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

PJM Staff Whitepaper
May 2012

EXECUTIVE SUMMARY

Since November, PJM has received notification from several generation owners of their intent to deactivate a number of generators totaling over 13,000 MW of generation. Generation owners are required to notify PJM of their intent to deactivate generation per Article V of the PJM tariff. Baseline reliability criteria violations have been identified as a result of the generation deactivations. Transmission reinforcements to address the reliability criteria violations are being developed.

The baseline upgrades related to the generation deactivation studies completed as of this time are summarized below. The requested generation deactivations range from May 2012 through the end of 2015. If the transmission upgrades that are required to maintain reliability cannot be implemented by the requested deactivation date, generation may need to be retained through Reliability Must Run (RMR) agreements. Based on the expected in-service date of some of the transmission upgrades included in this report, RMR agreements are being pursued.

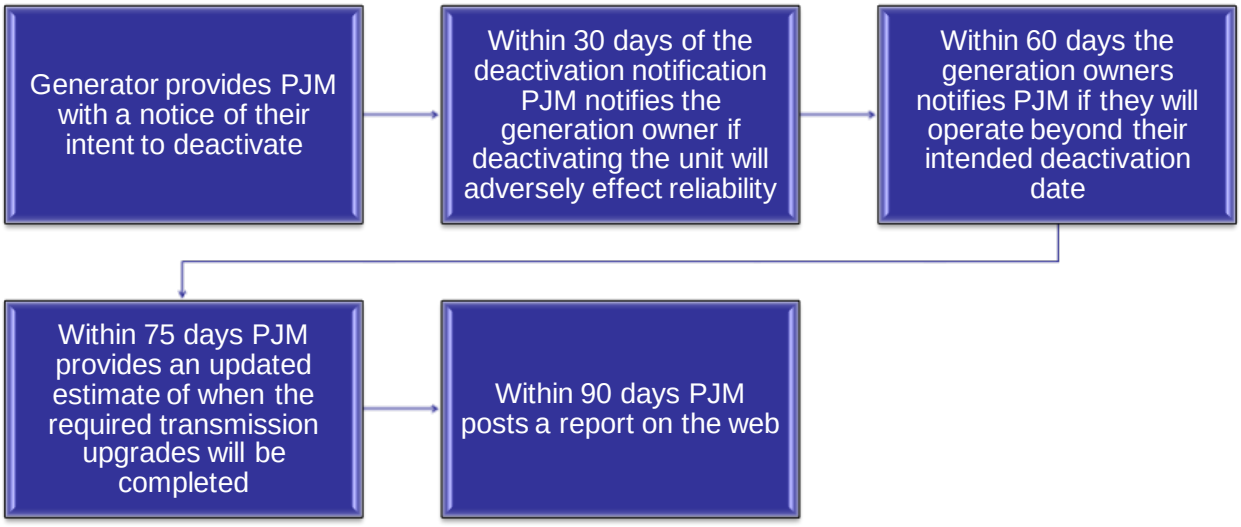
The total increase to the RTEP to include these baseline project changes is $1,881 million. With these changes, the RTEP will include over $23.410 billion of transmission additions and upgrades since the first plan was approved by the Board in 2000.

SUMMARY OF RESULTS

Generation Deactivation Process

As noted above, generation deactivation is covered under Article V of the PJM tariff. The flowchart below details the generation deactivation process. After a generation owner notifies PJM of their intent to deactivate a unit, PJM conducts a series of studies to determine if deactivating the generator will have an adverse impact on the reliability of the bulk electric system. This baseline analysis determines the compliance of the system with reliability criteria and standards. If reliability criteria violations are identified, transmission upgrades are developed to resolve the identified issues. If the transmission upgrades can be put in place prior to the intended deactivation date, the unit can retire as requested. If the transmission upgrades cannot be put in place prior to the requested deactivation date then an RMR agreement may be pursued. The generation owner is not under any obligation to pursue the RMR agreement and may retire the unit at any time. PJM cannot compel a generator to remain in-service. Transmission upgrades required to maintain a reliable system are identified and reviewed with the Sub-regional RTEP Committees and the

Transmission Expansion Advisory Committee (TEAC). The cost of transmission upgrades to mitigate criteria violations caused by generation deactivation is allocated to load.



The upgrades included in this report are needed due to the deactivation of multiple units from several different generation owners. The table below summarizes the generation deactivations driving the need for the upgrades included in this report.

Unit Name	Capacity (MW)	Owner	Official Owner Request Date
Chesapeake 1	111	Dominion	11/15/2011
Chesapeake 2	111	Dominion	11/15/2011
Yorktown 1	159	Dominion	11/15/2011
Chesapeake 3	147	Dominion	11/15/2011
Chesapeake 4	207	Dominion	11/15/2011
Bergen 3	21	PS Power	12/1/2011
Burlington 8	21	PS Power	12/1/2011
National Park 1	21	PS Power	12/1/2011
Mercer 3	115	PS Power	12/1/2011
Sewaren 6	111	PS Power	12/1/2011
Armstrong 1	172	FE Solutions	1/26/2012
Armstrong 2	171	FE Solutions	1/26/2012

Unit Name	Capacity (MW)	Owner	Official Owner Request Date
Ashtabula 5	244	FE Solutions	1/26/2012
Bay Shore 2	138	FE Solutions	1/26/2012
Bay Shore 3	142	FE Solutions	1/26/2012
Bay Shore 4	215	FE Solutions	1/26/2012
Eastlake 1	132	FE Solutions	1/26/2012
Eastlake 2	132	FE Solutions	1/26/2012
Eastlake 3	132	FE Solutions	1/26/2012
Eastlake 4	240	FE Solutions	1/26/2012
Eastlake 5	597	FE Solutions	1/26/2012
Lake Shore 18	245	FE Solutions	1/26/2012
R Paul Smith 3	28	FE Solutions	1/26/2012
R Paul Smith 4	87	FE Solutions	1/26/2012
Walter C Beckjord 1	94	Duke Energy	2/1/2012
Walter C Beckjord 2	94	Duke Energy	2/1/2012
Walter C Beckjord 3	128	Duke Energy	2/1/2012
Walter C Beckjord 4	150	Duke Energy	2/1/2012
Walter C Beckjord 5	238	Duke Energy	2/1/2012
Walter C Beckjord 6	414	Duke Energy	2/1/2012
Albright 1	73	Monongahela Power	2/8/2012
Albright 2	73	Monongahela Power	2/8/2012
Albright 3	137	Monongahela Power	2/8/2012
Rivesville 5	35	Monongahela Power	2/8/2012
Rivesville 6	86	Monongahela Power	2/8/2012
Willow Island 1	51	Monongahela Power	2/8/2012
Willow Island 2	138	Monongahela Power	2/8/2012
New Castle 3	93	GenOn	2/29/2012
New Castle 4	92	GenOn	2/29/2012
New Castle 5	140	GenOn	2/29/2012
New Castle Diesels	5.5	GenOn	2/29/2012
Portland 1	158	GenOn	2/29/2012
Portland 2	243	GenOn	2/29/2012
Glen Gardner CTs	160	GenOn	2/29/2012
Shawville 1 - 4	597	GenOn	2/29/2012
Titus 1 - 3	243	GenOn	2/29/2012
Niles 1 & 2	217	GenOn	2/29/2012
Elrama 1 - 4	396	GenOn	2/29/2012
Fisk 19	326	Midwest Generation	3/8/2012
Crawford 7	213	Midwest Generation	3/8/2012
Crawford 8	319	Midwest Generation	3/8/2012

The baseline deactivation analysis, discussed herein, resulted in the need for transmission upgrades in several transmission zones. In total these analyses identified over 130 upgrades ranging from simple line terminal equipment upgrades, new substations and substation additions to reinforce underlying systems, rebuilding existing lines to higher capacity, and new transmission lines. A summary of the major baseline project additions that are $5 million or greater are detailed below. A complete listing of all of the projects is included as an attachment to this document.

Mid-Atlantic Region System Upgrades

- PEPCO Transmission Zone
  - Reconductor 230 kV line 23032 and 23034 with high temperature conductor - $16M

- PENELEC Transmission Zone
  - Construct a 115 kV ring bus at Claysburg Substation - $5.25M
  - Construct Farmers Valley 345/230 kV and 230/115 kV substation by looping the Homer City to Stolle Road 345 kV line into Farmers Valley – $29.5M
  - Relocate the Erie South 345 kV line bay - $13M
  - Convert the Lewis Run – Farmers Valley 115 kV line to 230 kV - $46.8M

- PPL Transmission Zone
  - Install a new North Lancaster 500/230 kV substation - $42M

- JCPL Transmission Zone
  - Construct a new Whippany to Montville 230 kV line - $37.5M

Western Region System Upgrades

- American Electric Power
  - Reconductor Kammer – West Bellaire 345 kV - $20M
  - Install a new 765/345 substation at Mountaineer and build a ¾ mile 345 kV line to Sporn - $65M
  - Terminate Transformer #2 at SW Lima in a new bay position - $5M
  - Add four 765 kV breakers at Kammer - $30M

- APS Transmission Zone
  - Loop the Homer City-Handsome Lake 345 kV line into the Armstrong substation and install a 345/138 kV transformer at Armstrong - $27.8M
  - Install a new Buckhannon – Weston 138 kV line - $17.5M
  - Convert Moshannon substation to a four breaker 230 kV ring - $6.5M

- ATSI Transmission Zone
  - Install a 345/138 kV transformer at the Inland Q-11 station - $7.2M

