

PJM Generation Interconnection Request

Queue W4-021

Old Bridge Project

Feasibility Study

668519v1
October 2011

Preface

The intent of the feasibility study is to determine a plan, with ballpark cost and construction time estimates, to connect the subject generation interconnection project to the PJM network at a location specified by the Interconnection Customer. As a requirement for interconnection, the Interconnection Customer 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 system. All facilities required for interconnection of a generation interconnection project must be designed to meet the technical specifications (on PJM web site) for the appropriate transmission owner.

In some instances an interconnection customer may not be responsible for 100% of the identified network upgrade cost because other transmission network uses, e.g. another generation interconnection or merchant transmission upgrade, may also contribute to the need for the same network reinforcement. The possibility of sharing the reinforcement costs with other projects may be identified in the feasibility study, but the actual allocation will be deferred until the impact study is performed.

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. The project developer is responsible for the right of way, real estate, and construction permit issues. For properties currently owned by Transmission Owners, the costs may be included in the study.

General

The Interconnection Customer is proposing an 800MW Capacity 2 x 1 combined cycle generation project to be interconnected to the Jersey Central Power and Light (JCPL) transmission system and located near Cheesequake Road in Old Bridge, New Jersey. The proposed in-service date for this project is June 1, 2015.

This Generation Interconnection Feasibility Study provides analysis results to aid the Interconnection Customer in assessing the practicality and cost of incorporating the facility into the PJM system. This study was limited to load flow analyses of probable contingencies. Preliminary estimates of the scope, cost, and lead time for construction of facilities are provided below. If the interconnection customer elects to pursue a System Impact Study, a more comprehensive analysis will be performed.

Option 1:

The W4-021 project was studied as an 800MW Capacity injection with 50% tap between R11B and Atlantic 230kV line and 50% tap between Williams and Freneau 230kV line.

Facilities to Accommodate the Interconnection

Scope of Direct Connection Work

To accommodate this interconnection, a five-breaker ring bus must be installed along with the associated protection/metering/SCADA equipment.

The Interconnection Customer is responsible for constructing all of the facilities on the Interconnection Customer's side of the Point of Interconnection.

Revenue Metering and SCADA Requirements

For PJM: The Interconnection Customer will install equipment necessary to provide Revenue Metering (KWH, KVARH) and real time data (KW, KVAR) for Interconnection Customer's generating Resource. See PJM Manuals M-01 and M-14D, and PJM Tariff Section 24.1 to 24.2.

For JCPL: See Attachment appended at the end of this report.

Direct Connection Cost Estimate

The total preliminary cost estimate for Direct Connection work performed by JCPL is **\$13,404,200**. This estimate consists of:

Description	Total Cost
New five-breaker ring bus at Runyan 230kV substation	\$ 12,361,000
Attachment Facilities(Atlantic – South River (P1030) 230kV, Freneau – Williams (K1025) 230kV, On 230kV Generator attachment line)	\$1,053,200
Total Cost:	\$13,404,200

Non-Direct Connection Cost Estimate

The total preliminary cost estimate for Non-Direct Connection work performed by JCPL is **\$362,400**. This estimate consists of:

Description	Total Cost
Replace 230kV primary relaying and add backup relaying on the P1030 line at Atlantic substation.	\$ 362,400

Network Impacts

The W4-021 project was studied as an 800 MW Capacity injection into the JCPL area. Project W4-021 was evaluated for compliance with reliability criteria for summer peak conditions in 2014.

Potential network impacts were as follows:

Generator Deliverability

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

Table 1 below provides a summary of the impacts caused by the W4-021 project on the JCPL transmission system for generator deliverability:

Item #	Project	Contribution MVA	Overloaded Element	Overload %		Rating		Contingent Element
				From	To	Type	MVA	
1a	W4-021	277.03	W4-021 2 TAP to Freneau 230kV line	77.75%	113.64%	Emergency	772	'B_CNJ2-SX-#8_W4-021A'
1b	W4-021	408.38	R11 OP2 to Red Oak B Bus 230kV line	50.99%	101.72%	Emergency	805	'B_CNJ2-SX-#37'
1c	W4-021	351.52	Raritan River to Kilmer I 230kV line	97.72%	105.40%	Emergency	739	'PS56D'
1d	W4-021	407.56	Red Oak A Bus to Raritan River 230kV line	72.36%	110.52%	Emergency	1068	'B_CNJ2-SX-#36_R11A'
1e	W4-021	406.48	Red Oak B Bus to Raritan River 230kV line	76.27%	114.33%	Emergency	1068	'B_CNJ2-SX-#37'

Item 1a. (JCP&L) The W4-021 2 TAP-Freneau 230 kV line (from bus 905205 to bus 206292 ckt 1) loads from 77.75% to 113.64% (DC power flow) of its emergency rating (772 MVA) for the single contingency 'B_CNJ2-SX-#8_W4-021A'. This project contributes approximately 277.03 MW to the thermal violation.

CONTINGENCY 'B_CNJ2-SX-#8_W4-021A' /* ATLANTIC - SOUTH RIVER (P1030) 230 KV
DISCONNECT BRANCH FROM BUS 206286 TO BUS 905200 CKT 1 / BUS 206321 -> 295951
DUE TO R11. FEB. 17, 2009.
END

Item 1b. (JCP&L) The R11OP2-Red Oak B Bus 230 kV line (from bus 295950 to bus 206315 ckt 1) loads from 50.99% to 101.72% (DC power flow) of its emergency rating (805 MVA) for the single contingency 'B_CNJ2-SX-#37'. This project contributes approximately 408.38 MW to the thermal violation.

CONTINGENCY 'B_CNJ2-SX-#37' /* RARITAN RIVER - RED OAK - SOUTH RIVER (T1034) 230 KV
DISCONNECT BRANCH FROM BUS 206305 TO BUS 206314 CKT 1
DISCONNECT BRANCH FROM BUS 206314 TO BUS 295951 CKT 1 / BUS 206321 -> 295951
DUE TO R11 B. FEB. 17, 2009.
DISCONNECT BUS 206314
DISCONNECT BUS 206363
DISCONNECT BUS 206364
END

Item 1c. (JCP&L/PSEG) The Raritan River-Kilmer I 230 kV line (from bus 206305 to bus 218331 ckt 1) loads from 97.72% to 105.4% (DC power flow) of its emergency rating (739 MVA) for the single contingency 'PS56D'. This project contributes approximately 351.52 MW to the thermal violation.

