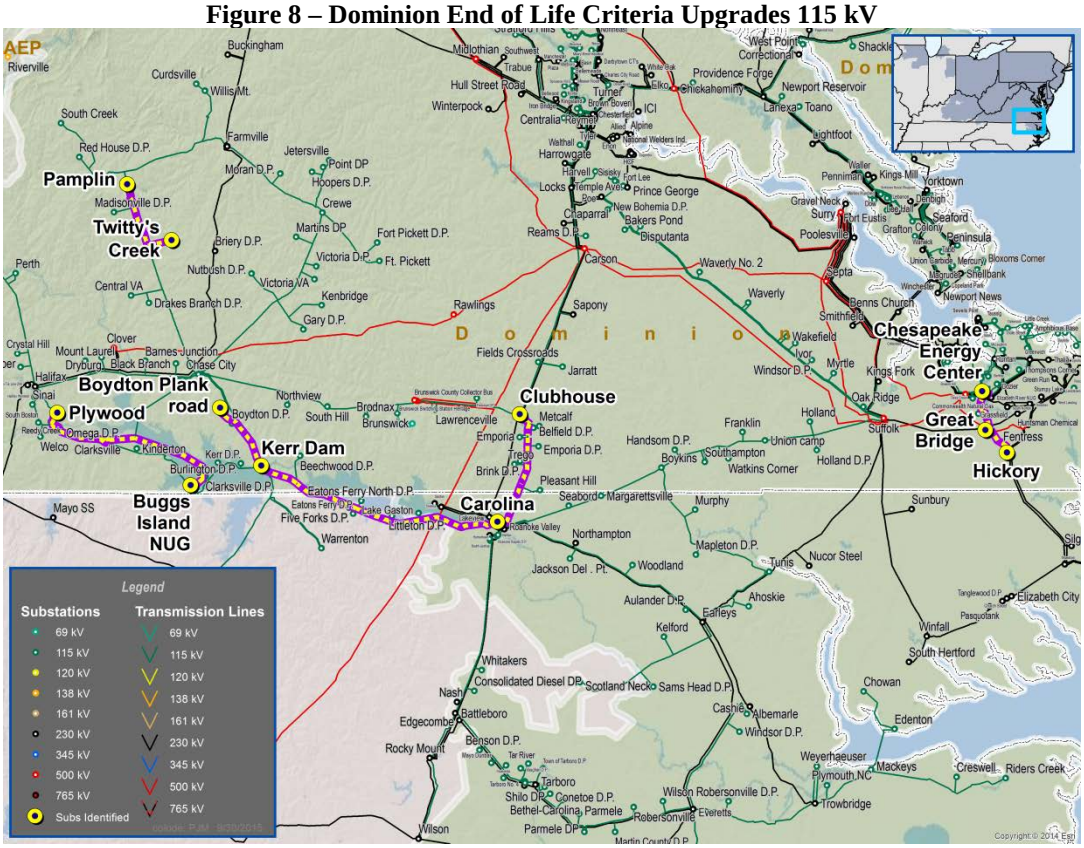
In 2014, Dominion added an end-of-life / aging infrastructure criteria to their Transmission Owner criteria. The criterion includes among other things a condition assessment of the equipment and an evaluation of the impact of retiring and permanently removing the facility.

Since adding the criteria in 2014, several 115 kV circuits have been identified using the End of Life Criteria. The Greatbridge – Hickory and Greatbridge – Chesapeake E.C.facilities were constructed on wood H-frames and Corten steel towers in the 1950s and 1960s. The lines utilize ACSR conductor and primarily 3/8" steel static wire. The system impact assessment revealed permanent loss of 83 MW of load should the lines fail. The recommended solution is to rebuild the identified lines to current standards with a summer emergency rating of 353 MVA at 115 kV. The estimated cost for this work is $21.7 million and the projected in service date is December 31. 2021.

Five other 115 kV circuits constructed primarily of wood H-frame structures and built in the 1950s and 1960s have reached their end of life. PJM staff is recommending rebuilding all of the lines discussed herein to current standards with a summer emergency rating of 353 MVA at 115 kV. The first circuit is the Boydton Plank Rd – Kerr Dam line that serves Mecklenburg's Boydton delivery point. The estimated cost to rebuild this line is $12.5 million and the projected in service date is December 31, 2020. The second circuit identified was the Carolina – Kerr Dam that serves Halifax ED and Mecklenburg EC delivery points of Beachwood and Five Forks. The estimated cost to rebuild this line is $58.6 million and the projected in

service date is December 31, 2019. The third line is Clubhouse – Carolina that serves Mecklenburg delivery points of Brink, Belfield, and Emporia. The estimated cost to rebuild the line is $27 million and the projected is service date is December 31, 2019. The fourth line is the Twittys Creek – Pamplin which serves the Southside delivery points of Drakes Branch and Madisonville. The estimated cost to rebuild this line is $25.7 million and the projected in service date is December 31, 2020.The last line identified is Buggs Island - Playwood that serves the Mecklenburg delivery point of Omega. The facility has passed its end of life and is being recommended to be rebuilt to current 230 kV standards and operated at 115 kV. The estimated cost for this work is $38.7 million and the projected in service date is December 31. 2021. All five of these rebuild projects are immediate need solutions as the timing required to include them in an RTEP proposal window is infeasible. As a result the local Transmission Owner, Dominion, is the designated entity.

Figure 8 – Dominion End of Life Criteria Upgrades 115 kV



Changes to Previously Approved Projects

Cost and scope of a number of previously approved RTEP baseline projects have been changed. In addition, a number or projects have been cancelled as they are no longer required. The net result of these changes to previously approved baseline projects is a net increase in the RTEP of $47.67 million. Some of the more significant cost changes are noted below.

The scope of the previously approved RTEP project B1467.2 to reconfigure the 138 kV bus at LaPorte Junction station has been modified to build a new Bosserman 138 kV station approximately 200 feet from the existing LaPorte Junction station. The 138 kV facilities will be interconnected at the Bosserman station and a roughly 200 foot tie line will be built to interconnect the 69 kV and 34.5 kV facilities at LaPorte. The estimated additional cost is $10 million.

The previously approved RTEP project B1603 to upgrade 19 miles of conductor on the Wattsville – Signepost – Stockton – Kennedy 69 kV circuit, which was identified as part of the 2011 RTEP has been modified to be included with the scope of project B2288 which was approved as part of the 2013 RTEP to build a new 138 kV line between Piney Grove and Wattsville. The scope of the revised project will rebuild the Wattsville – Kenney – Piney Grove 69 kV line and build a new 138 kV line from Piney Grove – Wattsville on the same structures. The net difference to modify the scope of B2288 is an additional estimated cost of $14.4 million.

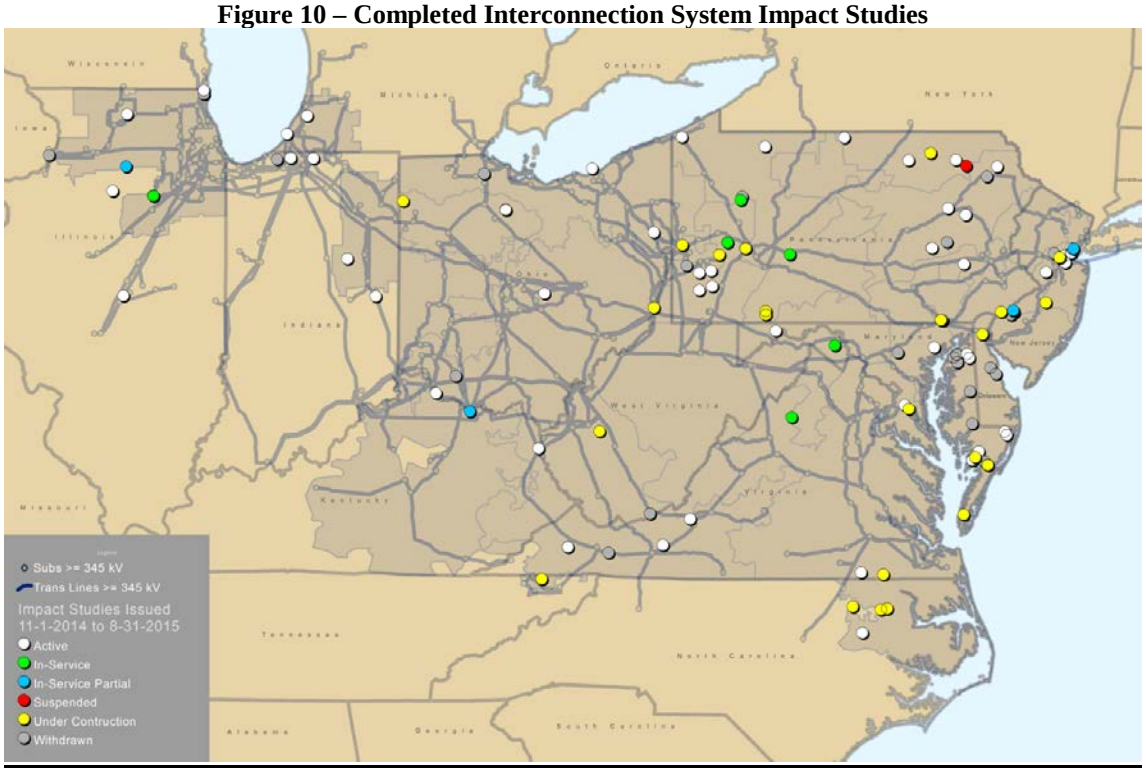
Baseline project B2256 to rebuild approximately 36 miles of 138 kV facilities between Harrison and Ross 138 kV stations was approved as part of the 2013 RTEP to address a number of N-1-1 violations. The outrage of this line jeopardizes a large pocket of load, and as a result a significant amount of the rebuild is going to need to be done with the facilities energized. The estimated additional cost to rebuild the line while it is energized is $ 89.5 million.

