PJM Generator Interconnection

X3-087 Brandywine 230 kV

744 MW Capacity / 914.2 MW Energy

Feasibility Study Report

May 2012
DMS #691118v1

Introduction

This Feasibility Study has been prepared in accordance with the PJM Open Access Transmission Tariff, §36.2, as well as the Feasibility Study Agreement between Interconnection Customer (IC), and PJM Interconnection, LLC (PJM), Transmission Provider (TP). The Interconnected Transmission Owner (ITO) is Potomac Electric Power Company.

Preface

The intent of this Feasibility Study is to determine a plan, with preliminary cost and construction time estimates, to connect the subject generation interconnection project to the PJM network at a location specified by IC. As a requirement for interconnection, IC may be responsible for the cost of constructing Network Upgrades, which are facility additions, or upgrades to existing facilities, that are needed to maintain the reliability of the PJM and the underlying system. All facilities required for interconnection of a generation interconnection project must be designed to meet ITO technical specifications.

The Feasibility Study estimates do not include the feasibility, cost, or time required to obtain property rights and permits for construction of the required facilities. IC is responsible for its right of way, real estate, and construction permit issues.

General

Queue project X3-087 was studied as a 914.2 MW (744.0 MW of which was Capacity) injection into ITO system. Project X3-087 was evaluated for compliance with reliability criteria for summer peak conditions in 2015.

Primary Option

The following contingencies resulted in overloads for the primary option:

Option 1 Impactful Contingencies	
Contingency Name	**File Description**
10PEPCO_S17_X2-030	CONTINGENCY '10PEPCO_S17_X2-030' DISCONNECT BRANCH FROM BUS 223988 TO BUS 223990 CKT 1 / MORGNTW230 – TALB068 DISCONNECT BRANCH FROM BUS 223990 TO BUS 223982 CKT 1 / TALB068 – OAKGV230 DISCONNECT BRANCH FROM BUS 223992 TO BUS 224078 CKT 1 / HAWK 076 230 - HAWK 69 DISCONNECT BRANCH FROM BUS 223990 TO BUS 290891 CKT 1 / TALB068 – S17TAP81230 DISCONNECT BRANCH FROM BUS 223988 TO BUS 909240 CKT 1 / MORGT230 – HAWK076 DISCONNECT BRANCH FROM BUS 909240 TO BUS 223992 CKT 1 END
11PEPCO	CONTINGENCY '11PEPCO' /* MORGT230 TO CHALK230 MODIFIED BY PEPCO 1/12/10 REMOVE DUMMY BUSSES DISCONNECT BUS 223986 DISCONNECT BUS 224062 DISCONNECT BUS 223987 DISCONNECT BUS 224063 END
12PEPCO_S17_X2-030	CONTINGENCY '12PEPCO_S17_X2-030' DISCONNECT BRANCH FROM BUS 223988 TO BUS 223991 CKT 1 / MORGNTW230 – TALB082 DISCONNECT BRANCH FROM BUS 223991 TO BUS 223982 CKT 1 / TALB068 – OAKGV230 DISCONNECT BRANCH FROM BUS 223993 TO BUS 224078 CKT 1 / HAWK077 – HAWK 69 DISCONNECT BRANCH FROM BUS 223991 TO BUS 290892 CKT 1 / TALB082 – S17TAP82230 DISCONNECT BRANCH FROM BUS 223988 TO BUS 909250 CKT 1 /MORGT230 – HAWK 077 DISCONNECT BRANCH FROM BUS 909250 TO BUS 223993 CKT 1 DISCONNECT BRANCH FROM BUS 223993 TO BUS 224124 CKT 1 / HAWK 077 – TALB 087 DISCONNECT BRANCH FROM BUS 224124 TO BUS 223982 CKT 1 / TALB 087 – OAKGV 230 END
5PEPCO	CONTINGENCY '5PEPCO' /* CHALK230 TO BOWIE044 DISCONNECT BRANCH FROM BUS 223983 TO BUS 224600 CKT 1 /* OAKGV230 TO AQUASCO1 DISCONNECT BRANCH FROM BUS 224600 TO BUS 224060 CKT 1 /* AQUASCO1 TO BOWIE044. FEB. 17, 2009. DISCONNECT BRANCH FROM BUS 224060 TO BUS 223979 CKT 1 DISCONNECT BRANCH FROM BUS 223982 TO BUS 223977 CKT 1 DISCONNECT BRANCH FROM BUS 223977 TO BUS 223962 CKT 1 END
7PEPCO_A	CONTINGENCY '7PEPCO_A' /* BOWIE045 TO OAKGV23 DISCONNECT BRANCH FROM BUS 223978 TO BUS 223961 CKT 1 /* OAKGV05 TO CHALK230 DISCONNECT BRANCH FROM BUS 223982 TO BUS 223978 CKT 1 DISCONNECT BRANCH FROM BUS 224061 TO BUS 223980 CKT 1 DISCONNECT BRANCH FROM BUS 292454 TO BUS 224061 CKT 1 /BUS 223983 -> 292454 END
8OX _8POSSUM _043	CONTINGENCY '8OX _8POSSUM _043' DISCONNECT BRANCH FROM BUS 314919 TO BUS 314922 CKT 1 /* 500/500KV, AREA 345/345. END

Option 1 Impactful Contingencies	
Contingency Name	**File Description**
BG_CKT2344	CONTINGENCY 'BG_CKT2344' /* BRANDON TO RIVERSIDE CKT #2344 DISCONNECT BUS 220989 /*CKT 2344 BRANDON – HAWKINS-SOLLERS DISCONNECT BUS 220990 /*CKT 2344 HAWKINS-SOLLERS-RIVERSIDE DISCONNECT BUS 220977 /* RIVERSIDE 230-1 H/S AND 2339 TO NORTHEAST DISCONNECT BUS 221230 /*RIVERSIDE 230-1 & L/S BUS CONNECTION END
BG_RIV230-2	CONTINGENCY 'BG_RIV230-2' /* RIVERSIDE 230-2 TRANSFORMER & CKT 2345 DISCONNECT BRANCH FROM BUS 220966 TO BUS 220988 CKT 1 /* CKT #2345 RIVERSIDE TO SOLLERS PT DISCONNECT BRANCH FROM BUS 220966 TO BUS 221231 CKT 1 /* RIVERSIDE 230-2 TRANSFORMER DISCONNECT BRANCH FROM BUS 221231 TO BUS 221147 CKT 1 /* RIVERSIDE 230-2 L/S BUS CONNECTION END
HIRDG_BURTVL	CONTINGENCY 'HIRDG_BURTVL' /* HIGH RIDGE TO BURTONSVILLE CKTS #2314 & #2334 DISCONNECT BUS 220983 /* CKT #2314 HIGH RIDGE – BURTONSVILLE & SANDY SPRINGS 230-2 DISCONNECT BUS 220984 /* CKT #2334 HIGH RIDGE – BURTONSVILLE & SANDY SPRINGS 230-1 END
PJM17	CONTINGENCY 'PJM17' DISCONNECT BRANCH FROM BUS 200004 TO BUS 200013 CKT 1 /* CNASTONE PEACHBTM 500 500 END
PJM67	CONTINGENCY 'PJM67' DISCONNECT BRANCH FROM BUS 200026 TO BUS 200004 CKT 1 /* HUNTERTN CNASTONE 500 500 END
PJM76	CONTINGENCY 'PJM76' REMOVE MACHINE 1 FROM BUS 200034 /* PB2 END
PJM77	CONTINGENCY 'PJM77' REMOVE MACHINE 1 FROM BUS 200035 /* PB3 END
PP1EB	CONTINGENCY 'PP1EB' / NO PATH OPEN BRANCH FROM BUS 200101 TO BUS 235632 CKT 1 / 200003 BRIGHTON 500 200004 CNASTONE 500 1 END
PP31	CONTINGENCY 'PP31' OPEN BRANCH FROM BUS 223961 TO BUS 223978 CKT 1 / 223961 BURT2314 230 223978 BOWIE045 230 1 END
PP36	CONTINGENCY 'PP36' OPEN BRANCH FROM BUS 223962 TO BUS 223977 CKT 1 / 223962 BURT2334 230 223977 BOWIE042 230 1 END
PP47	CONTINGENCY 'PP47' OPEN BRANCH FROM BUS 223982 TO BUS 223990 CKT 1 / 223982 OAKGV230 230 223990 TALB 068 230 1 OPEN BRANCH FROM BUS 290891 TO BUS 223990 CKT 1 / 290891 S17 230 223990 TALB 068 230 1 / S17. END
PP54_V3-017A	CONTINGENCY 'PP54_V3-017A' OPEN BRANCH FROM BUS 223982 TO BUS 224125 CKT 1 / 223982 OAKGV230 230 224125 TALB 066 230 1 OPEN BRANCH FROM BUS 223992 TO BUS 894610 CKT 1 / 223992 HAWK 076 230 224125 TALB 066 230 1 OPEN BRANCH FROM BUS 223992 TO BUS 224078 CKT 1 / 223992 HAWK 076 230 224078 HAWK 69 69.0 1 END

Option 1 Impactful Contingencies	
Contingency Name	**File Description**
PP85	CONTINGENCY 'PP85' OPEN BRANCH FROM BUS 224102 TO BUS 224104 CKT 1 / 224102 BENN T7 115 224104 TUX 504 115 1 END
WCHPL_BRNDN	CONTINGENCY 'WCHPL_BRNDN' /* WAUGH CHAPEL TO BRANDON SHORES CKTS #2342 & #2343 DISCONNECT BRANCH FROM BUS 220955 TO BUS 220960 CKT 42 /* CKT #2342 W. CHAPEL TO BRANDON SHORES DISCONNECT BRANCH FROM BUS 220955 TO BUS 220960 CKT 43 /* CKT #2343 W. CHAPEL TO BRANDON SHORES END

Network Impacts:

Generator Deliverability

(Single or N-1 contingencies for the Capacity portion only of the interconnection)

X3-087 Opt. 1 ###	Contingency		Affected Area	Facility Description	Bus		Circuit	Analyses Type	Loading		Rating		MW Contribution
	Type	Name			To	From			Before	After	Type	MVA	
001	N-1	PP1EB	METED	Germantown-Germantown Reactor 138 kV line	204530	204531	1	DC	95.25	96.15	ER	104	5.83
002	N-1	PJM67	PJM	EMORY GR500-Conastone 500 kV line	200101	200004	1	DC	92.49	93.11	ER	2901	111.03
003	Non	Non	PJM	EMORY GR500-Conastone 500 kV line	200101	200004	1	DC	86.44	87.27	NR	2338	119.94
004	N-1	PP47	PEPCO	Talbert 082-Oak Groove 230 kV line	223991	223982	1	DC	87.24	105.33	ER	680	122.99
005	N-1	PP1EB	BG&E	Columbia-Howard 2312 230 kV line	221010	220953	1	DC	95.84	96.65	ER	941	47.53
006	N-1	8OX_8POSSUM_043	DVP	Possum Point 500 kV-Possum Point 230 kV 500/230 kV transformer	314922	314074	1	DC	76.82	86.66	ER	969	95.46
007	N-1	PP1EB	METED	Germantown Reactor-Germantown 138/115 kV transformer	204531	204529	1	DC	95.25	96.15	ER	104	5.83
008	N-1	PP1EB	BG&E	Granite 2311 & 2312-North West 2311 & 2310 230 kV line	220972	220962	1	DC	93.59	94.76	ER	621	44.74