CONTINGENCY 'PS56D'
DISCONNECT BRANCH FROM BUS 206305 TO BUS 218332 /* RARITAN RIVER KILMER W 230 230
DISCONNECT BRANCH FROM BUS 218334 TO BUS 218332 /* LK NELSON KILMER W 230 230
DISCONNECT BRANCH FROM BUS 218332 TO BUS 218387 /* KILMER T3
DISCONNECT BRANCH FROM BUS 218332 TO BUS 218386 /* KILMER T1
MOVE 100 PERCENT LOAD FROM BUS 218386 TO BUS 218384 /* KILMER W T1 T2
MOVE 100 PERCENT LOAD FROM BUS 218387 TO BUS 218385 /* KILMER W T3 T4
END

Item 1d. (JCP&L) The Red Oak A Bus-Raritan River 230 kV line (from bus 206314 to bus 206305 ckt 1) loads from 72.36% to 110.52% (DC power flow) of its emergency rating (1068 MVA) for the single contingency 'B_CNJ2-SX-#36_R11A'. This project contributes approximately 407.56 MW to the thermal violation.

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CONTINGENCY 'B_CNJ2-SX-#36_R11A' /* RARITAN RIVER - RED OAK - PARLIN (G1047) 230
KV LINE
DISCONNECT BRANCH FROM BUS 206305 TO BUS 206315 CKT 1
DISCONNECT BRANCH FROM BUS 206315 TO BUS 295950 CKT 1 / BUS 206322 -> 295019
DUE TO Q11. FEB. 17, 2009.
DISCONNECT BUS 206315
DISCONNECT BUS 206362
DISCONNECT BUS 206365
END
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Item 1e. (JCP&L) The Red Oak B Bus-Raritan River 230 kV line (from bus 206315 to bus 206305 ckt 1) loads from 76.27% to 114.33% (DC power flow) of its emergency rating (1068 MVA) for the single contingency 'B_CNJ2-SX-#37'. This project contributes approximately 406.48 MW to the thermal violation.

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CONTINGENCY 'B_CNJ2-SX-#37' /* RARITAN RIVER - RED OAK - SOUTH RIVER (T1034) 230
KV
DISCONNECT BRANCH FROM BUS 206305 TO BUS 206314 CKT 1
DISCONNECT BRANCH FROM BUS 206314 TO BUS 295951 CKT 1 / BUS 206321 -> 295951
DUE TO R11 B. FEB. 17, 2009.
DISCONNECT BUS 206314
DISCONNECT BUS 206363
DISCONNECT BUS 206364
END
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Multiple Facility Contingency

(Double Circuit Tower Line contingencies were studied for the full energy output. The contingencies of Line with Failed Breaker and Bus Fault will be performed for the Impact Study.)

Table 2 below provides a summary of the impacts caused by the W4-021 project on the JCPL transmission system for multiple facility contingency:

Item #	Project	Contribution MVA	Overloaded Element	Overload %		Rating		Contingent Element
				From	To	Type	MVA	
2a	W4-021	401.7	Red Oak A Bus to Raritan River 230kV line	73.64%	111.25%	Emergency	1068	'C_CNJ-DCT-#4_W4-021B'

Item 2a. (JCP&L) The Red Oak A Bus-Raritan River 230 kV line (from bus 206314 to bus 206305 ckt 1) loads from 73.64% to 111.25% (DC power flow) of its emergency rating (1068 MVA) for the tower contingency 'C5_CNJ-DCT-#4_W4-021B'. This project contributes approximately 401.70 MW to the thermal violation.

CONTINGENCY 'C5_CNJ-DCT-#4_W4-021B' /* SOUTH RIVER-ATLANTIC & PARLIN-FRENEAU & FRENEAU-NJT ABERDEEN
 DISCONNECT BRANCH FROM BUS 905200 TO BUS 206286 CKT 1 / BUS 206321 IS REPLACED WITH 295951 DUE TO R11 B. FEB. 17, 2009.
 DISCONNECT BRANCH FROM BUS 905205 TO BUS 206292 CKT 1
 DISCONNECT BRANCH FROM BUS 206292 TO BUS 206267 CKT 1
 DISCONNECT BRANCH FROM BUS 206292 TO BUS 206267 CKT 2
 DISCONNECT BRANCH FROM BUS 206292 TO BUS 206267 CKT 6
 DISCONNECT BRANCH FROM BUS 206292 TO BUS 206317 CKT 1
 SET BUS 206317 LOAD TO 0 MW
 DISCONNECT BUS 206317
 END

Short Circuit

(Summary of impacted circuit breakers)

PJM has completed the short circuit analysis of the W4-021 queue project. One option was considered during this study: the first option was a tap between Williams and Freneau 230 kV Line and also a direct connection to R11 B. Our analysis found 6 new breakers for option 1 to be over-duty in the JCPL transmission area. The new over-duty breakers are listed below:

Bus	Breakers	Replacement Cost Estimate
S.RIVER 230.kV	BT, PB, PA, TA	\$2,046,400
RARTN RV 230.kV	F1046E, F1046F	\$1,523,800
	Total:	\$3,570,200

JCPL will replace the above breakers at the shown cost estimates to give a 63kA interrupting capability. In addition, the results show that W4-021 project has a significant fault contribution to twenty other breakers that were already identified as over-duty for preceding projects.