Finally, the scope to the existing RTEP project B2458 to uprate 27 miles of the Caroline – Woodland 115 kV line and replace 14 wood H-frame structures with a steel H-frame along with the replacement of 2.5 miles of static wire has been expanded to include the Dominion End of Life Criteria. Additional scope includes the replacement of 4.5 miles of conductor between Carolina and Jackson DP 115 kV and replacing 8 additional wood-H frame structures with steel H-frames. The estimated additional cost is $2 million.

Interconnection Projects

Since the last review of the PJM Interconnection Projects by the PJM Board of Managers in November 2014, PJM completed 155 interconnection System Impact Studies and 157 interconnection projects withdrew. The changes associated with the new and withdrawn projects resulted in a net increase in the RTEP of $595.40 million for the network upgrades. The map below shows the location of the units associated with the completed interconnection System Impact Studies. A listing of the projects with recently completed impact studies is provided in Attachment C to this white paper. A listing of the network upgrades associated with these projects is shown in Attachment D to this report.

Figure 10 – Completed Interconnection System Impact Studies



Summary of Interconnection Queue Activity (MW)

The following table shows the status of all of the generation projects in the Interconnection Queues.

Status of Generation Interconnection Queues

Queue	Active	Under Construction	In-Service*	Withdrawn	Suspended	Total MW Request**
A through T	820	5,062	37,866	193,231	1,798	238,777
U1	0	62	159	7,938	0	8,158
U2	300	300	528	15,932	120	17,180
U3	100	20	334	2,515	0	2,969
U4	300	0	85	4,445	200	5,030
V1	0	232	141	2,251	150	2,774
V2	150	22	990	3,469	0	4,631
V3	600	859	73	3,113	310	4,955
V4	499	8	746	3,575	0	4,828
W1	0	470	210	5,089	52	5,819
W2	73	154	164	2,885	133	3,408
W3	1,060	97	441	6,363	1,271	9,231
W4	883	823	344	3,601	173	5,823
X1	1,500	1,551	221	3,725	308	7,304
X2	776	3,508	46	5,514	52	9,897
X3	670	978	80	6,465	2	8,195
X4	80	2,942	12	2,334	0	5,368
Y1	145	1,861	70	5,642	568	8,286
Y2	2,185	914	388	7,756	38	11,281
Y3	297	1,784	217	3,892	24	6,214
Z1	3,800	629	86	3,723	20	8,258
Z2	4,028	258	42	1,858	1	6,186
AA1	10,727	25	5	1,274	0	12,031
AA2	13,836	0	0	2,530	0	16,366
AB1	6,391	3	0	31	0	6,425
TOTAL	49,220	22,560	43,247	299,148	5,219	419,393

* In-service MW can and do change to account for units that are phased into commercial operation
**Total MW Requests can change due to MW reduction in certain phases of the study process

Data Valid as of:
8/31/2015

Review by the Transmission Expansion Advisory Committee (TEAC)

The results of the analyses summarized in this report were reviewed with the TEAC and Subregional RTEP Committees over several meetings throughout 2015. The most recent analyses, along with recommended solutions, were reviewed at the September 10, 2015 TEAC meeting. Written comments were requested to be submitted to PJM communicating any concerns with the recommendation and any alternative transmission solutions for consideration.

Cost Allocation

Preliminary cost allocations for the projects that were recommended are shown in Attachment A for the projects that will be allocated to a single transmission zone and in Attachment B for the projects that will be allocated to multiple transmission zones.

Cost allocations for the projects were calculated in accordance with the Schedule 12 of the OATT. Baseline reliability project allocations are calculated using a distribution factor methodology that allocates the cost to the load zones that contribute to the loading on the new facility. The market efficiency projects are allocated to the load zones that benefit from the project. The allocations will be filed at FERC 30 days following approval by the Board.

Board Approval

The PJM Board Reliability Committee endorsed the new baseline reliability projects and associated cost allocations. The PJM Board Reliability Committee recommended to the Board the approval of the baseline upgrades to the 2015 RTEP. The PJM Board of Managers approved the changes to the RTEP.

Attachment A – Single Zone Baseline Cost Allocations

Market Efficiency and Reliability Project Single Zone Allocations

Upgrade ID	Description	Cost Estimate ($M)	Trans Owner	Cost Responsibility	Required IS Date
b2019.4	Remove both Burger 138 kV substations (East and West 138 kV buses) and all 138 kV lines on the property	$2.15	ATSI	ATSI	6/1/2016
b2019.5	Terminate and de-energize the 138 kV lines on the last structure before the Burger Plant property	$0.85	ATSI	ATSI	6/1/2016
b2301.1	Wave trap and line drop replacement at Beaver (312/380 MVA SN/SE)	$0.04	ATSI	ATSI	6/1/2015
b2458.5	Replace 4.5 miles of conductor between Carolina 115kV and Jackson DP 115kV with a minimum of 300 MVA summer STE rating and replace 8 wood H-frame structures located between Carolina and Jackson DP with steel H-frames.	$2.00	Dominion	Dominion	5/1/2016
b2461	Wreck and rebuild existing Remington CT - Warrrenton 230 kV (approx. 12 miles) as a double-circuit 230 kV line	$105.00	Dominion	Dominion	6/1/2017
b2461.1	Construct a new 230 kV line approximately 6 miles from NOVEC's Wheeler Substation to new 230 kV switching station in Vint Hill area		Dominion	Dominion	6/1/2017
b2461.2	Convert NOVEC's Gainesville - Wheeler line (approximately 6 miles) to 230 kV		Dominion	Dominion	6/1/2017
b2461.3	Bypass Gainesville and utilize Gainesville - Loudoun 230 kV to complete a Vint Hill - Wheeler - Loudoun 230 kV networked line		Dominion	Dominion	6/1/2017
b2616	Addition of 4th 345/138 kV transformer at Harding	$3.00	ATSI	ATSI	6/1/2015
b2621	Replace relays at East Towanda and East Sayre 115 kV substations (158/191 MVA SN/SE)	$0.10	PENELEC	PENELEC	6/1/2018
b2631	Replace the four Linden 230 kV GSU breakers with 80kA breakers	$4.50	PSEG Power	PSEG Power	6/1/2018
b2632	Replace the Oakland 138 kV 'Z-101 Arsenal' breaker	$0.33	DL	DL	6/1/2019
b2634	Convert Miami Fort 345 kV substation to a ring bus terminating Feeder 4504, TB 9 and TB10 in separate ring positions	$6.80	DEOK	DEOK	6/1/2015