- Convert Eastlake units 1, 2, 3, 4 and 5 to synchronous condensers - $100M
- Convert Lakeshore 18 to synchronous condensers - $20M
- Re-conductor the Galion – GM Mansfield – Ontario - Cairns 138 kV line - $9.8M
- Install a 2nd 345/138 kV transformer at the Allen Junction station - $7.2M
- Install a 2nd 345/138 kV transformer at the Bay Shore station - $7.2M
- Create a new Northfield Area 345 kV switching station by looping in the Eastlake – Juniper 345 kV line and the Perry - Inland 345 kV line - $37.5M
- Build a new Mansfield - Northfield Area 345 kV line - $184.5M
- Create a new Harmon 345/138/69 kV substation by looping in the Star – South Canton 345 kV line - $46M
- Build a new Harmon – Brookside + Harmon - Longview 138 kV line - $9.2M
- Create a new Five Points Area 345/138 kV substation by looping in the Lemoyne – Midway 345 kV line - $30M
- Build a new 345-138kV Substation at Niles - $32M
- Build a new substation near the ATSI-AEP border and a new 138kV line from new substation to Longview - $17.7M
- Build new Allen Jct - Midway - Lemonye 345kV line - $86.3M
- Build a new Leroy Center 345/138 kV substation by looping in the Perry – Harding 345 kV line - $46M
- Build a new Toronto to Harmon 345 kV line - $218.3M
- Build a new Toronto 345/138 kV substation - $41.8M
- Build a new West Fremont – Groton – Hayes 138 kV line - $45M
- Reconductor the ATSI portion of South Canton – Harmon 345 kV line - $6M
- Add a new 150 MVAR SVC and 100 MVAR capacitor at New Castle - $31.7M

- Duquesne Transmission Zone
  - Install a third 345/138 kV transformer at Collier - $8M

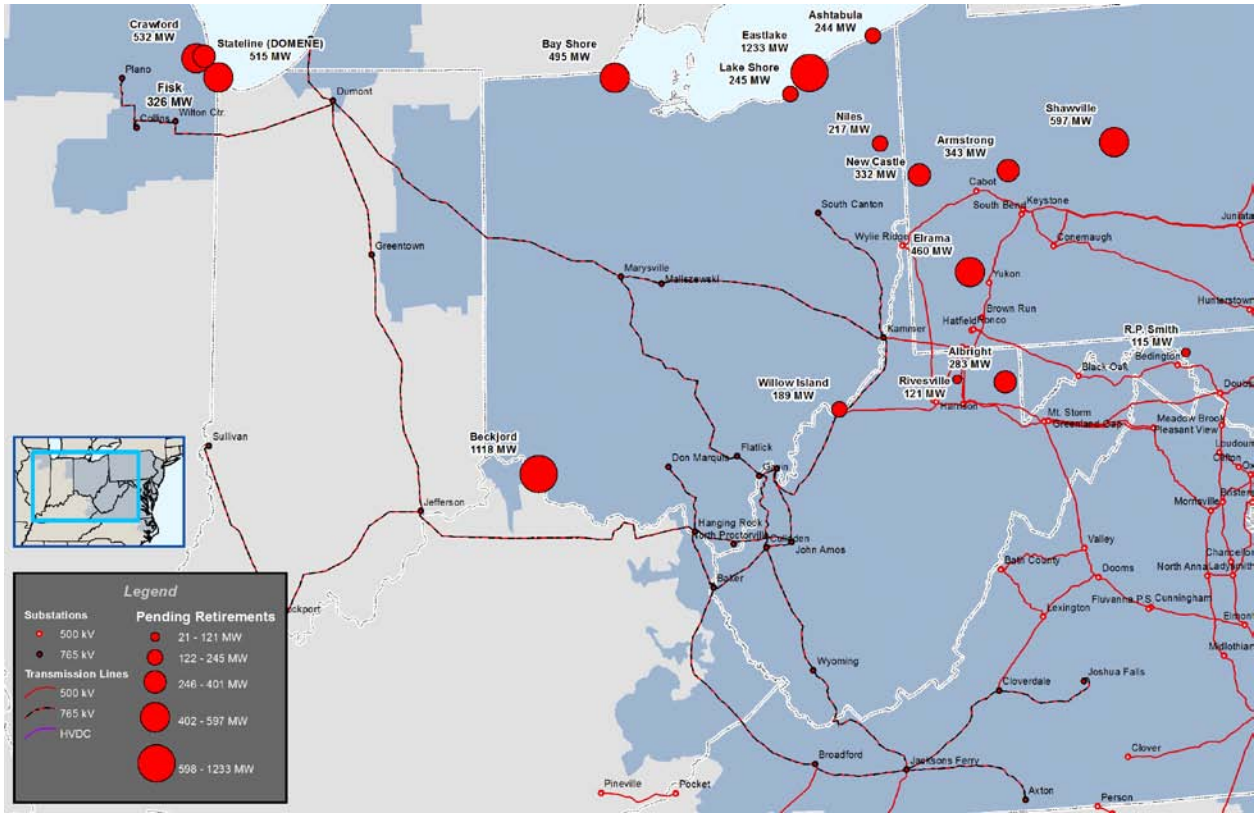
<u>Southern Region System Upgrades</u>

- Dominion Virginia Power Transmission Zone
  - Build new Surry to Skiffes Creek 500 kV line - $58.3M
  - Build new Skiffes Creek 500/230 substation - $42.4M
  - Build new Skiffes Creek – Whealton 230 kV line - $46.4M
  - Expand Yadkin 500/230 kV and 230/115 kV substation and Chesapeake 230/115 kV substation - $45M
  - Add a third 500/230 kV transformer at Yadkin - $16M
  - Add six 500 kV breakers at Yadkin - $8M
  - Install a third 500/230 kV transformer at Clover - $16M
  - Rebuild Lexington to Dooms 500 kV line - $120M

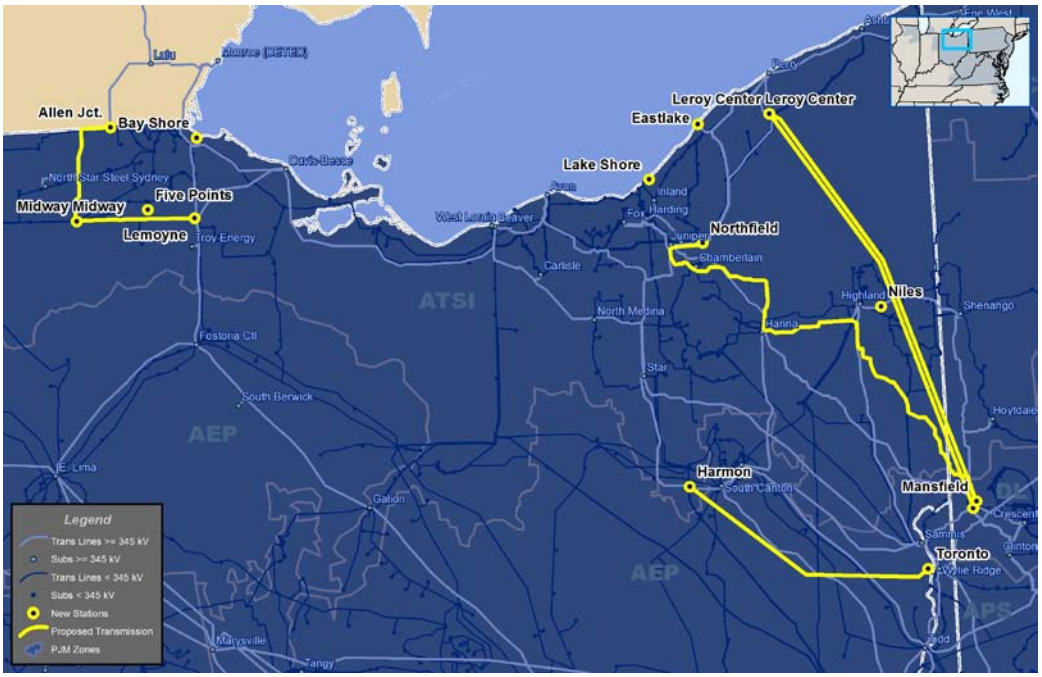
- Upgrade Bremo – Midlothian 230 kV line - $10M
- Build a new Suffolk to Yadkin 230 kV line - $40M
- Install a second Valley 500/230 kV transformer - $16M
- Build a 500 MVAR SVC at Landstown 230 kV - $60M

Western Region System Upgrades

The majority of the generator deactivations that PJM has received since November are for units in the western region of PJM. Generation owners including First Energy Solutions, Duke Energy, GenOn and Midwest Generation have notified PJM of their intent to deactivate units in the western region of PJM. As shown in the map below a number of these deactivations are clustered around Lake Erie in the American Transmission System Inc. (ATSI) transmission zone. Deactivation of the generation along Lake Erie will require significant transmission upgrades to resolve thermal and voltage violations in and around the City of Cleveland which has historically been constrained due to voltage limitations.



Several new 345 kV transmission lines, new 345/138 kV substations, and new reactive upgrades have been identified in addition to a large number of incremental upgrades to existing facilities. The map on the following page shows the new 345 kV lines and the new 345/138 kV stations.