Multiple Facility Contingency

(Double Circuit Tower Line Contingencies only with full energy output. Stuck Breaker and Bus Fault contingencies will be applied during the Impact Study)

X3-087 Opt. 1 ###	Contingency		Affected Area	Facility Description	Bus		Circuit	Analyses Type	Loading		Rating		MW Contribution
	Type	Name			To	From			Before	After	Type	MVA	
009	DCTL	WCHPL_BRNDN	BG&E	Pumphrey-Pumphrey 230/115 kV transformer	220974	221037	1	DC	95.2	96.23	ER	485	30.81
010	DCTL	10PEPCO_S17_X2-030	PEPCO	Talbert 082-Oak Groove 230 kV line	223991	223982	1	DC	92.07	114.33	ER	680	151.41
011	DCTL	HIRDG_BURTVL	PEPCO/BG&E	Bowie 043-Bowiebc1 2341 230 kV line	223980	220956	1	DC	96.63	98.06	ER	721	63.71
012	DCTL	HIRDG_BURTVL	PEPCO/BG&E	Bowie 044-Bowiebc0 2340 230 kV line	223979	220959	1	DC	99.06	100.52	ER	720	65.15
013	DCTL	WCHPL_BRNDN	BG&E	Howard 2332-Pumphrey 230 kV line	220954	220974	1	DC	95.39	96.41	ER	485	30.81

Contribution to Previously Identified Overloads

(Overloads initially caused by prior Queue positions with additional contribution to overloading by this project. This project may have % allocation of cost responsibility which will be calculated and reported for the Impact Study.)

X3-087 Opt. 1 ###	Contingency		Affected Area	Facility Description	Bus		Circuit	Analyses Type	Loading		Rating		MW Contribution
	Type	Name			To	From			Before	After	Type	MVA	
014	N-1	PP1EB	BG&E	High Ridge 2316-Howard 2332 230 kV line	220941	220954	1	DC	119.82	120.74	ER	941	54.16
015	N-1	PP1EB	BG&E	Howard 2332-Granite 2326 & 2332 230 kV line	220954	220973	1	DC	100.34	101.31	ER	728	43.66
016	N-1	PJM17	PECO	Nottingham Reactor-Nottingham 230 kV line	213846	213844	1	DC	118.5	119.37	ER	627	33.82
017	N-1	PP1EB	PENELEC	Roxbury-Roxbury 138/115 kV transformer	200532	200520	1	DC	126.27	127.44	ER	138	10
018	DCTL	12PEPCO_S17_X2-030	PEPCO	Talbert 068-Oak Groove 230 kV line	223990	223982	1	DC	103.95	123.04	ER	691	131.91
019	N-1	PP54_V3-017A	PEPCO	Talbert 068-Oak Groove 230 kV line	223990	223982	1	DC	104.98	116.51	ER	691	79.65
020	N-1	PJM17	BG&E/PL	Conastone-Otter Creek Switchyard 230 kV line	220963	208048	1	DC	156.56	157.69	ER	531	37.93
021	N-1	PP1EB	BG&E	Sandy Spring 2314-High Ridge 2316 230 kV line	220983	220941	1	DC	103.6	104.42	ER	941	47.88
022	DCTL	7PEPCO_A	PEPCO	Bowie 042-Burtonsville 2334 230 kV line	223977	223962	1	DC	127.72	129.86	ER	730	98.01

X3-087 Opt. 1 ###	Contingency		Affected Area	Facility Description	Bus		Circuit	Analyses Type	Loading		Rating		MW Contribution
	Type	Name			To	From			Before	After	Type	MVA	
023	N-1	PP31	PEPCO	Bowie 042-Burtonsville 2334 230 kV line	223977	223962	1	DC	115.9	117.57	ER	730	75.36
024	Non	Non	PEPCO	Bowie 042-Burtonsville 2334 230 kV line	223977	223962	1	DC	112.53	114.16	NR	608	61.3
025	DCTL	7PEPCO_A	PEPCO	Ft Slocum Par-Ft Slocum 69 kV line	224121	224122	1	DC	140.83	143.86	ER	150	28.1
026	N-1	PP31	PEPCO	Ft Slocum Par-Ft Slocum 69 kV line	224121	224122	1	DC	116.95	119.26	ER	150	21.5
027	Non	Non	PEPCO	Ft Slocum Par-Ft Slocum 69 kV line	224121	224122	1	DC	101.48	103.56	NR	130	16.75
028	N-1	PJM17	BG&E/PL	Graceton-Safe Harbor Units 3-4 Tap 230 kV line	220964	208071	1	DC	120.12	121.23	ER	485	33.58
029	N-1	PJM17	BG&E/PECO	Graceton-Cooper 230 kV line	220964	214089	1	DC	165.22	166.35	ER	485	33.82
030	N-1	PP1EB	BG&E	Howard 2312-Granite 2311 & 2312 230 kV line	220953	220972	1	DC	118.3	119.35	ER	728	47.53
031	DCTL	7PEPCO_A	PEPCO	Benning East-12Th & Irving 69 kV line	224023	224119	1	DC	127.33	129.25	ER	118	14.05
032	N-1	PP31	PEPCO	Benning East-12Th & Irving 69 kV line	224023	224119	1	DC	118.35	119.82	ER	118	10.75
033	Non	Non	PEPCO	Benning East-12Th & Irving 69 kV line	224023	224119	1	DC	113.2	114.47	NR	106	8.38
034	N-1	PJM17	PECO	Cooper-Peach Bottom 230 kV line	214089	213869	1	DC	162.73	163.86	ER	485	33.82
035	DCTL	7PEPCO_A	PEPCO	12Th & Irving-Ft Slocum Par 69 kV line	224119	224121	1	DC	179.26	182.89	ER	125	28.1
036	N-1	PP31	PEPCO	12Th & Irving-Ft Slocum Par 69 kV line	224119	224121	1	DC	151.23	154.01	ER	125	21.5
037	N-1	PP1EB	BG&E	Sandy Spring 2334-High Ridge 2316 230 kV line	220984	220941	1	DC	105.67	106.47	ER	941	46.72
038	DCTL	5PEPCO	PEPCO	Bowie 045-Burtonsville 2314 230 kV line	223978	223961	1	DC	128.83	130.98	ER	730	98.59
039	N-1	PP36	PEPCO	Bowie 045-Burtonsville 2314 230 kV line	223978	223961	1	DC	116.29	117.96	ER	730	75.23
040	Non	Non	PEPCO	Bowie 045-Burtonsville 2314 230 kV line	223978	223961	1	DC	113.09	114.71	NR	608	61.1
041	N-1	PP85	PEPCO	Benning T4-Tuxedo 503 115 kV line	224103	224105	1	DC	100.21	101.53	ER	180	14.73
042	N-1	PJM17	PECO	Peach Bottom-Nottingham Reactor 230 kV line	213869	213846	1	DC	118.56	119.43	ER	627	33.82
043	N-1	PJM17	PL	Safe Harbor Units 3-4 Tap-Manor Substation 230 kV line	208071	208019	1	DC	128.5	129.41	ER	579	32.83
044	N-1	BG_RIV230-2	BG&E	Brandon Shores-Hawkins Point 2344 230 kV line	220960	220989	1	DC	101.41	102	ER	1153	42.04

X3-087 Opt. 1 ###	Contingency		Affected Area	Facility Description	Bus		Circuit	Analyses Type	Loading		Rating		MW Contribution
	Type	Name			To	From			Before	After	Type	MVA	
045	DCTL	5PEPCO	PEPCO	Oak Groove-Bowie 045 230 kV line	223982	223978	1	DC	128.95	131.1	ER	730	98.59
046	N-1	PP36	PEPCO	Oak Groove-Bowie 045 230 kV line	223982	223978	1	DC	116.41	118.08	ER	730	75.23
047	Non	Non	PEPCO	Oak Groove-Bowie 045 230 kV line	223982	223978	1	DC	113.23	114.86	NR	608	61.1
048	N-1	BG_CKT2344	BG&E	Riverside 2317-Northeast 2315 & 2317 230 kV line	220966	220979	1	DC	103.03	103.88	ER	632	33.22
049	DCTL	7PEPCO_A	PEPCO	Benning East-12Th & Irving 69 kV line	224023	224119	2	DC	127.33	129.25	ER	118	14.05
050	N-1	PP31	PEPCO	Benning East-12Th & Irving 69 kV line	224023	224119	2	DC	118.35	119.82	ER	118	10.75
051	Non	Non	PEPCO	Benning East-12Th & Irving 69 kV line	224023	224119	2	DC	113.2	114.47	NR	106	8.38
052	DCTL	7PEPCO_A	PEPCO	Oak Groove-Bowie 042 230 kV line	223982	223977	1	DC	127.97	130.11	ER	730	98.01
053	N-1	PP31	PEPCO	Oak Groove-Bowie 042 230 kV line	223982	223977	1	DC	116.15	117.82	ER	730	75.36
054	Non	Non	PEPCO	Oak Groove-Bowie 042 230 kV line	223982	223977	1	DC	112.83	114.46	NR	608	61.3
055	N-1	BG_RIV230-2	BG&E	Sollers Point 2344-Riverside 2339 230 kV line	220990	220977	1	DC	117.47	118.13	ER	1036	42.04
056	N-1	PJM76	PJM	Conastone-Peach Bottom 500 kV line	200004	200013	1	DC	139.38	139.97	ER	2815	132.47
057	N-1	PP1EB	BG&E	High Ridge 2316-Columbia 230 kV line	220941	221010	1	DC	110.69	111.5	ER	941	47.26
058	DCTL	11PEPCO	PEPCO	Talbert 066-Oak Groove 230 kV line	224125	223982	1	DC	138.85	139.48	ER	680	35.32
059	N-1	PJM76	AP/PJM	Kemptown-EMORY GR500 500 kV line	235632	200101	1	DC	135.24	135.66	ER	2901	97.76
060	Non	Non	AP/PJM	Kemptown-EMORY GR500 500 kV line	235632	200101	1	DC	150.98	151.49	NR	2338	97.76

Energy Portion of Interconnection Request

PJM also studied the delivery of the energy portion of the surrounding generation. Any potential problems identified below are likely to result in operational restrictions to the project under study. The developer can proceed with network upgrades to eliminate the operational restriction at their discretion by submitting a Transmission Interconnection request.

Note: Only the most severely overloaded conditions are listed. There is no guarantee of full delivery of energy for this project by fixing only the conditions listed in this section. With a Transmission Interconnection Request, a subsequent analysis will be performed which analyzes all overload conditions associated with the overloaded element(s) identified. As a result of the aggregate energy resources in the area, the following violations were identified.