Contribution to Previously Identified Overloads

(W4-021 contributes to the following contingency overloads, i.e. "Network Impacts", identified for earlier generation or transmission interconnection projects in the PJM Queue)

Table 3 below provides a summary of the impacts on the JCPL transmission system for contributions to previously identified overloads with additional contribution by the W4-021 project:

Table 3: Contributions to Previously Identified Overloads								
Item #	Project	Contribution MVA	Overloaded Element	Overload %		Rating		Contingent Element
				From	To	Type	MVA	
3a	W4-021	62.61	Cooper to Graceton 230kV line	140.99%	143.04%	Emergency	485	'PJM17'
3b	W4-021	48.98	BAGLEY13 to Raphael Road 230kV line	148.17%	149.35%	Emergency	674	'CNSTN_NWEST'
3c	W4-021	51.82	Otter Creek Switchyard to Conastone 230kV line	122.48%	124.06%	Emergency	531	'PJM17'
3d	W4-021	242.74	Peach Bottom to Conastone 500kV line	139.62%	141.01%	Emergency	2815	'PJM67'
3e	W4-021	256.68	Peach Bottom to Conastone 500kV line	140.11%	141.77%	Emergency	2490	None
3f	W4-021	62.61	Nottingham to Nottingham Reactor 230kV line	111.43%	113.01%	Emergency	627	'PJM17'
3g	W4-021	62.61	Nottingham Reactor to Peach Bottom 230kV line	111.43%	113.01%	Emergency	627	'PJM17'
3h	W4-021	48.98	Graceton to BAGLEY13 230kV line	131.83%	132.82%	Emergency	800	'CNSTN_NWEST'
3i	W4-021	10.22	Glen Arm 110512 to Windy Edge 1 115kV line	113.50%	114.56%	Emergency	156	'CNSTN_NWEST'
3j	W4-021	62.61	Peach Bottom to Cooper 230kV line	144.06%	146.11%	Emergency	485	'PJM17'
3k	W4-021	41.18	Brunner Island Bus to Yorkana 230kV line	121.15%	122.20%	Emergency	617	'PJM17'
3l	W4-021	78.55	Three Mile Island to Three Mile Island 500/230kV Transformer	116.30%	117.48%	Emergency	1072	'PJM17'

Item 3a. (PECO/BG&E) The Cooper-Graceton 230 kV line (from bus 214089 to bus 220964 ckt 1) loads from 140.99% to 143.04% (DC power flow) of its emergency rating (485 MVA) for the single contingency 'PJM17'. This project contributes approximately 62.61 MW to the thermal violation.

CONTINGENCY 'PJM17'

DISCONNECT BRANCH FROM BUS 200004 TO BUS 200013 CKT 1 /* CNASTONE PEACHBTM 500 500
END

Item 3b. (BG&E) The BAGLEY13-Raphael Road 230 kV line (from bus 220999 to bus 220980 ckt 1) loads from 148.17% to 149.35% (DC power flow) of its emergency rating

(674 MVA) for the tower contingency 'CNSTN_NWEST'. This project contributes approximately 48.98 MW to the thermal violation.

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CONTINGENCY 'CNSTN_NWEST' /* CONASTONE TO NORTHWEST CKTS #2310 & #2322
DISCONNECT BRANCH FROM BUS 220963 TO BUS 220962 CKT 1 /* CONASTONE TO
NORTHWEST CKT#2310
DISCONNECT BRANCH FROM BUS 220963 TO BUS 220961 CKT 1 /* CONASTONE TO
NORTHWEST CKT #2322
END
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Item 3c. (PL/BG&E) The Otter Creek Switchyard-Conastone 230 kV line (from bus 208048 to bus 220963 ckt 1) loads from 122.48% to 124.06% (DC power flow) of its emergency rating (531 MVA) for the single contingency 'PJM17'. This project contributes approximately 51.82 MW to the thermal violation.

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CONTINGENCY 'PJM17'
DISCONNECT BRANCH FROM BUS 200004 TO BUS 200013 CKT 1 /* CNASTONE PEACHBTM
500 500
END
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Item 3d. (PJM) The Peach Bottom-Conastone 500 kV line (from bus 200013 to bus 200004 ckt 1) loads from 139.62% to 141.01% (DC power flow) of its emergency rating (2815 MVA) for the single contingency 'PJM67'. This project contributes approximately 242.74 MW to the thermal violation.

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CONTINGENCY 'PJM67'
DISCONNECT BRANCH FROM BUS 200026 TO BUS 200004 CKT 1 /* HUNTERTN CNASTONE
500 500
END
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Item 3e. (PJM) The Peach Bottom-Conastone 500 kV line (from bus 200013 to bus 200004 ckt 1) loads from 140.11% to 141.77% (DC power flow) of its normal rating (2490 MVA) for non contingency condition. This project contributes approximately 256.68 MW to the thermal violation.

Item 3f. (PECO) The Nottingham-Nottingham Reactor 230 kV line (from bus 213844 to bus 213846 ckt 1) loads from 111.43% to 113.01% (DC power flow) of its emergency rating (627 MVA) for the single contingency 'PJM17'. This project contributes approximately 62.61 MW to the thermal violation.

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CONTINGENCY 'PJM17'
DISCONNECT BRANCH FROM BUS 200004 TO BUS 200013 CKT 1 /* CNASTONE PEACHBTM
500 500
END
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Item 3g. (PECO) The Nottingham Reactor-Peach Bottom 230 kV line (from bus 213846 to bus 213869 ckt 1) loads from 111.43% to 113.01% (DC power flow) of its emergency rating (627 MVA) for the single contingency 'PJM17'. This project contributes approximately 62.61 MW to the thermal violation.

CONTINGENCY 'PJM17'

DISCONNECT BRANCH FROM BUS 200004 TO BUS 200013 CKT 1 /* CNASTONE PEACHBTM
500 500
END

Item 3h. (BG&E) The Graceton-BAGLEY13 230 kV line (from bus 220964 to bus 220999 ckt 1) loads from 131.83% to 132.82% (DC power flow) of its emergency rating (802 MVA) for the tower contingency 'CNSTN_NWEST'. This project contributes approximately 48.98 MW to the thermal violation.

CONTINGENCY 'CNSTN_NWEST' /* CONASTONE TO NORTHWEST CKTS #2310 & #2322

DISCONNECT BRANCH FROM BUS 220963 TO BUS 220962 CKT 1 /* CONASTONE TO
NORTHWEST CKT#2310

DISCONNECT BRANCH FROM BUS 220963 TO BUS 220961 CKT 1 /* CONASTONE TO
NORTHWEST CKT #2322

END

Item 3i. (BG&E) The Glen Arm 110512-Windy Edge 1 115 kV line (from bus 221090 to bus 221089 ckt 1) loads from 113.50% to 114.56% (DC power flow) of its emergency rating (156 MVA) for the tower contingency 'CNSTN_NWEST'. This project contributes approximately 10.22 MW to the thermal violation.