Attachment A – Single Zone Baseline Cost Allocations

b2634.1	Replace metering BCT on Tanners Creek CB T2 with a slip over CT with higher thermal rating in order to remove 1193 MVA limit on facility (Miami Fort-Tanners Creek 345 kV line)	$0.05	AEP	AEP	5/1/2017
b2636	Install three 230 kV bus breakers and 230 kV, 100 MVAR Variable Shunt Reactor at Dahlgren to provide line protection during maintenance, remove the operational hazard and provide voltage reduction during light load conditions	$6.70	Dominion	Dominion	5/1/2016
b2637	Convert Middletown Junction 230 kV substation to nine bay double breaker configuration.	$15.50	ME	ME	6/1/2015
b2639	Replace the Crescent 138kV 'NO3 - 4 138' breaker with a 63kA breaker	$0.33	DL	DL	6/1/2019
b2640	Replace the Crescent 138kV 'Z143 SWCKLY' breaker with a 63kA breaker	$0.33	DL	DL	6/1/2019
b2641	Replace the Crescent 138kV 'Z-24 MONTOUR' breaker with a 63kA breaker	$0.33	DL	DL	6/1/2019
b2642	Replace the Crescent 138kV 'Z-28 BEAVER' breaker with a 63kA breaker	$0.33	DL	DL	6/1/2019
b2643	Replace the Darrah 138 kV breaker 'L' with 40kA rated breaker	$0.90	AEP	AEP	6/1/2019
b2644	Install a 28.8 MVAR 115 kV capacitor at the Mountain substation	$0.96	ME	ME	6/1/2019
b2645	Ohio Central 138 kV Loop	$4.50	AEP	AEP	11/1/2015
b2647	Rebuild Boydton Plank Rd - Kerr Dam 115 kV Line #38 (8.3 miles) to current standards with summer emergency rating of 353 MVA at 115 kV.	$12.50	Dominion	Dominion	12/31/2020
b2648	Rebuild Carolina - Kerr Dam 115 kV Line #90 (38.7 miles) to current standards with summer emergency rating of 262 MVA at 115 kV.	$58.00	Dominion	Dominion	12/31/2019
b2649	Rebuild Clubhouse - Carolina 115 kV Line #130 (17.8 miles) to current standards with summer emergency rating of 262 MVA at 115 kV.	$26.70	Dominion	Dominion	12/31/2019
b2650	Rebuild Twittys Creek - Pamplin 115 kV Line #154 (17.8 miles) to current standards with summer emergency rating of 353 MVA at 115 kV.	$25.70	Dominion	Dominion	12/31/2020

Attachment A – Single Zone Baseline Cost Allocations

b2651	Rebuild Buggs Island - Plywood 115 kV Line #127 (25.8 miles) to current standards with summer emergency rating of 353 MVA at 115 kV. The line should be rebuilt for 230 kV and operated at 115 kV.	$38.70	Dominion	Dominion	12/31/2021
b2652	Rebuild Greatbridge - Hickory 115 kV Line #16 and Greatbridge - Chesapeak E.C. to current standard with summer emergency rating of 262 MVA at 115 kV.	$21.70	Dominion	Dominion	12/1/2021
b2653.1	Build 20 mile 115 kV line from Pantego to Trowbridge with summer emergency rating of 262 MVA.	$35.00	Dominion	Dominion	6/1/2018
b2653.2	Install 115 kV four-breaker ring bus at Pantego		Dominion	Dominion	6/1/2018
b2653.3	Install 115 kV breaker at Trowbridge		Dominion	Dominion	6/1/2018
b2654.1	Build 15 mile 115 kV line from Scotland Neck to S Justice Branch with summer emergency rating of 262 MVA. New line will be routed to allow HEMC to convert Dawson's Crossroads RP from 34.5 kV to 115 kV.	$33.00	Dominion	Dominion	6/1/2018
b2654.2	Install 115 kV three-breaker ring bus at S Justice Branch		Dominion	Dominion	6/1/2018
b2654.3	Install 115 kV breaker at Scotland Neck		Dominion	Dominion	6/1/2018
b2655	Increase the size of the existing Leon 69 kV capacitor bank from 13.2 MVAR to 18.36 MVAR	$0.04	EKPC	EKPC	12/1/2016
b2656	Reconductor the Leon - Airport Road 69 kV line section (5.72 miles) using 556.5 MCM ACTW conductor	$1.65	EKPC	EKPC	12/1/2018
b2657	Add 69 kV breaker at Thelma - AEP Thelma 69 kV tie	$0.20	EKPC	EKPC	12/1/2016
b2658	Increase the zone 3 distance relay setting at Barren County associated with the Barren County - Horse Cave Junction line to at least 103 MVA	$0.00	EKPC	EKPC	6/1/2016
b2659	Rebuild the Seymour Tap - KU Horse Cave Tap 69 kV line section (1.98 miles) to 302 degrees F	$0.40	EKPC	EKPC	6/1/2016
b2660	Increase the zone 3 distance relay setting at Elizabethtown associated with the Elizabethtown - Smithersville line section to at least 100 MVA	$0.00	EKPC	EKPC	12/1/2016
b2661	Reconductor the Baker Lane - Holloway Junction 69 kV (1.28 mi) line section using 556.5 MCM ACTW wire	$0.34	EKPC	EKPC	12/1/2016

Attachment A – Single Zone Baseline Cost Allocations

b2662	Increase the maximum operating temperature of the Hickory Plains - PPG 69 kV line section (0.21 miles) to 266 degrees F	$0.01	EKPC	EKPC	6/1/2017
b2663	Increase the zone 3 distance relay setting at EKPC Elizabethtown associated with the EKPC Elizabethtown to KU Elizabethtown 69 kV line to at least 126 MVA	$0.00	EKPC	EKPC	12/1/2017
b2664	Increase the maximum operating temperature of the Tharp Tap - KU Elizabethtown 69 kV line section (2.11 miles) to 266 degrees F. (LTE at 248 degrees F)	$0.08	EKPC	EKPC	12/1/2017
b2666	Yukon 138 kV Breaker Replacement	$11.50	APS	APS	6/1/2020
b2666.1	Replace Yukon 138kV breaker "Y-11(CHARL1)" with an 80kA breaker		APS	APS	6/1/2020
b2666.10	Replace Yukon 138kV breaker "Y12(1-1BUS)" with an 80kA breaker		APS	APS	6/1/2020
b2666.11	Replace Yukon 138kV breaker "Y14(4-1BUS)" with an 80kA breaker		APS	APS	6/1/2020
b2666.12	Replace Yukon 138kV breaker "Y2(1B-BETHE)" with an 80kA breaker		APS	APS	6/1/2020
b2666.13	Replace Yukon 138kV breaker "Y21(SHEPJ)" with an 80kA breaker		APS	APS	6/1/2020
b2666.14	Replace Yukon 138kV breaker "Y22(SHEPHJT)" with an 80kA breaker		APS	APS	6/1/2020
b2666.2	Replace Yukon 138kV breaker "Y-13(BETHEL)" with an 80kA breaker		APS	APS	6/1/2020
b2666.3	Replace Yukon 138kV breaker "Y-18(CHARL2)" with an 80kA breaker		APS	APS	6/1/2020
b2666.4	Replace Yukon 138kV breaker "Y-19(CHARL2)" with an 80kA breaker		APS	APS	6/1/2020
b2666.5	Replace Yukon 138kV breaker "Y-4(4B-2BUS)" with an 80kA breaker		APS	APS	6/1/2020
b2666.6	Replace Yukon 138kV breaker "Y-5(LAYTON)" with an 80kA breaker		APS	APS	6/1/2020
b2666.7	Replace Yukon 138kV breaker "Y-8(HUNTING)" with an 80kA breaker		APS	APS	6/1/2020
b2666.8	Replace Yukon 138kV breaker "Y-9(SPRINGD)" with an 80kA breaker		APS	APS	6/1/2020
b2666.9	Replace Yukon 138kV breaker "Y10(CHRL-SP)" with an 80kA breaker		APS	APS	6/1/2020
b2667	Replace the Muskingum 138 kV	$0.14	AEP	AEP	6/1/2020