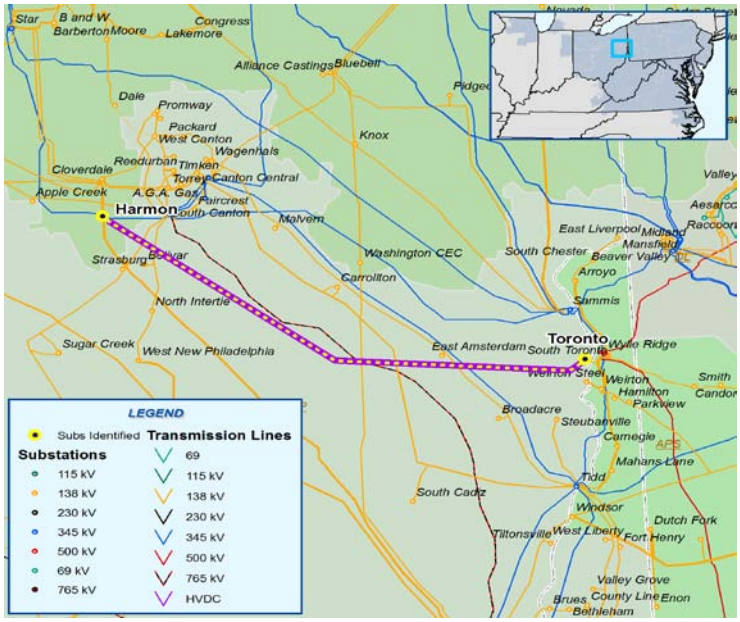


As noted above, the ability to import power into the Cleveland area has historically been limited by voltage problems. Deactivation of the generation in and around Cleveland will exacerbate these voltage limitations. As a result, a significant number of upgrades have been identified to address voltage and voltage stability criteria. The Eastlake units 1 – 5 and the Lakeshore 18 unit were recommended to be converted to synchronous condensers. The estimated cost for this work is $20M for each machine. The expected reactive capability for the Eastlake units 1 – 3 is 124 MVAR/machine, Eastlake unit 4 is 268 MVAR, Eastlake unit 5 is 485 MVAR and 260 MVAR for the Lakeshore 18 machine. In addition a new 345/138 kV substation at Leroy Center was recommended. The new station will be established by looping the existing Perry to Harding 345 kV line through the station. The estimated cost for the new Leroy Center substation is $46M. A new Northfield area 345/138 kV substation was recommended to address voltage violations under load deliverability conditions. The new substation will be established by tapping the existing Eastlake to Juniper 345 kV line and the Perry to Inland 345 kV line. The estimated cost for that work is $37.5M. A new 345 kV line from Mansfield to Northfield was also recommended to reinforce the 345 kV feed into the Northfield area. The estimated cost for this new line is $184.5M. In addition, a new 345 kV line from Beaver Valley to Leroy Center and another new 345 kV line from Mansfield to Leroy Center are being considered to address ATSI voltage stability criteria violations. The estimated cost of the two new 345 kV lines is $393M. The Beaver Valley to Leroy Center and Mansfield to Leroy Center 345 kV lines were not recommended to the PJM Board at this time. Additional analysis using the ATSI voltage stability is in progress.

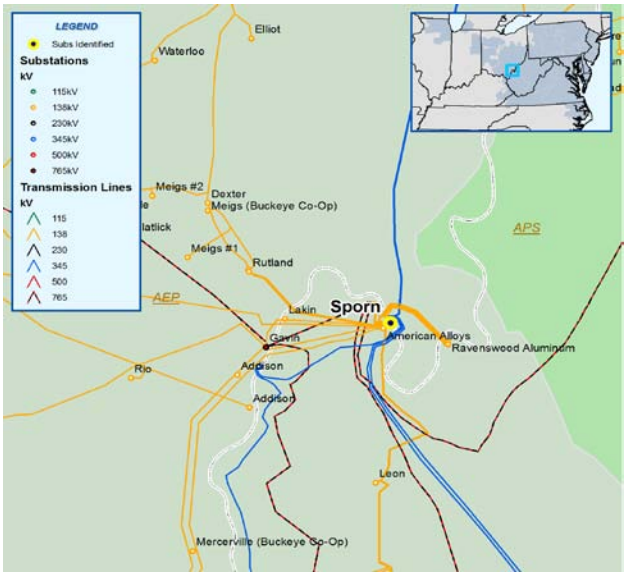
A new Five Points 345/138 kV substation was recommended to address NERC category C3 (N-1-1) voltage violations. The new station will be created by looping the existing Lemoyne to Midway 345 kV line through the station. The estimated cost for this work is $30M. A second Bayshore 345/138 kV transformer was also recommended to address NERC category C3 (N-1-1) voltage violations. The estimated cost for adding the second transformer at Bayshore is $7.2M. In addition to these upgrades to address voltage problems in and around the City of Cleveland, a 150 MVAR SVC and 100 MVAR capacitor were

recommended at New Castle station in western Pennsylvania to address voltage problems primarily related to the deactivation of the New Castle generation.

There are also a number of projects that are required to address thermal violations. A new Harmon 345/138/69 kV station was recommended to address several NERC category C (breaker failure) contingency overloads. The new Harmon station will be established by looping the South Canton to Star 345 kV line through the station. The estimated cost for this project is $46M. In addition, a new Toronto 345/138 kV substation was recommended to address a number of NERC category C3 (N-1-1) violations. The new substation will be established by looping the existing Sammis to Wylie Ridge 345 kV line through the station. The estimated cost for the new Toronto station is $41.8M. In addition, a new Toronto to Harmon 345 kV line was recommended to reinforce the 345 kV system in the area. The estimated cost for the new Toronto to Harmon 345 kV line is $218.3M.



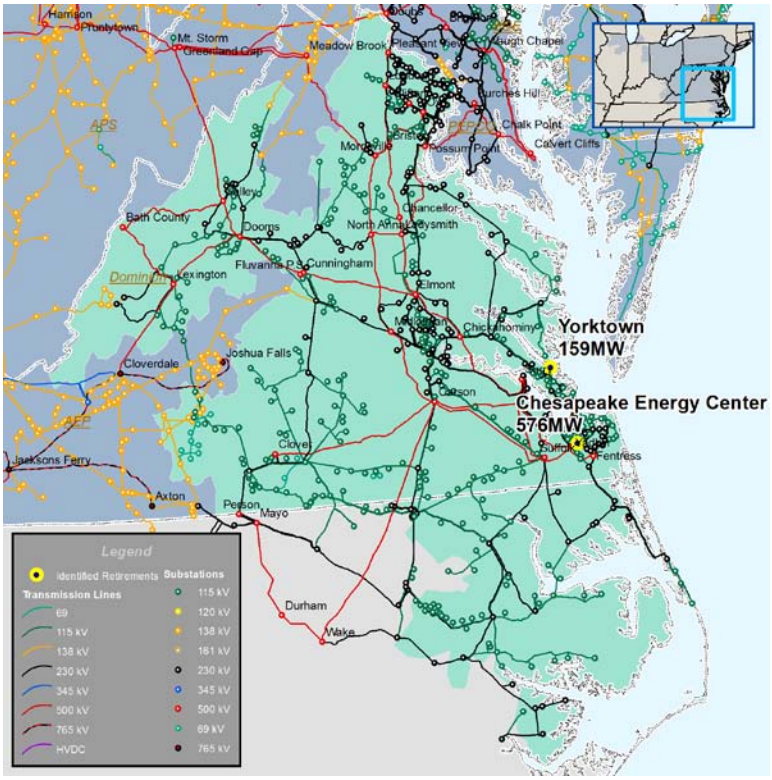
A new 345 kV line from Allen Junction to Midway to Lemoyne was recommended to address a NERC category C3 (N-1-1) thermal violation on Lemoyne to BG Tap 138 kV line. The violation is being driven by the loss of the Allen Junction to Lulu 345 kV tie line to Michigan and the Lemoyne to Five Points 345 kV line. Approximately 48 miles (roughly 3/4 of the line) will utilize an open tower position on an existing double circuit tower structures. The estimate cost for Allen Junction to Midway to Lemoyne line is $86.3M. A new 138 kV line between West Fremont and Hayes was recommended to address thermal violations on other 138 kV facilities for NERC category C5 (double circuit tower) contingency. Specifically the Ottowa to Lakeview 138 kV line and the Lakeview to Greenfield 138 kV line are both overloaded for a double circuit towerline contingency. The estimated cost of the new 138 kV line is $45M.



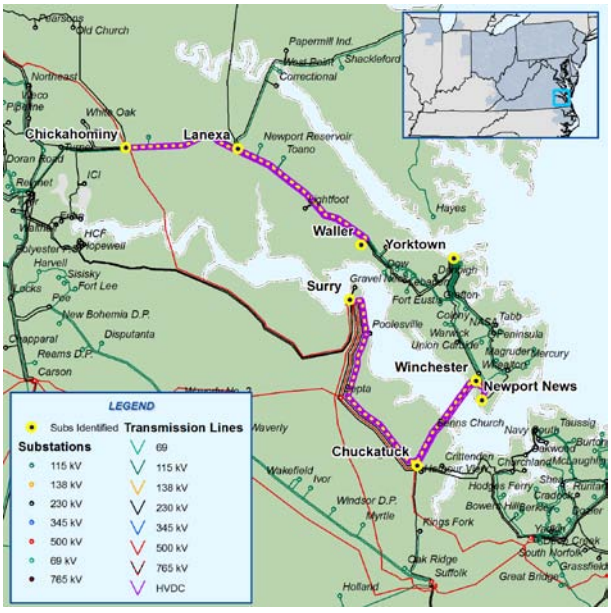
A new 345 kV source into the Sporn station was recommended to address an overload on the Mountain to Belmont 765 kV line for a NERC category C breaker failure contingency at Marysville that trips the Marysville – Sorenson 765 kV line and the Marysville – Flatlick 765 kV line. The recommended project is to add a new 765/345 kV transformer at Mountaineer and build a new 345 kV line from Mountaineer to Sporn. The Sporn station is approximately ¾ of a mile from Mountaineer. The estimated cost for this project is approximately $65M.

