

***PJM Generator Interconnection
V3-001 Burches Hill
750 MW Capacity & Energy
Feasibility Study***

January 2010
DMS#576840

General

Queue V3-001 is a request to interconnect a 750 MW Capacity Resource consisting of a 2x1 combined cycle facility to be located north of North Keys Road, in Prince George's County, Maryland. The proposed generating facility property is located adjacent to Potomac Electric Power Company's (PEPCO, Interconnected Transmission Owner (ITO)) Morgantown/Hawkins Gate - Talbert/Oak Grove 230 kV and the Burches Hill - Chalk Point 500 kV circuits. The Interconnection Customer is tentatively scheduling the generating facility to be commercially available by 2Q2015.

Network Impacts

The queue V3-001 project was studied as a 750 MW capacity injection into PEPCO's system. Two separate studies were performed to analyze the project's impact at two different points of interconnection. The primary interconnection point was a tap of the Burches Hill - Chalk Point 500kV line, while the secondary interconnection option was a double-line tap of the Morgantown - Talbert 230kV (23085) and Hawkins - Talbert 230kV (23087) lines. Project V3-001 was evaluated for compliance with reliability criteria for summer peak conditions in 2014. Potential network impacts were as follows:

Option 1: Burches Hill - Chalk Point 500 kV

Generator Deliverability

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

No problems identified.

Multiple Facility Contingency

(Double Circuit Tower Line contingencies only for the full energy output. Stuck breaker and bus fault contingencies will be performed for the Impact Study)

1. The BOWIE042-BURT2334 230kV line (from bus 223977 to bus 223962 ckt 1) loads from 99.15% to 100.19% (DC power flow) of its emergency rating (730MVA) for the tower contingency ('7PEPCO_A') as a result of V3-001. This project contributes approximately 7.6MW to cause this thermal violation.

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)

2. The OAKGV230-BOWIE045 230kV line (from bus 223982 to bus 223978 ckt 1) loads from 100.48% to 101.52% (DC power flow) of its emergency rating (730MVA) for the tower contingency ('5PEPCO') as a result of V3-001. This project contributes approximately 7.7MW to cause this thermal violation.
3. The BOWIE045-BURT2314 230kV line (from bus 223978 to bus 223961 ckt 1) loads from 100.27% to 101.32% (DC power flow) of its emergency rating

(730MVA) for the tower contingency ('5PEPCO') as a result of V3-001. This project contributes approximately 7.7MW to cause this thermal violation.

4. The H.RDGE16-HOWARD32 230kV line (from bus 220941 to bus 220954 ckt 1) loads from 112.79% to 113.93% (DC power flow) of its emergency rating (728MVA) for the tower contingency ('WCHPL_BRNDN') as a result of V3-001. This project contributes approximately 8.3MW to cause this thermal violation.

Short Circuit

There are no overduty breakers for the 500 kV option.

Option 2: Tap of 230kV lines 23085 and 23087

Generator Deliverability

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

1. The OAKGV230- BOWIE045 230kV line (from bus 223982 to bus 223978 ckt 1) loads from 92.19% to 108.86% (DC power flow) of its emergency rating (730MVA) for the single contingency ('PP36') as a result of V3-001. This project contributes approximately 121.6MW to cause this thermal violation.
2. The OAKGV230- BOWIE045 230kV line (from bus 223982 to bus 223978 ckt 1) loads from 88.89% to 104.92% (DC power flow) of its normal rating (608MVA) for non-contingency conditions as a result of V3-001. This project contributes approximately 97.5MW to cause this thermal violation.
3. The BOWIE045-BURT2314 230kV line (from bus 223978 to bus 223961 ckt 1) loads from 91.99% to 108.65% (DC power flow) of its emergency rating (730MVA) for the single contingency ('PP36') as a result of V3-001. This project contributes approximately 121.6MW to cause this thermal violation.
4. The OAKGV230- BOWIE042 230kV line (from bus 223982 to bus 223977 ckt 1) loads from 91.94% to 108.59% (DC power flow) of its emergency rating (730MVA) for the single contingency ('PP31') as a result of V3-001. This project contributes approximately 121.6MW to cause this thermal violation.
5. The OAKGV230- BOWIE042 230kV line (from bus 223982 to bus 223977 ckt 1) loads from 88.43% to 104.46% (DC power flow) of its normal rating (608MVA) for non-contingency conditions as a result of V3-001. This project contributes approximately 97.4MW to cause this thermal violation.
6. The BOWIE042-BURT2334 230kV line (from bus 223977 to bus 223962 ckt 1) loads from 91.49% to 108.14% (DC power flow) of its emergency rating (730MVA) for the single contingency ('PP31') as a result of V3-001. This project contributes approximately 121.6MW to cause this thermal violation.