X3-087 Opt. 1 ###	Contingency		Affected Area	Facility Description	Bus		Circuit	Analyses Type	Loading		Rating		MW Contribution
	Type	Name			To	From			Before	After	Type	MVA	
061	Op	PP1EB	BG&E	High Ridge 2316-Howard 2332 230 kV line	220941	220954	1	DC	115.7	116.3	ER	941	66.54
062	Op	PP1EB	BG&E	Howard 2332-Granite 2326 & 2332 230 kV line	220954	220973	1	DC	88.36	89.55	ER	728	53.65
063	Op	PJM17	PECO	Nottingham Reactor-Nottingham 230 kV line	213846	213844	1	DC	105.53	106.57	ER	627	41.56
064	Op	PP1EB	PENELEC	Roxbury-Roxbury 138/115 kV transformer	200532	200520	1	DC	156.33	156.9	ER	138	12.29
065	Non	Non	PENELEC	Roxbury-Roxbury 138/115 kV transformer	200532	200520	1	DC	107.13	108.28	NR	124	8.85
066	Op	PP1EB	METED	Germantown-Germantown Reactor 138 kV line	204530	204531	1	DC	122.74	123.85	ER	104	7.16
067	Op	PP54_V3-017A	PEPCO	Talbert 068-Oak Groove 230 kV line	223990	223982	1	DC	104.57	118.73	ER	691	97.87
068	Op	PJM67	PJM	EMORY GR500-Conastone 500 kV line	200101	200004	1	DC	90.91	91.51	ER	2901	136.44
069	Non	Non	PJM	EMORY GR500-Conastone 500 kV line	200101	200004	1	DC	90.3	91.14	NR	2338	147.38
070	Op	PJM17	BG&E/PL	Conastone-Otter Creek Switchyard 230 kV line	220963	208048	1	DC	137.56	138.97	ER	531	46.61
071	Op	PP1EB	BG&E	Sandy Spring 2314-High Ridge 2316 230 kV line	220983	220941	1	DC	107.47	108.48	ER	941	58.84
072	Op	PP31	PEPCO	Bowie 042-Burtonsville 2334 230 kV line	223977	223962	1	DC	115.32	117.34	ER	730	92.6
073	Non	Non	PEPCO	Bowie 042-Burtonsville 2334 230 kV line	223977	223962	1	DC	111.96	113.93	NR	608	75.32
074	Op	PP31	PEPCO	Ft Slocum Par-Ft Slocum 69 kV line	224121	224122	1	DC	115.26	118.1	ER	150	26.42
075	Non	Non	PEPCO	Ft Slocum Par-Ft Slocum 69 kV line	224121	224122	1	DC	99.88	102.44	NR	130	20.59

X3-087 Opt. 1 ###	Contingency		Affected Area	Facility Description	Bus		Circuit	Analyses Type	Loading		Rating		MW Contribution
	Type	Name			To	From			Before	After	Type	MVA	
076	Op	PP47	PEPCO	Talbert 082-Oak Groove 230 kV line	223991	223982	1	DC	86.76	108.98	ER	680	151.13
077	Op	PJM17	BG&E/PL	Graceton-Safe Harbor Units 3-4 Tap 230 kV line	220964	208071	1	DC	119.96	120.95	ER	485	41.27
078	Non	Non	BG&E/PL	Graceton-Safe Harbor Units 3-4 Tap 230 kV line	220964	208071	1	DC	98.01	99.06	NR	379	24.7
079	Op	PJM17	BG&E/PECO	Graceton-Cooper 230 kV line	220964	214089	1	DC	137.44	138.14	ER	485	41.56
080	Op	PP1EB	BG&E	Howard 2312-Granite 2311 & 2312 230 kV line	220953	220972	1	DC	105.94	106.63	ER	728	58.41
081	Op	PP31	PEPCO	Benning East-12Th & Irving 69 kV line	224023	224119	1	DC	118.35	120.16	ER	118	13.21
082	Non	Non	PEPCO	Benning East-12Th & Irving 69 kV line	224023	224119	1	DC	113.2	114.76	NR	106	10.29
083	Op	8OX_8POSSUM_043	DVP	Possum Point 500 kV-Possum Point 230 kV 500/230 kV transformer	314922	314074	1	DC	76.54	88.63	ER	969	117.29
084	Op	PP1EB	METED	Germantown Reactor-Germantown 138/115 kV transformer	204531	204529	1	DC	122.74	123.85	ER	104	7.16
085	Op	PJM17	PECO	Cooper-Peach Bottom 230 kV line	214089	213869	1	DC	135.41	136.1	ER	485	41.56
086	Op	PP31	PEPCO	12Th & Irving-Ft Slocum Par 69 kV line	224119	224121	1	DC	154.45	157.86	ER	125	26.42
087	Op	PP1EB	BG&E	Sandy Spring 2334-High Ridge 2316 230 kV line	220984	220941	1	DC	109.44	110.42	ER	941	57.41
088	Op	PP36	PEPCO	Bowie 045-Burtonsville 2314 230 kV line	223978	223961	1	DC	115.72	117.73	ER	730	92.43
089	Non	Non	PEPCO	Bowie 045-Burtonsville 2314 230 kV line	223978	223961	1	DC	112.53	114.49	NR	608	75.07
090	Op	PP85	PEPCO	Benning T4-Tuxedo 503 115 kV line	224103	224105	1	DC	100.21	101.83	ER	180	18.1
091	Op	PJM17	PECO	Peach Bottom-Nottingham Reactor 230 kV line	213869	213846	1	DC	105.6	106.64	ER	627	41.56
092	Op	PJM17	PL	Safe Harbor Units 3-4 Tap-Manor Substation 230 kV line	208071	208019	1	DC	127.69	128.53	ER	579	40.34
093	Non	Non	PL	Safe Harbor Units 3-4 Tap-Manor Substation 230 kV line	208071	208019	1	DC	102.41	103.24	NR	463	23.79
094	Op	BG_RIV230-2	BG&E	Brandon Shores-Hawkins Point 2344 230 kV line	220960	220989	1	DC	98.55	99.28	ER	1153	51.66
095	Op	PP36	PEPCO	Oak Groove-Bowie 045 230 kV line	223982	223978	1	DC	115.83	117.85	ER	730	92.43
096	Non	Non	PEPCO	Oak Groove-Bowie 045 230 kV line	223982	223978	1	DC	112.67	114.64	NR	608	75.07
097	Op	BG_CKT2344	BG&E	Riverside 2317-Northeast 2315 & 2317 230 kV line	220966	220979	1	DC	106.99	108.04	ER	632	40.82

X3-087 Opt. 1 ###	Contingency		Affected Area	Facility Description	Bus		Circuit	Analyses Type	Loading		Rating		MW Contribution
	Type	Name			To	From			Before	After	Type	MVA	
098	Op	PP31	PEPCO	Benning East-12Th & Irving 69 kV line	224023	224119	2	DC	118.35	120.16	ER	118	13.21
099	Non	Non	PEPCO	Benning East-12Th & Irving 69 kV line	224023	224119	2	DC	113.2	114.76	NR	106	10.29
100	Op	PP31	PEPCO	Oak Groove-Bowie 042 230 kV line	223982	223977	1	DC	115.57	117.59	ER	730	92.6
101	Non	Non	PEPCO	Oak Groove-Bowie 042 230 kV line	223982	223977	1	DC	112.27	114.24	NR	608	75.32
102	Op	BG_RIV230 -2	BG&E	Sollers Point 2344-Riverside 2339 230 kV line	220990	220977	1	DC	114.29	115.1	ER	103 6	51.66
103	Op	PP1EB	AP/PENEL EC	Greene-Roxbury 138 kV line	235188	200532	1	DC	104.97	106.02	ER	189	12.29
104	Op	PJM76	PJM	Conastone-Peach Bottom 500 kV line	200004	200013	1	DC	122.15	122.87	ER	281 5	162.77
105	Op	PP1EB	BG&E	High Ridge 2316-Columbia 230 kV line	220941	221010	1	DC	100.25	101.25	ER	941	58.07
106	Op	PJM77	AP/PJM	Kemptown-EMORY GR500 500 kV line	235632	200101	1	DC	123.84	124.3	ER	290 1	120.13
107	Non	Non	AP/PJM	Kemptown-EMORY GR500 500 kV line	235632	200101	1	DC	136.4	136.98	NR	233 8	120.13
108	Op	PJM17	PL	Millwood Transformer #1-South Akron Transformer 3 230 kV line	208030	208079	1	DC	99.24	100.06	ER	588	29.89

Short Circuit

(Report Overdutied breakers here)

Analysis found new breakers for the primary option to be over-duty in the ITO transmission area.

BUS_NO	BUS	BREAKER	Rating Type	Duty Percent With x3-087_PEPCO_opt1	Duty Percent Without x3-087_PEPCO_opt1	Duty Percent Difference	Note
314922	POSSUM POINT 500.kV	H1T560	S	109.50%	98.20%	11.30%	New Over-duty
314922	POSSUM POINT 500.kV	H1T568	S	109.50%	96.50%	13.00%	New Over-duty
314922	POSSUM POINT 500.kV	560T571	S	104.00%	98.20%	5.80%	New Over-duty
663	POSS PT230 T 230.kV	L1T2078	S	100.80%	80.50%	20.30%	New Over-duty
14900	BRISTERS 500.kV	H1T539	S	100.10%	99.60%	0.50%	New Over-duty
14900	BRISTERS 500.kV	H1T545	S	100.10%	99.60%	0.50%	New Over-duty
1371	PLEASANT CAP 230.kV	SC322	S	100.00%	99.90%	0.10%	New Over-duty
314918	NORTH ANNA 500.kV	57302	S	100.30%	100.00%	0.30%	New Over-duty
314918	NORTH ANNA 500.kV	57502	S	100.30%	100.00%	0.30%	New Over-duty
314918	NORTH ANNA 500.kV	57602	S	100.30%	100.00%	0.30%	New Over-duty

- The two overdutied 500 kV breakers H1T539 and H1T545 at Bristers substation are 500-SFM-50E breakers which have nameplate ratings of 40 kA. We can get a new nameplate ratings of 50 kA from the manufacturer for about $2,000 each.
- The estimated cost to replace three overdutied 500 kV breakers 57302, 57502 and 57602 at North Anna substation with 63 kA breakers will be $685,000 per breaker and will take 15 months including equipment order time.
- The estimated cost to replace one overdutied 230 kV breaker SC322 at Pleasant View substation with 50 kA breaker will be $200,000 and will take 12 months including equipment order time.
- The estimated cost to replace three overdutied 500 kV breakers 560T571, H1T560 and H1T568 at Possum Point substation with 50 kA breakers will be $650,000 per breaker and will take 14 months including equipment order time.
- At Possum Point 230 kV, most of the 230 kV breakers must interrupt more than 80 kA of fault currents which will require the split/rebuild the 230 kV bus at Possum Point and the estimated cost for this is about $18,000,000 and will tale about 30 months. Once the 230 kV bus is split, breaker L1T2078, which is shown as overdutied, will not be overdutied.

Analysis found this project contributes to the over-duty of the following breakers. Higher order queue projects are first to cause and allocations to these over-duty breakers will be provided at the System Impact Study. Note the discussion provided for Possum Point provided in the new over-duty breakers section. This project will receive a blend of first to cause and allocation for those breakers.