Southern Region System Upgrades

Several new upgrades have been identified in the Dominion transmission zone. A number of the more significant upgrades are summarized below. These upgrades are being driven primarily by the deactivation of the Yorktown 1 unit (159 MW) and the Chesapeake 1 – 4 units (576 MW total). The map below shows the relative location of these units within the Dominion transmission zone.

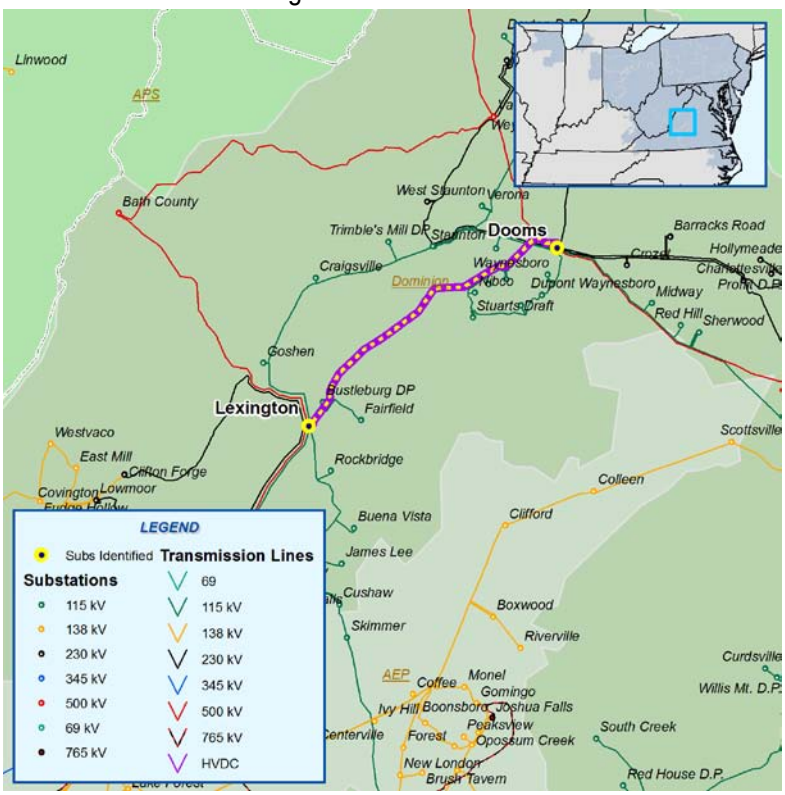


Thermal and voltage violations were identified on the 230 kV facilities noted on the diagram at the right which serve the northern Hampton Roads area of Virginia. Several alternatives were evaluated to address these issues including a new 500 kV line from Chickahominy to a new station called Skiffes Creek, a new 500 kV line from Surry crossing the James River to the new Skiffes Creek station, and a new 230 kV line from Surry to Skiffes Creek. Each of these alternatives also included a new 230 kV line from Skiffes Creek to Whealton with an estimated cost of $46.4 million. PJM staff is recommending the new 500 kV line from Surry to Skiffes Creek which has an estimated cost of $100.7 million including the new Skiffes Creek 500/230 kV substation. Each alternative resolved the reliability



criteria violations in 2015, however the 230 kV alternative was found to be less robust and would not be adequate under certain at-risk generation scenarios that were evaluated by PJM staff. In addition, the 230 kV alternative required a Phase Angle Regulator (PAR) to control the flow of power on the proposed Surry to Skiffes Creek 230 kV line which would add additional operational complexity. The 500 kV line from Chickohominy to Skiffes Creek was not chosen primarily due to it being the highest cost alternative.

A violation of Dominion planning criteria was identified on the Lexington to Dooms 500 kV line. One of the Dominion planning criteria establishes the critical system conditions by removing a single generator followed by the single contingency outage of any other line or generator. Under these conditions with either the Yorktown 3 unit or the Surry 2 unit off-line, the Lexington to Dooms 500 kV line overloads for the loss of the Bath to Valley 500 kV line. The recommended upgrade to address this violation is to rebuild the 40 mile Lexington to Dooms 500 kV line. The estimated cost for this work is $120 million. The line is being recommended to be rebuilt to address the thermal overload and to address the aging infrastructure issues that are similar to problems that are driving the need for the rebuild of the Mt Storm – Doubs 500 kV line.



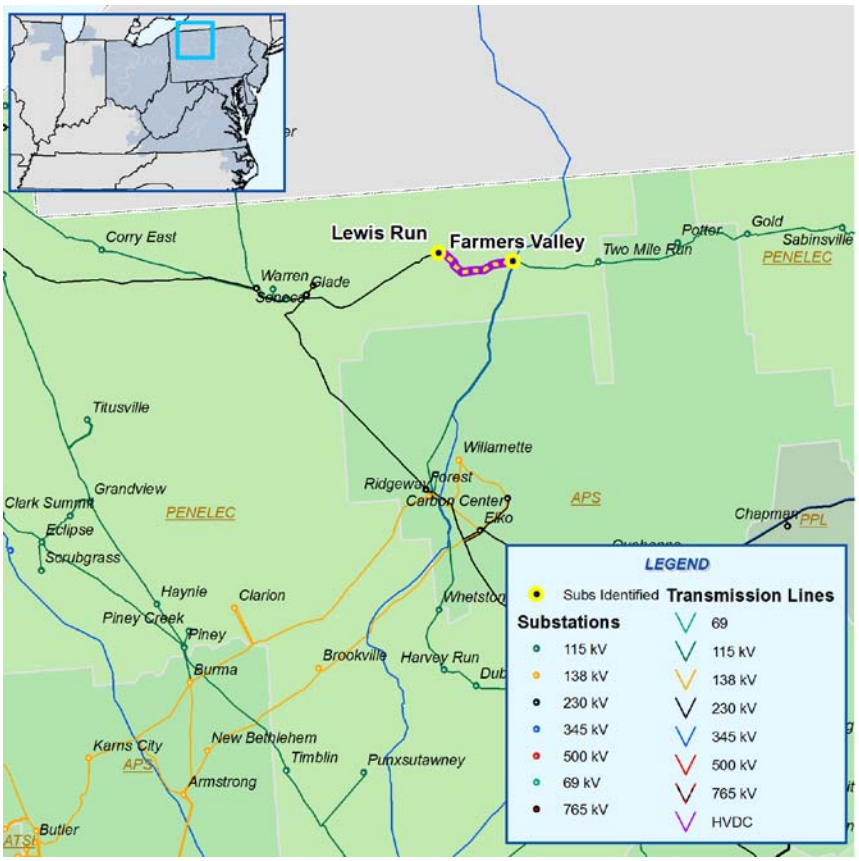
Other significant upgrades in the Dominion transmission zone include a third 500/230 kV transformer at Yadkin (estimated cost $16 million) to address thermal overloads on the existing Yadkin 500/230 kV transformers for the loss of the other transformer, a third 500/230 kV transformer at Clover (estimated cost $16 million) to address overloads on the existing Clover 500/230 kV transformers, a new Suffolk to Yadkin 230 kV line (estimated cost $40 million) to address a NERC category C3 (N-1-1) overload, a second Valley 500/230 kV transformer to address overloads on the existing transformer to address NERC category C3(N-1-1) violations, and a new 500 MVAR Static VAR Compensator (SVC) on the 230 kV at Landstown to address NERC category C3 (N-1-1) voltage violations in the Southern Hampton Roads area.

Mid-Atlantic Region System Upgrades

There are a number of upgrades in the Mid-Atlantic region. Many of these upgrades are being driven by the deactivation of the GenOn units at Portland, Shawville, Titus and Glen Gardner.

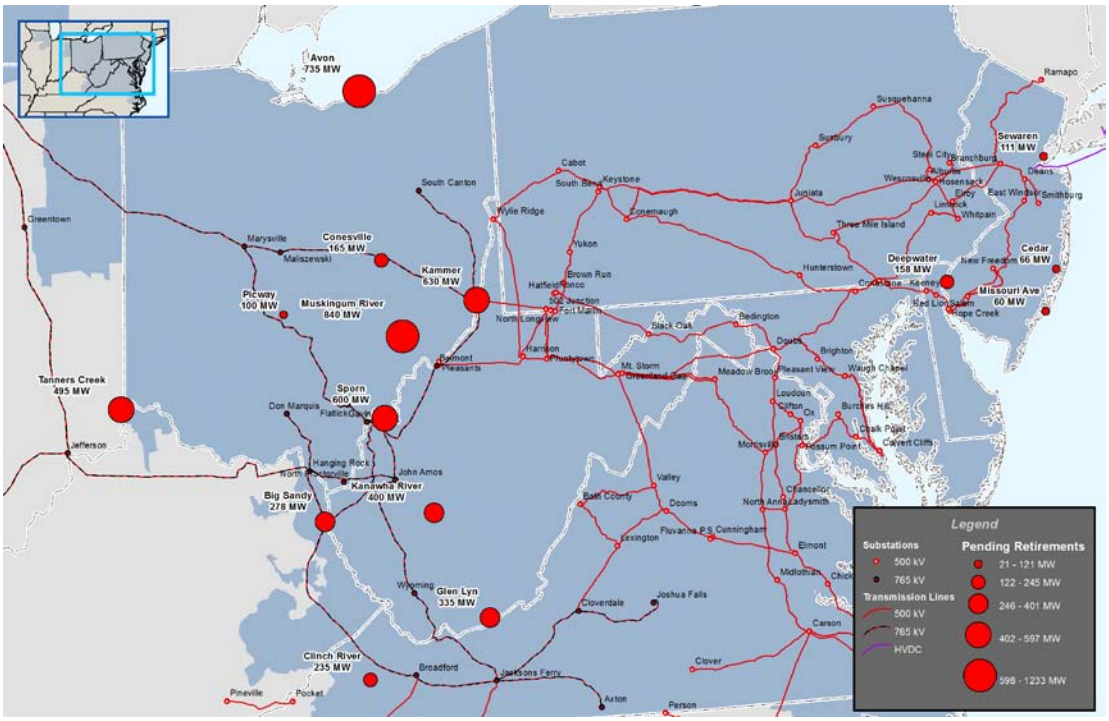
In the PPL transmission zone a new 500/230 kV substation is being recommended to address several overloads on 230 kV facilities in the South Akron and South Manheim areas. The estimated cost for the project is $42M. In the JCPL transmission zone a new 6.4 mile 230 kV line between Whippany and Montville is being recommended to address NERC Category C3 (N-1-1) violations due to the loss of the Montville to Roseland 230 kV line followed by the loss of the Kittatiny to Newton 230 kV line. The estimated cost for the project is $37.5M.