7. The BOWIE042-BURT2334 230kV line (from bus 223977 to bus 223962 ckt 1) loads from 87.89% to 103.92% (DC power flow) of its normal rating (608MVA) for non-contingency conditions as a result of V3-001. This project contributes approximately 97.4MW to cause this thermal violation.

Multiple Facility Contingency

(Double Circuit Tower Line contingencies only for the full energy output. Stuck breaker and bus fault contingencies will be performed for the Impact Study)

8. The V3-001 TAP-TALBT082 230kV line (from bus 293331 to bus 223991 ckt 1) loads from 70.97% to 123.79% (DC power flow) of its emergency rating (692MVA) for the tower contingency ('12PEPCOA_A_V3-001B') as a result of V3-001. This project contributes approximately 365.5MW to cause this thermal violation.

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)

9. The TALB 066-OAKGV230 230kV line (from bus 224125 to bus 223982 ckt 1) loads from 100.03% to 102.58% (DC power flow) of its emergency rating (680MVA) for the tower contingency ('12PEPCOA_A_V3-001B') as a result of V3-001. This project contributes approximately 17.4MW to cause this thermal violation.
10. The H.RDGE16-HOWARD32 230kV line (from bus 220941 to bus 220954 ckt 1) loads from 101.13% to 108.33% (DC power flow) of its emergency rating (728MVA) for the tower contingency ('WCHPL_BRNDN') as a result of V3-001. This project contributes approximately 10.0MW to cause this thermal violation.

Short Circuit

PJM and ITO analysis found 13 230 kV breakers to be newly over-duty at Morgantown Substation F (GSF). The analysis also identified contribution to 13 Oak Grove breakers initially over duty due to R17:

Bus#	Bus	Breaker	Rating Type	Duty Percent with v3-001 opt1 PEPCO(500)	Duty Percent without v3-001 opt1 PEPCO(500)	Duty % Difference	Note
7054	GSF 230 230.kV	WEST OCB	T	102.90%	96.20%	6.70%	New Overduty
7048	OAKGV 230 230.kV	ITE OCB	S	108.90%	105.60%	3.30%	Over 100%, > 3% contribution

The cost to replace 13 over duty breakers at Morgantown Substation F is \$17.2M and is estimated to take 48 months to complete. Determination of responsibility and cost will be provided at the System Impact Study.

The cost for Oak Grove is \$17.2M and will take 48 months to complete. V3-001's cost allocation to this upgrade will be provided in the System Impact Study.

