PJM Generator Interconnection

W4-044 Kelson Ridge

725 MW Capacity & Energy

Feasibility Study

April 2011
DMS #644330

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).

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 W4-044 is a request to interconnect a 725 MW Capacity Resource consisting of a gas-fired, 2x1 combined cycle facility to be located approximately 5 miles southeast of U.S. Route 301 on Piney Church Road, in Waldorf, Charles County, Maryland. The proposed generating facility is located approximately five miles north of ITO 230kV Hawkins Gate substation and close to a right of way containing four Morgantown/Hawkins Gate - Talbert/Oak Grove 230 kV circuits. The Interconnection Customer is tentatively scheduling the generating facility to be commercially available by 2Q2014.

Queue W4-044 requested that the interconnecting substation be arranged as a breaker and a half / 4 breakers per bay design, rather than a more conventional 3 breaker per bay design.

The IC requested that the interconnection be studied primary on the 23084 and 23086 lines (Attachment A). Secondary point of interconnection would be on the 23085 and 23087 lines (Attachment B).

Primary POI Network Impacts: refer to Attachment A

Queue project W4-044 was studied as a(n) 725.0 MW (725.0 MW of which was Capacity) injection into PEPCO's system at the V3-017 230.0 kV substation. Project W4-044 was evaluated for compliance with reliability criteria for summer peak conditions in 2014.

Potential transmission network impacts are as follows:

Generator Deliverability

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

1. (BG&E) The High Ridge 2316-Howard 2332 230 kV line (from bus 220941 to bus 220954 ckt 1) loads from 93.64% to 100.19% (DC power flow) of its normal rating (562 MVA) for non contingency condition. This project contributes approximately 37.01 MW to the thermal violation.

2. (PEPCO) The Bowie 042-Burtonsville 2334 230 kV line (from bus 223977 to bus 223962 ckt 1) loads from 98.88% to 115.1% (DC power flow) of its emergency rating (730 MVA) for the single contingency 'PP31'. This project contributes approximately 118.39 MW to the thermal violation.

```
CONTINGENCY 'PP31'
OPEN BRANCH FROM BUS 223961 TO BUS 223978 CKT 1  / 223961 BURT2314 230 223978 BOWIE045 230 1
END
```

3. (PEPCO) The Bowie 042-Burtonsville 2334 230 kV line (from bus 223977 to bus 223962 ckt 1) loads from 94.91% to 110.5% (DC power flow) of its normal rating (608 MVA) for non contingency condition. This project contributes approximately 94.79 MW to the thermal violation.

4. (PEPCO) The Bowie 045-Burtonsville 2314 230 kV line (from bus 223978 to bus 223961 ckt 1) loads from

99.40% to 115.62% (DC power flow) of its emergency rating (730 MVA) for the single contingency 'PP36'. This project contributes approximately 118.45 MW to the thermal violation.

```
CONTINGENCY 'PP36'
OPEN BRANCH FROM BUS 223962 TO BUS 223977 CKT 1   / 223962 BURT2334 230 223977 BOWIE042 230 1
END
```

5. (PEPCO) The Bowie 045-Burtonsville 2314 230 kV line (from bus 223978 to bus 223961 ckt 1) loads from 95.69% to 111.29% (DC power flow) of its normal rating (608 MVA) for non contingency condition. This project contributes approximately 94.82 MW to the thermal violation.

6. (PEPCO) The Oak Groove-Bowie 045 230 kV line (from bus 223982 to bus 223978 ckt 1) loads from 99.52% to 115.75% (DC power flow) of its emergency rating (730 MVA) for the single contingency 'PP36'. This project contributes approximately 118.45 MW to the thermal violation.

```
CONTINGENCY 'PP36'
OPEN BRANCH FROM BUS 223962 TO BUS 223977 CKT 1   / 223962 BURT2334 230 223977 BOWIE042 230 1
END
```

7. (PEPCO) The Oak Groove-Bowie 045 230 kV line (from bus 223982 to bus 223978 ckt 1) loads from 95.84% to 111.44% (DC power flow) of its normal rating (608 MVA) for non contingency condition. This project contributes approximately 94.82 MW to the thermal violation.