There are several upgrades in the Pennelec transmission zone to address both thermal and voltage violations. A new 345/230/115 kV substation was recommended at the existing Farmers Valley 115 kV substation. The 345 kV source will be from the Homer City to Stolle Road 345 kV line that passes near the station. This project is needed to address NERC category B (single contingency) voltage drop violations, generator deliverability violations and NERC category C3 (N-1-1) thermal violations. The estimated cost for this work is $29.5M. In addition to this upgrade, the existing 115 kV line from Farmers Valley to Lewis Run be converted to 230 kV. This upgrade is required to address generator deliverability violations. The estimated cost for this conversion work is $46.8M.



Next Steps

PJM staff continues to work on a number of generator deactivation studies for units shown on the map below including twenty two units in the AEP transmission zone, two Avon Lake units in the ATSI transmission zone, several units at Sewaren in the PSEG zone and several units in the Atlantic Electric transmission zone. Although upgrades will be required to address reliability violations for these deactivations, based on initial analysis the number and scope of upgrades required for these deactivations is expected to be less than those described in this report.



Review by the Transmission Expansion Advisory Committee (TEAC)

The results of all of the deactivation analyses were reviewed with the TEAC at the February 16th, March 15th, April 12th meetings. Final upgrades included in this report were reviewed with the TEAC at the April 27, 2012 meeting.

Board Approval

The PJM Board met on May 17th and approved the elements of the 2012 RTEP documented herein.

Appendix: Retirement Baseline Upgrades

Upgrade ID	Project Description	Transmission Owner	Cost Estimate
b1879	Perform a sag study on the Hansonville - Meadowview 138 kV line (Improve the emergency rating to 245 MVA)	AEP	$ 0.10
b1946	Perform a sag study on the Brues – West Bellaire 138 kV line	AEP	$ 0.03
b1947	A sag study of the Dequine - Meadowlake 345 kV line #1 line may improve the emergency rating to 1400 MVA	AEP	$ 0.01
b1948	Establish a new 765/345 interconnection at Sporn. Install a 765/345 kV transformer at Mountaineer and build ¾ mile of 345 kV to Sporn	AEP	$ 65.00
b1949	Perform a sag study on the Grant Tap – Deer Creek 138 kV line and replace bus and risers at Deer Creek station	AEP	$ 0.30
b1950	Perform a sag study on the Kammer – Ormet 138 kV line of the conductor section	AEP	$ 0.10
b1951	Perform a sag study of the Maddox- Convoy 345 kV line to improve the emergency rating to 1400 MVA	AEP	$ 0.03
b1952	Perform a sag study of the Maddox – T130 345 kV line to improve the emergency rating to 1400 MVA	AEP	$ 0.03
b1953	Perform a sag study of the Meadowlake - Olive 345 kV line to improve the emergency rating to 1400 MVA	AEP	$ 0.06
b1954	Perform a sag study on the Milan - Harper 138 kV line and replace bus and switches at Milan Switch station	AEP	$ 0.35
b1955	Perform a sag study of the R-049 - Tillman 138 kV line may improve the emergency rating to 245 MVA	AEP	$ 0.03
b1956	Perform a sag study of the Tillman - Dawkins 138 kV line may improve the emergency rating to 245 MVA	AEP	$ 0.03
b1957	Terminate Transformer #2 at SW Lima in a new bay position	AEP	$ 5.00
b1958	Perform a sag study on the Brookside - Howard 138 kV line and replace bus and risers at AEP Howard station	AEP	$ 0.50
b1960	Sag Study on 7.2 miles SE Canton-Canton Central 138kV ckt	AEP	$ 0.30
b1961	Sag study on the Southeast Canton – Sunnyside 138kV line	AEP	$ 0.25
b1962	Add four 765 kV breakers at Kammer	AEP	$ 30.00
b1963	Build approximately 1 mile of circuit comprising of 2-954 ACSR to get the rating of Waterford-Muskinum 345 kV higher	AEP	$ 3.50
b1970	Reconductor 13 miles of the Kammer – West Bellaire 345kV circuit	AEP	$ 20.00
b1971	Perform a sag study to improve the emergency rating on the Bridgville – Chandlersville 138 kV line	AEP	$ 0.05
b1972	Replace disconnect switch on the South Canton 765/345 kV transformer	AEP	$ 0.30
b1973	Perform a sag study to improve the emergency rating on the Carrollton – Sunnyside 138 kV line	AEP	$ 0.05
b1974	Perform a sag study to improve the emergency rating on the Bethel Church – West Dover 138 kV line	AEP	$ 0.03
b1975	Replace a switch at South Millersburg switch station	AEP	$ 0.20
b1837	Replace breaker risers and wave traps at Marlowe 138 kV and wave traps at Bedington 138 kV	APS	$ 0.60
b1840	Install a new Buckhannon - Weston 138 kV line	APS	$ 17.50

Upgrade ID	Project Description	Transmission Owner	Cost Estimate
b1902	Replace line trap at Stonewall on the Stephenson 138 kV line terminal	APS	$ 0.08
b1941	Loop the Homer City-Handsome Lake 345 kV line into the Armstrong substation and install a 345/138 kV transformer at Armstrong	APS	$ 27.80
b1942	Change the CT ratio at Millville to improve the Millville – Old Chapel 138 kV line ratings	APS	$ 0.05
b1964	Convert Moshannon substation to a 4 breaker 230 kV ring bus	APS	$ 6.50
b1965	Install a 44 MVAR 138 kV capacitor at Luxor substation	APS	$ 1.50
b1986	Upgrade the AP portion of the Elrama – Mitchell 138 kV line by replace breaker risers on the Mitchell 138 kV bus on the Elrama terminal	APS	$ 0.05
b1987	Reconductor the Osage-Collins Ferry 138 kV line with 795 ACSS. Upgrade terminal equipment at Osage and Collins Ferry	APS	$ 1.80
b1988	Raise structures between Lake Lynn and West Run to eliminate the clearance de-rates on the West Run – Lake Lynn 138 kV line	APS	$ 0.32
b1989	Raise structures between Collins Ferry and West Run to eliminate the clearance de-rates on the Collins Ferry - West Run 138 kV line	APS	$ 0.32
b1913	Convert Eastlake units 1, 2, 3, 4 and 5 to synchronous condensers	ATSI	$ 100.00
b1914	Convert Lakeshore 18 to a synchronous condenser	ATSI	$ 20.00
b1915	Install a 50 MVAR capacitor bank at the Maclean 138 kV station	ATSI	$ 3.00
b1916	Install a 345/138 kV transformer at the Inland Q-11 station	ATSI	$ 7.20
b1917	Install a 138 kV circuit breaker at the Inland Q-11 station	ATSI	$ 0.90
b1918	Upgrade terminal equipment on the Avon – Crestwood 138 kV line	ATSI	$ 0.30
b1919	Re-conductor the Galion – Leaside 138 kV line with 336 ACSS	ATSI	$ 4.90
b1920	Re-conductor the Galion – GM Mansfield – Ontario - Cairns 138 kV line with 477 ACSS	ATSI	$ 9.80
b1921	Install a 2nd 345/138 kV transformer at the Allen Junction station	ATSI	$ 7.20
b1922	Install a 2nd 345/138 kV transformer at the Bayshore station	ATSI	$ 7.20
b1923	Create a new Northfield Area 345 kV switching station by looping in the Eastlake – Juniper 345 kV line and the Perry - Inland 345 kV line	ATSI	$ 37.50
b1924	Build a new Mansfield - Northfield Area 345 kV line	ATSI	$ 184.50
b1925	Create a new Harmon 345/138/69 kV substation by looping in the Star – South Canton 345 kV line	ATSI	$ 46.00
b1926	Build a new Harmon – Brookside + Harmon - Longview 138 kV line	ATSI	$ 9.20
b1927	Create a new Five Points Area 345/138 kV substation by looping in the Lemoyne – Midway 345 kV line	ATSI	$ 30.00
b1928	Install a 50 MVAR capacitor at Hayes 138 kV	ATSI	$ 1.50
b1929	Install a 138/69 kV transformer at the Avery station	ATSI	$ 3.20
b1930	Increase design temperature limitation on the Avery – Hayes 138 kV line by raising the existing structures	ATSI	$ 0.13
b1931	Reconductor Cloverdale - Harmon #2 and #3 138 kV lines with 795 ACSS or greater conductor 6 miles total + Terminal upgrades	ATSI	$ 3.60
b1932	Change the transformer tap settings on the Maclean 138/69 kV transformers	ATSI	$ 0.05
b1933	Replace 336.4 ACSR SCCIR at Richland to upgrade the Richland – Naomi 138 kV line	ATSI	$ 0.04