Attachment A – Single Zone Baseline Cost Allocations

	bus # 1 and 2				
b2668	Reconductor Dequine to Meadow Lake 345 kV circuit #1 utilizing dual 954 ACSR 54/7 cardinal conductor	$5.10	AEP	AEP	6/1/2020
b2669	Install a second 345/138 kV transformer at Desoto	$10.60	AEP	AEP	6/1/2020
b2670	Replace switch at Elk Garden 138 kV substation (on the Elk Garden – Lebanon 138 kV circuit)	$1.25	AEP	AEP	6/1/2020
b2671	Replace/upgrade/add terminal equipment at Bradley, Mullensville, Pinnacle Creek, Itmann, and Tams Mountain 138 kV substations. Sag study on Mullens – Wyoming and Mullens – Tams Mt. 138 kV circuits	$5.36	AEP	AEP	6/1/2020
b2672	Change CT Ratio at Seneca Caverns from 120/1 to 160/1 and adjust relay settings accordingly	$0.01	APS	APS	6/1/2020
b2673	Rebuild the existing double circuit tower line section from Beaver substation to Brownhelm Jct. approx. 2.8 miles	$5.10	ATSI	ATSI	6/1/2020
b2674	Rebuild the 6.6 miles of Evergreen to Ivanhoe 138 kV circuit with 477 ACSS conductor	$4.60	ATSI	ATSI	6/1/2020
b2675	Install 26.4 MVAR capacitor and associated terminal equipment at Lincoln Park 138 kV substation	$1.00	ATSI	ATSI	6/1/2020
b2676	Install one (1) 72 MVAR fast switched capacitor at the Englishtown 230 kV substation	$1.50	JCPL	JCPL	6/1/2020
b2677	Replace wave trap, bus conductor and relay at Hilltop 115 kV substation. Replace relays at Prospect and Cooper substations	$0.60	PENELEC	PENELEC	6/1/2020
b2678	Convert the East Towanda 115 kV substation to breaker and half configuration	$13.25	PENELEC	PENELEC	6/1/2020
b2679	Install a 115 kV Venango Jct. line breaker at Edinboro South	$2.07	PENELEC	PENELEC	6/1/2020
b2680	Install a 115 kV breaker on Hooversville #1 115/23 kV transformer	$0.73	PENELEC	PENELEC	6/1/2020
b2681	Install a 115 kV breaker on the Eclipse #2 115/34.5 kV transformer	$0.38	PENELEC	PENELEC	6/1/2020
b2682	Install two 21.6 MVAR capacitors at the Shade Gap 115 kV substation	$2.50	PENELEC	PENELEC	6/1/2020
b2683	Install a 36 MVAR 115 kV capacitor and associated equipment at Morgan Street substation	$1.52	PENELEC	PENELEC	6/1/2020
b2684	Install a 36 MVAR 115 kV capacitor at Central City West substation	$1.50	PENELEC	PENELEC	6/1/2020

Attachment A – Single Zone Baseline Cost Allocations

b2685	Install a second 115 kV 3000A bus tie breaker at Hooversville substation	$1.42	PENELEC	PENELEC	6/1/2020
b2686	Pratts Area Improvement	$103.70	Dominion	Dominion	6/1/2018
b2686.1	Build a 230 kV line from Remington Substation to Gordonsville Substation utilizing existing ROW		Dominion	Dominion	6/1/2018
b2686.11	Upgrading sections of the Gordonsville - Somerset 115 kV circuit		Dominion	Dominion	6/1/2018
b2686.12	Upgrading sections of the Somerset - Doubleday 115 kV circuit		Dominion	Dominion	6/1/2018
b2686.13	Upgrading sections of the Orange - Somerset 115 kV circuit		Dominion	Dominion	6/1/2018
b2686.14	Upgrading sections of the Mitchell - Mt. Run 115 kV circuit		Dominion	Dominion	6/1/2018
b2686.2	Install a 3rd 230/115 kV transformer at Gordonsville Substation		Dominion	Dominion	6/1/2018
b2686.3	Upgrade Line 2088 between Gordonsville Substation and Lousia CT Station		Dominion	Dominion	6/1/2018
b2690	Reconductor two spans of the Graceton-Safe Harbor 230kV transmission line. Includes termination point upgrades	$1.10	PPL	PPL	6/1/2019
b2691	Reconductor three spans limiting the Brunner Island - Yorkana 230kV line, add 2 breakers to Brunner Island Switchyard, upgrade associated terminal equipment	$3.10	PPL	PPL	6/1/2019
b2693	Replace L7815 B phase line trap at Wayne substation	$0.10	ComEd	ComEd	6/1/2019
b2695	Rebuild Worcester - Ocean Pine 60 kV ckt 1 to 1400A capability summer emergency	$2.40	DPL	DPL	6/1/2019
b2696	Upgrade 138 kV substation equipment at Butler, Shanor Manor, and Krendale substations. New rating of the line will be 353 MVA summer normal and 422 MVA summer emergency	$0.60	APS	APS	6/1/2019
b2697	Mitigate all violations identified by the sag study to operate the Fieldale - Thornton - Franklin overhead 138 kV line conductor at its maximum operating temperature. Preliminary study results have identified 6 potential distribution/utility line crossings to be addressed. Also, replace terminal equipment at AEP's Danville and East Danville substations to improve the thermal	$0.80	AEP	AEP	6/1/2019

Attachment A – Single Zone Baseline Cost Allocations

	capacity of Danville - East Danville 138 kV circuit.				
b2698	Replace relays at AEP's Cloverdale and Jackson's Ferry substation to improve the thermal capacity of Cloverdale - Jackson's Ferry 765 kV line	$0.50	AEP	AEP	6/1/2019

Attachment B – Multiple Zone Baseline Cost Allocations

Market Efficiency and Reliability Project Multiple Zone Allocations

Upgrade ID	Description	Cost Estimate ($M)	Trans Owner	Cost Responsibility	Required IS Date
b2688	Upgrade terminal equipment on the Lincoln - Carroll 115/138kV path.	$5.20	APS	AEP - 12.87%, APS - 18.98%, ATSI - 1.23%, COMED - 0.35%, ConEd - 0.33%, Dayton - 1.44%, DEOK - 2.29%, Dominion - 44.70%, DL - 1.11%, EKPC - 0.78%, PEPCO - 15.80%, RE - 0.12%	6/1/2019
b2689	Reconductor approximately 7 miles of the Woodville-Peters (Z-117) 138kV circuit, reconfigure the West Mifflin-USS Clairton (Z-15) 138kV circuit to establish the Dravosburg-USS Clairton (Z-14) 138kV circuit and the West Mifflin-Wilson (Z-15) 138kV circuit	$11.20	DL	AEC - 0.99%, APS - 66.14%, BGE - 4.60%, Dominion - 8.81%, DPL - 5.83%, ECP - 0.34%, HTP - 0.04%, NEPTUNE - 0.12%, PECO - 3.39%, PEPCO - 6.29%, PSEG - 3.45%	6/1/2018
b2692	Replace station equipment at three stations and upgrade conductor rating of three lines by re-conductoring and mitigating sag limitations.	$24.60	ComEd	AEC - 0.18%, AEP - 18.67%, APS - 5.86%, ATSI - 7.84%, BGE - 3.32%, ComEd - 38.20%, ConEd - 0.03%, DAY - 2.76%, DEOK - 4.13%, Dominion - 5.15%, DPL - 1.97%, DUQ - 2.23%, EKPC - 1.36%, HTP - 0.05%, JCPL - 0.52%, METED - 0.04%, NEPTUNE - 0.04%, PECO - 1.08%, PENELEC - 1.25%, PEPCO - 3.56%, PLGRP - 0.45%, PSEG - 1.17%, RE - 0.14%	6/1/2019
b2694	Increase ratings of Peach Bottom 500-230 kV transformer to 1479 MVA normal / 1839 MVA emergency	$9.70	PECO	AEC - 3.97%, AEP - 5.77%, APS - 4.27%, ATSI - 6.15%, BGE - 1.63%, ComEd - 0.72%, DAY - 1.06%, DEOK - 1.98%, Dominion - 0.35%, DPL - 14.03%, DL - 2.25%, ECP - 0.69%, EKPC - 0.39%, HTP - 0.96%, JCPL - 6.84%, ME - 3.29%, NEPTUNE - 2.14%, PECO - 16.42%, PENELEC - 3.94%, PPL - 8.32%, PSEG - 14.13%, RE - 0.44%	6/1/2019

