

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

PJM Staff Whitepaper
December 2011

SUMMARY OF APPROVAL

On December 6, 2011 the PJM Board of Managers approved changes to the Regional Transmission Expansion Plan (RTEP), totaling \$620.24 million of baseline project changes. The PJM Board deferred a decision on the proposed SVCs at the Hunterstown, Meadow Brook, and Mt. Storm – Valley locations until the next PJM Board meeting in February 2012.

EXECUTIVE SUMMARY

Since the Board's last approval, PJM has completed further baseline analyses which identified additional baseline reliability criteria violations in the 2012 - 2026 time-frame. Transmission system upgrades to resolve the reliability criteria violations were identified. Among these baseline upgrades are a number of reactive upgrades including capacitors and Static Var Compensators (SVC) to address significant voltage violations for NERC category C3 (N-1-1) contingencies. In addition, the costs associated with a number of previously approved baseline upgrades were updated.

With these changes, the RTEP includes over \$21,330 million of transmission additions and upgrades since the first plan was approved by the Board in 2000.

SUMMARY OF RESULTS

2011 Baseline Transmission Upgrades Changes and Additions

One aspect of the development of the RTEP 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 Subregional RTEP Committees and the Transmission Expansion Advisory Committee (TEAC). The cost of transmission upgrades to mitigate such criteria violations are allocated to network load.

The baseline analysis, discussed herein, resulted in the need for transmission upgrades in several transmission zones. A summary of the major baseline project additions that are \$5 million or greater are detailed below.

Mid-Atlantic Region System Upgrades

- BGE Transmission Zone
 - Install 115kV tie breakers at Melvale - \$20 M

- ME Transmission Zone
 - ~~Build a 500 MVAR SVC at Hunterstown 500 kV - \$82 M~~ (PJM Board decision deferred until February 2012)
 - Build a 250 MVAR SVC at Altoona 230 kV - \$43 M

- PECO Transmission Zone
 - Install a second Waneeta 230/138 kV transformer on a separate bus section - \$6.5 M
- PENELEC Transmission Zone
 - Build a 100 MVAR Fast Switched Shunt and 200 MVAR Switched Shunt at Mansfield 345 kV - \$6.1M
- PPL Transmission Zone
 - Install a 3rd West Shore 230/69 kV transformer - \$9 M
 - Build a new Paupack - North 230 kV line (Approximately 21 miles) - \$37.1 M
 - Build a new 230-69 kV substations (Paupack) - \$19.5 M
 - Upgrade Sunbury T22 and T23 transformers to 170 MVA each - \$8.68 M
- PSE&G Transmission Zone
 - Build a second 230 kV circuit from Cox's Corner – Lumberton - \$46 M

Western Region System Upgrades

- American Electric Power
 - Rebuild 4 miles of 46 kV line to 138 kV from Pemberton to Cherry Creek - \$5 M
 - Install a new 765/138 kV transformer at Jackson Ferry substation - \$40 M
 - Install a second 138/69 kV transformer at Thelma station - \$12 M
 - Build an 8 breaker 138 kV station tapping both circuits of the Fostoria - East Lima 138 kV line - \$10 M
 - Establish Melmore as a switching station with both 138 kV circuits terminating at Melmore. Extend the double circuit 138 kV line from Melmore to Fremont Center - \$18 M
 - Install four 138 kV breakers in Danville area - \$5 M
- APS Transmission Zone
 - Build a 300 MVAR Switched Shunt at Doubs 500 kV and increase the existing Switched Shunt at Doubs 500 kV by ~50 MVAR - \$11.3 M
- ATSI Transmission Zone
 - Replace the Star 345/138 kV #3 transformer with a larger unit - \$5 M
- ComEd Transmission Zone
 - Reconductor approximately 16 miles of the Nelson to Electric Junction 345 kV line and replace associated terminal equipment - \$16.3 M
 - Reconductor approximately 12.51 miles of the East Frankfort - Crete 345 kV line - \$10M
 - Reconductor approximately 11.75 miles of the Crete - St. John 345 kV line - \$9.5 M
 - Reconductor 10.7 miles of the Marengo - Pleasant Valley 138 kV line and replace associated terminal and protective equipment - \$8.5 M
 - Reconductor approximately 11.5 miles of the Marengo - Woodstock 138 kV line and replace associated terminal equipment - \$8.85 M
 - Reconductor 7.2 miles of Steward – Haumesser 138 kV and upgrade station conductor at TSS 186 Steward - \$11.4 M
 - Reconductor 5.2 miles of the Kickapoo Creek - Marseilles Tap 138 kV line - \$8.3 M
- Primary Power Upgrades

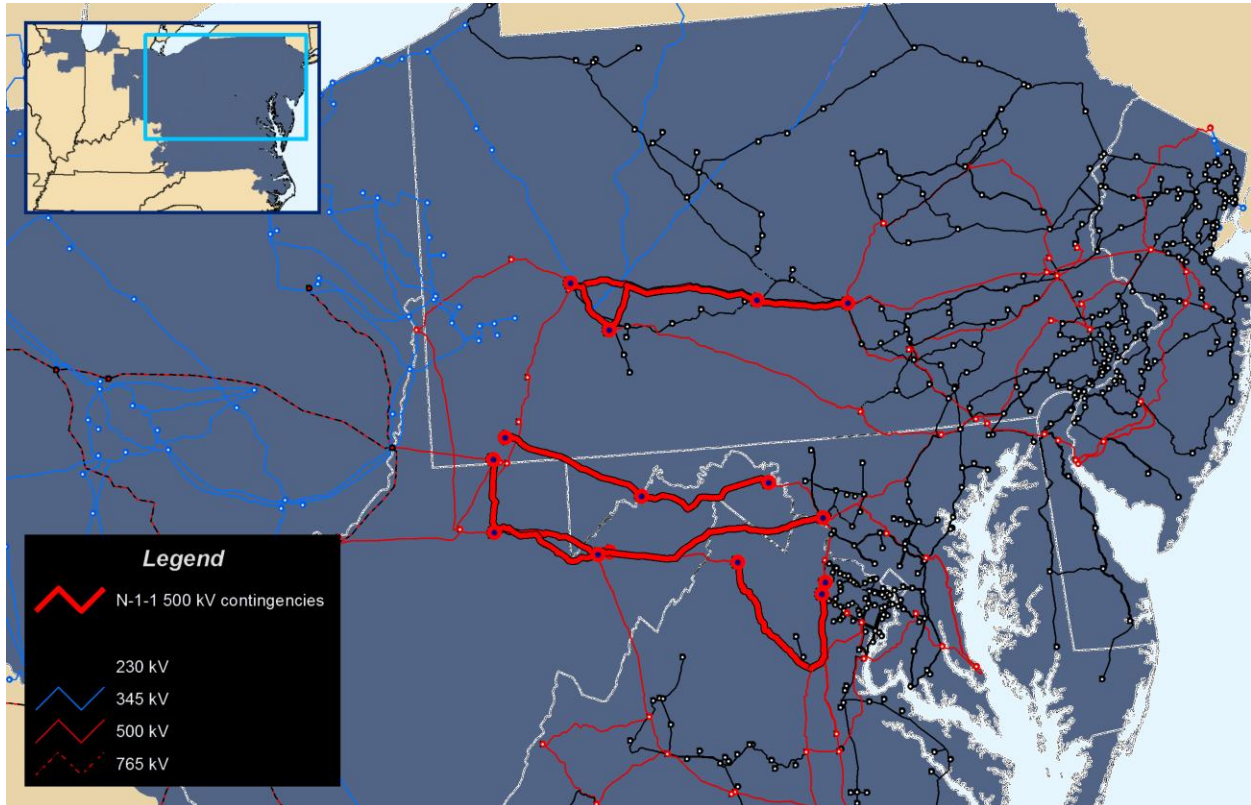
- ~~— Build a 600 MVAR SVC at Meadow Brook 500 kV - \$100 M (PJM Board decision deferred until February 2012)~~
- ~~— Build a 250 MVAR SVC at a new station on the existing Mt. Storm - Valley 500 kV transmission facility - \$50 M (PJM Board decision deferred until February 2012)~~

Southern Region System Upgrades

- Dominion Virginia Power Transmission Zone
 - Rebuild a 2.1 mile section of line between Gordonsville and Somerset - \$5.25 M
 - Rebuild Halifax to Chase City 230 line. Install 230 kV 4 breaker ring bus - \$26 M
 - Rebuild remaining section of Line #22 from Eatons Ferry to Carolina 115 kV, - \$25 M
 - Split Hornertown - Rocky Mount 230 kV Line and tap line to Battleboro Substation. Expand station, install a 230 kV 3 breaker ring bus and install a 230/115 kV transformer - \$8 M
 - Reconnector segment of Carolina to Woodland 115 kV - \$18 M
 - Rebuild 7 miles of the Dominion owned section of Cloverdale - Lexington 500 kV - \$18 M
 - Build a 450 MVAR SVC and 300 MVAR switched shunt at Loudoun 500 kV - \$70 M
 - Build 150 MVAR Switched Shunt at Pleasant View 500 kV - \$6 M

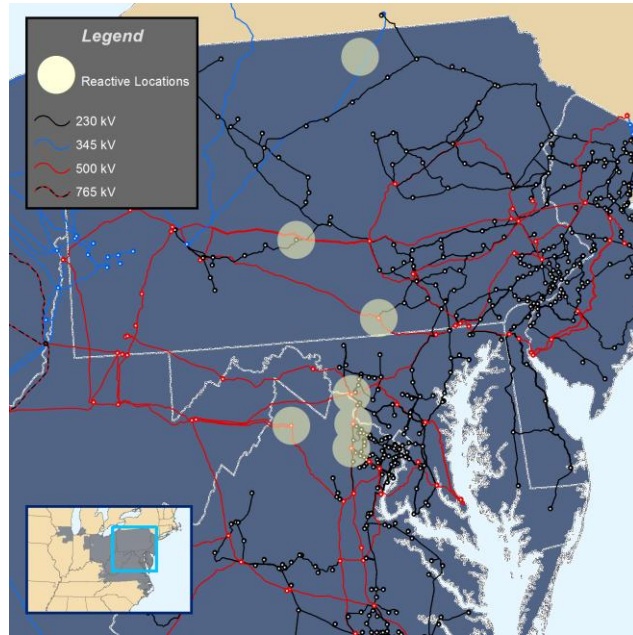
Reactive Upgrades

The 2011 RTEP has identified the need for reactive reinforcement to address a number of voltage violations identified for NERC category C3 (N-1-1) events. The N-1-1 test includes simulating a contingency, adjusting the system to prepare for the next contingency and then simulating a second contingency. The 2011 RTEP analyses identified widespread voltage violations for the loss of various combinations of 500 kV lines in the eastern half of PJM. Specifically combinations of the 500 kV lines hi-lighted in the map below resulted in widespread voltage violations and in some instances voltage collapse.



The lines hi-lighted on the map are major west to east 500 kV transmission lines. The loss of one of these lines will result in the flow increasing on the remaining facilities. In addition, reactive losses increase resulting in lower voltages as many of the lines are heavily loaded, in some instances well beyond the surge impedance loading of the line. The loss of the next facility (as part of the N-1-1 criteria) would further exacerbate these issues.

A combination of static capacitors, fast-switched shunt capacitors and SVCs were recommended to address the voltage violations. The locations of the reactive reinforcements are shown in the figure at the right and summarized in the table below. SVCs were recommended at a number of the locations. The basis for recommending an SVC at some of the locations was based in part on addressing the criteria violations as well as to address operational performance issues including high voltages during light load conditions as well as the loss of dynamic reactive capability due to generation deactivations.



The incidence of high voltages during light load conditions has been increasing. Operations has managed the high voltage conditions by removing switched capacitors, having on-line generation absorb reactive power and in some instances taking EHV transmission out of service to reduce line charging effects. The SVCs are being recommended in part because of their ability to absorb reactive power during light load conditions.

In addition to helping to address high voltage conditions the SVCs were also recommended to increase the amount of dynamic reactive capability on the system. Today the vast majority of the dynamic reactive capability on the system is provided by on-line generation. Given recent generation deactivations as well as the deactivations that are likely to occur due to compliance with new environmental regulations, the dynamic reactive capability of the system is expected to decrease. The SVCs will help to off-set the loss in dynamic reactive capability.

Location	Recommended Reinforcement*	Required In-service Date
Altoona 230 kV	250 MVAR SVC	<p>6/1/2014</p> <p>The required in-service dates will be adjusted pending detailed analysis of 2014-2016 period.</p>
Doubs 500 kV	300 MVAR switched shunt and an increase (~50 MVAR) in size of existing switched shunt	
Hunterstown 500 kV	500 MVAR SVC	
Loudoun 500 kV	450 MVAR SVC and 300 MVAR switched shunt	
Mansfield 345 kV	100 MVAR FSS and two 100 MVAR switched shunt	
Meadow Brook 500 kV	600 MVAR SVC	
Mt. Storm - Valley 500 kV	250 MVAR SVC	
Pleasant View 500 kV	150 MVAR switched shunt	



PJM staff recommended the upgrades shown in the table above be built by a combination of existing transmission owners as well as a non-incumbent transmission owner. First Energy was recommended as the entity responsible for building and operating the Altoona, Doubs, Hunterstown and Mansfield reactive upgrades. Dominion Virginia Power was recommended as the entity responsible for building and operating the Loudoun and Pleasant View reactive upgrades. Primary Power LLC was recommended as the entity responsible for building and operating the reactive upgrades at Meadow Brook and on the Mt. Storm – Valley 500 kV line.

Changes to Previously Approved Baseline Projects

The costs associated with a number of previously approved RTEP baseline projects were also updated. This resulted in a net decrease in cost of \$17 million.

Status of Generation Interconnection Queues

RTEP Status of Generation Interconnection Queues

Queue	Queue Open Date	Queue Close Date	Active	Under Construction	In-Service*	Withdrawn	Suspended	Total MW Request**
A	04/01/1994	01/31/1999	0	0	8,103	17,252	0	25,355
B	02/01/1999	11/30/1999	0	0	4,646	15,833	0	20,478
C	12/01/1999	03/31/2000	0	0	531	4,151	0	4,682
D	04/01/2000	07/31/2000	0	0	851	7,770	0	8,621
E	08/01/2000	11/30/2000	0	0	795	16,887	0	17,682
F	12/01/2000	01/31/2001	0	0	52	3,093	0	3,145
G	02/01/2001	07/31/2001	0	555	1,086	21,460	0	23,101
H	08/01/2001	01/31/2002	0	0	703	8,422	0	9,124
I	02/01/2002	07/31/2002	0	0	103	3,738	0	3,841
J	08/01/2002	01/31/2003	0	0	40	846	0	886
K	02/01/2003	07/31/2003	0	150	29	371	0	550
L	08/01/2003	01/31/2004	20	0	257	3,649	165	4,290
M	02/01/2004	07/31/2004	0	0	505	3,556	272	4,332
N	08/01/2004	01/31/2005	1,377	173	2,143	6,603	110	10,407
O	02/01/2005	07/31/2005	1,166	872	1,471	3,918	164	7,592
P	08/01/2005	01/31/2006	513	655	2,625	4,823	85	8,701
Q	02/01/2006	07/31/2006	1,109	3,478	1,384	8,293	350	14,614
R	08/01/2006	01/31/2007	4,587	1,133	841	16,174	20	22,755
S	02/01/2007	07/31/2007	2,337	945	2,618	10,431	512	16,843
T	08/01/2007	01/31/2008	11,425	471	927	14,105	740	27,667
U1	02/01/2008	04/30/2008	1,021	80	114	6,944	0	8,158
U2	05/01/2008	07/31/2008	2,482	218	53	14,088	340	17,180
U3	08/01/2008	10/31/2008	221	313	1	2,433	0	2,968
U4	11/01/2008	01/31/2009	2,571	0	39	2,401	110	5,121
V1	02/01/2009	04/30/2009	1,983	156	74	608	0	2,821
V2	05/01/2009	07/31/2009	2,699	987	33	920	0	4,639
V3	08/01/2009	10/31/2009	2,821	69	20	2,037	10	4,956
V4	11/01/2009	01/31/2010	3,363	595	13	1,109	0	5,078
W1	02/01/2010	04/30/2010	1,510	211	1	3,947	28	5,698
W2	05/01/2010	07/31/2010	2,693	239	2	476	0	3,410
W3	08/01/2010	10/31/2010	5,961	273	6	3,130	0	9,371
W4	11/01/2010	01/31/2011	5,281	35	0	461	0	5,777
X1	02/01/2011	04/30/2011	7,049	76	0	333	0	7,458
X2	05/01/2011	07/31/2011	10,816	0	0	54	0	10,870
X3	08/01/2011	10/31/2011	6,194	0	0	6	0	6,200
X4	11/01/2011	01/31/2012	221	0	0	0	0	221
TOTAL			78,420	11,684	30,088	210,622	2,908	334,692

* 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

Review by the Transmission Expansion Advisory Committee (TEAC)

The results of the 2011 RTEP baseline analysis were reviewed with the TEAC on November 3, 2011. Written comments were requested to be submitted to PJM communicating any concerns with the 2011 RTEP Baseline and any alternative transmission solutions for consideration. Formal comments were received from Dominion Virginia Power, Baltimore Gas and Electric, Old Dominion Electric Cooperative and First Energy.

Cost Allocation

Cost allocations for the baseline upgrades described in this report are summarized in the attached sheets.

Board Approval

As noted above, the PJM Board approved all of these projects with the exception of the Hunterstown SVC, Meadow Brook SVC and the SVC at the U2-086 substation on the Mt Storm to Valley 500 kV line. Given the issues raised by stakeholders in the letters submitted prior to their meeting, the Board requested PJM staff to address the concerns raised and provide a recommendation to the Board at their February meeting.

The following allocations are single-zone allocations

Upgrade ID	Description	Cost Estimate	Cost Allocation - 100%
b1659.1	Replace Sorenson 138 kV breaker 'L1'	\$ 0.80	AEP
b1659.10	Replace Sorenson 138 kV breaker 'N'	\$ 0.80	AEP
b1659.11	Replace Sorenson 138 kV breaker 'O'	\$ 0.80	AEP
b1659.12	Replace McKinley 138 kV breaker 'L1'	\$ 0.80	AEP
b1659.2	Replace Sorenson 138 kV breaker 'L2'	\$ 0.80	AEP
b1659.3	Replace Sorenson 138 kV breaker 'M1'	\$ 0.80	AEP
b1659.4	Replace Sorenson 138 kV breaker 'M2'	\$ 0.80	AEP
b1659.5	Replace Sorenson 138 kV breaker 'N1'	\$ 0.80	AEP
b1659.6	Replace Sorenson 138 kV breaker 'N2'	\$ 0.80	AEP
b1659.7	Replace Sorenson 138 kV breaker 'O1'	\$ 0.80	AEP
b1659.8	Replace Sorenson 138 kV breaker 'O2'	\$ 0.80	AEP
b1659.9	Replace Sorenson 138 kV breaker 'M'	\$ 0.80	AEP
b1662	Rebuild 4 miles of 46 kV line to 138 kV from Pemberton to Cherry Creek	\$ 5.00	AEP
b1662.1	Circuit Breakers are installed at Cherry Creek (facing Pemberton) and at Pemberton (facing Tams Mtn. and Cherry Creek)	\$ -	AEP
b1663	Install a new 765/138 kV transformer at Jackson Ferry substation	\$ 40.00	AEP
b1663.1	Establish a new 10 mile double circuit 138 kV line between Jackson Ferry and Wythe	\$ -	AEP
b1664	Install switched capacitor banks at Kenwood 138 kV stations	\$ 0.50	AEP
b1665	Install a second 138/69 kV transformer at Thelma station	\$ 12.00	AEP
b1665.1	Construct a single-circuit 69 kV line from West Paintsville to the new Paintsville station	\$ -	AEP
b1667	Establish Melmore as a switching station with both 138 kV circuits terminating at Melmore. Extend the double circuit 138 kV line from Melmore to Fremont Center	\$ 18.00	AEP
b1668	Revise the capacitor setting at Riverside 138 kV station	\$ 0.10	AEP
b1669	Capacitor setting changes at Ross 138 kV stations	\$ 0.10	AEP
b1670	Capacitor setting changes at Wooster 138 kV station	\$ 0.10	AEP
b1671	Install four 138 kV breakers in Danville area	\$ 5.00	AEP
b1676	Replace Natrium 138 kV breaker 'G (rehab)'	\$ 0.80	AEP
b1677	Replace Huntley 138 kV breaker '106'	\$ 0.80	AEP
b1678	Replace Kammer 138 kV breaker 'G'	\$ 0.80	AEP
b1679	Replace Kammer 138 kV breaker 'H'	\$ 0.80	AEP
b1680	Replace Kammer 138 kV breaker 'J'	\$ 0.80	AEP
b1681	Replace Kammer 138 kV breaker 'K'	\$ 0.80	AEP

The following allocations are single-zone allocations

Upgrade ID	Description	Cost Estimate (\$M)	Cost Allocation - 100%
b1682	Replace Kammer 138 kV breaker 'M'	\$ 0.80	AEP
b1683	Replace Kammer 138 kV breaker 'N'	\$ 0.80	AEP
b1684	Replace Clinch River 138 kV breaker 'E1'	\$ 0.80	AEP
b1685	Replace Lincoln 138 kV breaker 'D'	\$ 0.80	AEP
b1687	Advance s0251.7 (Replace Corrid 138 kV breaker '104S')	\$ -	AEP
b1688	Advance s0251.8 (Replace Corrid 138 kV breaker '104C')	\$ -	AEP
b1733	Perform a sag study of the Bluff Point - Jauy 138 kV line. Upgrade breaker, wavetrap, and risers at the terminal ends	\$ 2.00	AEP
b1734	Perform a sag study of Randolph - Hodgins 138 kV line. Upgrade terminal equipment	\$ 0.20	AEP
b1735	Perform a sag study of R03 - Magely 138 kV line. Upgrade terminal equipment	\$ 0.20	AEP
b1736	Perform a sag study of the Industrial Park - Summit 138 kV line	\$ 0.05	AEP
b1737	Sag study of Newcomerstown - Hillview 138 kV line. Upgrade terminal equipment	\$ 0.20	AEP
b1738	Perform a sag study of the Wolf Creek - Layman 138 kV line. Upgrade terminal equipment including a 138 kV breaker and wavetrap	\$ 2.00	AEP
b1739	Perform a sag study of the Ohio Central - West Trinway 138 kV line	\$ 0.05	AEP
b1741	Replace Beatty 138 kV breaker '2C(IPP)'	\$ 0.80	AEP
b1742	Replace Beatty 138 kV breaker '1E'	\$ 0.80	AEP
b1743	Replace Beatty 138 kV breaker '2E'	\$ 0.80	AEP
b1744	Replace Beatty 138 kV breaker '3C'	\$ 0.80	AEP
b1745	Replace Beatty 138 kV breaker '2W'	\$ 0.80	AEP
b1746	Replace St. Claire 138 kV breaker '8'	\$ 0.80	AEP
b1747	Replace Cloverdale 138 kV breaker 'C'	\$ 0.80	AEP
b1748	Replace Cloverdale 138 kV breaker 'D1'	\$ 0.80	AEP
b1780	Install two 138kV breakers and two 138kV circuit switchers at South Princeton Station and one 138kV breaker and one 138kV circuit switcher at Switchback Station	\$ 3.00	AEP
b1781	Install three 138 kV breakers and a 138kV circuit switcher at Trail Fork Station in Pineville, WV	\$ 4.50	AEP
b1782	Install a 46kV Moab at Montgomery Station facing Carbondale (on the London - Carbondale 46 kV circuit)	\$ 0.30	AEP
b1783	Add two 138 kV Circuit Breakers and two 138 kV circuit switchers on the Lonesome Pine - South Bluefield 138 kV line	\$ 1.00	AEP
b1784	Install a 52.8 MVar capacitor bank at the Clifford 138 kV station	\$ 2.00	AEP

The following allocations are single-zone allocations

Upgrade ID	Description	Cost Estimate (\$M)	Cost Allocation - 100%
b1281.1	Replace Greenfield 138 kV breaker '501-B-1'	\$ 0.17	ATSI
b1281.2	Replace Greenfield 138 kV breaker '501-B-21'	\$ 0.17	ATSI
b1281.3	Replace Greenfield 138 kV breaker '501-B-227'	\$ 0.17	ATSI
b1281.4	Replace Greenfield 138 kV breaker '501-B-23'	\$ 0.17	ATSI
b1281.5	Replace Greenfield 138 kV breaker '501-B-242'	\$ 0.17	ATSI
b1281.6	Replace Greenfield 138 kV breaker '501-B-36'	\$ 0.17	ATSI
b1281.7	Replace Greenfield 138 kV breaker '501-B-38'	\$ 0.17	ATSI
b1281.8	Replace Greenfield 138 kV breaker '501-B-40'	\$ 0.17	ATSI
b1611	Replace Avon Lake 138 kV breaker '10-B-9'	\$ 0.15	ATSI
b1612	Replace Pleasant Valley 138 kV breaker '194-B-7'	\$ 0.15	ATSI
b1613	Replace Brady 138 kV breaker '1003-B-6'	\$ 0.15	ATSI
b1614	Replace East Akron 138 kV breaker '36-B-56'	\$ 0.15	ATSI
b1615	Replace East Akron 138 kV breaker '36-B-40'	\$ 0.15	ATSI
b1616	Replace East Akron 138 kV breaker '36-B-45'	\$ 0.15	ATSI
b1617	Replace Greenfield 138 kV breaker '501-B-68'	\$ 0.15	ATSI
b1618	Replace Masury 138 kV breaker '103-B-118'	\$ 0.15	ATSI
b1619	Replace Roberts 138 kV breaker '601-B-26'	\$ 0.15	ATSI
b1620	Replace Roberts 138 kV breaker '601-B-113'	\$ 0.15	ATSI
b1621	Replace Roberts 138 kV breaker '601-B-13'	\$ 0.15	ATSI
b1622	Replace Sammis 138 kV breaker '780-B-44'	\$ 0.15	ATSI
b1623	Replace Sammis 138 kV breaker '780-B-45'	\$ 0.15	ATSI
b1624	Replace Sammis 138 kV breaker '780-B-9'	\$ 0.15	ATSI
b1625	Replace Sammis 138 kV breaker '780-B-75'	\$ 0.15	ATSI
b1626	Revise the reclosing of Eastlake 138 kV breaker '46-B-36'	\$ 0.01	ATSI
b1627	Revise the reclosing of Eastlake 138 kV breaker '46-B-35'	\$ 0.01	ATSI
b1628	Revise the reclosing of Eastlake 138 kV breaker '46-B-31'	\$ 0.01	ATSI
b1629	Revise the reclosing of Eastlake 138 kV breaker '46-B-34'	\$ 0.01	ATSI
b1630	Revise the reclosing of Eastlake 138 kV breaker '46-B-21'	\$ 0.01	ATSI
b1631	Revise the reclosing of Eastlake 138 kV breaker '46-B-27'	\$ 0.01	ATSI
b1632	Revise the reclosing of Eastlake 138 kV breaker '46-B-18'	\$ 0.01	ATSI
b1633	Revise the reclosing of Eastlake 138 kV breaker '46-B-24'	\$ 0.10	ATSI
b1634	Revise the reclosing of Eastlake 138 kV breaker '46-B-33'	\$ 0.01	ATSI
b1635	Revise the reclosing of Eastlake 138 kV breaker '46-B-32'	\$ 0.01	ATSI
b1636	Revise the reclosing of Fowles 138 kV breaker '64-B-9'	\$ 0.01	ATSI
b1637	Revise reclosing of Pleasant Valley 138 kV breaker '194-B-5'	\$ 0.01	ATSI
b1638	Revise the reclosing of Bluebell 138 kV breaker '301-B-9'	\$ 0.01	ATSI
b1639	Revise the reclosing of Bluebell 138 kV breaker '301-B-8'	\$ 0.01	ATSI
b1640	Revise the reclosing of East Akron 138 kV breaker '36-B-22'	\$ 0.01	ATSI

The following allocations are single-zone allocations

Upgrade ID	Description	Cost Estimate (\$M)	Cost Allocation - 100%
b1691	Install a new Bluebell - S. Akron 138 kV circuit	\$ 3.30	ATSI
b1691.1	Un-six wire sections of E. Akron - Knox 138 kV	\$ -	ATSI
b1691.2	Un-six wire sections of Bluebell - C. Central 138 kV	\$ -	ATSI
b1691.3	Reconductor approximately 5.5 miles of ACSR with ACSS conductor from Bluebell to start of 6-wire sections	\$ -	ATSI
b1691.4	Create Bluebell - South Akron 138 kV line with new connections	\$ -	ATSI
b1691.5	Replace 250 Cu and 336.4 ACSR with 954 ACSR SSCIR at Bluebell	\$ -	ATSI
b1691.6	Replace Relays at Bluebell and add line breaker at tap to Alliance Castings	\$ -	ATSI
b1692	Loop in E. Akron - Sammis 138 kV line and expand Knox to 6 breaker ring bus	\$ 3.70	ATSI
b1693	Replace the Star 345/138 kV #3 with a larger unit	\$ 5.00	ATSI
b1732	Create Brookside - Reedsburg - Longview 138 kV line and open Burger - Cloverdale #2 and #3 138 kV lines	\$ 0.02	ATSI
b1771	Perform reconfiguration at Richland 138kV that will permit the removal of the existing Richland SPS	\$ 0.62	ATSI
b1606.2	Installing 115kV tie breakers at Melvale	\$ 20.00	BGE
b1785	Revise the reclosing for Pumphrey 115 kV breaker '110521 DR'	\$ -	BGE
b1786	Revise the reclosing for Pumphrey 115 kV breaker '110526 DR'	\$ -	BGE
b1658	Replace Lombard 138kV breaker '120 10301' with 63kA breaker.	\$ 0.90	ComEd
b1775	Reconductor 10.7 miles of Marengo - Pleasant Valley 138 kV and replace associated terminal and protective equipment	\$ 8.50	ComEd
b1776	Reconductor 0.157 miles of McGirr Road - H440; RT 138 kV line of 477 ACSR	\$ 0.35	ComEd
b1777	Reconductor approximately 11.5 miles and replace associated terminal equipment of Marengo; TB - Woodstock; B 138 kV line	\$ 8.85	ComEd
b1778	Reconductor 7.181 miles of 477 ACSR and upgrade station conductor at TSS 186 Steward1	\$ 11.40	ComEd
b1779	Reconductor 5.242 miles of Kickapoo Creek - Marseilles Tap 138 kV line of 477 ACSR	\$ 8.30	ComEd
b1605	Replace Crescent 138 kV breaker 'Z143 #1'	\$ 0.33	Duquesne Light
b1645	Revise the reclosing of Beaver Valley 138kV breaker 'Z-29	\$ -	Duquesne Light
b1646	Revise the reclosing of Beaver Valley 138kV breaker 'Z-37 Raccoon'	\$ -	Duquesne Light

The following allocations are single-zone allocations

Upgrade ID	Description	Cost Estimate (\$M)	Cost Allocation - 100%
b1790	Split Wharton 115 kV capacitor bank into two smaller units and add additional reactive support in area by correcting power factor at Pantego 115 kV DP and Five Points 115 kV DP to minimum of 0.973	\$ 1.00	Dominion
b1792	Rebuild line #33 Halifax to Chase City, 26 miles. Install 230 kV 4 breaker ring bus	\$ 26.00	Dominion
b1793	Wreck and rebuild remaining section of Line #22, 19.5 miles and replace two pole H frame construction built in 1930	\$ 25.00	Dominion
b1794	Split 230 kV Line #2056 (Hornertown - Rocky Mount) and double tap line to Battleboro Substation. Expand station, install a 230 kV 3 breaker ring bus and install a 230/115 kV transformer	\$ 8.00	Dominion
b1795	Reconductor segment of Line #54 (carolina to Woodland 115 kV) to a minimum of 300 MVA	\$ 18.00	Dominion
b1796	Install 115 kV 25 MVAR capacitor bank at Kitty Hawk Substation	\$ 0.70	Dominion
b1723	Replace strand bus and disconnect switch at Glasgow 138 kV substation	\$ 0.08	DPL
b1727	Reconductor 2.4 miles of existing 556 and 795 ACSR from Harley Davidson to Pleasureville 115 kV with 795 ACSS to raise the ratings	\$ 2.06	ME
b1718	Reconductor the Crescentville - Foxchase 138 kV circuit	\$ 3.00	PECO
b1719	Reconductor the Foxchase - Bluegrass 138 kV circuit	\$ 1.00	PECO
b1720	Increase the effective rating of the Eddystone 230/138 kV transformer by replacing a circuit breaker at Eddystone	\$ 0.30	PECO
b1721	Increase the rating of the Waneeta - Tuna 138 kV circuit by replacing two 138 kV CTs at Waneeta	\$ 0.02	PECO
b1722	Increase the normal rating of the Cedarbrook - Whitemarsh 69 kV circuit by changing the CT ratio and replacing station cable at Whitemarsh 69 kV	\$ 0.06	PECO
b1768	Install 39 MVAR capacitor at Cromby 138 kV bus	\$ 1.50	PECO
b1769	Install a 75 MVAR cap bank on the Four Mile 230 kV bus	\$ 0.95	PENELEC
b1770	Install a 50 MVAR cap bank on the Buffalo Road 115 kV bus	\$ 0.75	PENELEC
b1531	Upgrade Sunbury T22 and T23 transformers to 170 MVA each	\$ 8.68	PPL
b1740	Install a 90 MVAR cap bank on the Frackville 230 kV bus #207973	\$ 3.00	PPL
b1756	Install a 3rd West Shore 230/69 kV transformer	\$ 9.00	PPL
b1757	Install a 230 kV motor-operated air-break switch on the Clinton - Elimsport 230 kV line	\$ 1.00	PPL
b1758	Rebuild 1.65 miles of Columbia - Danville 69 kV line	\$ 1.70	PPL
b1759	Install a 69 kV 16.2 MVAR Cap at Milton substation	\$ 0.88	PPL

The following allocations are single-zone allocations

Upgrade ID	Description	Cost Estimate (\$M)	Cost Allocation - 100%
b1760	Install motor operated devices on the existing disconnect switches that are located on each side of all four 230 kV CBs at	\$ 0.54	PPL
b1761	Build a new Paupack - North 230 kV line (Approximately 21 miles)	\$ 37.10	PPL
b1762	Replace 3.7 miles of the existing 230 kV Blooming Grove - Peckville line by building 8.4 miles of new 230 kV circuit onto the Lackawanna - Hopatcong tower-line	\$ 2.40	PPL
b1763	Re-terminate the Peckville - Jackson and the Peckville - Varden 69 kV lines from Peckville into Lackawanna	\$ 3.40	PPL
b1764	Build a new 230-69 kV substations (Paupack)	\$ 19.50	PPL
b1765	Install a 16.2 MVAR capacitor bank at Bohemia 69-12 kV substation	\$ 0.60	PPL
b1766	Reconductor/rebuild 3.3 miles of the Siegfried - Quarry #1 and #2 lines	\$ 4.94	PPL
b1767	Install 6 motor-operated disconnect switches at Quarry substation	\$ 0.54	PPL
b1749	Advance n1237 (Replace Essex 230 kV breaker '22H' with 80kA)	\$ 0.05	PSEG
b1750	Advance n0666.5 (Replace Hudson 230 kV breaker '1HB' with 80 kA (without TRV cap, so actually 63 kA))	\$ 0.05	PSEG
b1751	Advance n0666.3 (Replace Hudson 230 kV breaker '2HA' with 80 kA (without TRV cap, so actually 63 kA))	\$ 0.05	PSEG
b1752	Advance n0666.10 (Replace Hudson 230 kV breaker '2HB' with 80 kA (without TRV cap, so actually 63 kA))	\$ 0.05	PSEG
b1753	Marion 138 kV breaker '7PM' - delay the relay time to increase the contact parting time to 2.5 cycles	\$ -	PSEG
b1754	Marion 138 kV breaker '3PM' - delay the relay time to increase the contact parting time to 2.5 cycles	\$ -	PSEG
b1755	Marion 138 kV breaker '6PM' - delay the relay time to increase the contact parting time to 2.5 cycles	\$ -	PSEG

The following allocations are multi-zone allocations

Upgrade ID	Description	Cost Estimate (\$M)	Cost Allocation
b1666	Build an 8 breaker 138 kV station tapping both circuits of the Fostoria - East Lima 138 kV line	\$ 10.00	AEP - 90.65%, Dayton - 9.35%
b1772	Reconductor approximately 16 miles from Nelson to Electric Junction 345 kV and replace associated terminal equipment	\$ 16.30	ATSI - 3.81%, ComEd - 94.6%, Dayton - 1.03%, DL - 0.56%
b1791	Wreck and rebuild 2.1 mile section of Line #11 section between Gordonsville and Somerset	\$ 5.25	APS - 5.83%, BGE - 6.25%, Dominion - 78.38%, PEPCO - 9.54%
b1717	Install a second Waneeta 230/138 kV transformer on a separate bus section	\$ 6.50	HTP - 0.04%, PECO - 99.96%
b1774	Reconductor approximately 11.75 miles of Crete - St. John 345 kV	\$ 9.50	AEC - 1.96%, AEP - 21.56%, ATSI - 36.52%, BGE - 2.94%, Dayton - 6.85%, DL - 6.6%, DPL - 2.8%, ECP - 0.25%, HTP - 0.24%, JCPL - 4.91%, Neptune - 0.49%, PECO - 6.22%, PSEG - 8.33%, RE - 0.33%
b1774.1	Reconductor approximately 1 mile of Crete - St. John 345 kV in NIPS/MISO	\$ 0.75	AEC - 1.96%, AEP - 21.56%, ATSI - 36.52%, BGE - 2.94%, Dayton - 6.85%, DL - 6.6%, DPL - 2.8%, ECP - 0.25%, HTP - 0.24%, JCPL - 4.91%, Neptune - 0.49%, PECO - 6.22%, PSEG - 8.33%, RE - 0.33%
b1773	Reconductor approximately 12.51 miles of East Frankfort - Crete 345 kV line 6607	\$ 10.00	AEC - 1.97%, AEP - 23.38%, ATSI - 37.1%, Dayton - 7.06%, DL - 6.65%, DPL - 2.8%, ECP - 0.25%, HTP - 0.25%, JCPL - 4.96%, Neptune - 0.5%, PECO - 6.26%, PSEG - 8.48%, RE - 0.34%
b1803	Build a 300 MVAR Switched Shunt at Doubs 500 kV and increase (~50 MVAR) in size the existing Switched Shunt at Doubs 500 kV	\$ 11.30	AEC - 2.09%, AEP - 16.7%, APS - 6.03%, BGE - 4.92%, ComEd - 15.58%, Dayton - 2.41%, DL - 2.05%, DPL - 2.88%, Dominion - 13.61%, ECP - 0.22%, JCPL - 4.56%, ME - 2.09%, Neptune - 0.49%, PECO - 6.3%, PENELEC - 2.11%, PEPCO - 4.73%, PPL - 5.27%, PSEG - 7.65%, RE - 0.31%
b1797	Wreck and rebuild 7 miles of the Dominion owned section of Cloverdale - Lexington 500 kV	\$ 18.00	AEC - 2.09%, AEP - 16.7%, APS - 6.03%, BGE - 4.92%, ComEd - 15.58%, Dayton - 2.41%, DL - 2.05%, DPL - 2.88%, Dominion - 13.61%, ECP - 0.22%, JCPL - 4.56%, ME - 2.09%, Neptune - 0.49%, PECO - 6.3%, PENELEC - 2.11%, PEPCO - 4.73%, PPL - 5.27%, PSEG - 7.65%, RE - 0.31%
b1798	Build a 450 MVAR SVC and 300 MVAR switched shunt at Loudoun 500 kV	\$ 70.00	AEC - 2.09%, AEP - 16.7%, APS - 6.03%, BGE - 4.92%, ComEd - 15.58%, Dayton - 2.41%, DL - 2.05%, DPL - 2.88%, Dominion - 13.61%, ECP - 0.22%, JCPL - 4.56%, ME - 2.09%, Neptune - 0.49%, PECO - 6.3%, PENELEC - 2.11%, PEPCO - 4.73%, PPL - 5.27%, PSEG - 7.65%, RE - 0.31%

The following allocations are multi-zone allocations

Upgrade ID	Description	Cost Estimate (\$M)	Cost Allocation
b1799	Build 150 MVAR Switched Shunt at Pleasant View 500 kV	\$ 6.00	AEC - 2.09%, AEP - 16.7%, APS - 6.03%, BGE - 4.92%, ComEd - 15.58%, Dayton - 2.41%, DL - 2.05%, DPL - 2.88%, Dominion - 13.61%, ECP - 0.22%, JCPL - 4.56%, ME - 2.09%, Neptune - 0.49%, PECO - 6.3%, PENELEC - 2.11%, PEPCO - 4.73%, PPL - 5.27%, PSEG - 7.65%, RE - 0.31%
b1800	Build a 500 MVAR SVC at Hunterstown 500 kV	\$ 82.00	AEC - 2.09%, AEP - 16.7%, APS - 6.03%, BGE - 4.92%, ComEd - 15.58%, Dayton - 2.41%, DL - 2.05%, DPL - 2.88%, Dominion - 13.61%, ECP - 0.22%, JCPL - 4.56%, ME - 2.09%, Neptune - 0.49%, PECO - 6.3%, PENELEC - 2.11%, PEPCO - 4.73%, PPL - 5.27%, PSEG - 7.65%, RE - 0.31%
b1788	Install a new 500 kV circuit breaker at Wescosville	\$ 2.10	AEC - 2.09%, AEP - 16.7%, APS - 6.03%, BGE - 4.92%, ComEd - 15.58%, Dayton - 2.41%, DL - 2.05%, DPL - 2.88%, Dominion - 13.61%, ECP - 0.22%, JCPL - 4.56%, ME - 2.09%, Neptune - 0.49%, PECO - 6.3%, PENELEC - 2.11%, PEPCO - 4.73%, PPL - 5.27%, PSEG - 7.65%, RE - 0.31%
b1804	Build a 600 MVAR SVC at Meadow Brook 500 kV	\$ 100.00	AEC - 2.09%, AEP - 16.7%, APS - 6.03%, BGE - 4.92%, ComEd - 15.58%, Dayton - 2.41%, DL - 2.05%, DPL - 2.88%, Dominion - 13.61%, ECP - 0.22%, JCPL - 4.56%, ME - 2.09%, Neptune - 0.49%, PECO - 6.3%, PENELEC - 2.11%, PEPCO - 4.73%, PPL - 5.27%, PSEG - 7.65%, RE - 0.31%
b1805	Build a 250 MVAR SVC at a new station on the existing Mt. Storm - Valley 500 kV transmission facility	\$ 50.00	AEC - 2.09%, AEP - 16.7%, APS - 6.03%, BGE - 4.92%, ComEd - 15.58%, Dayton - 2.41%, DL - 2.05%, DPL - 2.88%, Dominion - 13.61%, ECP - 0.22%, JCPL - 4.56%, ME - 2.09%, Neptune - 0.49%, PECO - 6.3%, PENELEC - 2.11%, PEPCO - 4.73%, PPL - 5.27%, PSEG - 7.65%, RE - 0.31%
b1787	Build a second 230 kV circuit from Cox's Corner - Lumberton	\$ 46.00	AEC - 4.96%, ECP - 0.16%, HTP - 0.15%, JCPL - 44.2%, Neptune - 0.53%, PSEG - 48.08%, RE - 1.92%
b1801	Build a 250 MVAR SVC at Altoona 230 kV	\$ 43.00	AEC - 6.47%, AEP - 2.58%, APS - 6.88%, BGE - 6.57%, DPL - 12.39%, Dominion - 14.89%, ECP - 0.09%, JCPL - 8.14%, ME - 6.21%, Neptune - 0.82%, PECO - 21.57%, PPL - 4.88%, PSEG - 8.18%, RE - 0.33%
b1802	Build a 100 MVAR Fast Switched Shunt and 200 MVAR Switched Shunt at Mansfield 345 kV	\$ 6.10	AEC - 6.47%, AEP - 2.58%, APS - 6.88%, BGE - 6.57%, DPL - 12.39%, Dominion - 14.89%, ECP - 0.09%, JCPL - 8.14%, ME - 6.21%, Neptune - 0.82%, PECO - 21.57%, PPL - 4.88%, PSEG - 8.18%, RE - 0.33%