Upgrade ID	Project Description	Transmission Owner	Cost Estimate
b1934	Build a new 345/138 kV Substation at Niles	ATSI	$ 32.00
b1934.1	Loop 1.2 miles of 345 kV into substation of the Highland – Shenango 345 kV line	ATSI	
b1934.2	New 345/138 kV transformer at Niles	ATSI	
b1935	ATSI-AEP 138 kV Substation on near territory border + 138 kV from new substation to Longview approx. 8 miles	ATSI	$ 17.70
b1936	Build new Allen Jct - Midway - Lemonye 345 kV line (48 miles of open tower position)	ATSI	$ 86.30
b1937	Build a new Leroy Center 345/138 kV substation by looping in the Perry – Harding 345 kV line	ATSI	$ 46.00
b1938	Place a portion of the 138 kV Leroy Center 345/138 kV project into service by summer 2015	ATSI	$ 3.30
b1939	Reconductor the Barberton – West Akron 138 kV line with 477 ACSS or greater (7.3 miles) + Terminal upgrades at Barberton	ATSI	$ 4.23
b1959	Build a new West Fremont-Groton-Hayes 138kV line	ATSI	$ 45.00
b1976	Reconductor ATSI portion of South Canton – Harmon 345 kV line	ATSI	$ 6.00
b1977	Build new Toronto 345/138 kV substation by looping in the Sammis – Wylie Ridge 345 kV line and tie in four 138 kV lines	ATSI	$ 41.80
b1977.1	Build a new Toronto-Harmon 345kV line	ATSI	$ 218.30
b1978	Reconductor Inland – Clinic Health Q-11 138 kV line	ATSI	$ 1.10
b1981	Replace relay on the Highland – G689 138 kV line	ATSI	$ 0.05
b1982	Reconductor the Hoytdale – Newcastle 138 kV lines #1 and #2 with 795 ACSS	ATSI	$ 4.80
b1983	Add 150 MVAR SVC and a 100 MVAR capacitor at New Castle	ATSI	$ 31.70
b1984	Install a 50 MVAR capacitor at the Boardman 138 kV bus	ATSI	$ 1.70
b1968	Establish operating procedure such that breaker 89, connecting Cheswick-Logans Ferry Z-53 to the No. 3 138 kV bus at Cheswick Substation is normally open	DL	$ -
b1969	Install a third 345-138 kV autotransformer at Collier Substation. Currently s0321 and will be converted to baseline.	DL	$ 8.00
b1985	Upgrade the Duquesne portion of the Elrama – Mitchell 138 kV line	DL	
b1905.1	Surry to Skiffes Creek 500 kV Line (7 miles overhead)	Dominion	$ 58.30
b1905.2	Surry 500 kV Station Work	Dominion	$ 1.50
b1905.3	Skiffes Creek 500-230 kV Tx and Switching Station	Dominion	$ 42.40
b1905.4	New Skiffes Creek - Whealton 230 kV line	Dominion	$ 46.40
b1905.5	Whealton 230 kV breakers	Dominion	$ 2.10
b1905.6	Yorktown 230 kV work	Dominion	$ 0.20
b1905.7	Lanexa 115 kV work	Dominion	$ 0.13
b1905.8	Surry 230 kV work	Dominion	$ 0.13
b1905.9	Kings Mill, Peninmen, Toano, Waller, Warwick	Dominion	$ 0.03
b1906.1	At Yadkin 500 kV, install six 500 kV breakers	Dominion	$ 9.00
b1906.2	Install a 2nd 230/115 kV TX at Yadkin	Dominion	$ 5.00
b1906.3	Install a 2nd 230/115 kV TX at Chesapeake	Dominion	$ 5.00
b1906.4	Uprate Yadkin – Chesapeake 115 kV	Dominion	$ 10.00
b1906.5	Install a third 500/230 kV TX at Yadkin	Dominion	$ 16.00
b1907	Install a 3rd 500/230 kV TX at Clover	Dominion	$ 16.00

Upgrade ID	Project Description	Transmission Owner	Cost Estimate
b1908	Rebuild Lexington – Dooms 500 kV	Dominion	$ 120.00
b1909	Uprate Bremo – Midlothian 230 kV to its maximum operating temperature	Dominion	$ 10.00
b1910	Build a Suffolk – Yadkin 230 kV line (14 miles) and install 4 breakers	Dominion	$ 40.00
b1911	Add a second Valley 500/230 kV TX	Dominion	$ 16.00
b1912	Install a 500 MVAR SVC at Landstown 230 kV	Dominion	$ 60.00
b2003	Construct a Whippany to Montville 230 kV line (6.4 miles)	JCPL	$ 37.50
b1999	Replace limiting wave trap, circuit breaker, substation conductor, relay and current transformer components at Northwood	ME	$ 0.90
b2000	Replace limiting wave trap on the Glendon - Hosensack line	ME	$ 0.05
b2001	Replace limiting circuit breaker and substation conductor transformer components at Portland 230kV	ME	$ 0.40
b2002	Northwood 230/115 kV Transformer upgrade	ME	$ 4.00
b1943	Construct a 115 kV ring bus at Claysburg Substation. Bedford North and Saxton lines will no longer share a common breaker	PENELEC	$ 5.25
b1944	Reconductor Eclipse substation 115 kV bus with 1033 kcmil conductor.	PENELEC	$ 0.15
b1945	Install second 230/115 kV autotransformer at Johnstown	PENELEC	$ 4.50
b1966	Replace the 1200 Amp Line trap at Lewistown on the Raystown-Lewistown 230 kV line and replace substation conductor at Lewistown	PENELEC	$ 0.15
b1967	Replace the Blairsville 138/115 kV transformer	PENELEC	$ 4.20
b1990	Install a 25 MVAR 115 kV Capacitor at Grandview	PENELEC	$ 0.90
b1991	Construct Farmers Valley 345/230 kV and 230/115 kV substation. Loop the Homer City-Stolle Road 345 kV line into Farmers Valley	PENELEC	$ 29.50
b1992	Reconductor Cambria Slope-Summit 115kV with 795 ACSS Conductor	PENELEC	$ 4.80
b1993	Relocate the Erie South 345 kV line terminal	PENELEC	$ 13.00
b1994	Convert Lewis Run-Farmers Valley to 230 kV using 1033.5 ACSR conductor. Project to be completed in conjunction with new Farmers Valley 345/230 kV transformation	PENELEC	$ 46.80
b1995	Change CT Ratio at Claysburg	PENELEC	$ 0.00
b1996.1	Replace 600 Amp Disconnect Switches on Ridgeway-Whetstone 115 kV line with 1200 Amp Disconnects	PENELEC	$ 0.50
b1996.2	Reconductor Ridgway and Whetstone 115 kV Bus.	PENELEC	$ 0.20
b1996.3	Replace Wave Trap at Ridgway.	PENELEC	
b1996.4	Change CT Ratio at Ridgway	PENELEC	
b1997	Replace 600 Amp Disconnect Switches on Dubois-Harvey Run-Whetstone 115 kV line with 1200 Amp Disconnects	PENELEC	$ 0.20
b1998	Install a 75 MVAR 115 kV Capacitor at Shawville	PENELEC	$ 1.50
b2008	Reconductor feeder 23032 and 23034 to high temp. conductor (10 miles)	PEPCO	$ 16.00
b2004	Replace the CTs and switch in South Akron Bay 4 to increase the rating	PPL	$ 0.53
b2005	Replace the CTs and switch in SAKR Bay 3 to increase the rating of the Millwood-South Akron 230 kV Line and of the rating in Bay 3	PPL	$ 0.53
b2006	Install North Lancaster 500/230 kV substation	PPL	$ 42.00
b2007	Install a 90 MVAR capacitor bank at the Frackville 230 kV Substation	PPL	$ 3.00