BUS_NO	BUS	BREAKER	Rating Type	Duty Percent With x3-087_PEPCO_opt1	Duty Percent Without x3-087_PEPCO_opt1	Duty Percent Difference	Note
223994	BHILL 230 230.kV	ABB GCB	S	122.20%	105.30%	16.90%	Over 100%, > 3% contribution
223994	BHILL 230 230.kV	ITE OCB	S	122.20%	105.30%	16.90%	Over 100%, > 3% contribution
223994	BHILL 230 230.kV	WEST OCB	S	122.20%	105.30%	16.90%	Over 100%, > 3% contribution
314074	POSSUM POINT 230.kV	H9T237	S	134.40%	125.20%	9.20%	Over 100%, > 3% contribution
314074	POSSUM POINT 230.kV	H892	S	132.60%	123.40%	9.20%	Over 100%, > 3% contribution
314074	POSSUM POINT 230.kV	H8T2078	S	132.60%	123.40%	9.20%	Over 100%, > 3% contribution
314074	POSSUM POINT 230.kV	H992	S	132.60%	123.50%	9.10%	Over 100%, > 3% contribution
314074	POSSUM POINT 230.kV	23792	S	131.60%	122.20%	9.40%	Over 100%, > 3% contribution
314074	POSSUM POINT 230.kV	G6BTGT	S	131.60%	122.50%	9.10%	Over 100%, > 3% contribution
314074	POSSUM POINT 230.kV	GT92	S	131.60%	122.50%	9.10%	Over 100%, > 3% contribution
314074	POSSUM POINT 230.kV	202292	S	131.20%	121.80%	9.40%	Over 100%, > 3% contribution
314074	POSSUM POINT 230.kV	252T2022	S	131.20%	121.80%	9.40%	Over 100%, > 3% contribution
314074	POSSUM POINT 230.kV	21592	S	131.00%	121.50%	9.50%	Over 100%, > 3% contribution
314074	POSSUM POINT 230.kV	G5T215	S	131.00%	121.50%	9.50%	Over 100%, > 3% contribution
314074	POSSUM POINT 230.kV	25292	S	130.00%	120.90%	9.10%	Over 100%, > 3% contribution
314074	POSSUM POINT 230.kV	G492	S	130.00%	120.90%	9.10%	Over 100%, > 3% contribution
314074	POSSUM POINT 230.kV	G592	S	130.00%	120.90%	9.10%	Over 100%, > 3% contribution
314074	POSSUM POINT 230.kV	G6A92	S	130.00%	120.90%	9.10%	Over 100%, > 3% contribution
314074	POSSUM POINT 230.kV	G6B92	S	130.00%	120.90%	9.10%	Over 100%, > 3% contribution
314074	POSSUM POINT 230.kV	200192	S	128.10%	119.00%	9.10%	Over 100%, > 3% contribution
314074	POSSUM POINT 230.kV	207892	S	128.10%	119.00%	9.10%	Over 100%, > 3% contribution
314074	POSSUM POINT 230.kV	G4T2001	S	128.10%	119.00%	9.10%	Over 100%, > 3% contribution
314074	POSSUM POINT 230.kV	G6S92	S	128.10%	119.00%	9.10%	Over 100%, > 3% contribution
688	POSS PT CAP 230.kV	SC192	S	113.90%	108.60%	5.30%	Over 100%, > 3% contribution

Secondary Option

The following contingencies resulted in overloads for the secondary option:

Option 2 Impactful Contingencies	
Contingency Name	**File Description**

10PEPCO_S17_X2-030	CONTINGENCY '10PEPCO_S17_X2-030'
	  DISCONNECT BRANCH FROM BUS 223988 TO BUS 223990 CKT 1 / MORGNTW230 – TALB068
	  DISCONNECT BRANCH FROM BUS 223990 TO BUS 223982 CKT 1 / TALB068 – OAKGV230
	  DISCONNECT BRANCH FROM BUS 223992 TO BUS 224078 CKT 1 / HAWK 076 230 - HAWK 69
	  DISCONNECT BRANCH FROM BUS 223990 TO BUS 290891 CKT 1 / TALB068 – S17TAP81230
	  DISCONNECT BRANCH FROM BUS 223988 TO BUS 909240 CKT 1 / MORGT230 – HAWK076
	  DISCONNECT BRANCH FROM BUS 909240 TO BUS 223992 CKT 1
	END

12PEPCO_S17_X2-030	CONTINGENCY '12PEPCO_S17_X2-030'
	  DISCONNECT BRANCH FROM BUS 223988 TO BUS 223991 CKT 1 / MORGNTW230 – TALB082
	  DISCONNECT BRANCH FROM BUS 223991 TO BUS 223982 CKT 1 / TALB068 – OAKGV230
	  DISCONNECT BRANCH FROM BUS 223993 TO BUS 224078 CKT 1 / HAWK077 – HAWK 69
	  DISCONNECT BRANCH FROM BUS 223991 TO BUS 290892 CKT 1 / TALB082 – S17TAP82230
	  DISCONNECT BRANCH FROM BUS 223988 TO BUS 909250 CKT 1 /MORGT230 – HAWK 077
	  DISCONNECT BRANCH FROM BUS 909250 TO BUS 223993 CKT 1
	  DISCONNECT BRANCH FROM BUS 223993 TO BUS 224124 CKT 1 / HAWK 077 – TALB 087
	  DISCONNECT BRANCH FROM BUS 224124 TO BUS 223982 CKT 1 / TALB 087 – OAKGV 230
	END

5PEPCO	CONTINGENCY '5PEPCO' /* CHALK230 TO BOWIE044
	  DISCONNECT BRANCH FROM BUS 223983 TO BUS 224600 CKT 1 /* OAKGV230 TO AQUASCO1
	  DISCONNECT BRANCH FROM BUS 224600 TO BUS 224060 CKT 1 /* AQUASCO1 TO BOWIE044. FEB. 17, 2009.
	  DISCONNECT BRANCH FROM BUS 224060 TO BUS 223979 CKT 1
	  DISCONNECT BRANCH FROM BUS 223982 TO BUS 223977 CKT 1
	  DISCONNECT BRANCH FROM BUS 223977 TO BUS 223962 CKT 1
	END

7PEPCO_A	CONTINGENCY '7PEPCO_A' /* BOWIE045 TO OAKGV23
	  DISCONNECT BRANCH FROM BUS 223978 TO BUS 223961 CKT 1 /* OAKGV05 TO CHALK230
	  DISCONNECT BRANCH FROM BUS 223982 TO BUS 223978 CKT 1
	  DISCONNECT BRANCH FROM BUS 224061 TO BUS 223980 CKT 1
	  DISCONNECT BRANCH FROM BUS 292454 TO BUS 224061 CKT 1 /BUS 223983 -> 292454
	END

BG_CKT2314	CONTINGENCY 'BG_CKT2314' /* HIGH RIDGE-SANDY SPRINGS-BURTONSVILLE CKT#2314
	  DISCONNECT BRANCH FROM BUS 220941 TO BUS 220983 CKT 1 /* #2314 HIGH RIDGE - SANDY SPRINGS
	  DISCONNECT BRANCH FROM BUS 220983 TO BUS 223961 CKT 1 /* #2314 SANDY SPRINGS - BURTONSVILLE
	  CLOSE LINE FROM BUS 220983 TO BUS 220984 CKT 1 /* SANDY SPRINGS HIGH SIDE TIE
	END

BG_CKT2344	CONTINGENCY 'BG_CKT2344' /* BRANDON TO RIVERSIDE CKT #2344
	  DISCONNECT BUS 220989 /*CKT 2344 BRANDON – HAWKINS-SOLLERS
	  DISCONNECT BUS 220990 /*CKT 2344 HAWKINS-SOLLERS-RIVERSIDE
	  DISCONNECT BUS 220977 /* RIVERSIDE 230-1 H/S AND 2339 TO NORTHEAST
	  DISCONNECT BUS 221230 /*RIVERSIDE 230-1 & L/S BUS CONNECTION
	END

Option 2 Impactful Contingencies	
Contingency Name	**File Description**

BG_RIV230-2	CONTINGENCY 'BG_RIV230-2' /* RIVERSIDE 230-2 TRANSFORMER & CKT 2345
	  DISCONNECT BRANCH FROM BUS 220966 TO BUS 220988 CKT 1 /* CKT #2345 RIVERSIDE TO SOLLERS PT
	  DISCONNECT BRANCH FROM BUS 220966 TO BUS 221231 CKT 1 /* RIVERSIDE 230-2 TRANSFORMER
	  DISCONNECT BRANCH FROM BUS 221231 TO BUS 221147 CKT 1 /* RIVERSIDE 230-2 L/S BUS CONNECTION
	END

HIRDG_BURTVL	CONTINGENCY 'HIRDG_BURTVL' /* HIGH RIDGE TO BURTONSVILLE CKTS #2314 & #2334
	  DISCONNECT BUS 220983 /* CKT #2314 HIGH RIDGE – BURTONSVILLE & SANDY SPRINGS 230-2
	  DISCONNECT BUS 220984 /* CKT #2334 HIGH RIDGE – BURTONSVILLE & SANDY SPRINGS 230-1
	END

PANDASC1 _360	CONTINGENCY 'PANDASC1 _360' /* 13.80 KV, AREA 233. REMOVE MACHINE 1 FROM BUS 224101 END
PJM17_X3-068A	CONTINGENCY 'PJM17_X3-068A' DISCONNECT BRANCH FROM BUS 200004 TO BUS 911010 CKT 1 /* CNASTONE PEACHBTM 500 500 END
PJM17_X3-068B	CONTINGENCY 'PJM17_X3-068B' DISCONNECT BRANCH FROM BUS 911010 TO BUS 200013 CKT 1 /* CNASTONE PEACHBTM 500 500 END
PJM67	CONTINGENCY 'PJM67' DISCONNECT BRANCH FROM BUS 200026 TO BUS 200004 CKT 1 /* HUNTERTN CNASTONE 500 500 END
PJM76	CONTINGENCY 'PJM76' REMOVE MACHINE 1 FROM BUS 200034 /* PB2 END
PJM77	CONTINGENCY 'PJM77' REMOVE MACHINE 1 FROM BUS 200035 /* PB3 END
PP1EB	CONTINGENCY 'PP1EB' / NO PATH OPEN BRANCH FROM BUS 200101 TO BUS 235632 CKT 1 / 200003 BRIGHTON 500 200004 CNASTONE 500 1 END
PP27	CONTINGENCY 'PP27' OPEN BRANCH FROM BUS 220983 TO BUS 223961 CKT 1 / 220983 SANDY14T 230 223961 BURT2314 230 1 END
PP28	CONTINGENCY 'PP28' OPEN BRANCH FROM BUS 220984 TO BUS 223962 CKT 1 / 220984 SANDY34T 230 223962 BURT2334 230 1 END
PP31	CONTINGENCY 'PP31' OPEN BRANCH FROM BUS 223961 TO BUS 223978 CKT 1 / 223961 BURT2314 230 223978 BOWIE045 230 1 END
PP36	CONTINGENCY 'PP36' OPEN BRANCH FROM BUS 223962 TO BUS 223977 CKT 1 / 223962 BURT2334 230 223977 BOWIE042 230 1 END

PP47	CONTINGENCY 'PP47'
	  OPEN BRANCH FROM BUS 223982 TO BUS 223990 CKT 1 / 223982 OAKGV230 230 223990 TALB 068 230 1
	  OPEN BRANCH FROM BUS 290891 TO BUS 223990 CKT 1 / 290891 S17 230 223990 TALB 068 230 1 / S17.
	END