Attachment C – Interconnection Queue Projects

TO	Queue number	Fuel Type	MWC (FTIR/FTWR)	MWE (nFTIR/nFTWR)
AEC	AA1-075	Natural Gas	7.5	7.5
AEC	Z2-083	Natural Gas	74	74
AEP	AA1-007	Methane	6	6
AEP	AA1-013	Natural Gas	10	10
AEP	AA1-014	Natural Gas	5	5
AEP	AA1-032	N/A	45	0
AEP	AA1-121	Storage	0	2
AEP	AA1-125	Solar	7.6	20
AEP	AA1-128	Storage	0	10
AEP	R48	Wind	9.7	48.3
AEP	U4-028	Wind	13	100
AEP	U4-029	Wind	13	100
AEP	V4-033	Wind	39	299.2
AEP	Y2-045	Natural Gas	6	6
AEP	Y2-058	Natural Gas	668	762
AEP	Y3-025	Methane	3.18	3.18
AEP	Y3-039	Natural Gas	20	20
AEP	Y3-040	Natural Gas	20	20
AEP	Z1-006	ARR	N/A	N/A
AEP	Z1-051	nuclear	83	102
AEP	Z2-042	Wind	23.3	180
AEP	Z2-048	Natural Gas	20	20
AEP	Z2-112	Natural Gas	64.5	97
AEP	Z2-113	Solar	2.3	4.6
AEP	Z2-114	Solar	2.5	5
AEP	Z2-115	Solar	1.25	2.5
AEP	Z2-116	Solar	1.3	2.6
APS	AA1-112	Methane	4	7.2
APS	AA2-080	Natural Gas	19.9	19.9
APS	Z1-015	Natural Gas	26	0
APS	Z1-055	Natural Gas	10	10
APS	Z1-056	Natural Gas	6	6
APS	Z1-088	Hydro	5	0
APS	Z1-089	Hydro	5	0
APS	Z2-038	Solar	7.6	19.9
APS	Z2-039	Hydro	2.82	0
APS	Z2-040	Hydro	3.5	0
APS	Z2-064	Natural Gas	600	651

Attachment C – Interconnection Queue Projects

ATSI	AA1-006	Methane		0.8		0.8
ATSI	Y2-053	Natural Gas		35		35
ATSI	Z1-035	Wind		2.34		18
ATSI	Z2-028	Natural Gas		800		800
BGE	AA1-081	Solar		2		3
BGE	AA2-072	Solar		0		1.1
ComEd	AA1-030	MTX	N/A		N/A	
ComEd	T143	Wind		50		250
ComEd	V1-024	nuclear		11.9		20
ComEd	V1-025	nuclear		10.9		20
ComEd	W4-005	Wind		45.6		351
ComEd	Y2-094	ARR	N/A		N/A	
ComEd	Y2-103	Natural Gas		360		360
ComEd	Y3-013	Natural Gas		90		0
ComEd	Z1-073	Wind		5.2		0
ComEd	Z1-084	ARR	N/A		N/A	
ComEd	Z1-085	ARR	N/A		N/A	
ComEd	Z2-090	Storage		0		4
Dayton	Z2-029	Coal		20.5		20.5
DEOK	AA1-126	Solar		7.6		20
DEOK	Y3-073	Coal		50		50
DL	AA1-088	MTX	N/A		N/A	
DL	AA1-089	MTX	N/A		N/A	
DL	Y3-103	Natural Gas		97		205
Dominion	AA1-072	Solar		2.1		3.1
Dominion	Z1-086	Natural Gas		1630		1681
Dominion	Z2-043	Solar		14		20
Dominion	Z2-044	Solar		8.4		12
Dominion	Z2-088	Solar		30.4		80
Dominion	Z2-099	Solar		5.9		8.5
DPL	AA1-025	Solar		3.7		0
DPL	AA1-026	Solar		3.7		0
DPL	AA1-027	Solar		3.7		0
DPL	AA1-028	Solar		3.7		0
DPL	AA1-059	Solar		4.3		6
DPL	AA1-084	Natural Gas		10		0
DPL	AA1-091	Storage		0		2
DPL	AA1-102	Solar		37.5		0
DPL	AA1-107	Biomass		15.9		19.9

Attachment C – Interconnection Queue Projects

DPL	AA1-110	Solar		4	6
DPL	AA1-127	Solar		2.3	6
DPL	AA2-129	Storage		0	20
DPL	AA2-130	Methane		2	2
DPL	X2-067	Natural Gas		309	309
DPL	Z2-072	ARR	N/A	N/A	
DPL	Z2-073	Solar		3.36	5
DPL	Z2-074	Solar		4.03	6
DPL	Z2-075	Solar		3.7	5.5
DPL	Z2-076	Solar		3.99	6
DPL	Z2-077	Solar		3.99	6
DPL	Z2-096	Solar		7.07	10
DPL	Z2-097	Solar		3.54	5
JCPL	Z2-102	Solar		4.94	13
JCPL	Z2-109	Storage		0	20
ME	Z2-026	Natural Gas		800	800
ODEC	Z2-012	Solar		7.6	20
PECO	Y2-047	ARR	N/A	N/A	
PECO	Y2-064	Natural Gas		19	65.5
PECO	Y3-043	Natural Gas		760	760
Penelec	AA1-037	Hydro		5.26	5.26
Penelec	AA1-131	Natural Gas		5	8
Penelec	Y3-092	MTX	N/A	N/A	
Penelec	Z1-066	Storage		0	10.4
Penelec	Z1-069	Wind		13.3	70
Penelec	Z1-087	Hydro		40	40
Penelec	Z1-105	Natural Gas		19.9	19.9
Penelec	Z2-011	Natural Gas		19.9	19.9
Penelec	Z2-014	Wind		5.25	0
Penelec	Z2-103	Natural Gas		1	1
Penelec	Z2-104	Natural Gas		1.6	1.6
Penelec	Z2-108	Storage		0	18
PEPCO	Z1-052	Natural Gas		44.5	64.5
PEPCO	Z2-060	Natural Gas		116	33
PPL	Y2-015	Natural Gas		337	344
PPL	Y2-063	Natural Gas		337	344
PPL	Y3-041	Wind		8	62
PPL	Z2-009	Wind		6.7	52
PPL	Z2-046	Natural Gas		900	1050

Attachment C – Interconnection Queue Projects

PPL	Z2-101	Wind		8.78		67.5
PPL	Z2-107	Storage		0		10
PSEG	AA1-019	Solar		2.7		7.3
PSEG	AA1-073	Natural Gas		3.9		5.6
PSEG	AA1-105	Storage		0		2
PSEG	AA2-052	Natural Gas		3		0
PSEG	AA2-058	Solar		0.3		1
PSEG	AA2-066	Natural Gas		0		2
PSEG	AA2-099	Natural Gas		32		0
PSEG	AA2-125	Natural Gas		504		580.08
PSEG	Y2-105	Natural Gas		50		50
PSEG	Z1-058	Natural Gas		36		23
PSEG	Z1-083	ARR	N/A		N/A	
PSEG	Z1-109	Natural Gas		208		208
PSEG	Z1-116	Natural Gas		725		785
PSEG	Z2-002	Natural Gas		56		71
PSEG	Z2-053	ARR	N/A		N/A	
PSEG	Z2-069	ARR	N/A		N/A	
PSEG	Z2-089	Natural Gas		509		568
Unknown	AA1-001	LTF	N/A		N/A	
Unknown	AA1-002	LTF	N/A		N/A	
Unknown	AA1-003	LTF	N/A		N/A	
Unknown	AA1-004	LTF	N/A		N/A	
Unknown	AA1-005	LTF	N/A		N/A	
Unknown	AA1-051	LTF	N/A		N/A	
Unknown	AA1-052	LTF	N/A		N/A	
Unknown	AA1-053	LTF	N/A		N/A	
Unknown	AA1-054	LTF	N/A		N/A	
Unknown	AA1-055	LTF	N/A		N/A	
Unknown	AA1-058	LTF	N/A		N/A	
Unknown	AA1-071	LTF	N/A		N/A	
Unknown	AA1-074	LTF	N/A		N/A	
Unknown	Y2-082	LTF	N/A		N/A	
Unknown	Y3-032	LTF	N/A		N/A	
Unknown	Z1-019	LTF	N/A		N/A	
Unknown	Z2-063	LTF	N/A		N/A	
Unknown	Z2-065	LTF	N/A		N/A	
Unknown	Z2-066	LTF	N/A		N/A	
Unknown	Z2-067	LTF	N/A		N/A	