Appendix: Baseline Cost Allocation

Upgrade ID	Description	Cost Estimate	Transmission Owner	Required IS Date
b1840	Install a new Buckhannon - Weston 138 kV line	$ 17.50	APS	6/1/2016
b1906.2	Install a 2nd 230/115 kV TX at Yadkin	$ 5.00	Dominion	6/1/2015
b1906.3	Install a 2nd 230/115 kV TX at Chesapeake	$ 5.00	Dominion	6/1/2015
b1906.4	Uprate Yadkin – Chesapeake 115 kV	$ 10.00	Dominion	6/1/2015
b1906.5	Install a third 500/230 kV TX at Yadkin	$ 16.00	Dominion	6/1/2016
b1910	Build a Suffolk – Yadkin 230 kV line (14 miles) and install 4 breakers	$ 40.00	Dominion	6/1/2016
b1913	Convert Eastlake units 1, 2, 3, 4 and 5 to synchronous condensers	$ 100.00	ATSI	6/1/2015
b1914	Convert Lakeshore 18 to a synchronous condenser	$ 20.00	ATSI	6/1/2015
b1915	Install a 50 MVAR capacitor bank at the Maclean 138 kV station	$ 3.00	ATSI	6/1/2013
b1916	Install a 345/138 kV transformer at the Inland Q-11 station	$ 7.20	ATSI	6/1/2013
b1917	Install a 138 kV circuit breaker at the Inland Q-11 station	$ 0.90	ATSI	6/1/2013
b1918	Upgrade terminal equipment on the Avon – Crestwood 138 kV line	$ 0.30	ATSI	6/1/2013
b1919	Re-conductor the Galion – Leaside 138 kV line with 336 ACSS	$ 4.90	ATSI	6/1/2014
b1921	Install a 2nd 345/138 kV transformer at the Allen Junction station	$ 7.20	ATSI	6/1/2014
b1922	Install a 2nd 345/138 kV transformer at the Bayshore station	$ 7.20	ATSI	6/1/2014
b1923	Create a new Northfield Area 345 kV switching station by looping in	$ 37.50	ATSI	6/1/2015
b1924	Build a new Mansfield - Northfield Area 345 kV line	$ 184.50	ATSI	6/1/2015
b1925	Create a new Harmon 345/138/69 kV substation by looping in the Star	$ 46.00	ATSI	6/1/2015
b1926	Build a new Harmon – Brookside + Harmon - Longview 138 kV line	$ 9.20	ATSI	6/1/2015
b1927	Create a new Five Points Area 345/138 kV substation by looping in	$ 30.00	ATSI	6/1/2015
b1928	Install a 50 MVAR capacitor at Hayes 138 kV	$ 1.50	ATSI	6/1/2015
b1929	Install a 138/69 kV transformer at the Avery station	$ 3.20	ATSI	6/1/2015
b1930	Increase design temperature limitation on the Avery – Hayes 138 kV	$ 0.13	ATSI	6/1/2015
b1931	Reconductor Cloverdale - Harmon #2 and #3 138 kV lines with 795	$ 3.60	ATSI	6/1/2015
b1932	Change the transformer tap settings on the Maclean 138/69 kV	$ 0.05	ATSI	6/1/2015
b1933	Replace 336.4 ACSR SCCIR at Richland to upgrade the Richland –	$ 0.04	ATSI	6/1/2015
b1934	Build a new 345/138 kV Substation at Niles	$ 32.00	ATSI	6/1/2015
b1934.1	Loop 1.2 miles of 345 kV into substation of the Highland – Shenango		ATSI	6/1/2015
b1934.2	New 345/138 kV transformer at Niles		ATSI	6/1/2015
b1936	Build new Allen Jct - Midway - Lemonye 345 kV line (48 miles of open	$ 86.30	ATSI	6/1/2016
b1937	Build a new Leroy Center 345/138 kV substation by looping in the	$ 46.00	ATSI	6/1/2016
b1938	Place a portion of the 138 kV Leroy Center 345/138 kV project into	$ 3.30	ATSI	6/1/2015
b1939	Reconductor the Barberton – West Akron 138 kV line with 477 ACSS	$ 4.23	ATSI	6/1/2016
b1942	Change the CT ratio at Millville to improve the Millville – Old Chapel 138	$ 0.05	APS	6/1/2015
b1943	Construct a 115 kV ring bus at Claysburg Substation. Bedford North	$ 5.25	PENELEC	6/1/2015
b1944	Reconductor Eclipse substation 115 kV bus with 1033 kcmil	$ 0.15	PENELEC	6/1/2013
b1945	Install second 230/115 kV autotransformer at Johnstown	$ 4.50	PENELEC	6/1/2015
b1946	Perform a sag study on the Brues – West Bellaire 138 kV line	$ 0.03	AEP	12/1/2014
b1947	A sag study of the Dequine - Meadowlake 345 kV line #1 line may improve the emergency rating to 1400 MVA	$ 0.01	AEP	12/1/2013
b1949	Perform a sag study on the Grant Tap – Deer Creek 138 kV line and replace bus and risers at Deer Creek station	$ 0.30	AEP	12/1/2014

Upgrade ID	Description	Cost Estimate	Transmission Owner	Required IS Date
b1950	Perform a sag study on the Kammer – Ormet 138 kV line of the conductor section	$ 0.10	AEP	12/1/2012
b1951	Perform a sag study of the Maddox- Convoy 345 kV line to improve the emergency rating to 1400 MVA	$ 0.03	AEP	12/1/2013
b1952	Perform a sag study of the Maddox – T130 345 kV line to improve the emergency rating to 1400 MVA	$ 0.03	AEP	12/1/2013
b1953	Perform a sag study of the Meadowlake - Olive 345 kV line to improve the emergency rating to 1400 MVA	$ 0.06	AEP	12/1/2013
b1954	Perform a sag study on the Milan - Harper 138 kV line and replace bus and switches at Milan Switch station	$ 0.35	AEP	12/1/2014
b1955	Perform a sag study of the R-049 - Tillman 138 kV line may improve the emergency rating to 245 MVA	$ 0.25	AEP	12/1/2014
b1956	Perform a sag study of the Tillman - Dawkins 138 kV line may improve the emergency rating to 245 MVA	$ 0.25	AEP	12/1/2013
b1958	Perform a sag study on the Brookside - Howard 138 kV line and replace bus and risers at AEP Howard station	$ 0.50	AEP	12/1/2014
b1960	Sag Study on 7.2 miles SE Canton-Canton Central 138kV ckt	$ 0.30	AEP	12/1/2012
b1961	Sag study on the Southeast Canton – Sunnyside 138kV line	$ 0.25	AEP	12/1/2012
b1963	Build approximately 1 mile of circuit comprising of 2-954 ACSR to get the rating of Waterford-Muskinum 345 kV higher	$ 3.50	AEP	12/1/2013
b1965	Install a 44 MVAR 138 kV capacitor at Luxor substation	$ 1.50	APS	6/1/2014
b1966	Replace the 1200 Amp Line trap at Lewistown on the Raystown-	$ 0.15	PENELEC	12/1/2013
b1967	Replace the Blairsville 138/115 kV transformer	$ 4.20	PENELEC	6/1/2014
b1968	Establish operating procedure such that breaker 89, connecting	$ -	DL	6/1/2012
b1971	Perform a sag study to improve the emergency rating on the Bridgville – Chandlersville 138 kV line	$ 0.05	AEP	12/1/2014
b1972	Replace disconnect switch on the South Canton 765/345 kV transformer	$ 0.30	AEP	12/1/2014
b1973	Perform a sag study to improve the emergency rating on the Carrollton – Sunnyside 138 kV line	$ 0.05	AEP	12/1/2014
b1974	Perform a sag study to improve the emergency rating on the Bethel Church – West Dover 138 kV line	$ 0.03	AEP	12/1/2014
b1975	Replace a switch at South Millersburg switch station	$ 0.20	AEP	12/1/2014
b1978	Reconductor Inland – Clinic Health Q-11 138 kV line	$ 1.10	ATSI	6/1/2015
b1981	Replace relay on the Highland – G689 138 kV line	$ 0.05	ATSI	12/31/2012
b1982	Reconductor the Hoytdale – Newcastle 138 kV lines #1 and #2 with	$ 4.80	ATSI	6/1/2015
b1983	Add 150 MVAR SVC and a 100 MVAR capacitor at New Castle	$ 31.70	ATSI	6/1/2015
b1984	Install a 50 MVAR capacitor at the Boardman 138 kV bus	$ 1.70	ATSI	6/1/2015
b1985	Upgrade the Duquesne portion of the Elrama – Mitchell 138 kV line	TBD	DL	4/16/2015
b1986	Upgrade the AP portion of the Elrama – Mitchell 138 kV line by replace	$ 0.05	APS	6/1/2015
b1987	Reconductor the Osage-Collins Ferry 138 kV line with 795 ACSS.	$ 1.80	APS	6/1/2015
b1988	Raise structures between Lake Lynn and West Run to eliminate the	$ 0.32	APS	6/1/2015
b1989	Raise structures between Collins Ferry and West Run to eliminate the	$ 0.32	APS	6/1/2015

Upgrade ID	Description	Cost Estimate	Transmission Owner	Required IS Date
b1990	Install a 25 MVAR 115 kV Capacitor at Grandview	$ 0.90	PENELEC	6/1/2015
b1991	Construct Farmers Valley 345/230 kV and 230/115 kV substation.	$ 29.50	PENELEC	6/1/2015
b1992	Reconductor Cambria Slope-Summit 115kV with 795 ACSS Conductor	$ 4.80	PENELEC	6/1/2015
b1995	Change CT Ratio at Claysburg	$ 0.00	PENELEC	6/1/2015
b1996.1	Replace 600 Amp Disconnect Switches on Ridgeway-Whetstone 115	$ 0.50	PENELEC	6/1/2015
b1996.2	Reconductor Ridgway and Whetstone 115 kV Bus.	$ 0.20	PENELEC	6/1/2015
b1996.3	Replace Wave Trap at Ridgway.		PENELEC	6/1/2015
b1996.4	Change CT Ratio at Ridgway		PENELEC	6/1/2015
b1997	Replace 600 Amp Disconnect Switches on Dubois-Harvey Run-	$ 0.20	PENELEC	6/1/2015
b1998	Install a 75 MVAR 115 kV Capacitor at Shawville	$ 1.50	PENELEC	6/1/2015
b1999	Replace limiting wave trap, circuit breaker, substation conductor,	$ 0.90	ME	6/1/2015
b2000	Replace limiting wave trap on the Glendon - Hosensack line	$ 0.05	ME	6/1/2015
b2001	Replace limiting circuit breaker and substation conductor transformer	$ 0.40	ME	6/1/2015
b2002	Northwood 230/115 kV Transformer upgrade	$ 4.00	ME	6/1/2015
b2003	Construct a Whippany to Montville 230 kV line (6.4 miles)	$ 37.50	JCPL	6/1/2015
b2004	Replace the CTs and switch in South Akron Bay 4 to increase the	$ 0.53	PPL	6/1/2014
b2005	Replace the CTs and switch in SAKR Bay 3 to increase the rating of	$ 0.53	PPL	6/1/2014
b2007	Install a 90 MVAR capacitor bank at the Frackville 230 kV Substation	$ 3.00	PPL	6/1/2015