CONTINGENCY 'CNSTN_NWEST' /* CONASTONE TO NORTHWEST CKTS #2310 & #2322

DISCONNECT BRANCH FROM BUS 220963 TO BUS 220962 CKT 1 /* CONASTONE TO
NORTHWEST CKT#2310

DISCONNECT BRANCH FROM BUS 220963 TO BUS 220961 CKT 1 /* CONASTONE TO
NORTHWEST CKT #2322

END

Item 3j. (PECO) The Peach Bottom-Cooper 230 kV line (from bus 213869 to bus 214089 ckt 1) loads from 144.06% to 146.11% (DC power flow) of its emergency rating (485 MVA) for the single contingency 'PJM17'. This project contributes approximately 62.61 MW to the thermal violation.

CONTINGENCY 'PJM17'

DISCONNECT BRANCH FROM BUS 200004 TO BUS 200013 CKT 1 /* CNASTONE PEACHBTM
500 500
END

Item 3k. (PL/METED) The Brunner Island Bus-Yorkana 230 kV line (from bus 207922 to bus 204515 ckt 1) loads from 121.15% to 122.2% (DC power flow) of its emergency rating (617 MVA) for the single contingency 'PJM17'. This project contributes approximately 41.18 MW to the thermal violation.

CONTINGENCY 'PJM17'

DISCONNECT BRANCH FROM BUS 200004 TO BUS 200013 CKT 1 /* CNASTONE PEACHBTM
500 500
END

Item 3l. (PJM/METED) The Three Mile Island-Three Mile Island 500/230 kV transformer (from bus 200016 to bus 204514 ckt 2) loads from 116.30% to 117.48% (DC power flow) of its emergency rating (1072 MVA) for the single contingency 'PJM17'. This project contributes approximately 78.55 MW to the thermal violation.

CONTINGENCY 'PJM17'

DISCONNECT BRANCH FROM BUS 200004 TO BUS 200013 CKT 1 /* CNASTONE PEACHBTM
500 500
END

New System Reinforcements

(Upgrades required to mitigate reliability criteria violations, I.e. “Network Impacts”, initially caused by the addition of this project’s generation.)

In Item 1a, the overload of the W4-021 2 TAP to Freneau 230kV line can be relieved by reconductoring the line from 1590 Kcmil 45/7 ACSR (7.77 mile DCT) to 1590 Kcmil 54/19 ACSS/AW-Bundled (7.37 mile DCT) for 907/1052 MVA summer normal/emergency ratings and replacing a disconnect switch (4000 amp) (1) and bundled drop loop conductor at Freneau substation and at Williams substation. The estimated cost to correct this overload is **\$5,419,700**.

For Item 1b, the overload of the R11 OP2 to Red Oak B Bus 230kV line can be relieved by reconductoring DCT – 1590 Kcmil 54/19 ACSS/AW – (1.1 mile DCT – One side). The estimated cost to correct this overload is **\$947,000**.

For Item 1c, the overload of the RAR RVR-KILMER I 230kV (JCP&L/PSEG) line can be relieved by replacing 1590 Kcmil 54/19 ACSR Bus conductor with Bundled 1590 ACSR wire. The estimated cost to perform this work is **\$33,600**.

For Items 1d, 1e, and 2a, with the overload of Red Oak A to Raritan River and the Red Oak B to Raritan River 230kV lines can be relieved by reconductoring of the double circuit tower line from 1590 Kcmil 45/7 ACSR (2.6 mile) to 1590 Kcmil 54/19 ACSS/AW – Bundled (2.6 mile) for 1642/1850 MVA summer normal/emergency ratings. It also requires replacement of bundled drop loop conductors at Raritan River substation and at Red Oak A and B substations. The estimated cost to perform this work is **\$8,331,000**.

Contribution to Previously Identified System Reinforcements

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

Note: The costs allocations for all of the following reinforcements required for this project to interconnect using Option 1 will be provided in the System Impact Study should this option be chosen. The costs shown below are the full costs for each upgrade.

For Item 3a, the overload of the Cooper to Graceton 230kV line is mitigated by reinforcements from PECO and BGE:

PECO portion: Reconductor approximately 4 miles of line 220-93 from Cooper Substation to Graceton Substation to get a minimum summer emergency rating of 725 MVA. The estimated cost to perform the work for PECO is **\$2,800,000**, and will require 24 months to complete.

BGE portion: Build a double circuit line with 1033.5kcmil ACSR, creating one circuit by connecting the two lines into one. The rating for 2 – 1033.5kcmil 45/7 ACSR (Ortolan) at 125°C = 968/1227MVA SN/SE. BGE ownership is for 1.85 miles and the rebuild of 11 structures. It would be built as a double circuit line with the conductors jumpered across at the terminal ends. The estimated cost of the line construction is **\$3,000,000**. The replacement of two breakers at Graceton is required(**\$400,000/breaker**) at an estimated cost of **\$800,000**. An additional cost of **\$200,000** will also be incurred for 4 breaker disconnects and line connections to cover thermal. The project is estimated to take 30 months to complete: 12 months for the CPCN process & design and an additional 18 months for construction. The total estimated cost to perform the work for BGE is **\$4,000,000**.

For Items 3b and 3h, the overloads of the BAGLEY13 to Raphael Road and Graceton to BAGLEY13 230kV lines can be relieved by the addition of 6-230kV breakers to Graceton Station and 6-230kV breakers to Raphael Road station. The estimated cost to add the breakers is **\$20,000,000**. This reinforcement also requires the rebuilding of the Graceton to Raphael Road to double circuit 2-conductor bundled with an estimated cost of **\$30,000,000**. This work would take an estimate of 2-3 years for the substation work concurrently with 5-6 years for the line work. The total estimated cost to perform the work for Items 3b and 3h is **\$50,000,000**.