Option 2 Impactful Contingencies	
Contingency Name	**File Description**
PP54_V3-017A	CONTINGENCY 'PP54_V3-017A' OPEN BRANCH FROM BUS 223982 TO BUS 224125 CKT 1 / 223982 OAKGV230 230 224125 TALB 066 230 1 OPEN BRANCH FROM BUS 223992 TO BUS 894610 CKT 1 / 223992 HAWK 076 230 224125 TALB 066 230 1 OPEN BRANCH FROM BUS 223992 TO BUS 224078 CKT 1 / 223992 HAWK 076 230 224078 HAWK 69 69.0 1 END
PP85	CONTINGENCY 'PP85' OPEN BRANCH FROM BUS 224102 TO BUS 224104 CKT 1 / 224102 BENN T7 115 224104 TUX 504 115 1 END
WCHPL_BRNDN	CONTINGENCY 'WCHPL_BRNDN' /* WAUGH CHAPEL TO BRANDON SHORES CKTS #2342 & #2343 DISCONNECT BRANCH FROM BUS 220955 TO BUS 220960 CKT 42 /* CKT #2342 W. CHAPEL TO BRANDON SHORES DISCONNECT BRANCH FROM BUS 220955 TO BUS 220960 CKT 43 /* CKT #2343 W. CHAPEL TO BRANDON SHORES END

Network Impacts:

Generator Deliverability

(Single or N-1 contingencies for the Capacity portion only of the interconnection)

X3-087 Opt. 2 ###	Contingency		Affected Area	Facility Description	Bus		Circuit	Analyses Type	Loading		Rating		MW Contribution
	Type	Name			To	From			Before	After	Type	MVA	
001	N-1	PP1EB	METED	Germantown-Germantown Reactor 138 kV line	204530	204531	1	DC	95.25	96.15	ER	104	5.83
002	Non	Non	PEPCO	Panda-Burches Hill 230 kV line	224098	223994	1	DC	41.06	173.99	NR	559	743.09
003	Non	Non	PJM	EMORY GR500-Conastone 500 kV line	200101	200004	1	DC	86.44	87.27	NR	2338	119.94
004	N-1	PP47	PEPCO	Talbert 082-Oak Groove 230 kV line	223991	223982	1	DC	87.23	105.32	ER	680	122.99
005	N-1	PP1EB	BG&E	Columbia-Howard 2312 230 kV line	221010	220953	1	DC	95.83	96.65	ER	941	47.53
006	N-1	PP1EB	METED	Germantown Reactor-Germantown 138/115 kV transformer	204531	204529	1	DC	95.25	96.15	ER	104	5.83
007	N-1	PP1EB	BG&E	Granite 2311 & 2312-North West 2311 & 2310 230 kV line	220972	220962	1	DC	93.64	94.81	ER	621	44.74
008	N-1	BG_CKT2314	PEPCO/BG&E	Burtonsville 2334-Sandy Spring 2334 230 kV line	223962	220984	1	DC	87.27	87.94	ER	1227	51.04
009	N-1	PP1EB	PEPCO/BG&E	Burtonsville 2314-Sandy Spring 2314 230 kV line	223961	220983	1	DC	84.4	85.03	ER	1227	47.88
010	N-1	PJM17_X3-068B	BG&E/PL	Graceton-Safe Harbor Units 3-4 Tap 230 kV line	220964	208071	1	DC	98.43	99.53	ER	485	33.58

Multiple Facility Contingency

(Double Circuit Tower Line contingencies only with full energy output. Stuck Breaker and Bus Fault contingencies will be applied during the Impact Study)

X3-087 Opt. 2 ###	Contingency		Affected Area	Facility Description	Bus		Circuit	Analyses Type	Loading		Rating		MW Contribution
	Type	Name			To	From			Before	After	Type	MVA	
011	DCTL	WCHPL_BRNDN	BG&E	Pumphrey-Pumphrey 230/115 kV transformer	220974	221037	1	DC	95.2	96.22	ER	485	30.81
012	DCTL	10PEPCO_S17_X2-030	PEPCO	Talbert 082-Oak Groove 230 kV line	223991	223982	1	DC	90.49	112.75	ER	680	151.41
013	DCTL	HIRDG_BURTVL	PEPCO/BG&E	Bowie 043-Bowiebc1 2341 230 kV line	223980	220956	1	DC	96.63	98.06	ER	721	63.71
014	DCTL	HIRDG_BURTVL	PEPCO/BG&E	Bowie 044-Bowiebc0 2340 230 kV line	223979	220959	1	DC	99.06	100.52	ER	720	65.15
015	DCTL	WCHPL_BRNDN	BG&E	Howard 2332-Pumphrey 230 kV line	220954	220974	1	DC	95.38	96.41	ER	485	30.81

Contribution to Previously Identified Overloads

(This project contributes to the following contingency overloads, i.e. "Network Impacts", identified for earlier generation or transmission interconnection projects in the PJM Queue.)

X3-087 Opt. 2 ###	Contingency		Affected Area	Facility Description	Bus		Circuit	Analyses Type	Loading		Rating		MW Contribution
	Type	Name			To	From			Before	After	Type	MVA	
016	N-1	PP1EB	BG&E	High Ridge 2316-Howard 2332 230 kV line	220941	220954	1	DC	119.86	120.78	ER	941	54.16
017	N-1	PP1EB	BG&E	Howard 2332-Granite 2326 & 2332 230 kV line	220954	220973	1	DC	101.18	102.15	ER	728	43.66
018	N-1	PJM17_X3-068B	PECO	Nottingham Reactor-Nottingham 230 kV line	213846	213844	1	DC	108.74	109.61	ER	627	33.82
019	N-1	PP1EB	PENELEC	Roxbury-Roxbury 138/115 kV transformer	200532	200520	1	DC	126.25	127.42	ER	138	10
020	DCTL	12PEPCO_S17_X2-030_X2-102	PEPCO	Talbert 068-Oak Groove 230 kV line	223990	223982	1	DC	103.94	123.03	ER	691	131.91
021	N-1	PP54_V3-017A	PEPCO	Talbert 068-Oak Groove 230 kV line	223990	223982	1	DC	104.98	116.5	ER	691	79.65
022	N-1	PJM17_X3-068B	BG&E/PL	Conastone-Otter Creek Switchyard 230 kV line	220963	208048	1	DC	165.92	167.06	ER	531	37.93
023	N-1	PP28	BG&E	Sandy Spring 2314-High Ridge 2316 230 kV line	220983	220941	1	DC	108.14	109.02	ER	941	51.57

X3-087 Opt. 2 ###	Contingency		Affected Area	Facility Description	Bus		Circuit	Analyses Type	Loading		Rating		MW Contribution
	Type	Name			To	From			Before	After	Type	MVA	
024	DCTL	7PEPCO_A	PEPCO	Bowie 042-Burtonsville 2334 230 kV line	223977	223962	1	DC	127.72	129.88	ER	730	98.01
025	N-1	PP31	PEPCO	Bowie 042-Burtonsville 2334 230 kV line	223977	223962	1	DC	115.9	117.56	ER	730	75.36
026	Non	Non	PEPCO	Bowie 042-Burtonsville 2334 230 kV line	223977	223962	1	DC	112.52	114.15	NR	608	61.3
027	N-1	PJM17_X3 -068B	BG&E/PEC O	Graceton-Cooper 230 kV line	220964	214089	1	DC	152.62	153.74	ER	485	33.82
028	DCTL	7PEPCO_A	PEPCO	Benning East-12Th & Irving 69 kV line	224023	224119	1	DC	127.33	129.25	ER	118	14.05
029	N-1	PP31	PEPCO	Benning East-12Th & Irving 69 kV line	224023	224119	1	DC	118.34	119.81	ER	118	10.75
030	Non	Non	PEPCO	Benning East-12Th & Irving 69 kV line	224023	224119	1	DC	113.2	114.47	NR	106	8.38
031	DCTL	7PEPCO_A	PEPCO	Ft Slocum Par-Ft Slocum 69 kV line	224121	224122	1	DC	140.83	143.86	ER	150	28.1
032	N-1	PP31	PEPCO	Ft Slocum Par-Ft Slocum 69 kV line	224121	224122	1	DC	116.95	119.26	ER	150	21.5
033	Non	Non	PEPCO	Ft Slocum Par-Ft Slocum 69 kV line	224121	224122	1	DC	101.49	103.57	NR	130	16.75
034	N-1	PJM77	PJM	Conastone-X3-068 TAP 500 kV line	200004	911010	1	DC	138.39	138.94	ER	2815	132.47
035	N-1	PJM17_X3 -068B	PECO	Cooper-Peach Bottom 230 kV line	214089	213869	1	DC	150.14	151.27	ER	485	33.82
036	DCTL	7PEPCO_A	PEPCO	12Th & Irving-Ft Slocum Par 69 kV line	224119	224121	1	DC	179.25	182.88	ER	125	28.1
037	N-1	PP31	PEPCO	12Th & Irving-Ft Slocum Par 69 kV line	224119	224121	1	DC	151.22	154	ER	125	21.5
038	N-1	PP27	BG&E	Sandy Spring 2334-High Ridge 2316 230 kV line	220984	220941	1	DC	108.52	109.39	ER	941	51.04
039	DCTL	5PEPCO	PEPCO	Bowie 045-Burtonsville 2314 230 kV line	223978	223961	1	DC	128.82	131	ER	730	98.59
040	N-1	PP36	PEPCO	Bowie 045-Burtonsville 2314 230 kV line	223978	223961	1	DC	116.29	117.95	ER	730	75.23
041	Non	Non	PEPCO	Bowie 045-Burtonsville 2314 230 kV line	223978	223961	1	DC	113.09	114.71	NR	608	61.1
042	N-1	PP85	PEPCO	Benning T4-Tuxedo 503 115 kV line	224103	224105	1	DC	100.2	101.53	ER	180	14.73
043	N-1	PJM17_X3 -068B	PECO	Peach Bottom-Nottingham Reactor 230 kV line	213869	213846	1	DC	108.8	109.67	ER	627	33.82
044	N-1	PJM17_X3 -068B	PL	Safe Harbor Units 3-4 Tap-Manor Substation 230 kV line	208071	208019	1	DC	111.17	112.08	ER	579	32.83
045	N-1	BG_RIV23 0-2	BG&E	Brandon Shores-Hawkins Point 2344 230 kV line	220960	220989	1	DC	101.41	102	ER	1153	42.04