Upgrade ID	Description	Multi-Zone Cost Allocation	Required IS Date
b1905.1	Surry to Skiffes Creek 500 kV Line (7 miles overhead)	AEC - 1.83%, AEP - 15.12%, APS - 5.53%, ATSI - 8.65%, BGE - 4.46%, ComEd - 14.64%, ConEd - 0.55%, Dayton - 2.21%, DL - 1.85%, DPL - 2.61%, Dominion - 12.38%, ECP - 0.19%, JCPL - 4.07%, ME - 1.92%, Neptune - 0.41%, PECO - 5.54%, PENELEC - 1.93%, PEPCO - 4.33%, PPL - 4.77%, PSEG - 6.74%, RE - 0.27%,	6/1/2015
b1905.2	Surry 500 kV Station Work	AEC - 1.83%, AEP - 15.12%, APS - 5.53%, ATSI - 8.65%, BGE - 4.46%, ComEd - 14.64%, ConEd - 0.55%, Dayton - 2.21%, DL - 1.85%, DPL - 2.61%, Dominion - 12.38%, ECP - 0.19%, JCPL - 4.07%, ME - 1.92%, Neptune - 0.41%, PECO - 5.54%, PENELEC - 1.93%, PEPCO - 4.33%, PPL - 4.77%, PSEG - 6.74%, RE - 0.27%,	6/1/2015
b1905.3	Skiffes Creek 500-230 kV Tx and Switching Station	Dominion - 99.84%, PEPCO - 0.16%,	6/1/2015
b1905.4	New Skiffes Creek - Whealton 230 kV line	Dominion - 99.84%, PEPCO - 0.16%,	6/1/2016
b1905.5	Whealton 230 kV breakers	Dominion - 99.84%, PEPCO - 0.16%,	6/1/2016
b1905.6	Yorktown 230 kV work	Dominion - 99.84%, PEPCO - 0.16%,	6/1/2016
b1905.7	Lanexa 115 kV work	Dominion - 99.84%, PEPCO - 0.16%,	6/1/2016
b1905.8	Surry 230 kV work	Dominion - 99.84%, PEPCO - 0.16%,	6/1/2016
b1905.9	Kings Mill, Peninmen, Toano, Waller, Warwick	Dominion - 99.84%, PEPCO - 0.16%,	6/1/2016
b1906.1	At Yadkin 500 kV, install six 500 kV breakers	AEC - 1.83%, AEP - 15.12%, APS - 5.53%, ATSI - 8.65%, BGE - 4.46%, ComEd - 14.64%, ConEd - 0.55%, Dayton - 2.21%, DL - 1.85%, DPL - 2.61%, Dominion - 12.38%, ECP - 0.19%, JCPL - 4.07%, ME - 1.92%, Neptune - 0.41%, PECO - 5.54%, PENELEC - 1.93%, PEPCO - 4.33%, PPL - 4.77%, PSEG - 6.74%, RE - 0.27%,	6/1/2016
b1907	Install a 3rd 500/230 kV TX at Clover	APS - 5.83%, BGE - 4.74%, Dominion - 81.79%, PEPCO - 7.64%,	6/1/2016

Upgrade ID	Description	Multi-Zone Cost Allocation	Required IS Date
b1908	Rebuild Lexington – Dooms 500 kV	AEC - 1.83%, AEP - 15.12%, APS - 5.53%, ATSI - 8.65%, BGE - 4.46%, ComEd - 14.64%, ConEd - 0.55%, Dayton - 2.21%, DL - 1.85%, DPL - 2.61%, Dominion - 12.38%, ECP - 0.19%, JCPL - 4.07%, ME - 1.92%, Neptune - 0.41%, PECO - 5.54%, PENELEC - 1.93%, PEPCO - 4.33%, PPL - 4.77%, PSEG - 6.74%, RE - 0.27%,	6/1/2016
b1909	Uprate Bremo – Midlothian 230 kV to its maximum operating temperature	APS - 6.31%, BGE - 3.81%, Dominion - 81.9%, PEPCO - 7.98%,	6/1/2016
b1911	Add a second Valley 500/230 kV TX	APS - 14.85%, BGE - 3.1%, Dominion - 74.12%, PEPCO - 7.93%,	6/1/2016
b1912	Install a 500 MVAR SVC at Landstown 230 kV	DEOK - 0.46%, Dominion - 99.54%,	6/1/2016
b1920	Re-conductor the Galion – GM Mansfield – Ontario - Cairns 138 kV line with 477 ACSS	ATSI - 94.47%, DL - 2.9%, PENELEC - 2.63%,	6/1/2014
b1935	ATSI-AEP 138 kV Substation on near territory border + 138 kV from new substation to Longview approx. 8 miles	ATSI - 94.9%, DL - 2.97%, PENELEC - 2.13%,	
b1941	Loop the Homer City-Handsome Lake 345 kV line into the Armstrong substation and install a 345/138 kV transformer at Armstrong	APS - 67.86%, PENELEC - 32.14%,	6/1/2014
b1948	Establish a new 765/345 interconnection at Sporn. Install a 765/345 kV transformer at Mountaineer and build ¾ mile of 345 kV to Sporn	ATSI - 61.08%, DL - 21.87%, Dominion - 13.97%, PENELEC - 3.08%,	6/1/2015
b1957	Terminate Transformer #2 at SW Lima in a new bay position	AEP - 69.41%, ATSI - 23.11%, ECP - 0.17%, HTP - 0.19%, PENELEC - 2.42%, PSEG - 4.52%, RE - 0.18%,	12/1/2014
b1959	Build a new West Fremont-Groton-Hayes 138kV line	APS - 4.24%, ATSI - 87.76%, DL - 4.27%, PENELEC - 3.73%,	6/1/2018

Upgrade ID	Description	Multi-Zone Cost Allocation	Required IS Date
b1962	Add four 765 kV breakers at Kammer	AEC - 1.83%, AEP - 15.12%, APS - 5.53%, ATSI - 8.65%, BGE - 4.46%, ComEd - 14.64%, ConEd - 0.55%, Dayton - 2.21%, DL - 1.85%, DPL - 2.61%, Dominion - 12.38%, ECP - 0.19%, JCPL - 4.07%, ME - 1.92%, Neptune - 0.41%, PECO - 5.54%, PENELEC - 1.93%, PEPCO - 4.33%, PPL - 4.77%, PSEG - 6.74%, RE - 0.27%,	6/1/2015
b1964	Convert Moshannon substation to a 4 breaker 230 kV ring bus	APS - 41.06%, DPL - 6.68%, JCPL - 5.48%, ME - 10.7%, Neptune - 0.53%, PECO - 15.53%, PPL - 20.02%,	6/1/2014
b1969	Install a third 345-138 kV autotransformer at Collier Substation. Currently s0321 and will be converted to baseline.	APS - 18.69%, DL - 81.31%,	6/1/2013
b1970	Reconductor 13 miles of the Kammer – West Bellaire 345kV circuit	APS - 33.51%, ATSI - 32.21%, DL - 18.64%, Dominion - 6.01%, ECP - 0.1%, HTP - 0.11%, JCPL - 1.68%, Neptune - 0.18%, PENELEC - 4.58%, PSEG - 2.87%, RE - 0.11%,	6/1/2014
b1976	Reconductor ATSI portion of South Canton – Harmon 345 kV line	ATSI - 88.77%, ECP - 0.12%, HTP - 0.14%, JCPL - 1.24%, Neptune - 0.13%, PENELEC - 6.54%, PSEG - 2.94%, RE - 0.12%,	6/1/2015
b1977	Build new Toronto 345/138 kV substation by looping in the Sammis – Wylie Ridge 345 kV line and tie in four 138 kV lines	APS - 7%, ATSI - 88.14%, DL - 0.81%, PENELEC - 4.05%,	6/1/2017
b1977.1	Build a new Toronto-Harmon 345kV line	APS - 7%, ATSI - 88.14%, DL - 0.81%, PENELEC - 4.05%,	6/1/2017
b1993	Relocate the Erie South 345 kV line terminal	APS - 10.09%, ECP - 0.45%, HTP - 0.49%, JCPL - 5.14%, Neptune - 0.54%, PENELEC - 70.71%, PSEG - 12.1%, RE - 0.48%,	6/1/2015
b1994	Convert Lewis Run-Farmers Valley to 230 kV using 1033.5 ACSR conductor. Project to be completed in conjunction with new Farmers Valley 345/230 kV transformation	APS - 33.2%, ECP - 0.44%, HTP - 0.44%, JCPL - 8.64%, ME - 5.52%, Neptune - 0.86%, PENELEC - 36.81%, PSEG - 13.55%, RE - 0.54%,	6/1/2015
b2006	Install North Lancaster 500/230 kV substation	AEC - 1.1%, ECP - 0.37%, HTP - 0.37%, JCPL - 9.61%, ME - 19.42%, Neptune - 0.75%, PECO - 6.01%, PPL - 50.57%, PSEG - 11.35%, RE - 0.45%,	6/1/2017
b2008	Reconductor feeder 23032 and 23034 to high temp. conductor (10 miles)	BGE - 33.05%, DPL - 1.38%, PECO - 1.35%, PEPCO - 64.22%,	6/1/2015