8. (PEPCO) The Oak Groove-Bowie 042 230 kV line (from bus 223982 to bus 223977 ckt 1) loads from 99.14% to 115.36% (DC power flow) of its emergency rating (730 MVA) for the single contingency 'PP31'. This project contributes approximately 118.39 MW to the thermal violation.

```
CONTINGENCY 'PP31'
OPEN BRANCH FROM BUS 223961 TO BUS 223978 CKT 1   / 223961 BURT2314 230 223978 BOWIE045 230 1
END
```

9. (PEPCO) The Oak Groove-Bowie 042 230 kV line (from bus 223982 to bus 223977 ckt 1) loads from 95.22% to

110.81% (DC power flow) of its normal rating (608 MVA) for non contingency condition. This project contributes approximately 94.79 MW to the thermal violation.

10. (BG&E) The High Ridge 2316-Columbia 230 kV line (from bus 220941 to bus 221010 ckt 1) loads from 93.36% to 99.43% (DC power flow) of its emergency rating (728 MVA) for the single contingency 'BG_CKT2332'. This project contributes approximately 44.36 MW to the thermal violation.

```
CONTINGENCY 'BG_CKT2332'     /* GRANITE TO HIGH RIDGE TO PUMPHREY CKT #2332/-A/-B
DISCONNECT BRANCH FROM BUS 220954 TO BUS 220973 CKT 1     /* CKT #2332 GRANITE - HOWARD
DISCONNECT BRANCH FROM BUS 220954 TO BUS 220941 CKT 1     /* CKT #2332-A HOWARD TO HIGH RIDGE
DISCONNECT BRANCH FROM BUS 220954 TO BUS 220974 CKT 1     /* CKT #2332-B HOWARD TO PUMPHREY
DISCONNECT BRANCH FROM BUS 220974 TO BUS 221037 CKT 1     /* PUMPHREY 230-1 TRANSFORMER
CLOSE LINE FROM BUS 220953 TO BUS 220954 CKT 1            /* HOWARD H/S TIE
END
```

11. (PEPCO) The Talbert 066-Oak Groove 230 kV line (from bus 224125 to bus 223982 ckt 1) loads from 96.53% to 139.64% (DC power flow) of its emergency rating (680 MVA) for the single contingency 'PP47'. This project contributes approximately 293.12 MW to the thermal violation.

```
CONTINGENCY 'PP47'
OPEN BRANCH FROM BUS 223982 TO BUS 223990 CKT 1  / 223982 OAKGV230 230 223990 TALB 068 230 1
OPEN BRANCH FROM BUS 292423 TO BUS 223990 CKT 1  / 223988 MORGT230 230 223990 TALB 068 230 1 /*
BUS 223988 IS REPLACED WITH 292423 DUE TO R17. FEB. 13, 2009.
END
```

12. (PEPCO) The Talbert 066-Oak Groove 230 kV line (from bus 224125 to bus 223982 ckt 1) loads from 85.71% to 121.46% (DC power flow) of its normal rating (559 MVA) for non contingency condition. This project contributes approximately 199.85 MW to the thermal violation.

13. (PEPCO) The V3-017-R17 230 kV line (from bus 293363 to bus 292630 ckt 1) loads from 72.57% to 145.15% (DC power flow) of its normal rating (999 MVA) for non contingency condition. This project contributes approximately 725.00 MW to the thermal violation.

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)

No violations identified.

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.)

14. (BG&E) The High Ridge 2316-Howard 2332 230 kV line (from bus 220941 to bus 220954 ckt 1) loads from 116.41% to 117.51% (DC power flow) of its emergency rating (728 MVA) for the tower contingency 'WCHPL_BRNDN'. This project contributes approximately 61.25 MW to the thermal violation.

```
CONTINGENCY 'WCHPL_BRNDN'     /* WAUGH CHAPEL TO BRANDON SHORES CKTS #2342 & #2343
DISCONNECT BRANCH FROM BUS 220955 TO BUS 220960 CKT 1     /* CKT #2342 W. CHAPEL TO BRANDON SHORES
DISCONNECT BRANCH FROM BUS 220955 TO BUS 220960 CKT 2     /* CKT #2343 W. CHAPEL TO BRANDON SHORES
END
```