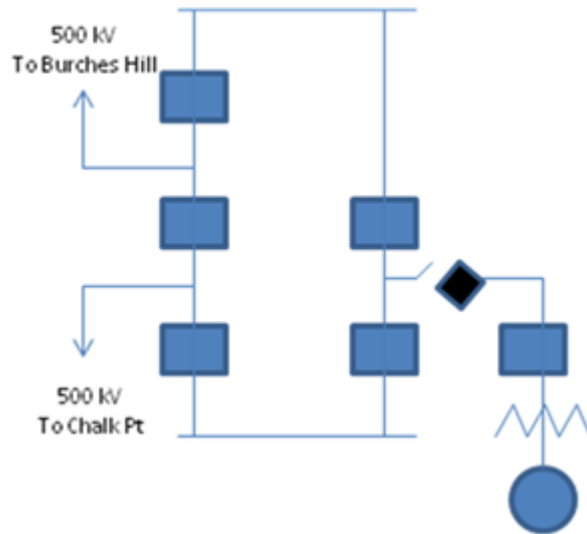


Figure 1 - 500 kV Option

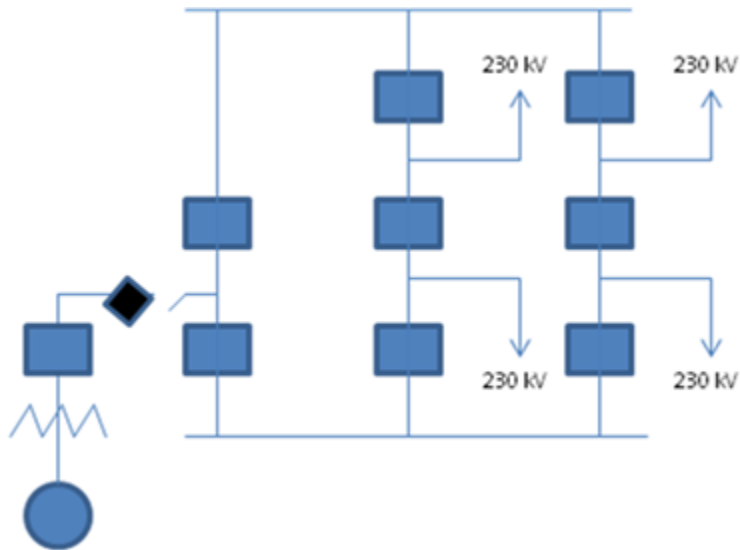


Figure 2 - 230 kV Option

Attachment Facilities

For the 500 kV option, IC is responsible for all Attachment Facilities from the generator to the Point of Interconnection as depicted in Figure 1. ITO estimates the cost for the disconnect switch, deadend structure and tie-in work to be \$2M and will be coordinated with the Direct Connection Substation for completion.

For the 230 kV option, IC is responsible for all Attachment Facilities from the generator to the Point of Interconnection as depicted in Figure 2. ITO estimates the cost for the disconnect switch, deadend structure and tie-in work to be \$2M and will be coordinated with the Direct Connection Substation for completion.

Direct Connection Requirements

For the 500 kV option, ITO requires a breaker and a half design for the interconnection substation. The cost for the five breaker substation depicted in Figure 1 is \$25M and will take 36 months to complete. This cost includes the loop in and out of the Burches Hill - Chalk Point circuit. The relay and communications cost will be \$2.25M.

For the 230 kV option, ITO requires a breaker and a half design for the interconnection substation. The cost for the eight breaker substation depicted in Figure 1 is \$23 and will take 36 months to complete. This cost includes the loop in and out of the 23085 and 23087 lines. The relay and communications cost will be \$2M.

Non-Direct Connection Requirements

The numbers in the left two columns coincide with the option and network impact number from the Network Impacts section of this document. The “Rate” column represents the existing rating value for the impacted line. The “Rate Type” column indicates whether it is a normal or emergency rating. The column labeled “Cont” identifies the contingency type: -: non-contingency, S: single-contingency, and T: tower-contingency. The MW column shows the energy contribution from the queue project. The TO column identifies the affected Interconnected Transmission Owner. The Upgrade column identifies the recommend mitigation upgrade, estimated cost and construction schedule.¹ The breaker costs are identified in the Short Circuit section above.