X3-087 Opt. 2 ###	Contingency		Affected Area	Facility Description	Bus		Circuit	Analyses Type	Loading		Rating		MW Contribution
	Type	Name			To	From			Before	After	Type	MVA	
046	DCTL	5PEPCO	PEPCO	Oak Groove-Bowie 045 230 kV line	223982	223978	1	DC	128.94	131.12	ER	730	98.59
047	N-1	PP36	PEPCO	Oak Groove-Bowie 045 230 kV line	223982	223978	1	DC	116.41	118.07	ER	730	75.23
048	Non	Non	PEPCO	Oak Groove-Bowie 045 230 kV line	223982	223978	1	DC	113.23	114.85	NR	608	61.1
049	N-1	BG_CKT2344	BG&E	Riverside 2317-Northeast 2315 & 2317 230 kV line	220966	220979	1	DC	103.02	103.87	ER	632	33.22
050	DCTL	7PEPCO_A	PEPCO	Benning East-12Th & Irving 69 kV line	224023	224119	2	DC	127.33	129.25	ER	118	14.05
051	N-1	PP31	PEPCO	Benning East-12Th & Irving 69 kV line	224023	224119	2	DC	118.34	119.81	ER	118	10.75
052	Non	Non	PEPCO	Benning East-12Th & Irving 69 kV line	224023	224119	2	DC	113.2	114.47	NR	106	8.38
053	DCTL	7PEPCO_A	PEPCO	Oak Groove-Bowie 042 230 kV line	223982	223977	1	DC	127.97	130.13	ER	730	98.01
054	N-1	PP31	PEPCO	Oak Groove-Bowie 042 230 kV line	223982	223977	1	DC	116.15	117.82	ER	730	75.36
055	Non	Non	PEPCO	Oak Groove-Bowie 042 230 kV line	223982	223977	1	DC	112.83	114.45	NR	608	61.3
056	N-1	BG_RIV230-2	BG&E	Sollers Point 2344-Riverside 2339 230 kV line	220990	220977	1	DC	117.47	118.12	ER	1036	42.04
057	N-1	PP1EB	BG&E	Howard 2312-Granite 2311 & 2312 230 kV line	220953	220972	1	DC	118.34	119.4	ER	728	47.53
058	N-1	PP1EB	BG&E	High Ridge 2316-Columbia 230 kV line	220941	221010	1	DC	110.69	111.5	ER	941	47.26
059	N-1	PJM67	AP/PJM	Kemptown-EMORY GR500 500 kV line	235632	200101	1	DC	134.67	135.02	ER	2901	89.85
060	Non	Non	AP/PJM	Kemptown-EMORY GR500 500 kV line	235632	200101	1	DC	147.7	148.23	NR	2338	97.76
061	N-1	PJM77	PJM	X3-068 TAP-Peach Bottom 500 kV line	911010	200013	1	DC	145.65	146.2	ER	2815	132.47

Short Circuit

(Report over-dutied breakers.)

Analysis found new breakers for the primary option to be over-duty in the ITO transmission area.

BUS_NO	BUS	BREAKER	Rating Type	Duty Percent With x3-087_PEPCO_opt1	Duty Percent Without x3-087_PEPCO_opt1	Duty Percent Difference	Note
314922	POSSUM POINT 500.kV	H1T560	S	108.80%	98.20%	10.60%	New Overduty
314922	POSSUM POINT 500.kV	H1T568	S	108.80%	96.50%	12.30%	New Overduty
314922	POSSUM POINT 500.kV	560T571	S	103.70%	98.20%	5.50%	New Overduty
663	POSS PT230 T 230.kV	L1T2078	S	100.70%	80.50%	20.20%	New Overduty
314918	NORTH ANNA 500.kV	57302	S	100.20%	100.00%	0.20%	New Overduty
314918	NORTH ANNA 500.kV	57502	S	100.20%	100.00%	0.20%	New Overduty
314918	NORTH ANNA 500.kV	57602	S	100.20%	100.00%	0.20%	New Overduty

- The estimated cost to replace three overdutied 500 kV breakers 57302, 57502 and 57602 at North Anna substation with 63 kA breakers will be $685,000 per breaker and will take 15 months including equipment order time.
- The estimated cost to replace three overdutied 500 kV breakers 560T571, H1T560 and H1T568 at Possum Point substation with 50 kA breakers will be $650,000 per breaker and will take 14 months including equipment order time.
- At Possum Point 230 kV, most of the 230 kV breakers must interrupt more than 80 kA of fault currents which will require the split/rebuild the 230 kV bus at Possum Point and the estimated cost for this is about $18,000,000 and will tale about 30 months. Once the 230 kV bus is split, breaker L1T2078, which is shown as overdutied, will not be overdutied.

Analysis found this project contributes to the over-duty of the following breakers. Higher order queue projects are first to cause and allocations to these over-duty breakers will be provided at the System Impact Study. Note the discussion provided for Possum Point provided in the new over-duty breakers section. This project will receive a blend of first to cause and allocation for those breakers.

BUS_NO	BUS	BREAKER	Rating Type	Duty Percent With x3-087_PEPCO_opt2	Duty Percent Without x3-087_PEPCO_opt2	Duty Percent Difference	Note
223994	BHILL 230 230.kV	ABB GCB	S	113.00%	105.30%	7.70%	Over 100%, > 3% contribution
223994	BHILL 230 230.kV	ITE OCB	S	113.00%	105.30%	7.70%	Over 100%, > 3% contribution
223994	BHILL 230 230.kV	WEST OCB	S	113.00%	105.30%	7.70%	Over 100%, > 3% contribution
314074	POSSUM POINT 230.kV	H9T237	S	134.10%	125.20%	8.90%	Over 100%, > 3% contribution
314074	POSSUM POINT 230.kV	H992	S	132.40%	123.50%	8.90%	Over 100%, > 3% contribution
314074	POSSUM POINT 230.kV	H892	S	132.30%	123.40%	8.90%	Over 100%, > 3% contribution
314074	POSSUM POINT 230.kV	H8T2078	S	132.30%	123.40%	8.90%	Over 100%, > 3% contribution
314074	POSSUM POINT 230.kV	23792	S	131.40%	122.20%	9.20%	Over 100%, > 3% contribution
314074	POSSUM POINT 230.kV	G6BTGT	S	131.40%	122.50%	8.90%	Over 100%, > 3% contribution
314074	POSSUM POINT 230.kV	GT92	S	131.40%	122.50%	8.90%	Over 100%, > 3% contribution
314074	POSSUM POINT 230.kV	202292	S	131.00%	121.80%	9.20%	Over 100%, > 3% contribution
314074	POSSUM POINT 230.kV	252T2022	S	131.00%	121.80%	9.20%	Over 100%, > 3% contribution
314074	POSSUM POINT 230.kV	21592	S	130.80%	121.50%	9.30%	Over 100%, > 3% contribution
314074	POSSUM POINT 230.kV	G5T215	S	130.80%	121.50%	9.30%	Over 100%, > 3% contribution
314074	POSSUM POINT 230.kV	25292	S	129.80%	120.90%	8.90%	Over 100%, > 3% contribution
314074	POSSUM POINT 230.kV	G492	S	129.80%	120.90%	8.90%	Over 100%, > 3% contribution
314074	POSSUM POINT 230.kV	G592	S	129.80%	120.90%	8.90%	Over 100%, > 3% contribution
314074	POSSUM POINT 230.kV	G6A92	S	129.80%	120.90%	8.90%	Over 100%, > 3% contribution
314074	POSSUM POINT 230.kV	G6B92	S	129.80%	120.90%	8.90%	Over 100%, > 3% contribution
314074	POSSUM POINT 230.kV	200192	S	127.90%	119.00%	8.90%	Over 100%, > 3% contribution
314074	POSSUM POINT 230.kV	207892	S	127.90%	119.00%	8.90%	Over 100%, > 3% contribution
314074	POSSUM POINT 230.kV	G6S92	S	127.90%	119.00%	8.90%	Over 100%, > 3% contribution
314074	POSSUM POINT 230.kV	G4T2001	S	127.80%	119.00%	8.80%	Over 100%, > 3% contribution
688	POSS PT CAP 230.kV	SC192	S	113.80%	108.60%	5.20%	Over 100%, > 3% contribution

Energy Portion of Interconnection Request

PJM also studied the delivery of the energy portion of the surrounding generation. Any potential problems identified below are likely to result in operational restrictions to the project under study. The developer can proceed with network upgrades to eliminate the operational restriction at their discretion by submitting a Transmission Interconnection request.

Note: Only the most severely overloaded conditions are listed. There is no guarantee of full delivery of energy for this project by fixing only the conditions listed in this section. With a Transmission Interconnection Request, a subsequent analysis will be performed which analyzes all overload conditions associated with the overloaded element(s) identified. As a result of the aggregate energy resources in the area, the following violations were identified.

X3-087 Opt. 2 ###	Contingency		Affected Area	Facility Description	Bus		Circuit	Analyses Type	Loading		Rating		MW Contribution
	Type	Name			To	From			Before	After	Type	MVA	
062	Op	PP1EB	BG&E	High Ridge 2316-Howard 2332 230 kV line	220941	220954	1	DC	115.76	116.37	ER	941	66.54
063	Op	PP1EB	BG&E	Howard 2332-Granite 2326 & 2332 230 kV line	220954	220973	1	DC	88.41	89.6	ER	728	53.65
064	Op	PJM17_X3-068B	PECO	Nottingham Reactor-Nottingham 230 kV line	213846	213844	1	DC	104.73	105.77	ER	627	41.56
065	Op	PP1EB	PENELEC	Roxbury-Roxbury 138/115 kV transformer	200532	200520	1	DC	156.26	156.82	ER	138	12.29
066	Non	Non	PENELEC	Roxbury-Roxbury 138/115 kV transformer	200532	200520	1	DC	107.09	108.24	NR	124	8.85
067	Op	PP1EB	METED	Germantown-Germantown Reactor 138 kV line	204530	204531	1	DC	122.74	123.85	ER	104	7.16
068	Op	PP54_V3-017A	PEPCO	Talbert 068-Oak Groove 230 kV line	223990	223982	1	DC	104.57	118.73	ER	691	97.87
069	Non	Non	PEPCO	Panda-Burches Hill 230 kV line	224098	223994	1	DC	41.06	204.4	NR	559	913.08
070	Op	PANDASC1_360	PEPCO	Panda-Burches Hill 230 kV line	224098	223994	1	DC	23.67	157.95	ER	680	913.08
071	Non	Non	PJM	EMORY GR500-Conastone 500 kV line	200101	200004	1	DC	90.31	91.14	NR	2338	147.38
072	Op	PJM17_X3-068B	BG&E/PL	Conastone-Otter Creek Switchyard 230 kV line	220963	208048	1	DC	138.22	139.63	ER	531	46.61
073	Op	PP1EB	BG&E	Sandy Spring 2314-High Ridge 2316 230 kV line	220983	220941	1	DC	107.47	108.48	ER	941	58.84
074	Op	PP31	PEPCO	Bowie 042-Burtonsville 2334 230 kV line	223977	223962	1	DC	115.32	117.36	ER	730	92.6
075	Non	Non	PEPCO	Bowie 042-Burtonsville 2334 230 kV line	223977	223962	1	DC	111.96	113.96	NR	608	75.32
076	Op	PP47	PEPCO	Talbert 082-Oak Groove 230 kV line	223991	223982	1	DC	86.75	108.98	ER	680	151.13