Upgrade ID	Project Description	Transmission Owner	Cost Estimate ($M)	ISA In Service Date
n1576.2	Sammis - Wylie Ridge - 3000A Wave Trap	PENELEC	0.07	10/30/2010
n4029	Install a new 69 kV single breaker interconnection switching station ... see notes	AEP	3.20	12/1/2013
n4030	New Switching Station: Protection and Relaying Cost: Carrier Option	AEP	0.42	12/1/2013
n4031	New Switching Station: Protection and Relaying Cost: Carrier Option	AEP	0.36	12/1/2013
n4032	Carrier Option: Expand the existing Willard station to facilitate modification into a station initially operated as a 3-breaker ring bus...see notes	AEP	4.21	12/1/2013
n4033	Fiber Optic Option: Expand the existing Willard station to facilitate modification into a station initially operated as a 3-breaker ring bus...see notes	AEP	4.75	12/1/2013
n4034	Willard Station Carrier Option: Protection and Relaying Cost	AEP	0.29	12/1/2013
n4239	05Millbr - Replace 138kV breaker H with a 40kA breaker	AEP	0.55	11/1/2014
n4240	05Millbr - Replace 138kV breaker O with a 40kA breaker	AEP	0.55	11/1/2014
n4242	Mansfield SS: Upgrade carrier equipment for 115 kV Niles Valley line exit & 115 kV Everts Drive line exit due to T121 interconnection station.	Penelec	0.21	12/1/2009
n4243	Evert Drive SS: Add transfer trip to existing carrier relaying on 115 kV Mansfield line exit due to T121 interconnection station.	Penelec	0.03	12/1/2009
n4244	Farmers Valley SS: Add transfer trip to existing carrier relaying on 115 kV Potter line exit due to T121 interconnection.	Penelec	0.03	12/1/2009
n4246	Modify relay settings	AEP	0.01	10/31/2010
n4247	Modify relay settings	AEP	0.37	10/31/2010
n4248	Modify relay settings	AEP	1.80	10/31/2010
n4249	Modify relay settings	AEP	0.89	10/31/2010
n4250	Revenue Metering	AEP	0.27	10/31/2010
n4251.1	Replace Todhunter 138kV breaker 911 from 63kA to 80kA	DEOK	0.49	6/1/2018
n4251.10	Replace Todhunter 138kV breaker 939 from 63kA to 80kA	DEOK	0.49	6/1/2018
n4251.11	Replace Todhunter 138kV breaker 937 from 63kA to 80kA	DEOK	0.49	6/1/2018
n4251.12	Replace Todhunter 138kV breaker 945 from 63kA to 80kA	DEOK	0.49	6/1/2018
n4251.13	Replace Todhunter 138kV breaker 941 from 63kA to 80kA	DEOK	0.49	6/1/2018
n4251.2	Replace Todhunter 138kV breaker 915 from 63kA to 80kA	DEOK	0.49	6/1/2018
n4251.3	Replace Todhunter 138kV breaker 917 from	DEOK	0.49	6/1/2018

	63kA to 80kA			
n4251.4	Replace Todhunter 138kV breaker 921 from 63kA to 80kA	DEOK	0.49	6/1/2018
n4251.5	Replace Todhunter 138kV breaker 923 from 63kA to 80kA	DEOK	0.49	6/1/2018
n4251.6	Replace Todhunter 138kV breaker 927 from 63kA to 80kA	DEOK	0.49	6/1/2018
n4251.7	Replace Todhunter 138kV breaker 929 from 63kA to 80kA	DEOK	0.49	6/1/2018
n4251.8	Replace Todhunter 138kV breaker 933 from 63kA to 80kA	DEOK	0.49	6/1/2018
n4251.9	Replace Todhunter 138kV breaker 935 from 63kA to 80kA	DEOK	0.49	6/1/2018
n4254	Reconductor the Todhunter - Nickel 138 kV line.	DEOK	1.50	6/1/2018
n4258	raise ten towers and replace wavetraps	Dominion	4.14	6/1/2018
n4259	Adjust Mountaineer relay trip limit or install new relay package on the Mountaineer - Belmont 765 kV line.	AEP	0.30	6/1/2018
n4263	Reconductor the Loretto - Wilton Center 'B' 345 kV line.	ComEd	8.00	12/31/2016
n4264	Reconductor the Loretto - Pontiac 'B' 345 kV line.	ComEd	6.00	
n4265	New three breaker ring bus	Dominion	6.00	12/1/2016
n4267	Engineering and design related activities required to construct a four position 69 kV ring bus at the Stockton substation with provisions for a fifth position, inclusive of a terminal position for the	DPL	4.10	12/15/2015
n4268	Reconfigure Line 6712 to accommodate the new line terminal positions at the Stockton substation.	DPL	0.35	12/15/2015
n4269	Construct a 69 kV terminal position on the 69 kV ring bus constructed as part of the Z1-076 queue project at the Stockton Substation	DPL	1.50	12/15/2015
n4270	Build new transmission tap from the Jackson-Peckville 69kV line to the Z1-098 customer facility.	PPL	1.70	12/1/2015
n4272	Install new transfer trip equipment for the Z1-098 project.	PPL	0.27	12/1/2015
n4273	Install new transfer trip equipment for the Z1-098 project.	PPL	0.23	12/1/2015
n4274	Mitigate the sag limitations on the conductor and upgrade 345kV CB 1-2 at TSS 974 Zion EC	ComEd	3.20	6/1/2015
n4275	Install a new 3 breaker ring bus on the S-2271 line	PSEG	16.60	6/1/2016
n4276	Reconductor the VFT - Warinanco 230 kV line	PSEG	36.40	6/1/2016
n4277	Construct new bay at Metuchen substation and install 2 breakers for a new position to connect the Z1-116 generator	PSEG	4.00	6/1/2017
n4278	Reconductor the Warinanco - Aldene 230 kV line	PSEG	65.70	6/1/2017
n4279	Three – 345 kV breaker string	AEP	2.76	12/31/2016

n4280	Dual – 345 kV revenue metering	AEP	0.68	12/31/2016
n4287	Install 34.5kV tap, radio controlled switch and associated equipment	Penelec	0.10	12/31/2015
n4288	RTU programming for connection to FirstEnergy SCADA and relay support for generation installation	Penelec	0.02	12/31/2015
n4289	Install transfer trip relaying at North Meshoppen substation on the Tunkhannock 34.5kV line. Install 34.5kV PT and sync relaying on the Tunkhannock 34.5kV line circuit breaker.	Penelec	0.15	12/31/2015
n4290	Install transfer trip relaying at Tunkhannock substation on the North Meshoppen 34.5kV line. Install 34.5kV PT and sync relaying on the North Meshoppen 34.5kV line circuit breaker.	Penelec	0.08	12/31/2015
n4291	34.5kV recloser work at distribution pole NMT – 164A	Penelec	0.15	12/31/2015
n4292	new 33MVA #2 and add transfer trip capability	Dominion	3.10	10/15/2015
n4293	1500 feet of overhead conductor	Dominion	0.20	10/15/2015
n4294	new 33MVA #2 and associated equipment including transfer trip capability	Dominion	3.10	10/31/2015
n4295	1200 feet of overhead conductor and replace line reclosure 330R5	Dominion	0.20	10/31/2015
n4296	The SCULL #2-MILL #2 138 kV line: In order to mitigate the overloads, the relay settings should be adjusted at Mill 138 kV bus. The new emergency rating will be 270 MVA. The estimated cost is $5,000,	AEC	0.01	6/1/2015
n4297	Rebuild the BL England - Middle Tap 138 kV line. The new emergency rating will be 286 MVA.	AEC	19.50	6/1/2015
n4298	Rebuild the BL England – Merion 138 kV line. The new emergency rating will be 286 MVA.	AEC	4.10	6/1/2015
n4299	three breaker ringbus, option to build	Dominion	0.87	10/31/2015
n4300	three breaker ringbus	Dominion	18.07	12/1/2018
n4301	Construct new bay at Deans substation and install 2 500 kV breakers for a new position to connect the X1-078 converter station.	PSEG	20.00	5/1/2016
n4302	Hatfield-Yukon 500kV. Relocate Loop to 4-Breaker Ring Bus for PJM Y2-080. (full description in notes)	APS	3.73	6/1/2016
n4303	Attachment Facilities (Switchyard) - To be built along Pepco ROW. Final location to be determined by the Developer.	PEPCO	20.30	6/1/2016
n4304	Two four bay dead end structures to cut feeders 23080, 23082, 23081 and 23083 to be built inside new switchyard.	PEPCO	0.70	6/1/2016
n4305	Non-Direct Network Upgrades (Remote End Relay & Telecom) at Burches Hill and Talbert Substations	PEPCO	1.90	6/1/2016
n4306	Rehabilitation of Feeder 23080: Feeder 23080 hasn't been used for a long period and will need rehabilitation work to bring it to use. (see notes	PEPCO	0.60	6/1/2016