For Item 3c, the overload of the Otter Creek Switchyard to Conastone 230kV line can be relieved by reinforcements from PPL and BGE:

PPL portion: The magnitude cost estimate to rebuild PPL's portion of the Otter Creek - Conastone 230kV line is **\$0**. PPL has recently submitted plans to PJM to rebuild the Otter Creek - Conastone 230kV line as part of a modernization project (submitted to PJM as supplemental project S0233). This project is tentatively scheduled to be complete by May 2013 (prior to the IPP's 2014 requested in-service date). The S0233 upgrade will consist of rebuilding approximately 12 miles of 795 kcmil 30/19 ACSR (current ratings 425/531MVA Summer Normal/Summer Emergency based on conductor temp @ 125 Deg C) with new 1590 kcmil 45/7 ACSR or equivalent (new ratings 653/793MVA Summer Normal/Summer Emergency based on conductor temp @ 125 Deg C). The new circuit will be designed for double circuit but built single circuit initially. Existing structures will need to be removed and rebuilt as part of this upgrade. **This does not include rebuilding of the remaining ~ 5 miles of the BG&E portion of the line or the upgrade of any substation terminal equipment required at Conastone 230 kV substation.**

BGE portion:

Rebuild the 4.7 mile BGE portion of Otter Creek to Conastone 230kV line from 2302 to PA border to acquire a new rating of 648/802. The total estimated cost

for this BGE reinforcement is **\$19,000,000** to be completed in 60 months. *Notes: Rebuilding to 230kV single 1590 MCM conductor circuit costs **\$19 million** with a completion timeframe of 36 – 48 months. CPCN requirement adds about 18 months.*

For Items 3d and 3e, the overload of Peach Bottom to Conastone 500kV line can be relieved by reinforcements from BGE and PECO:

BGE Portion:

- 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 - Peachbottom 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]

The total cost for these upgrades is **\$85,800,000** and will take up to 7 years to complete.

For Item 3f, the overload of Nottingham to Nottingham Reactor 230kV line can be relieved by replacing line 220-08 reactor and by-pass circuit switcher at the Nottingham substation to get a minimum summer emergency rating of 741 MVA. The estimated cost to perform this work is **\$1,700,000**, and will require 24 months to complete.

For Item 3g, the overload of Nottingham Reactor to Peach Bottom 230kV line can be relieved by reconductoring a 14 mile line 220-08 from Nottingham Reactor to Peach Bottom Tap to get a minimum summer emergency rating of 741 MVA. The estimated cost to perform this work is **\$10,000,000**, and will require 48 months to be completed.

For Item 3i, the overload of Glen Arm 110512 to Windy Edge 1 115kV line can be relieved by upgrading wire drop terminations at Windy Edge. The estimated cost to perform this work is **\$200,000** and will require 12 months to be completed.

For Item 3j, the overload of Peach Bottom to Cooper 230kV line can be relieved by reconductoring a 1.4 mile line 220-08 from Peach Bottom Tap to Cooper Substation to get a minimum summer emergency rating of 741 MVA. The estimated cost to perform this work is **\$1,000,000**, and will require 24 months to be completed.

For Item 3k, the overload of Brunner Island Bus to Yorkana 230kV line can be relieved by PPL and MetEd:

PPL portion: To relieve the Brunner – Yorkana 230kV line overload PPL EU will rebuild and upgrade approximately 0.6 miles of PPL EU owned Brunner Island – Yorkana 230kV line and the substation line terminal equipment. The existing 1033 kcmil ACSR conductor will be replaced with new 1590 kcmil ACSR conductor or equivalent with an operating temperature of 140deg C to achieve the summer normal and emergency ratings of 712 MVA and 865 MVA respectively. The Yorkana 230kV bay conductors at Brunner Island 230kV switchyard will also be upgraded to conform to higher line ratings. PPL EU will require 24 months to construct this upgrade after the ISA/CSA are signed. The total transmission and substation upgrade cost is **\$1,300,000**. **This reinforcement is a sufficient solution for both PPL and MetEd.**

For Item 3l, the overload of Three Mile Island to Three Mile Island 500/230kV transformer overload can be relieved by the addition of a second 500/230kV transformer at Three Mile Island as well as transmission line upgrades between the 230kV and 500kV substations. The estimated cost to perform this work is **\$15,000,000** and will take 36 months to complete. *Note: According to JCPL/FE, if the 2nd Conastone to Peach Bottom Line is built, this reinforcement is not needed. If Option 1 is chosen, this will be reviewed during the System Impact Study.*

Delivery of Energy Portion of Interconnection Request

PJM also studied the delivery of the energy portion of this interconnection request. Any 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 Merchant Transmission Interconnection request.

Note: Only the most severely overloaded conditions are listed below. 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 shall study all overload conditions associated with the overloaded element(s) identified.

As a result of the aggregate energy resources in the area, no violations were identified.

Option 2:

The W4-021 project was studied as an 800MW Capacity injection with a tap on the Williams and Freneau 230kV line.

Revenue Metering and SCADA Requirements

For PJM: The Interconnection Customer will install equipment necessary to provide Revenue Metering (KWH, KVARH) and real time data (KW, KVAR) for Interconnection Customer's generating Resource. See PJM Manuals M-01 and M-14D, and PJM Tariff Section 24.1 to 24.2.

For JCPL: See Attachment appended at the end of this report.

Network Impacts

The W4-021 project was studied as a 800 MW Capacity injection a tap on the Williams and Freneau 230kV line in the JCPL area. Project W4-021 was evaluated for compliance with reliability criteria for summer peak conditions in 2014. Potential network impacts were as follows:

Generator Deliverability

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

Table 4 below provides a summary of the impacts caused by the W4-021 project on the JCPL transmission system for generator deliverability:

Item #	Project	Contribution MVA	Overloaded Element	Overload %		Rating		Contingent Element
				From	To	Type	MVA	
4a	W4-021	293.62	W4-021 TAP to Freneau 230kV line	63.88%	101.91%	Emergency	772	'B_CNJ2-SX-#14'
4b	W4-021	307.31	W4-021 TAP to Freneau 230kV line	60.47%	107.75%	Emergency	650	None
4c	W4-021	425.17	R11 OP2 to Red Oak B Bus 230kV line	50.74%	103.55%	Emergency	805	'B_CNJ2-SX-#37'
4d	W4-021	423.91	Red Oak A Bus to Raritan River 230kV line	72.17%	111.86%	Emergency	1068	'B_CNJ2-SX-#36_R11A'
4e	W4-021	423.26	Red Oak B Bus to Raritan River 230kV line	76.09%	115.72%	Emergency	1068	'B_CNJ2-SX-#37'
4f	W4-021	46.89	Safe Harbor Units 3-4 Tap to Graceton 230kV line	97.19%	98.75%	Emergency	485	'PJM17'

Item 4a. (JCP&L) The W4-021 TAP-Freneau 230 kV line (from bus 905200 to bus 206292 ckt 1) loads from 63.88% to 101.91% (DC power flow) of its emergency rating (772 MVA) for the single contingency 'B_CNJ2-SX-#14'. This project contributes approximately 293.62 MW to the thermal violation.