15. (BG&E) The High Ridge 2316-Howard 2332 230 kV line (from bus 220941 to bus 220954 ckt 1) loads from 101.20% to 107.92% (DC power flow) of its emergency rating (728 MVA) for the single contingency 'BG_CKT2312'. This project contributes approximately 49.07 MW to the thermal violation.

```
CONTINGENCY 'BG_CKT2312'     /* HIGH RIDGE-COLUMBIA-HOWARD-GRANITE CKT#2312 & GRANITE 230-1
DISCONNECT BUS 221010                                    /* 2312 COLUMBIA TAP BUS
DISCONNECT BRANCH FROM BUS 220953 TO BUS 220972          /* CKT #2312 GRANITE TO HOWARD
DISCONNECT BRANCH FROM BUS 220972 TO BUS 221183          /* GRANITE 230-1 TRANSFORMER
CLOSE LINE FROM BUS 220949 TO BUS 220948 CKT 1           /* COLUMBIA 230KV TIE
CLOSE LINE FROM BUS 220953 TO BUS 220954 CKT 1           /* HOWARD H/S TIE
END
```

16. (PEPCO) The Bowie 042-Burtonsville 2334 230 kV line (from bus 223977 to bus 223962 ckt 1) loads from 109.42% to 126.6% (DC power flow) of its emergency rating (730 MVA) for the tower contingency '7PEPCO_A'. This project contributes approximately 125.98 MW to the thermal violation.

```
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
END
```

17. (PEPCO) The Bowie 045-Burtonsville 2314 230 kV line (from bus 223978 to bus 223961 ckt 1) loads from 110.59% to 127.92% (DC power flow) of its emergency rating (730 MVA) for the tower contingency '5PEPCO'. This project contributes approximately 127.07 MW to the thermal violation.

```
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
```

18. (PEPCO) The Oak Groove-Bowie 045 230 kV line (from bus 223982 to bus 223978 ckt 1) loads from 110.71% to 128.04% (DC power flow) of its emergency rating (730 MVA) for the tower contingency '5PEPCO'. This project contributes approximately 127.07 MW to the thermal violation.

```
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
```

19. (PEPCO) The Oak Groove-Bowie 042 230 kV line (from bus 223982 to bus 223977 ckt 1) loads from 109.68% to 126.86% (DC power flow) of its emergency rating (730 MVA) for the tower contingency '7PEPCO_A'. This project contributes approximately 125.98 MW to the thermal violation.

```
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
END
```

20. (PEPCO) The Talbert 066-Oak Groove 230 kV line (from bus 224125 to bus 223982 ckt 1) loads from 105.97% to 152.9% (DC power flow) of its emergency rating (680 MVA) for the tower contingency '12PEPCOA_A'. This project contributes approximately 320.01 MW to the thermal violation.

```
CONTINGENCY '12PEPCOA_A'
DISCONNECT BRANCH FROM BUS 292423 TO BUS 223990 CKT 1
DISCONNECT BRANCH FROM BUS 223993 TO BUS 224078 CKT 1
DISCONNECT BRANCH FROM BUS 223993 TO BUS 224124 CKT 1
END
```

Primary POI New System Reinforcements

(Upgrades required to mitigate reliability criteria violations, i.e. "Network Impacts", initially caused by the addition of this project generation.)

1,14,15.Rebuild line to accommodate double bundle 1272 ACSR. Estimated cost: $ 24 M. estimated time: 5 yrs.

2,3,16. Bowie – Burtonsville 230 kV circuit (23042) is approximately 8 miles. Currently this circuit is an ACSR conductor, which is rated at 730 MVA SE. Upgrading this circuit will require replacing the existing conductor to an ACCR conductor, which will be rated at 3000 amps or 1200 MVA SE. The approximate cost is $8,000,000. Estimated construction time is two years.

4,5,17. Bowie – Burtonsville 230 kV circuit (23045) is approximately 8 miles. Currently this circuit is an ACSR conductor, which is rated at 730 MVA SE. Upgrading this circuit will require replacing the existing conductor to an ACCR conductor, which will be rated at 3000 amps or 1200 MVA SE. The approximate cost is $8,000,000. Estimated construction time is two years.

6,7,18. Oak Grove – Bowie 230 kV circuit (23045) is approximately 12 miles. Currently this circuit is an ACSR conductor, which is rated at 730 MVA SE. Upgrading this circuit will require replacing the existing conductor to an ACCR conductor, which will be rated at 3000 amps or 1200 MVA SE. The approximate cost is $12,000,000. Estimated construction time is two years.

8,9,19. Oak Grove – Bowie 230 kV circuit (23042) is approximately 12 miles. Currently this circuit is an ACSR conductor, which is rated at 730 MVA SE. Upgrading this circuit will require replacing the existing conductor to an ACCR conductor, which will be rated at 3000 amps or 1200 MVA SE. The approximate cost is $12,000,000. Estimated construction time is two years.

10. Current PJM Rating Chart indicates 1590 ACSR @ 160 deg. C provides 941 MVA SE rating; therefore, line is O.K. as is.

11,12,20. Preliminary cost estimate to upgrade the approximately 10 miles of Talbert-Oak Grove is $14M. Two years for engineering and construction. Both circuits on the same tower line are required to be upgraded not just a single circuit.

13. This will be upgraded as part of the W4-044 project (outlet for generation of W4-044).

Contribution to Previously Identified System Reinforcements

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

Performed at the System Impact Study.

Short Circuit

(Report over-dutied breakers.)

PJM analysis found 16 new breakers, to be over-duty in the PEPCO transmission area. The new over-duty breakers are listed below:

BUS_NO	BUS	BREAKER	Rating Type	Duty Percent With w4-044	Duty Percent Without w4-044	Duty Percent Difference	Note
7054	Morgantown 230 kV	WEST OCB	T	101.00%	96.90%	4.10%	New Over-duty

In the Aspen case, ITO models only one breaker type. If a station has one breaker type, ITO models only one breaker. At Morgantown, all the 16 breakers are of the same type, thus only one breaker is modeled. So, the breakers you see in the Aspen case equate to the number of breakers at the station.

The cost to upgrade the Morgantown breakers is $1.5 million per breaker ($24 million total) and the lead time would need to be at least 4 years at a rate of 4 breakers per year. Note that GenOn owns four of the breakers.

In addition, the analysis also showed a significant fault contribution (i.e. above 3%) to Oak Grove breakers, which

were already identified as over-duty. The breakers are listed below:

BUS_NO	BUS	BREAKER	Rating Type	Duty Percent With w4-044	Duty Percent Without w4-044	Duty Percent Difference	Note
7048	OAKGV 230 kV	ITE OCB	S	109.60%	106.50%	3.10%	Over 100%, > 3% contribution

While these breakers are being upgraded by a PJM baseline upgrade, it is important that this project ensure that the baseline upgrades are completed prior to its in-service date.

Attachment Facilities

IC has responsibility for design and construction of all generating and Attachment Facilities on IC side of the Point of Interconnection (POI). In addition, under the PJM Tariff "Option to Build" provisions, IC will assume all responsibility to construct all Attachment Facilities including the new 230-kV substation. All construction must meet ITO technical specifications. Prior to commercial operation of Queue R17 generation, IC will transfer ownership of the Attachment Facilities from the POI into the new 230-kV Interconnection substation to ITO.

Direct Connection Requirements

Queue W4-044 generation can be connected to the two Morgantown/Hawkins Gate - Talbert/Oak Grove 230 kV circuits as depicted below.

Under the PJM Tariff "Option to Build" provisions, IC will assume all responsibility to construct the new 230-kV substation. All construction must meet ITO technical standard specifications. Prior to commercial operation of generation, IC will transfer ownership of the new 230-kV Interconnection substation to ITO.

ITO will review IC design of the new 230-kV substation, and perform the necessary construction management, engineering review and commissioning testing associated with the attachment and substation facilities added for Queue W4-044; ITO estimates this work to cost $2,000,000. Additionally, ITO will be required to replace relays at the remote terminal ends of the new substation. The cost for this work is estimated to be approximately $1,750,000. Also new revenue metering will be required and will cost approximately $250,000.

ITO estimate for the 230-kV extensions from existing lines to the new substation is approximately $1,500,000. This estimate includes cutting 23084 and 23086 lines, installation of two heavy duty 90 degree double circuit poles and bringing the lines to the A-frame structures in the new 230-kV substation. This work will be coordinated with IC substation construction and availability for outages for 23084 and 23086. The duration of this work is expected to be twelve to twenty-four months, depending on outage availability.

The overall ITO work in support of the new interconnection substation will cost approximately $5,500,000. ITO work will be done concurrently with IC 230-kV substation work.

Secondary POI Network Impacts: refer to Attachment B

Secondary options results are provided to show impacts. Details for secondary options are not provided in the Feasibility Study.

Generator Deliverability

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

1. (PEPCO) The W4-044 2 TAP-Talbert 082 230 kV line (from bus 905407 to bus 223991 ckt 1) loads from 49.39% to 106.72% (DC power flow) of its emergency rating (692 MVA) for the single contingency 'PP53_W4-044 OP2_B'. This project contributes approximately 396.77 MW to the thermal violation.

```
CONTINGENCY 'PP53_W4-044 OP2_B'
  OPEN BRANCH FROM BUS 223982 TO BUS 905405 CKT 1 / 223982 OAKGV230 230 224124 TALB 087 230 1
  OPEN BRANCH FROM BUS 223993 TO BUS 224124 CKT 1 / 223993 HAWK 077 230 224124 TALB 087 230 1
  OPEN BRANCH FROM BUS 223993 TO BUS 224078 CKT 1 / 223993 HAWK 077 230 224078 HAWK 69 69.0 1
END
```

2. (BG&E) The High Ridge 2316-Howard 2332 230 kV line (from bus 220941 to bus 220954 ckt 1) loads from 96.86% to 103.76% (DC power flow) of its emergency rating (728 MVA) for the single contingency 'BG_CKT2312'. This project contributes approximately 50.26 MW to the thermal violation.

```
CONTINGENCY 'BG_CKT2312'     /* HIGH RIDGE-COLUMBIA-HOWARD-GRANITE CKT#2312 & GRANITE 230-1
  DISCONNECT BUS 221010                                  /* 2312 COLUMBIA TAP BUS
  DISCONNECT BRANCH FROM BUS 220953 TO BUS 220972        /* CKT #2312 GRANITE TO HOWARD
  DISCONNECT BRANCH FROM BUS 220972 TO BUS 221183        /* GRANITE 230-1 TRANSFORMER
  CLOSE LINE FROM BUS 220949 TO BUS 220948 CKT 1         /* COLUMBIA 230KV TIE
  CLOSE LINE FROM BUS 220953 TO BUS 220954 CKT 1         /* HOWARD H/S TIE
END
```

3. (PEPCO) The Bowie 042-Burtonsville 2334 230 kV line (from bus 223977 to bus 223962 ckt 1) loads from 96.38% to 113.65% (DC power flow) of its normal rating (608 MVA) for non contingency condition. This project contributes approximately 104.99 MW to the thermal violation.

4. (PEPCO) The W4-044 TAP-Oak Groove 230 kV line (from bus 905405 to bus 223982 ckt 1) loads from 91.64% to 162.59% (DC power flow) of its emergency rating (680 MVA) for the single contingency 'PP48_W4-044 OP2_B'. This project contributes approximately 482.93 MW to the thermal violation.

```
CONTINGENCY 'PP48_W4-044 OP2_B'
  OPEN BRANCH FROM BUS 223982 TO BUS 223991 CKT 1 / 223982 OAKGV230 230 223991 TALBT082 230 1
  OPEN BRANCH FROM BUS 905407 TO BUS 223991 CKT 1 / 223988 MORGT230 230 223991 TALBT082 230 1
END
```

5. (PEPCO) The W4-044 TAP-Oak Groove 230 kV line (from bus 905405 to bus 223982 ckt 1) loads from 95.46% to 163.07% (DC power flow) of its normal rating (559 MVA) for non contingency condition. This project contributes approximately 377.95 MW to the thermal violation.

6. (PEPCO) The Bowie 045-Burtonsville 2314 230 kV line (from bus 223978 to bus 223961 ckt 1) loads from 97.16% to 114.43% (DC power flow) of its normal rating (608 MVA) for non contingency condition. This project contributes approximately 105.03 MW to the thermal violation.

7. (PEPCO) The Oak Groove-Bowie 045 230 kV line (from bus 223982 to bus 223978 ckt 1) loads from 97.30% to 114.58% (DC power flow) of its normal rating (608 MVA) for non contingency condition. This project contributes approximately 105.03 MW to the thermal violation.

8. (PEPCO) The Oak Groove-Bowie 042 230 kV line (from bus 223982 to bus 223977 ckt 1) loads from 96.70% to 113.96% (DC power flow) of its normal rating (608 MVA) for non contingency condition. This project contributes approximately 104.99 MW to the thermal violation.

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)

9. (PEPCO) The W4-044 2 TAP-Morgantown Bus 230 kV line (from bus 905407 to bus 223988 ckt 1) loads from 0.56% to 104.21% (DC power flow) of its emergency rating (692 MVA) for the tower contingency '12PEPCO_W4-044 OP2_B'. This project contributes approximately 725.00 MW to the thermal violation.

```
CONTINGENCY '12PEPCO_W4-044 OP2_B'
  DISCONNECT BRANCH FROM BUS 905407 TO BUS 223991 CKT 1
  DISCONNECT BRANCH FROM BUS 223991 TO BUS 223982 CKT 1
  DISCONNECT BRANCH FROM BUS 223993 TO BUS 224078 CKT 1
  DISCONNECT BRANCH FROM BUS 223991 TO BUS 290892 CKT 1
  DISCONNECT BRANCH FROM BUS 223988 TO BUS 223993 CKT 1
  DISCONNECT BRANCH FROM BUS 223993 TO BUS 224124 CKT 1
  DISCONNECT BRANCH FROM BUS 905405 TO BUS 223982 CKT 1
END
```

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.)

10. (BG&E) The High Ridge 2316-Howard 2332 230 kV line (from bus 220941 to bus 220954 ckt 1) loads from 102.86% to 104.24% (DC power flow) of its emergency rating (728 MVA) for the tower contingency 'WCHPL_BRNDN'. This project contributes approximately 61.97 MW to the thermal violation.

```
CONTINGENCY 'WCHPL_BRNDN'     /* WAUGH CHAPEL TO BRANDON SHORES CKTS #2342 & #2343
  DISCONNECT BRANCH FROM BUS 220955 TO BUS 220960 CKT 1 /* CKT #2342 W. CHAPEL TO BRANDON SHORES
  DISCONNECT BRANCH FROM BUS 220955 TO BUS 220960 CKT 2   /* CKT #2343 W. CHAPEL TO BRANDON SHORES
END
```

11. (PEPCO) The Bowie 042-Burtonsville 2334 230 kV line (from bus 223977 to bus 223962 ckt 1) loads from 110.52% to 129.32% (DC power flow) of its emergency rating (730 MVA) for the tower contingency '7PEPCO_A'. This project contributes approximately 137.84 MW to the thermal violation.

```
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
END
```

12. (PEPCO) The Bowie 042-Burtonsville 2334 230 kV line (from bus 223977 to bus 223962 ckt 1) loads from 100.11% to 118.02% (DC power flow) of its emergency rating (730 MVA) for the single contingency 'PP31'. This project contributes approximately 130.74 MW to the thermal violation.

```
CONTINGENCY 'PP31'
  OPEN BRANCH FROM BUS 223961 TO BUS 223978 CKT 1  / 223961 BURT2314 230 223978 BOWIE045 230 1
END
```

13. (PEPCO) The W4-044 TAP-Oak Groove 230 kV line (from bus 905405 to bus 223982 ckt 1) loads from 130.14% to 186.45% (DC power flow) of its emergency rating (680 MVA) for the tower contingency '10PEPCO_B1'. This project contributes approximately 383.95 MW to the thermal violation.

```
CONTINGENCY '10PEPCO_B1'
  DISCONNECT BRANCH FROM BUS 292423 TO BUS 223990 CKT 1
  DISCONNECT BRANCH FROM BUS 223990 TO BUS 223982 CKT 1
  DISCONNECT BRANCH FROM BUS 223990 TO BUS 290891 CKT 1
  DISCONNECT BRANCH FROM BUS 224125 TO BUS 292424 CKT 1
  DISCONNECT BRANCH FROM BUS 224125 TO BUS 223982 CKT 1
  REMOVE MACHINE 1 FROM BUS 293363                        /* * V3-017
END
```

14. (PEPCO) The Bowie 045-Burtonsville 2314 230 kV line (from bus 223978 to bus 223961 ckt 1) loads from 111.68% to 130.66% (DC power flow) of its emergency rating (730 MVA) for the tower contingency '5PEPCO'. This project contributes approximately 139.11 MW to the thermal violation.

```
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
```

15. (PEPCO) The Bowie 045-Burtonsville 2314 230 kV line (from bus 223978 to bus 223961 ckt 1) loads from 100.64% to 118.56% (DC power flow) of its emergency rating (730 MVA) for the single contingency 'PP36'. This project contributes approximately 130.80 MW to the thermal violation.

```
CONTINGENCY 'PP36'
  OPEN BRANCH FROM BUS 223962 TO BUS 223977 CKT 1   / 223962 BURT2334 230 223977 BOWIE042 230 1
END
```

16. (PEPCO) The Oak Groove-Bowie 045 230 kV line (from bus 223982 to bus 223978 ckt 1) loads from 111.80% to 130.78% (DC power flow) of its emergency rating (730 MVA) for the tower contingency '5PEPCO'. This project contributes approximately 139.11 MW to the thermal violation.

```
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
```

17. (PEPCO) The Oak Groove-Bowie 045 230 kV line (from bus 223982 to bus 223978 ckt 1) loads from 100.76% to 118.68% (DC power flow) of its emergency rating (730 MVA) for the single contingency 'PP36'. This project contributes approximately 130.80 MW to the thermal violation.

```
CONTINGENCY 'PP36'
  OPEN BRANCH FROM BUS 223962 TO BUS 223977 CKT 1 / 223962 BURT2334 230 223977 BOWIE042 230 1
END
```

18. (PEPCO) The Oak Groove-Bowie 042 230 kV line (from bus 223982 to bus 223977 ckt 1) loads from 110.79% to 129.59% (DC power flow) of its emergency rating (730 MVA) for the tower contingency '7PEPCO_A'. This project contributes approximately 137.84 MW to the thermal violation.

```
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
END
```

19. (PEPCO) The Oak Groove-Bowie 042 230 kV line (from bus 223982 to bus 223977 ckt 1) loads from 100.39% to 118.29% (DC power flow) of its emergency rating (730 MVA) for the single contingency 'PP31'. This project contributes approximately 130.74 MW to the thermal violation.

```
CONTINGENCY 'PP31'
  OPEN BRANCH FROM BUS 223961 TO BUS 223978 CKT 1  / 223961 BURT2314 230 223978 BOWIE045 230 1
END
```

Short Circuit

(Report over-dutied breakers.)

The second option considered was a tap between the line F23087 which is between Talb087 and Hawk077 and also the line F23085 which is between Talb082 and GSF 230. We found the following new breakers over duty:

BUS_NO	BUS	BREAKER	Rating Type	Duty Percent With w4-044_Opt2	Duty Percent Without w4-044_Opt2	Duty Percent Difference	Note
7054	GSF 230 230.kV	WEST OCB	T	106.50%	96.90%	9.60%	New Over-duty
7060	BHILL 230 230.kV	ABB GCB	S	100.50%	94.40%	6.10%	New Over-duty
7060	BHILL 230 230.kV	ITE OCB	S	100.50%	94.40%	6.10%	New Over-duty
7060	BHILL 230 230.kV	WEST OCB	S	100.50%	94.40%	6.10%	New Over-duty

Also, The following breakers had a contribution of 3% or more:

BUS_NO	BUS	BREAKER	Rating Type	Duty Percent With w4-044_Opt2	Duty Percent Without w4-044_Opt2	Duty Percent Difference	Note
7049	GSE 230-1 230.kV	ABB GCB	S	119.80%	115.00%	4.80%	Over 100%, > 3% contribution
7049	GSE 230-1 230.kV	GE OCB	S	119.80%	115.00%	4.80%	Over 100%, > 3% contribution
7049	GSE 230-1 230.kV	WEST OCB	S	119.80%	115.00%	4.80%	Over 100%, > 3% contribution
7048	OAKGV 230 230.kV	ITE OCB	S	111.50%	106.50%	5.00%	Over 100%, > 3% contribution
0	BURT 230-3 230.kV	WEST OCB 3C	T	106.30%	102.80%	3.50%	Over 100%, > 3% contribution
0	BURT 230-4 230.kV	WEST OCB 4C	T	106.10%	102.60%	3.50%	Over 100%, > 3% contribution
7028	BURT 230-2 230.kV	WEST OCB 2C	T	105.70%	102.20%	3.50%	Over 100%, > 3% contribution
7027	BURT 230-1 230.kV	WEST OCB 1C	T	105.60%	102.20%	3.40%	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.

No violations identified.