X3-087 Opt. 2 ###	Contingency		Affected Area	Facility Description	Bus		Circuit	Analyses Type	Loading		Rating		MW Contribution
	Type	Name			To	From			Before	After	Type	MVA	
077	Op	PJM17_X3-068B	BG&E/PECO	Graceton-Cooper 230 kV line	220964	214089	1	DC	136.74	137.41	ER	485	41.56
078	Op	PP31	PEPCO	Benning East-12Th & Irving 69 kV line	224023	224119	1	DC	118.34	120.15	ER	118	13.21
079	Non	Non	PEPCO	Benning East-12Th & Irving 69 kV line	224023	224119	1	DC	113.2	114.76	NR	106	10.29
080	Op	PP31	PEPCO	Ft Slocum Par-Ft Slocum 69 kV line	224121	224122	1	DC	115.26	118.1	ER	150	26.42
081	Non	Non	PEPCO	Ft Slocum Par-Ft Slocum 69 kV line	224121	224122	1	DC	99.89	102.45	NR	130	20.59
082	Op	PJM77	PJM	Conastone-X3-068 TAP 500 kV line	200004	911010	1	DC	121.74	122.47	ER	2815	162.77
083	Op	PP1EB	METED	Germantown Reactor-Germantown 138/115 kV transformer	204531	204529	1	DC	122.74	123.85	ER	104	7.16
084	Op	PJM17_X3-068B	PECO	Cooper-Peach Bottom 230 kV line	214089	213869	1	DC	134.71	135.39	ER	485	41.56
085	Op	PP31	PEPCO	12Th & Irving-Ft Slocum Par 69 kV line	224119	224121	1	DC	154.44	157.86	ER	125	26.42
086	Op	PP1EB	BG&E	Sandy Spring 2334-High Ridge 2316 230 kV line	220984	220941	1	DC	109.43	110.42	ER	941	57.41
087	Op	PP36	PEPCO	Bowie 045-Burtonsville 2314 230 kV line	223978	223961	1	DC	115.71	117.75	ER	730	92.43
088	Non	Non	PEPCO	Bowie 045-Burtonsville 2314 230 kV line	223978	223961	1	DC	112.52	114.51	NR	608	75.07
089	Op	PP85	PEPCO	Benning T4-Tuxedo 503 115 kV line	224103	224105	1	DC	100.2	101.83	ER	180	18.1
090	Op	PJM17_X3-068B	PECO	Peach Bottom-Nottingham Reactor 230 kV line	213869	213846	1	DC	104.8	105.83	ER	627	41.56
091	Op	PJM17_X3-068B	PL	Safe Harbor Units 3-4 Tap-Manor Substation 230 kV line	208071	208019	1	DC	116.42	117.55	ER	579	40.34
092	Op	BG_RIV230-2	BG&E	Brandon Shores-Hawkins Point 2344 230 kV line	220960	220989	1	DC	98.55	99.27	ER	1153	51.66
093	Op	PP36	PEPCO	Oak Groove-Bowie 045 230 kV line	223982	223978	1	DC	115.83	117.87	ER	730	92.43
094	Non	Non	PEPCO	Oak Groove-Bowie 045 230 kV line	223982	223978	1	DC	112.66	114.66	NR	608	75.07
095	Op	BG_CKT2344	BG&E	Riverside 2317-Northeast 2315 & 2317 230 kV line	220966	220979	1	DC	106.98	108.03	ER	632	40.82
096	Op	PP31	PEPCO	Benning East-12Th & Irving 69 kV line	224023	224119	2	DC	118.34	120.15	ER	118	13.21
097	Non	Non	PEPCO	Benning East-12Th & Irving 69 kV line	224023	224119	2	DC	113.2	114.76	NR	106	10.29
098	Op	PP31	PEPCO	Oak Groove-Bowie 042 230 kV line	223982	223977	1	DC	115.57	117.61	ER	730	92.6

X3-087 Opt. 2 ###	Contingency		Affected Area	Facility Description	Bus		Circuit	Analyses Type	Loading		Rating		MW Contribution
	Type	Name			To	From			Before	After	Type	MVA	
099	Non	Non	PEPCO	Oak Groove-Bowie 042 230 kV line	223982	223977	1	DC	112.26	114.26	NR	608	75.32
100	Op	BG_RIV230-2	BG&E	Sollers Point 2344-Riverside 2339 230 kV line	220990	220977	1	DC	114.29	115.09	ER	1036	51.66
101	Op	PJM17_X3-068B	BG&E/PL	Graceton-Safe Harbor Units 3-4 Tap 230 kV line	220964	208071	1	DC	101.97	102.66	ER	485	41.27
102	Op	PP1EB	AP/PENELEC	Greene-Roxbury 138 kV line	235188	200532	1	DC	104.89	105.94	ER	189	12.29
103	Op	PP1EB	BG&E	Howard 2312-Granite 2311 & 2312 230 kV line	220953	220972	1	DC	106.02	106.71	ER	728	58.41
104	Op	PP1EB	BG&E	High Ridge 2316-Columbia 230 kV line	220941	221010	1	DC	100.24	101.24	ER	941	58.07
105	Op	PJM67	AP/PJM	Kemptown-EMORY GR500 500 kV line	235632	200101	1	DC	122.21	122.66	ER	2901	110.41
106	Non	Non	AP/PJM	Kemptown-EMORY GR500 500 kV line	235632	200101	1	DC	133.32	133.95	NR	2338	120.13
107	Op	PJM17_X3-068A	PL	Millwood Transformer #1-South Akron Transformer 3 230 kV line	208030	208079	1	DC	97.99	98.81	ER	588	29.89
108	Op	PJM76	PJM	X3-068 TAP-Peach Bottom 500 kV line	911010	200013	1	DC	129.29	130.01	ER	2815	162.77

Primary Option:

Attachment Facilities:

It is assumed that IC will construct all Attachment Facilities.

Direct Connection Network Upgrades:

Add 230 kV station: $20 million

Remote end relay and telecom costs: $500K

If station is provided by Interconnection Customer: $2 million for commissioning costs.

Non-Direct Connection Network Upgrades:

X3-087 Opt. 1 ###	ITO	Work Description	Estimated Cost	Approximate Duration
001	METED	Based on an initial review, we have determined that the reactor cannot be upgraded. Therefore the apparent mitigation action will be to replace the Germantown 138/115 kV transformer and miscellaneous substation components.	$5,028,600	
002	PJM	The two breaker bay at Conastone for the Brighton line is over the continuous rating. Upgrade Conastone bay with two 4000A breakers, four 4000A breaker disconnects and a 4000 A line switch need to be either. New rating 3710.	$3,000,000	36
003	PJM	Same as X3-087-1-002	already addressed	already addressed
004	PEPCO	Engineering and construction includes time to allow for the longer lead time to acquire the ACCR conductor. All the breakers and switches at the Oak Grove Sub are in the process of being upgraded as a baseline upgrade so there are no breaker replacement cost associated with the feeder upgrades. Relaying and testing will for the upgraded 3 feeders will be 100K per feeder at Oak Grove. Currently there are no breakers at Talbert but as part of the suspended S17 project, breakers were added for that project. These breakers would need to be 3000 amps when installed.	$24,300,000	30
005	BG&E	Rebuild 3.6 miles of double circuit line with bundled 1033.5 MCM conductor. Rate line to 968/1227 MVA. Duration includes CPCN.	$12,000,000	48
006	DVP	Dominion would need to install a second 500-230 kV transformer at this location to resolve this overload.	$20,000,000	
007	METED	Same as X3-087-1-001	already addressed	already addressed
008	BG&E	The overload can be alleviated by reconductoring the line with 2167 ACSR which will increase the rating to 1105 MVA. There will also be substation terminal cost upgrades associated with the reinforcement.	$23,600,000	72
009	BG&E	Remove the wire drop limitation at Pumphrey for new ratings of 525/640.	$200,000	12
010	PEPCO	Same as X3-087-1-004	already addressed	already addressed

X3-087 Opt. 1 ###	ITO	Work Description	Estimated Cost	Approximate Duration
011	PEPCO/BG&E	**PEPCO:** The Two tie lines at Bowie 043 and 044 are limited on the Pepco end by metering. Substation Engineering estimates the replacement of the metering and associated equipment to be $250K per feeder. This would raise the emergency limit to the conductor rating of 800 MVA. **BGE:** Pepco equipment limits the line. Removing the limitation then the BGE rating is 799 SN/974 SE.	$500,000	
012	PEPCO/BG&E	Same as X3-087-1-011	already addressed	already addressed
013	BG&E	Remove wire drop limitation on the disconnect (ABSU) at Howard. Transmission line has sag limitations multiple spans line near obsolesce condition and upgrading is not possible requires total rebuild Howard to Pumphrey circuit. Effort includes CPCN.	$12,000,000	48
014	BG&E	Rebuild line to accommodate double bundle 1272 ACSR. Existing: Circuit 2332-A is 1590 kcm ACSR @ 160 deg. C Assumptions: Length of line is 8.9 miles, 2+ year CPCN process required, Existing tower removal included	$24,000,000	60
015	BG&E	Replace wire drops and upgrade structures. New rating 825 MVA	$500,000	18
016	PECO	Replace Line 220-08 reactor and by-pass circuit switcher at Nottingham substation to get a minimum summer emergency rating of 741 MVA.	$1,700,000	24
017	PENELEC	Install a standard 115kV Circuit Breaker with 3000A.	$717,300	
018	PEPCO	Same as X3-087-1-004	already addressed	already addressed
019	PEPCO	Same as X3-087-1-004	already addressed	already addressed

X3-087 Opt. 1 ###	ITO	Work Description	Estimated Cost	Approximate Duration
020	BG&E/PL	A PPL project to re-conductor Manor-Conastone with 1590 ACSR is underway. The BG&E portion of the Conastone to Otter Creek line can be upgraded by reconducting from Gorsuch Mills to the Pennsylvania State Line (change of ownership to PPL). The existing circuit 2302 conductor is 1590 kcmil 45/7 ACSR from Conastone to Gorsuch Mills and 795 kcm 30/19 ACSR from Gorsuch Mills to the PA State Line. Assumptions: • Reconductor with 1590 kcm ACSR from Gorsuch Mills to PA line to match capability of remainder of line. • Length of this line section is 1.7 miles. • Towers can be reinforced instead of replaced. • Based on previous estimate by R.W.M. for PJM (B48) study on circuit 22008	$700,000	36
021	BG&E	Rebuild existing line using double bundle 1033 ACSR @ 125 degC (1227 MVA), Assumptions: Full structure replacement required, Existing structure removal included, Line length of 3.61 miles, 2+ year CPCN process required	$10,000,000	60
022	PEPCO	Upgrading this circuit will require replacing the existing conductor to an ACCR conductor, which will be rated at 3000 amps or 1200 MVA SE.	$8,000,000	24
023	PEPCO	Same as X3-087-1-022	already addressed	already addressed
024	PEPCO	Same as X3-087-1-022	already addressed	already addressed
025	PEPCO	For the overloads identified on the Pepco 69kV (Benning, 12 Street & Irving and Ft Slocum) - Pepco found these violations to not be valid because the 2015 load flow cases dispatched the Benning and Buzzard Generation which deactivate in 2012. The dispatch of these units are the reason for these violations in this report. Given the retirement, these overloads do not require addressing.	TO dismissed	TO dismissed
026	PEPCO	Same as X3-087-1-025	already addressed	already addressed
027	PEPCO	Same as X3-087-1-025	already addressed	already addressed