	for full description)			
n4307	Installation of New Riser Structure (full description in notes)	PEPCO	0.88	6/1/2016
n4308	Replacement of existing 24 count skywrap OPGW with 96 count OPGW: The existing 24 count skywrap OPGW on feeder 23080 needs to be replaced with 96 count OPGW between Burches Hill Substation and Talbert	PEPCO	0.75	6/1/2016
n4309	Construct underground portion of the transmission line from tower number N1085NA to the Burches Hill Substation	PEPCO	16.20	6/1/2016
n4316	Remove overdutied 138kV circuit breaker 432-B-23 at W. LORAIN and rework the 138kV line	ATSI FE Genco	0.15	12/31/2017
n4317.2	Install one 345 kV breaker at the Erie West 345 kV	PENELEC	1.68	12/31/2017
n4317.4	Install a fiber on the new Leroy Center - Erie West 345 kV line	PENELEC	4.32	12/31/2017
n4321	Expand 345kV bus and install two new 345kV breakers for new line exit at Erie West 345kV substation	PENELEC	3.89	12/31/2017
n4322	Beaver Valley substation–replace the Crescent 138kV (Z-29) breaker with a 3000A, 63kA breaker. Replace the primary protection as the Crescent and Racoon substation to coordinate with the protection s	DL	0.61	5/1/2018
n4331	Upgrade primary & backup line relaying & carrier relaying on the 115 kV Potter (future T121 interconnect) line exit.	Penelec	0.66	12/31/2009
n4332	Upgrade carrier equipment and install DTT on the 115 kV Niles Valley line. Utilize existing equipment on Everts Drive (future Mainesburg) line to receive breaker status from Mainesburg breaker.	Penelec	0.26	12/31/2009
n4333	Install anti-islanding scheme to transmit breaker open status of the Mansfield 115 kV line breaker.	Penelec	0.16	12/31/2009
n4334	Install anti-islanding scheme to transmit breaker open status of the Potter 115 kV line breaker.	Penelec	0.13	12/31/2009
n4344	Provide revenue metering equipment.	PENELEC	0.10	7/31/2015
n4345	Add a new 34.5kV line exit at Grover substation for Z1-110 19.9MW injection.	PENELEC	0.58	7/31/2015
n4346.1	Replace Clifton 230kV 201182 breaker from 50kA to 63kA.	Dominion	0.34	5/1/2018
n4346.2	Replace Clifton 230kV XT2011 breaker from 50kA to 63kA.	Dominion	0.34	5/1/2018
n4348	to mitigate sag limitations to achieve full conductor thermal capability	ComEd	16.70	12/31/2016
n4349	reconductor or rebuild AEP portion of the University Park - Olive 345 kV line. Also upgrade risers and relays	AEP	45.00	12/31/2016
n4352	Construct a three-position 138 kV ring bus at a new location. Substation would include two bus positions for termination of Line 13714 and one	DPL	3.70	

	position for interconnection to AA1-107.			
n4353	Reconfigure Line 13714 to accommodate the new line terminal positions at the new substation between Kings Creek Substation and Pocomoke Substation.	DPL	0.60	
n4367	Construct a three-switch tap structure substation by cutting the Bayview-Kellam 69 kV circuit.	DPL	0.50	12/31/2016
n4368	Oxbow 34.5 kV Line Tap The proposed attachment of this project will be made by a tap connection from the Oxbow – Lenox 34.5 kV line near or at pole LK-247. (more under 'notes')	Penelec	0.15	7/31/2015
n4369.1	Lenox 34.5 kV Substation Add sync check relaying to 34.5kV Oxbow line breaker (including one PT). Add conduit to Developer provided "DTT transmitter cabinet" on this exit to send breaker status to De	Penelec	0.18	7/31/2015
n4369.2	RTU programming for connection to the FirstEnergy SCADA and relay support for the generation installation	Penelec	0.01	7/31/2015
n4370	Milan 34.5kV Line Tap for Z1-092	Penelec	0.16	10/1/2015
n4371	"Athens 34.5 KV Substation Install sync check (including one PT) and line relaying for 34.5kV Milan line due to Z1-092 Developer generation interconnect."	Penelec	0.17	10/1/2015
n4372	"East Sayre 34.5 KV Substation Install sync check (including one PT) and line relaying due to Z1-092 Developer generation interconnect."	Penelec	0.18	10/1/2015
n4373	"Thomas Avenue 34.5 KV Recloser Location Install sync check and direct transfer trip relaying due to Z1-092 Developer generation interconnect."	Penelec	0.19	10/1/2015
n4374	"Milan 34.5 KV Recloser Location Install sync check and direct transfer trip relaying due to Z1-092 Developer generation interconnect."	Penelec	0.19	10/1/2015
n4375	RTU programming for connection to FirstEnergy SCADA and relay support for Interconnection Customer generation installation	Penelec	0.01	10/1/2015
n4376	A reactive deficiency of 122.76MVAr was identified in accordance with attachment H of PJM manual 14a - "Generator Reactive Deficiency Mitigation Process"	DEOK	30.00	3/31/2015
n4378	Cut in work at Segreto Substation for the Palisades to Segreto 345 Transmission line	ITCI	0.05	3/1/2010
n4381	Revise relay and metering settings to connect Z2-109	JCPL	0.02	12/1/2015
n4382	34.5kV tap, radio controlled switch, and associated equipment	PENELEC	0.12	1/1/2016
n4383	Install transfer trip transmitter and sync check relaying on the 34.5kV West Leroy line exit at	PENELEC	0.16	1/1/2016

	the Canton 34.5kV substation			
n4384	RTU programming for interconnection to the FirstEnergy SCADA and relay support for the generation installation	PENELEC	0.02	1/1/2016
n4385	34.5kV recloser work at pole # CWL-30	PENELEC	0.03	1/1/2016
n4386	Cut in work at Segreto Substation for the Covert to Segreto 345 Transmission line	ITCI	0.05	3/1/2010
n4387	Build new 345kV five-breaker ring bus substation to interconnect project Z2-028	ATSI	11.91	4/29/2019
n4388	Loop in new 345kV five-breaker ring bus substation to Highland - Mansfield and Highland - Sammis 345kV lines: each approximately 900 ft. in length, utilizing steel pol structures	ATSI	7.30	4/29/2019
n4389	Upgrade Highland 345kV substation line relaying to new Z2-028 interconnection bus	ATSI	0.21	4/29/2019
n4390	Install approximately 1.23 miles of fiber from Z2-028 interconnection substation to Highland 345kV substation	ATSI	0.11	4/29/2019
n4391	Install 3rd transfomer, and add 69 kV bus and assciated equipments at N. temple	ME	8.49	6/1/2018
n4392	Expand N.temple 230 kV to a breaker and half bus configuration and its assoctiated work	ME	14.99	6/1/2018
n4393	Rebuild 4.5 miles of the condutor using 556 ACSR, remove 110 structures, install 55 new conductors, remove 24,000ft of (3) 336 MCM 30/7 ACSR.	PPl	13.50	12/31/2015
n4394	Modify SCADA, alarm, Alarm Management System, perform system checks and testing at Lackawanna substation in support of Z2-107	PPl	0.15	12/31/2015
n4397	Build a new 69kV Attachment line from the Harwood-East Hazelton line to the POI for Z2-009.	PPL	2.48	12/1/2015
n4398	Replace protective relaying and control equipment at Harwood to support the interconnection of Z2-009.	PPL	0.15	12/31/2016
n4399	Build new 500kV lead line to connect Z2-046	PPL	2.50	6/1/2018
n4400	Build new 500kV substation to connect Z2-046	PPL	30.00	6/1/2018
n4401	Tie in new 500kV substation built to connect Z2-046.	PPL	4.85	6/1/2018
n4402	Installation of fiber optic line to support new substation for Z2-046	PPL	3.60	6/1/2018
n4403	Modification of protection system at Lackawanna to connect the new 500kV switchyard built for Z2-046	PPL	0.15	6/1/2018
n4404	Modification of protection system at Susquehanna to connect the new 500kV switchyard built for Z2-046	PPL	0.15	6/1/2018
n4407	Remote Terminal work at remote substations (Edgecomb, Everett, and Tarboro)	Dominion	0.19	10/31/2015
n4408	Construct new 3 breaker 138 kV Switching Station including revenue metering and SCADA	AEP	12.41	12/31/2017
n4409	Line Protection and Controls for new Substation	AEP	0.33	12/31/2017

n4410	Line Protection and Controls for Jackson Ferry Station	AEP	0.04	12/31/2017
n4411	Line Protection and Controls for Peak Creek Station	AEP	0.15	12/31/2017
n4450	Reconductor 1590 ACSS	PSEG	0.81	
n4451	Reconductor 1590 ACSS	PSEG	0.82	
n4452	New circuit, Restricted by river 3500 kcmil	PSEG	93.60	
n4458	Readington Sub - Replace 230 kV bus tie breaker (MU), affiliated CT's and disconnects	JCPL	0.41	
n4459	Reconductor 1590 ACSS	PSEG	5.60	
n4460	Reconductor 1590 ACSS	PSEG	5.58	
n4461	Reconductor 1590 ACSS	PSEG	13.24	
n4462	Reconductor 1590 ACSS	PSEG	13.76	
n4466	Reconductor with 3500 kcmil, circuit has 10 inch pipe	PSEG	16.67	
n4469	Replace transmission line	PSEG	142.71	
n4471	Reconductor 1590 ACSS	PSEG	0.57	
n4473	Build new 345 kV line to connect Z1-079 to new 345kV substation	DEOK	2.95	6/1/2018
n4474	Build new 3 breaker 345kV ring bus substation along the Foster-Todhunter line	DEOK	5.54	6/1/2018
n4476	Loop line #2131 into	Dominion	1.68	12/1/2016
n4477	for transfer trip transmitter	Dominion	0.03	12/1/2016
n4478	for transfer trip transmitter and receiver	Dominion	0.05	12/1/2016
n4479	Remote relaying setting changes	PENELEC	0.01	12/30/2015
n4481	Tx Line Loop Niles Valley-Potter 115 kV, Loop to 3-Breaker Ring Bus...see notes for more details	Penelec	0.37	6/1/2017
n4482	"Z1-069 Interconnection Substation Construct Z1-069 115 kV three breaker ring bus interconnection substation."	Penelec	6.14	6/1/2017
n4483	Adjust remote relaying settings.	Penelec	0.59	6/1/2017
n4485	to cut in new interconnection substation	Dominion	2.30	12/31/2015
n4486	option to build oversite and protection to accommodate new generation and interconnection substation	Dominion	0.50	12/31/2015
n4487.1	Replacing Tosco 5110 230kV CB1 breaker from 63kA to 80kA	PSEG	0.16	6/1/2017
n4487.2	Replacing Tosco 5110 230kV CB2 breaker from 63kA to 80kA	PSEG	0.16	6/1/2017
n4492	Tx Line Loop Niles Valley-Potter 115 kV	Penelec	0.37	
n4493	Z1-069 Interconnection Substation Construct Z1-069 115 kV three breaker ring bus interconnection substation.	Penelec	6.14	
n4494	Adjust remote relaying settings.	Penelec	0.59	
n4496	to accommodate new generation and interconnection substation	Dominion	0.06	12/31/2015
n4501	"SVC: 120.24 MVAR (lagging) -84.82 MVAR (leading)"	DEOK	30.00	

n4502	three breaker ringbus	Dominion	4.00	10/31/2015
n4503	to split the existing line and connect new interconnection substation	Dominion	1.00	10/31/2015
n4504	to accommodate new generation and interconnection substation	Dominion	0.60	10/31/2015
n4505	Perform a sag study on the Z2-042 - Claytor 138 kV line.	AEP	0.04	12/31/2017
n4506	three breaker ringbus	Dominion	4.20	
n4507	to split the existing line and connect new interconnection substation	Dominion	0.60	
n4508	to accommodate new generation and interconnection substation	Dominion	0.50	
n4509	Reconductor the Hennepin Tap - Oglesby Tap 138 kV line.	ComEd	16.40	12/31/2016
n4512	Perform a sag study on the X2-052 Tap - Dumont 345 kV line.	AEP	0.06	6/1/2016
n4513	to split the existing line and connect new interconnection substation	Dominion	8.09	6/1/2018
n4526	Reconductor 1590 ACSS	PSEG	12.98	
n4534	Replace Bus 2 w/ 1590 AAC 61 str (Engineering position 4TH at Athenia)* & Reconductor 3000 kcmil	PSEG	20.20	
n4535	Replace Disconnect 2 Switches at Athenia (Engineering position 11H)* & Reconductor 1590 ACSS	PSEG	12.00	
n4541	Reconductor 1590 ACSS	PSEG	17.87	
n4546	New parallel underground circuit*	PSEG	86.97	
n4550	Reconductor 1590 ACSS*	PSEG	5.61	
n4551	#320 to three phase 477MCM AL	Dominion	0.30	12/15/2014
n4552	for transfer trip scheme with IC	Dominion	0.40	12/15/2014
n4553	#320 to three phase 477MCM AL	Dominion	0.05	12/15/2014
n4554	Reconductor 1590 ACSS*	PSEG	5.89	
n4555	Whippany Sub, Roseland terminal - replace disconnects, bus Conductor, primary and backup relaying.	JCPL	0.34	
n4557	for transfer trip transmitter and receiver	Dominion	0.06	12/1/2016
n4558	for transfer trip transmitter	Dominion	0.04	12/1/2016
n4574	Cut the West Cambridge-Vienna 69 kV circuit and loop it into and out of the new substation to be constructed by the Interconnection Customer as part of Option to Build. (Final tie-in work)	DPL	1.30	12/31/2012
n4575	Line protection and controls at the Stone Coal Gap 34.5 kV station will need to be upgraded.	AEP	0.16	6/1/2016
n4576	Line protection and controls at the Mount Union 34.5 kV station will need to be upgraded.	AEP	0.10	6/1/2016
n4577	Install new metering at the PCC	AEP	0.08	6/1/2016
n4579	The replacement of terminal end conductor on the Glen Gardner Terminal at Chester will cost $50,000.	JCPL	0.05	
n4580	The replacement of terminal end conductor on the West Wharton terminal at Chester and the	JCPL	0.15	

	Chester terminal at West Wharton will cost $150,000.			
n4581	A total of 4 disconnect switches would need to be replaced at 2 different substations.	PECO	0.80	
n4582	new parallel underground line	PSEG	12.00	
n4583	Reconductor with 3000 kcmil copper cable	PSEG	23.91	
n4584	Reconductor with 3000 kcmil copper cable	PSEG	30.60	
n4585	Reconductor 1590 ACSS*	PSEG	8.64	10/31/2015
n4586	Greystone-Whippany J 230kV line reconductor 8 Miles with 1590 ACSS	JCPL	17.41	
n4587	Whippany Sub Q 230kV line Terminal - replace 1590 ACSR bus conductor	JCPL	0.04	
n4588	Greystone Sub and West Wharton Sub - Replace terminal end SS conductor.	JCPL	0.07	
n4589	Add 2nd circuit on Susquehanna-Jenkins 230kV line for 22 miles, tie to Jenkins-Acahela 230kV line, so it becomes Susquehanna-Acahela 230kV. Install a CB at Susquehanna for termination.	PPL	25.00	
n4590	Reconductor 1590 ACSS	PSEG	2.80	
n4591	new circuit 3500 kcmil	PSEG	4.88	
n4592	Replace Keeney AT50 (Keeney 500/230kV)	DPL	15.00	
n4593	Reconductor with 3000 kcmil	PSEG	21.73	
n4594	Reconductor 1590 ACSS*	PSEG	8.77	
n4595	Reconductor 1590 ACSS*	PSEG	8.21	
n4599	Install OPGW on circuit 6727 from the Church Substation to the new Y3-033 substation constructed by the Interconnection Customer pursuant to Option to Build (a distance of 15 miles). Replace approxim	DPL	5.60	9/15/2015
n4600	Replace relays at the Church 69 kV Substation.	DPL	0.17	9/15/2015
n4602	Install two circuit breakers	AEP	1.11	12/31/2013
n4603	Install revenue metering	AEP	0.13	12/31/2013
n4604	Relocate Distribution facilities for T-line Clearance	AEP	0.39	12/31/2013
n4605	Modify Baker 345 kV Station Relay Settings	AEP	0.05	6/30/2014