Option	ID	Voltage	Source	Sink	Start	End	Rate	Rate Type	Cont	MW	ITO	Upgrade
1	1	230k	BOWIE042	BURT2334	99.15	100.19	730	E	T	7.6	PEPCO	The estimated cost to upgrade the Bowie - Burtonsville 230 kV circuit (23042) is \$9.6 M. This cost represents the addition of ACCR conductor to circuit 23042 from Bowie to Burtonsville (approximately 8 miles). Must complete both circuits on a tower line from
	2	230k	OAKGV230	BOWIE045	100.48	101.52	730	E	T	7.7	PEPCO	The estimated cost to upgrade the Oak Grove - Bowie 230 kV circuit (23045) is \$14.4 M. This cost represents the addition of ACCR to circuit 23045 from Oak Grove to Bowie
	3	230k	BOWIE045	BURT2314	100.27	101.32	730	E	T	7.7	PEPCO	The estimated cost to upgrade the Bowie - Burtonsville 230 kV circuit (23045) is \$9.6 M. This cost represents the addition of ACCR conductor to circuit 23045 from Bowie to
	4	230k	H.RDGE16	HOWARD32	112.79	113.93	728	E	T	8.3	BGE	High Ridge - Howard 230 kV Upgrade: The existing circuit 2332-A has 1590 Kcmil conductor which will need to be replaced. The estimated cost to rebuild the structures to accommodate new 2167 Kcmil ACSR conductor is \$16,000,000 and it will take approximately 60 months. Assumptions: <ul style="list-style-type: none"> • Length of line 8.0 miles • 2+ year CPCN process at a cost of \$500,000 • Existing tower removal at a cost of \$1M included.
2	1	230k	OAKGV230	BOWIE045	92.19	108.86	730	E	S	121.6	PEPCO	The estimated cost to upgrade the Oak Grove - Bowie 230 kV circuit (23045) is \$14.4 M. This cost represents the addition of ACCR to circuit 23045 from Oak Grove to Bowie
	2	230k	OAKGV230	BOWIE045	88.89	104.92	608	N	0	97.5	PEPCO	Same as 2.
	3	230k	BOWIE045	BURT2314	91.99	108.65	730	E	S	121.6	PEPCO	Same as 3 under option 1.
	4	230k	OAKGV230	BOWIE042	91.94	108.59	730	E	S	121.6	PEPCO	The estimated cost to upgrade the Oak Grove - Bowie 230 kV circuit (23042) is \$14.4 M. This cost represents the addition of ACCR conductor to circuit 23042 from Oak Grove to Bowie
	5	230k	OAKGV230	BOWIE042	88.43	104.46	608	N	0	97.4	PEPCO	Same as 4.
	6	230k	BOWIE042	BURT2334	91.49	108.14	730	E	S	121.6	PEPCO	The estimated cost to upgrade the Bowie - Burtonsville 230 kV circuit (23042) is \$9.6 M. This cost represents the addition of ACCR conductor to circuit 23042 from Bowie to Burtonsville (approximately 8 miles). Must complete both circuits on a tower line from
	7	230k	BOWIE042	BURT2334	87.89	103.92	608	N	0	97.4	PEPCO	Same as 6.
	8	230k	V3-001 TAP	TALBT082	70.97	123.79	692	E	T	365.5	PEPCO	The cost to construct and upgrade conductors between the V3-001 tap TALBT082 is
	9	230k	TALB 066	OAKGV230	100.03	102.58	680	E	T	17.4	PEPCO	The cost to upgrade Oak Grove- Talbert is approximately \$24.0 M (10 miles). Use ACCR all
	10	230k	H.RDGE16	HOWARD32	101.13	108.33	728	E	T	10	BGE	High Ridge - Howard 230 kV Upgrade: The existing circuit 2332-A has 1590 Kcmil conductor which will need to be replaced. The estimated cost to rebuild the structures to accommodate new 2167 Kcmil ACSR conductor is \$16,000,000 and it will take approximately 60 months. Assumptions: <ul style="list-style-type: none"> • Length of line 8.0 miles • 2+ year CPCN process at a cost of \$500,000 • Existing tower removal at a cost of \$1M included.

¹ Line upgrades may require additional terminal equipment and breakers to be replaced or upgraded to match the revised ampere rating.