CONTINGENCY 'B_CNJ2-SX-#14' /* EAST WINDSOR - SMITHBRG (E2005) 230 KV
DISCONNECT BRANCH FROM BUS 206326 TO BUS 206309 CKT 1
END

Item 4b. (JCP&L) The W4-021 TAP-Freneau 230 kV line (from bus 905200 to bus 206292 ckt 1) loads from 60.47% to 107.75% (DC power flow) of its normal rating (650 MVA) for non contingency condition. This project contributes approximately 307.31 MW to the thermal violation.

Item 4c. (JCP&L) The R11OP2-Red Oak B Bus 230 kV line (from bus 295950 to bus 206315 ckt 1) loads from 50.74% to 103.55% (DC power flow) of its emergency rating (805 MVA) for the single contingency 'B_CNJ2-SX-#37'. This project contributes approximately 425.17 MW to the thermal violation.

```
CONTINGENCY 'B_CNJ2-SX-#37' /* RARITAN RIVER - RED OAK - SOUTH RIVER (T1034) 230
KV
DISCONNECT BRANCH FROM BUS 206305 TO BUS 206314 CKT 1
DISCONNECT BRANCH FROM BUS 206314 TO BUS 295951 CKT 1 /BUS 206321 -> 295951
DUE TO R11 B. FEB. 17, 2009.
DISCONNECT BUS 206314
DISCONNECT BUS 206363
DISCONNECT BUS 206364
END
```

Item 4d. (JCP&L) The Red Oak A Bus-Raritan River 230 kV line (from bus 206314 to bus 206305 ckt 1) loads from 72.17% to 111.86% (DC power flow) of its emergency rating (1068 MVA) for the single contingency 'B_CNJ2-SX-#36_R11A'. This project contributes approximately 423.91 MW to the thermal violation.

```
CONTINGENCY 'B_CNJ2-SX-#36_R11A' /* RARITAN RIVER - RED OAK - PARLIN (G1047) 230
KV LINE
DISCONNECT BRANCH FROM BUS 206305 TO BUS 206315 CKT 1
DISCONNECT BRANCH FROM BUS 206315 TO BUS 295950 CKT 1 /BUS 206322 -> 295019
DUE TO Q11. FEB. 17, 2009.
DISCONNECT BUS 206315
DISCONNECT BUS 206362
DISCONNECT BUS 206365
END
```

Item 4e. (JCP&L) The Red Oak B Bus-Raritan River 230 kV line (from bus 206315 to bus 206305 ckt 1) loads from 76.09% to 115.72% (DC power flow) of its emergency rating (1068 MVA) for the single contingency 'B_CNJ2-SX-#37'. This project contributes approximately 423.26 MW to the thermal violation.

```
CONTINGENCY 'B_CNJ2-SX-#37' /* RARITAN RIVER - RED OAK - SOUTH RIVER (T1034) 230
KV
DISCONNECT BRANCH FROM BUS 206305 TO BUS 206314 CKT 1
DISCONNECT BRANCH FROM BUS 206314 TO BUS 295951 CKT 1 /BUS 206321 -> 295951
DUE TO R11 B. FEB. 17, 2009.
DISCONNECT BUS 206314
DISCONNECT BUS 206363
DISCONNECT BUS 206364
END
```

Item 4f. (PL/BG&E) The Safe Harbor Units 3-4 Tap-Graceton 230 kV line (from bus 208071 to bus 220964 ckt 1) loads from 97.19% to 98.75% (DC power flow) of its emergency rating (485 MVA) for the single contingency 'PJM17'. This project contributes approximately 46.89 MW to the thermal violation.

CONTINGENCY 'PJM17'

DISCONNECT BRANCH FROM BUS 200004 TO BUS 200013 CKT 1 /* CNASTONE PEACHBTM
500 500
END

Multiple Facility Contingency

(Double Circuit Tower Line contingencies were studied for the full energy output. The contingencies of Line with Failed Breaker and Bus Fault will be performed for the Impact Study.)

Table 5 below provides a summary of the impacts caused by the W4-021 project on the JCPL transmission system for multiple facility contingency:

Table 5: Multiple Facility Contingency								
Item #	Project	Contribution MVA	Overloaded Element	Overload %		Rating		Contingent Element
				From	To	Type	MVA	
5a	W4-021	512.6	W4-021 TAP to Freneau 230kV line	58.68%	125.07%	Emergency	772	'C5_CNJ-DCT-#3'

Item 5a. (JCP&L) The W4-021 TAP-Freneau 230 kV line (from bus 905200 to bus 206292 ckt 1) loads from 58.68% to 125.07% (DC power flow) of its emergency rating (772 MVA) for the tower contingency 'C5_CNJ-DCT-#3'. This project contributes approximately 512.60 MW to the thermal violation.

CONTINGENCY 'C5_CNJ-DCT-#3' /* PARLIN-RED OAK-RAR R & S.RIVER-RED OAK-RAR RIVER

DISCONNECT BRANCH FROM BUS 295950 TO BUS 206315 CKT 1 / BUS 206322 IS
REPLACED WITH 295019 DUE TO Q11. FEB. 17, 2009.
DISCONNECT BRANCH FROM BUS 206315 TO BUS 206305 CKT 1
DISCONNECT BUS 206315
DISCONNECT BUS 206362
DISCONNECT BUS 206365
DISCONNECT BRANCH FROM BUS 206305 TO BUS 206314 CKT 1
DISCONNECT BRANCH FROM BUS 206314 TO BUS 295951 CKT 1 / BUS 206321 IS
REPLACED WITH 295951 DUE TO R11 B. FEB. 17, 2009.
DISCONNECT BUS 206314
DISCONNECT BUS 206363
DISCONNECT BUS 206364
END

Short Circuit

(Summary of impacted circuit breakers)

PJM has completed the short circuit analysis of the W4-021 queue project. One option was considered during this study: the second option was a tap between Williams and Freneau 230 kV Line. Our analysis found 6 new breakers for option 2 to be over-duty in the JCPL transmission area. The new over-duty breakers are listed below:

Bus	Breakers
S.RIVER 230.kV	BT, PB, PA, TA
RARTN RV 230.kV	F1046E, F1046F
	Total:

JCPL will replace the above breakers at the shown cost estimates to give a 63kA interrupting capability. In addition, the results show that W4-021 project has a significant fault contribution to twenty other breakers that were already identified as over-duty for preceding projects.

Contribution to Previously Identified Overloads

(W4-021 contributes to the following contingency overloads, i.e. "Network Impacts", identified for earlier generation or transmission interconnection projects in the PJM Queue)

Table 6 below provides a summary of the impacts on the JCPL transmission system for contributions to previously identified overloads with additional contribution by the W4-021 project:

Item #	Project	Contribution MVA	Overloaded Element	Overload %		Rating		Contingent Element
				From	To	Type	MVA	
6a	W4-021	62.39	Cooper to Graceton 230kV line	140.98%	143.02%	Emergency	485	'PJM17'
6b	W4-021	48.95	BAGLEY13 to Raphael Road 230kV line	148.12%	149.29%	Emergency	674	'CNSTN_NWEST'
6c	W4-021	51.85	Otter Creek Switchyard to Conastone 230kV line	122.45%	124.03%	Emergency	531	'PJM17'
6d	W4-021	242.28	Peach Bottom to Conastone 500kV line	139.62%	141.01%	Emergency	2815	'PJM67'
6e	W4-021	256.13	Peach Bottom to Conastone 500kV line	140.11%	141.77%	Emergency	2490	None
6f	W4-021	62.90	Nottingham to Nottingham Reactor 230kV line	111.42%	113.00%	Emergency	627	'PJM17'
6g	W4-021	62.39	Nottingham Reactor to Peach Bottom 230kV line	111.42%	113.00%	Emergency	627	'PJM17'
6h	W4-021	48.95	Graceton to BAGLEY13 230kV line	131.78%	132.77%	Emergency	802	'CNSTN_NWEST'
6i	W4-021	10.22	Glen Arm 110512 to Windy Edge 1 115kV line	113.45%	114.50%	Emergency	156	'CNSTN_NWEST'
6j	W4-021	62.39	Peach Bottom to Cooper 230kV line	144.05%	146.09%	Emergency	485	'PJM17'
6k	W4-021	41.20	Brunner Island Bus to Yorkana 230kV line	121.13%	122.19%	Emergency	617	'PJM17'
6l	W4-021	78.37	Three Mile Island to Three Mile Island 500/230kV Transformer	116.31%	117.49%	Emergency	1072	'PJM17'

Item 6a. (PECO/BG&E) The Cooper-Graceton 230 kV line (from bus 214089 to bus 220964 ckt 1) loads from 140.98% to 143.02% (DC power flow) of its emergency rating (485 MVA) for the single contingency 'PJM17'. This project contributes approximately 62.39 MW to the thermal violation.

CONTINGENCY 'PJM17'

DISCONNECT BRANCH FROM BUS 200004 TO BUS 200013 CKT 1 /* CNASTONE PEACHBTM
500 500
END

Item 6b. (BG&E) The BAGLEY13-Raphael Road 230 kV line (from bus 220999 to bus 220980 ckt 1) loads from 148.12% to 149.29% (DC power flow) of its emergency rating (674 MVA) for the tower contingency 'CNSTN_NWEST'. This project contributes approximately 48.95 MW to the thermal violation.

CONTINGENCY 'CNSTN_NWEST' /* CONASTONE TO NORTHWEST CKTS #2310 & #2322
DISCONNECT BRANCH FROM BUS 220963 TO BUS 220962 CKT 1 /* CONASTONE TO
NORTHWEST CKT#2310
DISCONNECT BRANCH FROM BUS 220963 TO BUS 220961 CKT 1 /* CONASTONE TO
NORTHWEST CKT #2322
END

Item 6c. (PL/BG&E) The Otter Creek Switchyard-Conastone 230 kV line (from bus 208048 to bus 220963 ckt 1) loads from 122.45% to 124.03% (DC power flow) of its emergency rating (531 MVA) for the single contingency 'PJM17'. This project contributes approximately 51.85 MW to the thermal violation.

CONTINGENCY 'PJM17'
DISCONNECT BRANCH FROM BUS 200004 TO BUS 200013 CKT 1 /* CNASTONE PEACHBTM
500 500
END

Item 6d. (PJM) The Peach Bottom-Conastone 500 kV line (from bus 200013 to bus 200004 ckt 1) loads from 139.62% to 141.01% (DC power flow) of its emergency rating (2815 MVA) for the single contingency 'PJM67'. This project contributes approximately 242.28 MW to the thermal violation.

CONTINGENCY 'PJM67'
DISCONNECT BRANCH FROM BUS 200026 TO BUS 200004 CKT 1 /* HUNTERTN CNASTONE
500 500
END

Item 6e. (PJM) The Peach Bottom-Conastone 500 kV line (from bus 200013 to bus 200004 ckt 1) loads from 140.11% to 141.77% (DC power flow) of its normal rating (2490 MVA) for non contingency condition. This project contributes approximately 256.13 MW to the thermal violation.

Item 6f. (PECO) The Nottingham-Nottingham Reactor 230 kV line (from bus 213844 to bus 213846 ckt 1) loads from 111.42% to 113.0% (DC power flow) of its emergency rating (627 MVA) for the single contingency 'PJM17'. This project contributes approximately 62.39 MW to the thermal violation.

CONTINGENCY 'PJM17'
DISCONNECT BRANCH FROM BUS 200004 TO BUS 200013 CKT 1 /* CNASTONE PEACHBTM
500 500
END

Item 6g. (PECO) The Nottingham Reactor-Peach Bottom 230 kV line (from bus 213846 to bus 213869 ckt 1) loads from 111.42% to 113.0% (DC power flow) of its emergency rating (627 MVA) for the single contingency 'PJM17'. This project contributes approximately 62.39 MW to the thermal violation.

CONTINGENCY 'PJM17'

DISCONNECT BRANCH FROM BUS 200004 TO BUS 200013 CKT 1 /* CNASTONE PEACHBTM
500 500
END

Item 6h. (BG&E) The Graceton-BAGLEY13 230 kV line (from bus 220964 to bus 220999 ckt 1) loads from 131.78% to 132.77% (DC power flow) of its emergency rating (802 MVA) for the tower contingency 'CNSTN_NWEST'. This project contributes approximately 48.95 MW to the thermal violation.

CONTINGENCY 'CNSTN_NWEST' /* CONASTONE TO NORTHWEST CKTS #2310 & #2322

DISCONNECT BRANCH FROM BUS 220963 TO BUS 220962 CKT 1 /* CONASTONE TO
NORTHWEST CKT#2310

DISCONNECT BRANCH FROM BUS 220963 TO BUS 220961 CKT 1 /* CONASTONE TO
NORTHWEST CKT #2322

END

Item 6i. (BG&E) The Glen Arm 110512-Windy Edge 1 115 kV line (from bus 221090 to bus 221089 ckt 1) loads from 113.45% to 114.5% (DC power flow) of its emergency rating (156 MVA) for the tower contingency 'CNSTN_NWEST'. This project contributes approximately 10.22 MW to the thermal violation.

CONTINGENCY 'CNSTN_NWEST' /* CONASTONE TO NORTHWEST CKTS #2310 & #2322

DISCONNECT BRANCH FROM BUS 220963 TO BUS 220962 CKT 1 /* CONASTONE TO
NORTHWEST CKT#2310

DISCONNECT BRANCH FROM BUS 220963 TO BUS 220961 CKT 1 /* CONASTONE TO
NORTHWEST CKT #2322

END

Item 6j. (PECO) The Peach Bottom-Cooper 230 kV line (from bus 213869 to bus 214089 ckt 1) loads from 144.05% to 146.09% (DC power flow) of its emergency rating (485 MVA) for the single contingency 'PJM17'. This project contributes approximately 62.39 MW to the thermal violation.

CONTINGENCY 'PJM17'

DISCONNECT BRANCH FROM BUS 200004 TO BUS 200013 CKT 1 /* CNASTONE PEACHBTM
500 500
END

Item 6k. (PL/METED) The Brunner Island Bus-Yorkana 230 kV line (from bus 207922 to bus 204515 ckt 1) loads from 121.13% to 122.19% (DC power flow) of its emergency rating (617 MVA) for the single contingency 'PJM17'. This project contributes approximately 41.20 MW to the thermal violation.

CONTINGENCY 'PJM17'

DISCONNECT BRANCH FROM BUS 200004 TO BUS 200013 CKT 1 /* CNASTONE PEACHBTM
500 500
END

Item 6l. (PJM/METED) The Three Mile Island-Three Mile Island 500/230 kV transformer (from bus 200016 to bus 204514 ckt 2) loads from 116.31% to 117.49% (DC power flow) of its emergency rating (1072 MVA) for the single contingency 'PJM17'. This project contributes approximately 78.37 MW to the thermal violation.

CONTINGENCY 'PJM17'
DISCONNECT BRANCH FROM BUS 200004 TO BUS 200013 CKT 1 /* CNASTONE PEACHBTM
500 500
END

New System Reinforcements

(Upgrades required to mitigate reliability criteria violations, I.e. “Network Impacts”, initially caused by the addition of this project’s generation.)

If Option 2 is chosen, New System Reinforcements will be provided in the System Impact Study.

Contribution to Previously Identified System Reinforcements

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

If Option 2 is chosen, Contribution to Previously Identified System Reinforcements will be provided in the System Impact Study.

Delivery of Energy Portion of Interconnection Request

PJM also studied the delivery of the energy portion of this interconnection request. Any 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 Merchant Transmission Interconnection request.

Note: Only the most severely overloaded conditions are listed below. 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 shall study all overload conditions associated with the overloaded element(s) identified.

As a result of the aggregate energy resources in the area, no violations were identified.

Attachment 1
FirstEnergy Revenue Metering Requirements
For Generation Facilities Connected 69 kV and Higher

This document addresses the revenue metering requirements for new generation-only facilities connected to FirstEnergy (FE) system voltages 69 kV and higher. This document is not intended for existing retail or wholesale load facilities where behind-the-meter generation is being installed.

The Interconnection Customer (IC) shall install, own, operate, test, and maintain the necessary revenue metering equipment. This includes current transformers, voltage transformers, mounting structures, wiring, meters, communication circuits, and associated devices. The metering equipment must meet the specifications listed in the FE and PJM connection documents.

The revenue metering equipment shall be located at the generation facility on the high voltage side of the generator step-up transformers or facility main step-up transformer and/or station service power transformers. Power flows to and from the facility shall be compensated to the Point of Interconnection.

FE will provide revenue metering equipment for a station service power supply at a generation facility if the supply is from the local FE distribution system.

The revenue metering equipment shall be capable of collecting and storing bidirectional billing data. The billing data shall be stored in intervals specified by FE, typically fifteen minutes or thirty minutes. The IC must provide FE with remote access to the billing data in the revenue meter via a dedicated voice-grade analog telephone circuit. The IC shall provide FE with contact information for the person or persons responsible for meter programming and metering equipment maintenance.

The IC shall consult with FE regarding the revenue metering system design and provide the following information:

- Facility one line and revenue metering installation drawings (schematics, wiring diagrams, etc.)
- Estimated power flows to and from the facility at all revenue metering points
- Current transformer and voltage transformer specifications, including manufacturer, type, nameplate drawings, and certified accuracy test reports
- Revenue meter specifications including manufacturer, type, model number, and accuracy
- Revenue meter program information including but not limited to billing data recorder channel assignments, recorder pulse weights (Ke), and read-only password for access to interval data by the FE billing data collection system (MV-90)
- Revenue meter telephone number
- Revenue meter loss compensation data (if applicable)

The IC shall provide FE with prior notification of any modifications at the facility that will affect the revenue meter measurements, including substation reconfigurations and meter program changes.

The revenue metering system at each location shall be tested for accuracy by the IC once every two years. The IC shall give reasonable notice to FE of the time when the testing is scheduled so that FE may have representatives present. FE and PJM shall

have the right to audit the revenue metering equipment and/or related documents. The IC shall be given a reasonable period of time to comply with any requests associated with an audit.