X3-087 Opt. 1 ###	ITO	Work Description	Estimated Cost	Approximate Duration
028	BG&E/PL	PPL: A PPL project to re-conductor Manor-Graceton 230 kV with 1590 ACSR is underway. BGE: Line rated 559/674. There are substation limitations at Graceton that will be removed with project b0497.	identified projects must be completed	identified projects must be completed
029	BG&E/PECO	Rebuild Cooper to Graceton 230kV line 1.85 miles to PA border. New rating would be 648/802. Estimated time includes obtaining CPCN.	$7,500,000	54
030	BG&E	Same as X3-087-1-015	already addressed	already addressed
031	PEPCO	Same as X3-087-1-025	already addressed	already addressed
032	PEPCO	Same as X3-087-1-025	already addressed	already addressed
033	PEPCO	Same as X3-087-1-025	already addressed	already addressed
034	PECO	Reconductor Line 220-08 from Peach Bottom tap to Cooper Substation to get a minimum summer emergency rating of 741 MVA. The line is approximately 1.4 miles long.	$1,000,000	24
035	PEPCO	Same as X3-087-1-025	already addressed	already addressed
036	PEPCO	Same as X3-087-1-025	already addressed	already addressed
037	BG&E	Same as X3-087-1-021	already addressed	already addressed
038	PEPCO	Upgrading this circuit will require replacing the existing conductor to an ACCR conductor, which will be rated at 3000 amps or 1200 MVA SE.	$8,000,000	24
039	PEPCO	Same as X3-087-1-038	already addressed	already addressed
040	PEPCO	Same as X3-087-1-038	already addressed	already addressed
041	PEPCO	Same as X3-087-1-025	already addressed	already addressed
042	PECO	Reconductor Line 220-08 from Nottingham Reactor to Peach Bottom tap to get a minimum	$10,000,000	48
043	PL	Upgrade current 795 kcmil 30/19 (140 degrees C) line section to 1590 kcmil 45/7 (125 degrees).	$56,000	

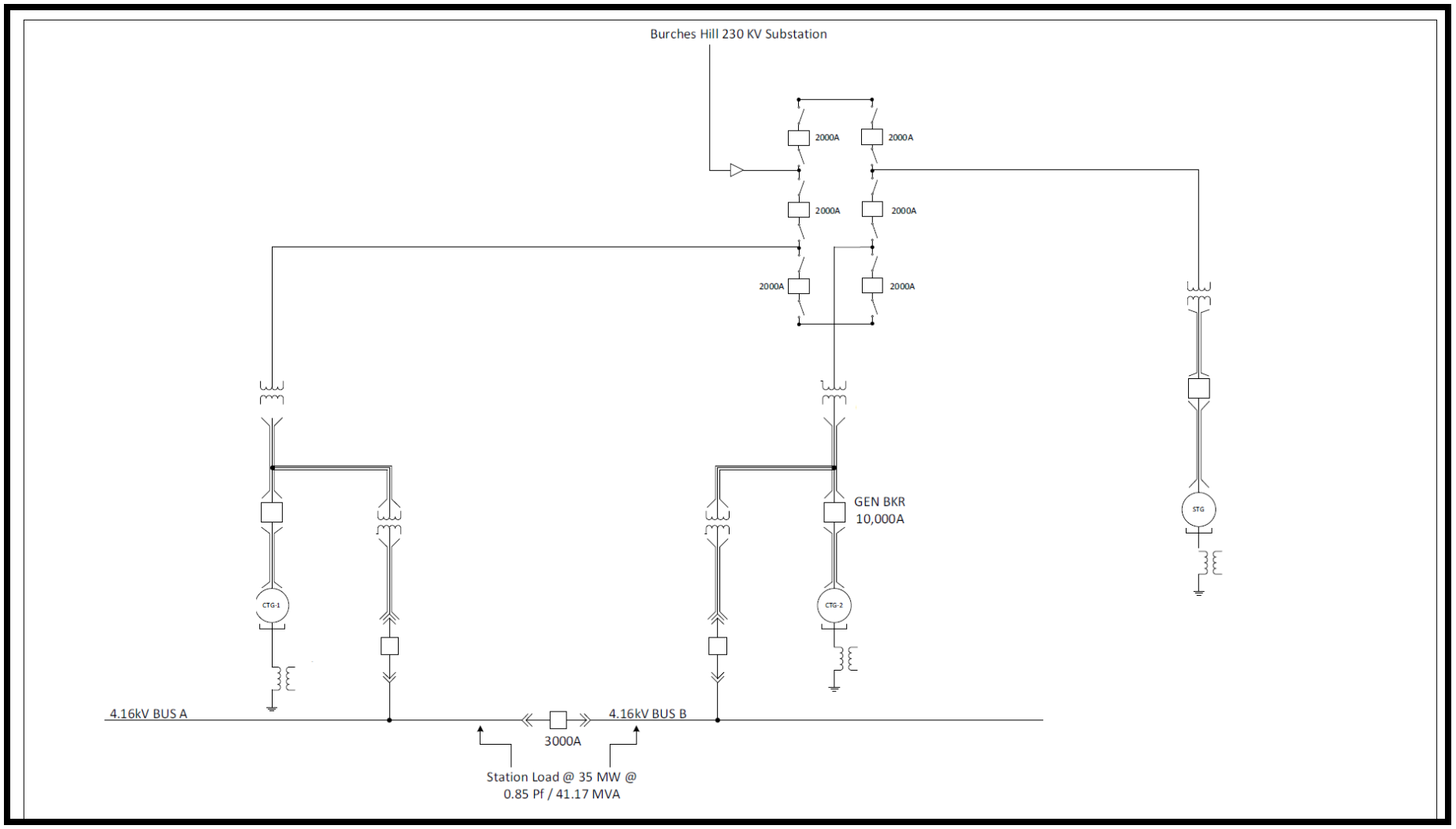
X3-087 Opt. 1 ###	ITO	Work Description	Estimated Cost	Approximate Duration
044	BG&E	Install one additional Harbor Crossing cable Hawkins Point to Sollers Point, re-rate new OH sections to 180C.	$40,250,000	120
045	PEPCO	Upgrading this circuit will require replacing the existing conductor to an ACCR conductor, which will be rated at 3000 amps or 1200 MVA SE.	$12,000,000	24
046	PEPCO	Same as X3-087-1-045	already addressed	already addressed
047	PEPCO	Same as X3-087-1-045	already addressed	already addressed
048	BG&E	Existing rating should be 675 SE.	TO dismissed	TO dismissed
049	PEPCO	Same as X3-087-1-025	already addressed	already addressed
050	PEPCO	Same as X3-087-1-025	already addressed	already addressed
051	PEPCO	Same as X3-087-1-025	already addressed	already addressed
052	PEPCO	Upgrading this circuit will require replacing the existing conductor to an ACCR conductor, which will be rated at 3000 amps or 1200 MVA SE.	$12,000,000	24
053	PEPCO	Same as X3-087-1-052	already addressed	already addressed
054	PEPCO	Same as X3-087-1-052	already addressed	already addressed
055	BG&E	Same as X3-087-1-044	already addressed	already addressed

X3-087 Opt. 1 ###	ITO	Work Description	Estimated Cost	Approximate Duration
056	PJM	BGE: • At Conastone construct a new two breaker 4000A bay (breakers D, F) with two 63 kA breakers. Includes line termination structures, allowance for a second line and the relocation of the 500kV cap bank. 36 months to complete - $14M • Construct a new 500kV line from Conastone - Peachbotton rated for a minimum of 2939/3733 SN/SE. Build 9.6 miles 500KV line from Conastone to Pennsylvania line. Purchase 150’ R/W. Total for project $46.8 million 5-7 years. PECO: • Replace existing Peach Bottom-Conastone 500kV Line (5012) terminal equipment at Peach Bottom Substation to match the conductor summer normal and emergency rating of 2920 / 3707 MVA (PECO portion only)- $5 million, 3 years • Build new second Peach Bottom-Conastone 500kV Line on separate towers from existing 5012 Line with a minimum summer emergency rating of 3510 MVA (PECO portion only)- $20 million, 5 years [Right-of-way costs are not included]	$85,800,000	84
057	BG&E	This line is at its full rating requires a total rebuildfor the 4.4 mile 230kV line and CPCN needed. Rebuild with bundle 1590 MCM and new rating 1604 SE.	$15,000,000	60
058	PEPCO	Same as X3-087-1-004	already addressed	already addressed
059	AP/PJM	Same as X3-087-1-002	already addressed	already addressed
060	AP/PJM	Same as X3-087-1-002	already addressed	already addressed
Non-Direct Connection Thermal Upgrades Summary			$337,851,900	120

Primary Option Contingency Overload Summary:

Contingency	Overloads Identified																				
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
10PEPCO_S17_X2-030	010																				
11PEPCO	058																				
12PEPCO_S17_X2-030	018																				
5PEPCO	038	045																			
7PEPCO_A	022	025	031	035	049	052															
8OX _8POSSUM _043	006	083																			
BG_CKT2344	048	097																			
BG_RIV230-2	044	055	094	102																	
HIRDG_BURTVL	011	012																			
Non	003	024	027	033	040	047	051	054	060	065	069	073	075	078	082	089	093	096	099	101	107
PJM17	016	020	028	029	034	042	043	063	070	077	079	085	091	092	108						
PJM67	002	068																			
PJM76	056	059	104																		
PJM77	106																				
PP1EB	001	005	007	008	014	015	017	021	030	037	057	061	062	064	066	071	080	084	087	103	105
PP31	023	026	032	036	050	053	072	074	081	086	098	100									
PP36	039	046	088	095																	
PP47	004	076																			
PP54_V3-017A	019	067																			
PP85	041	090																			
WCHPL_BRNDN	009	013																			

Primary Option One-line:



Secondary Option:

Attachment Facilities:

It is assumed that IC will construct all Attachment Facilities.

Direct Connection Network Facilities:

Add 230 kV station: $19.8 million

Remote end relay and telecom costs: $500K

If station is provided by Interconnection Customer: $2 million for commissioning costs.

Secondary Option Contingency Overload Summary:

Option 2																					
Contingency	**Overloads Identified**																				
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**
10PEPCO_S17_X2-030	012																				
12PEPCO_S17_X2-030	020																				
5PEPCO	039	046																			
7PEPCO_A	024	028	031	036	050	053															
BG_CKT2314	008																				
BG_CKT2344	049	095																			
BG_RIV230-2	045	056	092	100																	
HIRDG_BURTVL	013	014																			
Non	002	003	026	030	033	041	048	052	055	060	066	069	071	075	079	081	088	094	097	099	106
PANDASC1 _360	070																				
PJM17_X3-068A	107																				
PJM17_X3-068B	010	018	022	027	035	043	044	064	072	077	084	090	091	101							
PJM67	059	105																			
PJM76	108																				
PJM77	034	061	082																		
PP1EB	001	005	006	007	009	016	017	019	057	058	062	063	065	067	073	083	086	102	103	104	
PP27	038																				
PP28	023																				
PP31	025	029	032	037	051	054	074	078	080	085	096	098									
PP36	040	047	087	093																	
PP47	004	076																			
PP54_V3-017A	021	068																			
PP85	042	089																			
WCHPL_BRNDN	011	015																			

Secondary Option One-line: