Generation Interconnection Feasibility Study Report

For

PJM Generation Interconnection Request Queue Position X2-012

Clinton 230kV

January 2012

Preface

The intent of the feasibility study is to determine a plan, with ballpark cost and construction time estimates, to connect the subject generation to the PJM network at a location specified by the Interconnection Customer. The Interconnection Customer may request the interconnection of generation as a capacity resource or as an energy-only resource. As a requirement for interconnection, the Interconnection Customer may be responsible for the cost of constructing: (1) Direct Connections, which are new facilities and/or facilities upgrades needed to connect the generator to the PJM network, and (2) Network Upgrades, which are facility additions, or upgrades to existing facilities, that are needed to maintain the reliability of the PJM system.

In some instances a generator interconnection may not be responsible for 100% of the identified network upgrade cost because other transmission network uses, e.g. another generation interconnection, 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 (IC), has proposed a natural generating facility located in Clinton Township, Pennsylvania. The installed facilities will have a total capability of 905 MW with 905 MW of this output being recognized by PJM as capacity. The proposed in-service date for this project is February 1, 2015. **This study does not imply a PPL Electric Utilities (PPL EU) commitment to this in-service date.**

Point of Interconnection

X2-012 will interconnect with the PPL EU transmission system under one of two options. Option 1 is to connect at the Clinton 230kV substation. Option 2 is to construct a new 230kV substation tying into the 230kV Montour-Elimsport and Montour-Clinton lines.

Direct Connection

Two connection options are described below. Only Option 2 includes a detailed cost estimate and schedule for a 230 kV interconnection, as PPL EU believes that this option is the worst-case scenario from a cost and scheduling standpoint. Magnitude costs were used to develop Option 1; this option provides the developer with an alternate design to interconnect with the PPL EU system.

Based only on a desktop review of the land in the vicinity of this proposed project, the PPL EU Siting and Certification group observed that Option 2 would traverse farm and industrial lands. That situation could benefit the line routing process because of less environmental impact. Option 1, with its longer line length, would place the line route close to nearby residential areas, and could result in opposition to the lines.

In addition, the PPL EU Substation Engineering group observed that under Option 1 the existing Clinton substation would be expanded into the side of a hill, requiring a good deal of grading to create a level substation site. Under Option 2, a new switchyard would be constructed on farmland and less grading would be needed. Also, the existing Clinton substation must remain energized to serve local load during the rebuilding of the 230 kV yard. This will be a difficult task to achieve if Option 1 is selected. It will not be an issue with Option 2 because Clinton substation will not require any modifications.

Based on the above issues, PPL EU recommends that Option 2 be selected.

Option 1: Existing Clinton 230 kV Substation Connection

The X2-012 project can be connected to the existing Clinton 230 kV substation by expanding the existing site into a 3 bay breaker-and-a-half arrangement designed for a future fourth bay. With this option, the connection to the generator facility will be an approximately 2.5 mile tap.

A functional one-line diagram of the proposed substation is shown in Attachment A.

The total estimated cost of Direct Connection Facilities needed to connect to the existing Clinton 230 kV substation is **$16,845,192** (excluding any applicable state or federal taxes). The 230 kV connection estimate is based on the assumption that only 2.5 miles of 230 kV transmission tap would be required.

A further breakdown of the direct connection costs for the **existing Clinton 230kV connection** is as follows:

$ 7,182,311	Transmission work for the direct connection
$ 8,778,381	Substation work at PPL EU Clinton Substation.
$ 884,500	Siting, Certification, and Right-of-Way Acquisition

After the Interconnection Service Agreement and Construction Service Agreement are signed, the typical time needed to complete the direct connection work is about 25 months for the transmission work and 24-30 months for the substation work. The transmission and substation work can be completed concurrently.

230 kV Transmission Tap Direct Connection Work

$7,182,311 (230 kV Transmission tap)

The transmission direct connection cost includes construction of approximately 2.5 miles of 230 kV line consisting of 6-1590 ACSR conductors with one ½-inch H.S. steel overhead ground wire (OHGW) and one 0.752-inch overhead ground wire with fiber optic cable (OPGW) within a 150 foot wide right-of-way from the existing substation to the X2-012 Point of Interconnection dead-end structure.

Also, the existing Montour – Elimsport 230 kV line will be broken at the Clinton Substation and re-terminated into the rebuilt 230 kV yard.

The transmission tap to the IPP facility would be traversing to-be-acquired right-of-way and would be owned by PPL EU. Full PA PUC Certification will be required, as the tap exceeds 2 miles in length. The estimated cost of this filing and the acquisition of right-of-way is approximately $884,500 and is not included in the transmission tap cost estimate. The time required to prepare, file and obtain PA PUC approval is approximately 24 months and assumes there is no litigation or condemnation.

Clinton 230 kV Substation Expansion - Direct Connection Work

$8,778,381 (Total cost of the Clinton 230 kV Substation expansion)

The 230 kV substation work includes removing the existing substation and constructing a new 3 bay breaker-and-a-half substation with space for a future fourth bay. One bay will sectionalize the Montour – Elimsport line and must be designed for at least 2000 A. Another bay will accommodate the existing Montour – Clinton and Clinton – Elimsport lines. Lastly, the bay designed to accommodate the X2-012 project will be designed for double breaker operation (future breaker-and-a-half) and rated for at least 3000 A.

Each of the two existing 230/69 kV transformers will be connected to one of the new 230 kV buses via a motor operated disconnect switch.

Additionally, because extended outages on 230 kV lines may be difficult to obtain, other temporary measures may be required and costs for those measures are not included.

Option 2: New 230 kV Switchyard Connection

Alternatively, the X2-012 project can be connected to a new 3 bay breaker-and-a-half switchyard, with room for a future fourth bay, to be constructed on or adjacent to the developer's site. With this option, the connection to the generation facility will be an approximately 0.5 mile tap from the new switchyard location. The new switchyard will require breaking the existing Montour – Elimsport and Montour – Clinton lines and routing them to and from the new switchyard. The distance between the new switchyard location and the 230 kV double-circuit right-of-way is approximately 1 mile.

A functional one-line diagram of the proposed substation would be as shown in Attachment B.

The total estimated cost of Direct Connection Facilities needed to connect to a new 230 kV switchyard is **$19,723,862** (excluding any applicable state or federal taxes). The 230 kV

connection estimate is based on the assumption that two pieces of 230 kV transmission work will be required. First, a 0.5 mile 230 kV tap will be built between the new switchyard and the developer's dead-end structure. Second, two double-circuit 230 kV lines, approximately 1 mile each, will be built between the new switchyard and existing 230 kV double-circuit transmission lines.

A further breakdown of the direct connection costs for the new 230kV switchyard connection is as follows:

$	9,127,609	Transmission work for the direct connection.
$	9,934,245	Substation work at new PPL EU switchyard
$	662,008	Siting and certification

230 kV Transmission Tap Direct Connection Work

$9,127,609 (230 kV Transmission tap)

The transmission direct connection cost includes construction of two double-circuit 230 kV lines, each approximately 1.0 mile in length, between the new switchyard and the Montour – Elimsport / Montour – Clinton right-of-way.

This transmission extension would be traversing to-be-acquired right-of-way and would be owned by PPL EU. PA PUC Certification is required. The estimated cost to acquire right-of-way and PUC approval is approximately $662,008 and is not included in the transmission tap cost estimate. The lead time required to prepare, file and obtain PA PUC approval will be approximately 9 months and assumes that no litigation or condemnation is required.

The transmission direct connection cost also includes construction of approximately 0.5 miles of 230 kV line consisting of 6-1590 ACSR conductors with one ½-inch H.S. steel overhead ground wire (OHGW) and one 0.752-inch overhead ground wire with fiber optic cable (OPGW) in a 150 foot wide right-of-way from the new 230 kV switchyard to the X2-012 Point of Interconnection dead-end structure.

PA PUC Certification requirements are determined by the ownership of the 230 kV tap. It is assumed that the transmission tap would be traversing land within the developer's plant site and would be owned by Queue X2-012. If this is the case, then PA PUC certification is not required. However, if for any reason PPL EU owns the tap, then PA PUC certification will be required. The certification would be through the abbreviated "Letter of Notification" (LON) process since the tap is less than 2 miles long. If required, the estimated cost for this filing is approximately $35,000 and is not included in the transmission tap cost estimate. The elapsed time required from filing preparation to PA PUC approval is approximately 9 months.

New 230 kV Switchyard Near IPP Facility – Direct Connection Work

$9,934,245 (Substation work at new switchyard)

The 230 kV substation work includes constructing a new 3 bay breaker-and-a-half switchyard with space for a future fourth bay. One bay will sectionalize the Montour – Elimsport line and will be designed for at least 2000 A. Another bay, also designed for at least 2000 A, will sectionalize the Montour – Clinton line. Lastly, the bay designed to accommodate the X2-012

project shall be designed for double breaker operation (future breaker-and-a-half) and rated for at least 3000 A.

Additionally, because extended outages on 230 kV lines may be difficult to obtain, other temporary measures may be required and costs for those measures are not included.

Option of X2-012 Injection to the 500 kV System

PPL EU reviewed the connection of project X2-012 onto the 500 kV system. The 500 kV connection is not considered viable due to the high cost of direct connection. Over 30 miles of new 500 kV right-of-way would have to be acquired, and a new line constructed to connect the IPP to the nearest 500 kV yard at PPL EU's Susquehanna Substation. The preliminary results for the 500 kV connection option were discussed with Queue X2-012 personnel and a decision was made to drop this option.

Synchronizing Breaker Requirement

Because the one line diagram provided by X2-012 shows no 230 kV dedicated synchronizing breaker for the X2-012 generator, a synchronizing breaker would be required at the generation site. Alternatively, X2-012 can choose to install 230 kV breakers in Bay 3 during the initial installation and use them as synchronizing breakers. **Queue X2-012 must make this decision at the start of the impact study stage. (Please indicate in spaces provided on the Queue X2-012 "Impact Study Agreement")**

X2-012 Generator Regulation or Reactive Support Requirements at Clinton 230 kV Substation

The PPL EU preliminary load flow studies have indicated that the X2-012 generator will maintain the required voltage regulation on the Clinton 230 kV bus within its required range. A voltage schedule of 1.05 or higher may be specified on the Clinton 230 kV bus.

As specified in Part IV, Subpart E at 54.7 of the PJM OATT, the Project X2-012 generator shall design its "Facility" to maintain a composite power factor delivery at continuous rated power output at the generator terminals at a power factor of at least 0.95 leading (absorbing vars) to 0.90 lagging (supplying vars).

X2-012 Generator and GSU modeling for the Clinton 230 kV Connection

Per the X2-012 supplied data the following was used in modeling the generator and the GSU:

X2-012 Generator: Generator MVA base 1100, Net injected into PPL EU system 905 MW, pf at the generator terminals .9 lead and .9 lag, saturated sub-transient reactance = 12% on 1100 MVA base

GSU (Unit Step up Transformer): Rating 1000 MVA, 500/24 kV, Positive Sequence Impedance is R = 0.0029 pu and X = 0.1450 pu, all at 1000 MVA base.

Estimated Schedules:

Option 2

- Siting and Right of Way – 7 months
- Engineering – 12 months
- Construction – 13 months

The requested in-service date of February 2015 cannot be met if this option is chosen.

Partial Schedule for Option 1

(Engineering Design and Construction Only)

The estimated PPL EU elapsed time to complete the Clinton 230 kV substation upgrade is 24-30 months. The ~ 2.5 mile tap construction lead time is 6 months.

PPL EU engineering activities to upgrade the Clinton 230 kV substation must start by mid-2013 to accommodate X2-012's connection in the existing 230 kV substation by 2015.

The chosen substation work and the transmission tap to X2-012 would depend on the project start date as well as the project start window. PPL EU's outage windows for construction are typically available in the spring and the fall of the year. Missing an outage window will cause at least a delay of 6 months.

Notes:

- PPL EU recommends that an Interim ISA/CSA be completed during the Facilities Study stage or earlier to address the critical path items, such as long lead-time purchases and the compressed project schedule.
- Procurement lead-times for metering equipment may extend to 30 weeks. Meter design, procurement and installation schedules must be implemented accordingly.
- Excepting any operational, governmental and/or environmental regulatory delays, the use of additional resources, such as overtime, premiums for expedited material, and/or contractor labor, may enable PPL EU to decrease this construction period for an additional cost. It is also assumed that all rights-of-way, easements, and permits are secured without impact on anticipated construction start dates.

PA PUC Certification & Environmental Issues

If option 1 is selected, all required land and rights-of-way will be purchased by PPL EU for the tap from the Clinton substation to the X2-012 dead-end structure. If option 2 is selected, it is assumed that the 0.5 mile 230 kV tap from the new switchyard to the X2-012 dead-end structure will be located within the developer's plant site and will be owned by the IPP developer.

PPL EU is required to file before the PA PUC for the certification of the 230 kV transmission work, because either approximately 1.0 or 2.5 miles of new right-of-way is required. PPL EU

will determine environmental impacts and mitigation strategies of the facilities being certified (i.e. - the transmission lines). These costs are not included in this estimate.

To avoid duplication of costs and efforts, PPL EU recommends that the project X2-012 obtain all environmental approvals required for construction of its generating station and share pertinent details with PPL EU prior to PPL EU beginning its work.

Cost Estimate to Provide Start up Auxiliary Station Service Connection

To be provided in the Impact Study report; not available at this stage of study.

Metering Equipment Installation at the Point of Interconnection

Installation of revenue grade metering equipment will be required at the X2-012 point of interconnection. PPL EU will design and supply the required metering equipment but all the installation cost would be borne by the developer. All metering equipment must meet applicable PPL EU tariff requirements as well as being compliant with all applicable requirements of the PJM agreements. The equipment must provide bi-directional revenue metering (KWH and KVARH) and real-time data (KW, KVAR, circuit breaker status, and generator bus voltages) for the developer's generating resource.

The developer is also required to provide revenue metering (KWH and KVARH) and real-time telemetry data (KW, KVAR, and KV) to PJM in compliance with the requirements listed in PJM Manuals M-01 and M-14. Any data from the PPL EU revenue meters can be transferred by fiber optic link to the PJM RTU located at the IPP facility.

Estimate Assumptions for Interconnection

- This magnitude estimate has been prepared without extensive research and field review.
- Estimate is based on the assumption that the Interconnection Customer will provide additional land required to expand the 230 kV substation with no cost to PPL EU.
- It is assumed here that if option 2 is selected, no new R/W and siting study would be required and the 0.5 mile 230 kV tap would be owned by X2-012.
- No environmental, real estate, or permitting issues were reviewed for the estimate of this project.

Network Impacts

Queue project X2-012 was studied as a(n) 905.0 MW (770.0 MW of which was Capacity) injection into PPL's system. Project X2-012 was evaluated for compliance with reliability criteria for summer peak conditions in 2015.

Option 1: CLIN TR1 230.0 kV substation

Potential transmission network impacts are as follows:

Generator Deliverability

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

1. (PECO) The Nottingham-Nottingham Reactor 230 kV line (from bus 213844 to bus 213846 ckt 1) loads from 95.12% to 96.11% (DC power flow) of its emergency rating (627 MVA) for the single contingency 'PJM17'. This project contributes approximately 43.44 MW to the thermal violation.

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

2. (PJM) The Conastone-EMORY GR500 500 kV line (from bus 200004 to bus 200101 ckt 1) loads from 97.26% to 99.04% (DC power flow) of its emergency rating (2901 MVA) for the single contingency 'CNSTN__230-4'. This project contributes approximately 167.12 MW to the thermal violation.

```
CONTINGENCY 'CNSTN__230-4'
     /* CONASTONE 230-4 TRANSFORMER
  DISCONNECT BRANCH FROM BUS 220963 TO BUS 200004 CKT 2
     /* CONASTONE 500-4 TRANSFORMER
END
```

3. (PECO) The Nottingham Reactor-Peach Bottom 230 kV line (from bus 213846 to bus 213869 ckt 1) loads from 94.99% to 95.98% (DC power flow) of its emergency rating (627 MVA) for the single contingency 'PJM17'. This project contributes approximately 43.44 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 only with full energy output. Stuck Breaker and Bus Fault contingencies will be applied during the Impact Study)

4. (PL/UGI) The Berwick-Koonsville Ab 69 kV line (from bus 212060 to bus 234263 ckt 1) loads from 98.98% to 104.07% (DC power flow) of its emergency rating (51 MVA) for

the tower contingency 'UGI - MOUNTAIN - SUSQHNA TOWER_SPS'. This project contributes approximately 16.08 MW to the thermal violation.

```
CONTINGENCY 'UGI - MOUNTAIN - SUSQHNA TOWER_SPS'
     /* WITH SPS 8227 TRIP SCHEME
  OPEN BRANCH FROM BUS 208113 TO BUS 234250 CKT 1
     / 208113 SUSQ 230 234250 MOUN-TAP 230 1
  OPEN BRANCH FROM BUS 208120 TO BUS 234251 CKT 1
     / 208120 SU10 230 234251 MOUNT-H1 230 1
  OPEN BRANCH FROM BUS 234251 TO BUS 234252 CKT 1
     / 234251 MOUNT-H1 230 234252 MOUNTAIN 230 1
  OPEN BRANCH FROM BUS 234251 TO BUS 234254 CKT 1
     / 234251 MOUNT-H1 230 234254 MNTN TR1 69.0 1
  OPEN BRANCH FROM BUS 234257 TO BUS 234254 CKT 1
     / 234257 MOUNT 2 69.0 234254 MNTN TR1 69.0 1
  OPEN BRANCH FROM BUS 234256 TO BUS 234254 CKT 1
     / 234256 MOUNT 1 69.0 234254 MNTN TR1 69.0 1
  DISCONNECT BUS 207999
     /* BUS 208000 REPLACED WITH BUS 207999 MAR 3, 2010
  DISCONNECT BRANCH FROM BUS 208095 TO BUS 207999 CKT 2
  DISCONNECT BRANCH FROM BUS 207999 TO BUS 208001 CKT 1
END
```

5. (PL) The Elimsport Bus-Lycoming #2 @Elimsport 230 kV line (from bus 207968 to bus 207970 ckt 1) loads from 26.20% to 134.44% (DC power flow) of its emergency rating (531 MVA) for the tower contingency 'PL100487'. This project contributes approximately 852.99 MW to the thermal violation.

```
CONTINGENCY 'PL100487'
     /*MONT-ELIM-LYCOM1 & MONT-CLINT 230& LYCOMT1&CLINTT2
  DISCONNECT BRANCH FROM BUS 207938 TO BUS 207937 CKT 1
  DISCONNECT BRANCH FROM BUS 207969 TO BUS 208015 CKT 1
  DISCONNECT BRANCH FROM BUS 208040 TO BUS 207938 CKT 1
  DISCONNECT BRANCH FROM BUS 212090 TO BUS 207938 CKT 2
  DISCONNECT BRANCH FROM BUS 212274 TO BUS 208015 CKT 1
  DISCONNECT BRANCH FROM BUS 207969 TO BUS 208040 CKT 1
END
```

6. (PL) The Clinton Transformer #1-Clinton Transformer #2 230 kV line (from bus 207937 to bus 207938 ckt 1) loads from 0.00% to 126.22% (DC power flow) of its emergency rating (717 MVA) for the tower contingency 'PL100488'. This project contributes approximately 905.00 MW to the thermal violation.

```
CONTINGENCY 'PL100488'
     /*MONT-ELIM-LYCOM1 & ELIM-CLINT 230& LYCOMT1&CLINTT1
  DISCONNECT BRANCH FROM BUS 212274 TO BUS 208015 CKT 1
  DISCONNECT BRANCH FROM BUS 212090 TO BUS 207937 CKT 1
  DISCONNECT BRANCH FROM BUS 207969 TO BUS 208040 CKT 1
  DISCONNECT BRANCH FROM BUS 207969 TO BUS 208015 CKT 1
  DISCONNECT BRANCH FROM BUS 207969 TO BUS 207968 CKT 1
  DISCONNECT BRANCH FROM BUS 207968 TO BUS 207937 CKT 1
END
```

7. (PL) The Lycoming #2 @Elimsport-Sunbury Bus 230 kV line (from bus 207970 to bus 208109 ckt 1) loads from 45.25% to 110.12% (DC power flow) of its emergency rating

(531 MVA) for the tower contingency 'PL100485'. This project contributes approximately 359.72 MW to the thermal violation.

```
CONTINGENCY 'PL100485'
     /* D/C MONT-COLU 230KV & SUNB-MONT 230KV
  DISCONNECT BUS 207943
  DISCONNECT BUS 208034
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.)

8. (BG&E) The North West 2311 & 2310-Granite 2311 & 2312 230 kV line (from bus 220962 to bus 220972 ckt 1) loads from 121.22% to 123.13% (DC power flow) of its emergency rating (621 MVA) for the single contingency 'PP1EB'. This project contributes approximately 44.82 MW to the thermal violation.

```
CONTINGENCY 'PP1EB'
     / NO PATH
  OPEN BRANCH FROM BUS 200101 TO BUS 235632 CKT 1
     / 200003 BRIGHTON 500 200004 CNASTONE 500 1
END
```

9. (BG&E) The Conastone-EMORY GRV230 230 kV line (from bus 220963 to bus 220400 ckt 2) loads from 105.45% to 106.23% (DC power flow) of its emergency rating (941 MVA) for the single contingency 'PP1EC'. This project contributes approximately 53.51 MW to the thermal violation.

```
CONTINGENCY 'PP1EC'
     / NO PATH
  OPEN BRANCH FROM BUS 200101 TO BUS 200004 CKT 1
     / 200003 BRIGHTON 500 200004 CNASTONE 500 1
END
```

10. (PECO/BG&E) The Cooper-Graceton 230 kV line (from bus 214089 to bus 220964 ckt 1) loads from 125.01% to 126.29% (DC power flow) of its emergency rating (485 MVA) for the single contingency 'PJM17'. This project contributes approximately 43.44 MW to the thermal violation.

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

11. (PL/METED) The Brunner Island Bus-Yorkana 230 kV line (from bus 207922 to bus 204515 ckt 1) loads from 134.51% to 137.13% (DC power flow) of its emergency rating (617 MVA) for the single contingency 'PJM17'. This project contributes approximately 39.72 MW to the thermal violation.

```
CONTINGENCY 'PJM17'
  DISCONNECT BRANCH FROM BUS 200004 TO BUS 200013 CKT 1
```

```
     /     /* CNASTONE PEACHBTM 500 500
END
```

12. (PL/BG&E) The Otter Creek Switchyard-Conastone 230 kV line (from bus 208048 to bus 220963 ckt 1) loads from 101.35% to 102.98% (DC power flow) of its emergency rating (531 MVA) for the single contingency 'PJM17'. This project contributes approximately 53.98 MW to the thermal violation.

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

13. (BG&E) The North West 2326 & 2322-Granite 2326 & 2332 230 kV line (from bus 220961 to bus 220973 ckt 1) loads from 100.53% to 102.1% (DC power flow) of its emergency rating (728 MVA) for the single contingency 'PP1EB'. This project contributes approximately 43.31 MW to the thermal violation.

```
CONTINGENCY 'PP1EB'
     / NO PATH
  OPEN BRANCH FROM BUS 200101 TO BUS 235632 CKT 1
     / 200003 BRIGHTON 500 200004 CNASTONE 500 1
END
```

14. (PJM) The Peach Bottom-Conastone 500 kV line (from bus 200013 to bus 200004 ckt 1) loads from 136.34% to 137.96% (DC power flow) of its emergency rating (2815 MVA) for the single contingency 'PJM67'. This project contributes approximately 194.48 MW to the thermal violation.

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

15. (PJM) The Peach Bottom-Conastone 500 kV line (from bus 200013 to bus 200004 ckt 1) loads from 137.41% to 139.23% (DC power flow) of its normal rating (2490 MVA) for non contingency condition. This project contributes approximately 198.14 MW to the thermal violation.

16. (BG&E) The EMORY GRV230-North West 2326 & 2322 230 kV line (from bus 220400 to bus 220961 ckt 1) loads from 101.25% to 101.59% (DC power flow) of its emergency rating (1800 MVA) for the single contingency 'BG_CKT2322A'. This project contributes approximately 39.06 MW to the thermal violation.

```
CONTINGENCY 'BG_CKT2322A'
     /*CONASTONE TO NORTHWEST CKT #2322
  DISCONNECT BRANCH FROM BUS 220962 TO BUS 220400 CKT 1
     /* CONASTONE TO NORTHWEST CKT #2322
END
```

17. (PJM) The Conastone-EMORY GR500 500 kV line (from bus 200004 to bus 200101 ckt 1) loads from 110.73% to 112.88% (DC power flow) of its normal rating (2338 MVA)

for non contingency condition. This project contributes approximately 163.17 MW to the thermal violation.

18. (BG&E) The Conastone-EMORY GRV230 230 kV line (from bus 220963 to bus 220400 ckt 1) loads from 122.33% to 122.8% (DC power flow) of its emergency rating (819 MVA) for the single contingency 'PP1EC'. This project contributes approximately 52.88 MW to the thermal violation.

```
CONTINGENCY 'PP1EC'
     / NO PATH
  OPEN BRANCH FROM BUS 200101 TO BUS 200004 CKT 1
     / 200003 BRIGHTON 500 200004 CNASTONE 500 1
END
```

19. (PL/BG&E) The Safe Harbor Units 3-4 Tap-Graceton 230 kV line (from bus 208071 to bus 220964 ckt 1) loads from 103.36% to 104.84% (DC power flow) of its emergency rating (485 MVA) for the single contingency 'PJM17'. This project contributes approximately 44.51 MW to the thermal violation.

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

20. (METED) The Three Mile Island-Jackson 1 230 kV line (from bus 204514 to bus 204502 ckt 1) loads from 106.46% to 107.44% (DC power flow) of its emergency rating (591 MVA) for the single contingency 'PJM17'. This project contributes approximately 35.84 MW to the thermal violation.

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

21. (PECO) The Peach Bottom-Cooper 230 kV line (from bus 213869 to bus 214089 ckt 1) loads from 126.48% to 127.76% (DC power flow) of its emergency rating (485 MVA) for the single contingency 'PJM17'. This project contributes approximately 43.44 MW to the thermal violation.

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

22. (BG&E) The EMORY GRV230-North West 2311 & 2310 230 kV line (from bus 220400 to bus 220962 ckt 1) loads from 101.29% to 101.62% (DC power flow) of its emergency rating (1800 MVA) for the single contingency 'BG_CKT2310A'. This project contributes approximately 39.20 MW to the thermal violation.

```
CONTINGENCY 'BG_CKT2310A'
     /* CONASTONE TO NORTHWEST CKT #2310
  DISCONNECT BRANCH FROM BUS 220961 TO BUS 220400 CKT 1
```

```
     /* CONASTONE TO NORTHWEST CKT#2310
END
```

23. (PJM/METED) The Three Mile Island-Three Mile Island 500/230 kV transformer (from bus 200016 to bus 204514 ckt 2) loads from 112.79% to 113.81% (DC power flow) of its emergency rating (1072 MVA) for the single contingency 'PJM17'. This project contributes approximately 69.25 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 generation.)

1. To mitigate the overload on Nottingham-Nottingham Reactor 230 kV line, PECO has proposed to replace the line 220-08 reactor and bypass circuit switcher at Nottingham substation to achieve a minim summer emergency rating of 741 MVA. The upgrade is estimated to cost **$1,700,000** and take approximately 24 months. This overload has been caused by a later project within the X2 queue. Cost allocations for this upgrade will be determined during the System Impact Study phase.

2. The upgrade described under #17 of the Contributions to Previously Identified System Reinforcements will correct this overload.

3. To mitigate the overload on Nottingham Reactor-Peach Bottom 230 kV line, PECO has proposed to reconductor line 220-08 between Nottingham Reactor and Peach Bottom Tap to achieve a minimum summer emergency rating of 741 MVA. This line is approximately 14 miles long. The upgrade is estimated to cost **$10,000,000** and take approximately 48 months. This overload has been caused by a later project within the X2 queue. The total cost of the upgrade exceeds the cost allocation threshold so this project will not have a cost responsibility for the upgrade.

4. To mitigate the overload on Berwick-Koonsville Ab 69 kV line, PPL has proposed to reconductor 9.73 miles of the 69kV line. The upgrade is estimated to cost **$7,900,000** and take approximately 12 months.

5. To mitigate the overload on the Elimsport Bus-Lycoming #2 @Elimsport 230 kV line, PPL has proposed to upgrade the Elimsport line bay conductors and related equipment. The upgrade is estimated to cost **$750,000**.

6. To mitigate the overload on the Clinton Transformer #1-Clinton Transformer #2 230 kV line, PPL has proposed to upgrade the Elimsport line bay conductors and related equipment. The upgrade is estimated to cost **$750,000**.

7. To mitigate the overload on the Lycoming #2 @Elimsport-Sunbury Bus 230 kV line, PPL has proposed to reconductor the Sunbury-Elimsport line and associated line terminals. The line is approximately 26 miles long, and PPL EU would rebuild as single

circuit 230 kV using 1590 ACSR (648 MVA S/N, 802 MVA S/E). The upgrade is estimated to cost **$55,000,000**.

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.)

8. To mitigate the overload on North West 2311 & 2310-Granite 2311 & 2312 230 kV line, BGE has proposed to reconductor the line with 2,167 ACSR which will increase the rating to 1105MVA. There will also be substation terminal cost upgrades associated with the reinforcement. The upgrade is estimated to cost **$23,600,000** and take approximately 6 years. This overload has been caused by a prior project. Cost allocations for this upgrade will be determined during the System Impact Study phase.

9, 16, 18, 22.
To mitigate the overload on Conastone-EMORY GRV230 230 kV line (#9 & 19), EMORY GRV230-North West 2326 & 2322 230 kV line (#17), and EMORY GRV230-North West 2311 & 2310 230 kV line (#23), BGE has proposed to construct a new double circuit 230kV line between Conastone and North West using 1590MCM conductor. The upgrade is estimated to cost **$54,700,000** and take approximately 72-84 months. This overload has been caused by a prior project. Cost allocations for this upgrade will be determined during the System Impact Study phase.

10. To mitigate the overload on Cooper-Graceton 230 kV line, BGE and PECO have proposed the following:

BGE: A double circuit line will be built with 1033.5kcmil ACSR creating one circuit by connecting the two lines into one. 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 line construction is estimated at $3,000,000. Two breakers ($400,000/breaker) would need to be replaced at Graceton for a cost of $800,000. An additional cost of $200,000 would 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 cost of the project is estimated at $4,000,000.

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

The total upgrade is estimated to cost **$6,800,000** and take approximately 30 months. This overload has been caused by a prior project. Cost allocations for this upgrade will be determined during the System Impact Study phase.

11. To mitigate the overload on Brunner Island Bus-Yorkana 230 kV line, PPL and METED have proposed the following:

PPL: 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 and 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 the 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.

METED: Reconductor Met-Ed's 12.5 mile section of the Brunner -Yorkana (1055) 230 kV line with 1590 ACSS conductor. Based on the Feasibility Study review performed, the total cost of this Network Upgrade is $9,270,900 excluding tax. It is estimated that it will take three years to complete the work needed to implement this project.

The total upgrade is estimated to cost **$10,570,900** and take approximately 36 months. This overload has been caused by a prior project. Cost allocations for this upgrade will be determined during the System Impact Study phase.

12. To mitigate the overload on Otter Creek Switchyard-Conastone 230 kV line, BGE and PPL have proposed the following:

BGE: Rebuild the Otter Creek-Conastone 230kV line to the PA border. The line is approximately 4.7 miles long. The new rating of the line will be 648MVA (normal) and 802MVA (emergency). The upgrade is estimated to cost $19,000,000 and will take 36-60 months to complete.

PPL: A PPL project to reconductor the Manor-Conastone line with 1590 ACSR is underway. This project will equip the line to handle 653/793 MVA (Summer Normal/ Emergency and is estimated to cost $17,000,000. The upgraded is estimated to be in-service by October 2013.

The total upgrade is estimated to cost **$36,000,000** and take approximately 60 months/years. This overload has been caused by a prior project. Cost allocations for this upgrade will be determined during the System Impact Study phase.

13. To mitigate the overload on North West 2326 & 2322-Granite 2326 & 2332 230 kV line, BGE has proposed to reconductor the line with 2,167 ACSR which will increase the rating to 1105MVA. There will also be substation terminal cost upgrades associated with the reinforcement. The upgrade is estimated to cost **$23,600,000** and take approximately 6 years. This overload has been caused by a prior project. Cost allocations for this upgrade will be determined during the System Impact Study phase.

14, 15. To mitigate the overload on Peach Bottom-Conastone 500 kV line, BGE and PECO have proposed the following:

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]

The total upgrade is estimated to cost **$85,800,000** and take approximately 7 years. This overload has been caused by a prior project. Cost allocations for this upgrade will be determined during the System Impact Study phase.

17. To mitigate the overload on Conastone-EMORY GR500 500 kV line, BGE has proposed to upgrade the two breaker bay at Conastone with two 4000A circuit breakers, four 4000A circuit breaker disconnect switches, a one 4000A line switch. The upgrade is estimated to cost **$3,000,000** and take approximately 24-36 months. This overload has been caused by a prior project. Cost allocations for this upgrade will be determined during the System Impact Study phase.

19. To mitigate the overload on Safe Harbor Units 3-4 Tap-Graceton 230 kV line, PPL has proposed to reconductor Manor-Graceton 230 kV with 1590 ACSR. This project will equip the line to handle 653/793 MVA (Summer Normal/Emergency). The upgrade is estimated to cost **$22,700,000**. The upgrade is currently underway and is scheduled to be completed by November 2013. This overload has been caused by a prior project. Cost allocations for this upgrade will be determined during the System Impact Study phase.

20. To mitigate the overload on Three Mile Island-Jackson 1 230 kV line, METED has proposed to replace 18.05 miles of the 230kV line. The upgrade is estimated to cost **$10,910,000**. This overload has been caused by a prior project. Cost allocations for this upgrade will be determined during the System Impact Study phase.

21. To mitigate the overload on Peach Bottom-Cooper 230 kV line, PECO has proposed to reconductor Line 220-08 from PB Tap to Cooper Substation to achieve a minimum summer emergency rating of 741 MVA. The line is approximately 1.4 miles long. . The upgrade is estimated to cost **$1,000,000** and take approximately 24 months. This

overload has been caused by a prior project. Cost allocations for this upgrade will be determined during the System Impact Study phase.

23. To mitigate the overload on Three Mile Island-Three Mile Island 500/230 kV transformer, METED has proposed to add a second 500/230kV transformer at Three Mile Island and several transmission line upgrades between the 230kV and 500kV substations. The upgrade is estimated to cost **$15,000,000** and take approximately 36 months/years. This overload has been caused by a prior project. Cost allocations for this upgrade will be determined during the System Impact Study phase.

Short Circuit

(Report over-dutied breakers.)

None required.

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.

25. (PL/METED) The Brunner Island Bus-Yorkana 230 kV line (from bus 207922 to bus 204515 ckt 1) loads from 145.92% to 146.48% (DC power flow) of its emergency rating (617 MVA) for the operational contingency 'PJM17'. This project contributes approximately 46.68 MW to the thermal violation.

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

26. (PENELEC) The Blairsville East-Blairsville 115/138 kV transformer (from bus 200740 to bus 200763 ckt 1) loads from 117.32% to 118.37% (DC power flow) of its normal rating (130 MVA) for non contingency condition. This project contributes approximately 8.51 MW to the thermal violation.

27. (FE) The Ashtabula No. 8 Tr 345/-Ashtabula Bus 3 345/138 kV transformer (from bus 239082 to bus 238544 ckt 8) loads from 95.75% to 96.71% (DC power flow) of its emergency rating (370 MVA) for the operational contingency 'DQE_161'. This project contributes approximately 21.97 MW to the thermal violation.

```
CONTINGENCY 'DQE_161'
     /* "LINE 02AT TO 02PERRY 345 CK 1"
```

```
  DISCONNECT BRANCH FROM BUS 238547 TO BUS 239036 CKT 1
END
```

28. (NYISO/PENELEC) The FALCONER-Warren 115 kV line (from bus 135277 to bus 200579 ckt 1) loads from 85.03% to 85.93% (DC power flow) of its emergency rating (118 MVA) for the operational contingency 'B_PN230-SX-#17_W3-099A'. This project contributes approximately 6.60 MW to the thermal violation.

```
CONTINGENCY 'B_PN230-SX-#17_W3-099A'
     /* ERIE EAST - ERIE SOUTH (ESEE) 230 KV
  DISCONNECT BRANCH FROM BUS 200819 TO BUS 903980 CKT 1
END
```

29. (PL) The FrackVille Bus-Siegfried Bus 230 kV line (from bus 207973 to bus 208074 ckt 1) loads from 91.67% to 96.5% (DC power flow) of its emergency rating (616 MVA) for the operational contingency 'PJM69'. This project contributes approximately 184.11 MW to the thermal violation.

```
CONTINGENCY 'PJM69'
  DISCONNECT BRANCH FROM BUS 200021 TO BUS 200009 CKT 1
     /* SUNBURY JUNIATA 500 500
  DISCONNECT BRANCH FROM BUS 200021 TO BUS 200022 CKT 2
     /* SUNBURY SUSQHANA 500 500 / CKT 1 -> 2
  DISCONNECT BRANCH FROM BUS 200021 TO BUS 208109 CKT 24
     /* SUNBURY SUNBURY 500 230
END
```

30. (PL) The W3-022 TAP-FrackVille Transformer #3 230 kV line (from bus 903340 to bus 207975 ckt 1) loads from 83.77% to 86.17% (DC power flow) of its emergency rating (455 MVA) for the operational contingency 'PL100456'. This project contributes approximately 67.68 MW to the thermal violation.

```
CONTINGENCY 'PL100456'
     /*SUNBURY 500-230 TRAN 24 OUT"
  DISCONNECT BRANCH FROM BUS 200021 TO BUS 208109 CKT 24
END
```

31. (PL/BG&E) The Safe Harbor Units 3-4 Tap-Graceton 230 kV line (from bus 208071 to bus 220964 ckt 1) loads from 145.84% to 146.29% (DC power flow) of its emergency rating (485 MVA) for the operational contingency 'PJM17'. This project contributes approximately 52.32 MW to the thermal violation.

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

32. (METED) The Three Mile Island-Jackson 1 230 kV line (from bus 204514 to bus 204502 ckt 1) loads from 103.16% to 104.31% (DC power flow) of its emergency rating (591 MVA) for the operational contingency 'PJM17'. This project contributes approximately 42.12 MW to the thermal violation.

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

33. (PENELEC) The Shade Gap-Roxbury 115 kV line (from bus 200522 to bus 200520 ckt 1) loads from 112.75% to 113.71% (DC power flow) of its normal rating (111 MVA) for non contingency condition. This project contributes approximately 6.54 MW to the thermal violation.

34. (PJM/METED) The Three Mile Island-Three Mile Island 500/230 kV transformer (from bus 200016 to bus 204514 ckt 2) loads from 132.23% to 134.02% (DC power flow) of its emergency rating (1072 MVA) for the operational contingency 'PJM17'. This project contributes approximately 81.40 MW to the thermal violation.

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

Option 2: 50.0% tap between Montour Switchyard and Lycoming #1 @Elimsport230.0 kV line

Potential transmission network impacts are as follows:

Generator Deliverability

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

1. (PECO) The Nottingham-Nottingham Reactor 230 kV line (from bus 213844 to bus 213846 ckt 1) loads from 95.12% to 96.11% (DC power flow) of its emergency rating (627 MVA) for the single contingency 'PJM17'. This project contributes approximately 43.54 MW to the thermal violation.

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

2. (PJM) The Conastone-EMORY GR500 500 kV line (from bus 200004 to bus 200101 ckt 1) loads from 97.26% to 99.04% (DC power flow) of its emergency rating (2901 MVA) for the single contingency 'CNSTN__230-4'. This project contributes approximately 167.25 MW to the thermal violation.

```
CONTINGENCY 'CNSTN__230-4'
     /* CONASTONE 230-4 TRANSFORMER
  DISCONNECT BRANCH FROM BUS 220963 TO BUS 200004 CKT 2
     /* CONASTONE 500-4 TRANSFORMER
END
```

3. (PECO) The Nottingham Reactor-Peach Bottom 230 kV line (from bus 213846 to bus 213869 ckt 1) loads from 94.99% to 95.99% (DC power flow) of its emergency rating

(627 MVA) for the single contingency 'PJM17'. This project contributes approximately 43.54 MW to the thermal violation.

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

4. (PL) The X2-012 TAP-Lycoming #1 @Elimsport 230 kV line (from bus 909080 to bus 207969 ckt 1) loads from 0.04% to 102.35% (DC power flow) of its emergency rating (752 MVA) for the single contingency 'PL100460_X2-012B'. This project contributes approximately 770.00 MW to the thermal violation.

5. (PL) The X2-012 TAP-Montour Switchyard 230 kV line (from bus 909080 to bus 208040 ckt 1) loads from 0.04% to 102.35% (DC power flow) of its emergency rating (752 MVA) for the single contingency 'PL100460_X2-012A'. This project contributes approximately 770.00 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)

6. (PL/UGI) The Berwick-Koonsville Ab 69 kV line (from bus 212060 to bus 234263 ckt 1) loads from 98.98% to 104.16% (DC power flow) of its emergency rating (51 MVA) for the tower contingency 'UGI - MOUNTAIN - SUSQHNA TOWER_SPS'. This project contributes approximately 16.34 MW to the thermal violation.

```
CONTINGENCY 'UGI - MOUNTAIN - SUSQHNA TOWER_SPS'
     /* WITH SPS 8227 TRIP SCHEME
  OPEN BRANCH FROM BUS 208113 TO BUS 234250 CKT 1
     / 208113 SUSQ 230 234250 MOUN-TAP 230 1
  OPEN BRANCH FROM BUS 208120 TO BUS 234251 CKT 1
     / 208120 SU10 230 234251 MOUNT-H1 230 1
  OPEN BRANCH FROM BUS 234251 TO BUS 234252 CKT 1
     / 234251 MOUNT-H1 230 234252 MOUNTAIN 230 1
  OPEN BRANCH FROM BUS 234251 TO BUS 234254 CKT 1
     / 234251 MOUNT-H1 230 234254 MNTN TR1 69.0 1
  OPEN BRANCH FROM BUS 234257 TO BUS 234254 CKT 1
     / 234257 MOUNT 2 69.0 234254 MNTN TR1 69.0 1
  OPEN BRANCH FROM BUS 234256 TO BUS 234254 CKT 1
     / 234256 MOUNT 1 69.0 234254 MNTN TR1 69.0 1
  DISCONNECT BUS 207999
     /* BUS 208000 REPLACED WITH BUS 207999 MAR 3, 2010
  DISCONNECT BRANCH FROM BUS 208095 TO BUS 207999 CKT 2
  DISCONNECT BRANCH FROM BUS 207999 TO BUS 208001 CKT 1
END
```

7. (PL) The Elimsport Bus-Lycoming #2 @Elimsport 230 kV line (from bus 207968 to bus 207970 ckt 1) loads from 65.84% to 126.64% (DC power flow) of its emergency rating (531 MVA) for the tower contingency 'PL100485'. This project contributes approximately 338.08 MW to the thermal violation.

```
CONTINGENCY 'PL100485'
     /* D/C MONT-COLU 230KV & SUNB-MONT 230KV
  DISCONNECT BUS 207943
  DISCONNECT BUS 208034
END
```

8. (PL) The Lycoming #2 @Elimsport-Sunbury Bus 230 kV line (from bus 207970 to bus 208109 ckt 1) loads from 45.25% to 104.96% (DC power flow) of its emergency rating (531 MVA) for the tower contingency 'PL100485'. This project contributes approximately 332.33 MW to the thermal violation.

```
CONTINGENCY 'PL100485'
     /* D/C MONT-COLU 230KV & SUNB-MONT 230KV
  DISCONNECT BUS 207943
  DISCONNECT BUS 208034
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.)

9. (BG&E) The North West 2311 & 2310-Granite 2311 & 2312 230 kV line (from bus 220962 to bus 220972 ckt 1) loads from 121.22% to 123.14% (DC power flow) of its emergency rating (621 MVA) for the single contingency 'PP1EB'. This project contributes approximately 44.85 MW to the thermal violation.

```
CONTINGENCY 'PP1EB'
     / NO PATH
  OPEN BRANCH FROM BUS 200101 TO BUS 235632 CKT 1
     / 200003 BRIGHTON 500 200004 CNASTONE 500 1
END
```

10. (BG&E) The Conastone-EMORY GRV230 230 kV line (from bus 220963 to bus 220400 ckt 2) loads from 105.45% to 106.23% (DC power flow) of its emergency rating (941 MVA) for the single contingency 'PP1EC'. This project contributes approximately 53.55 MW to the thermal violation.

```
CONTINGENCY 'PP1EC'
     / NO PATH
  OPEN BRANCH FROM BUS 200101 TO BUS 200004 CKT 1
     / 200003 BRIGHTON 500 200004 CNASTONE 500 1
END
```

11. (PECO/BG&E) The Cooper-Graceton 230 kV line (from bus 214089 to bus 220964 ckt 1) loads from 125.00% to 126.28% (DC power flow) of its emergency rating (485 MVA) for the single contingency 'PJM17'. This project contributes approximately 43.54 MW to the thermal violation.

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

12. (PL/METED) The Brunner Island Bus-Yorkana 230 kV line (from bus 207922 to bus 204515 ckt 1) loads from 134.51% to 137.13% (DC power flow) of its emergency rating (617 MVA) for the single contingency 'PJM17'. This project contributes approximately 39.72 MW to the thermal violation.

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

13. (PL/BG&E) The Otter Creek Switchyard-Conastone 230 kV line (from bus 208048 to bus 220963 ckt 1) loads from 101.35% to 102.98% (DC power flow) of its emergency rating (531 MVA) for the single contingency 'PJM17'. This project contributes approximately 54.02 MW to the thermal violation.

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

14. (BG&E) The North West 2326 & 2322-Granite 2326 & 2332 230 kV line (from bus 220961 to bus 220973 ckt 1) loads from 100.53% to 102.1% (DC power flow) of its emergency rating (728 MVA) for the single contingency 'PP1EB'. This project contributes approximately 43.34 MW to the thermal violation.

```
CONTINGENCY 'PP1EB'
     / NO PATH
  OPEN BRANCH FROM BUS 200101 TO BUS 235632 CKT 1
     / 200003 BRIGHTON 500 200004 CNASTONE 500 1
END
```

15. (PJM) The Peach Bottom-Conastone 500 kV line (from bus 200013 to bus 200004 ckt 1) loads from 136.34% to 137.96% (DC power flow) of its emergency rating (2815 MVA) for the single contingency 'PJM67'. This project contributes approximately 194.72 MW to the thermal violation.

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

16. (PJM) The Peach Bottom-Conastone 500 kV line (from bus 200013 to bus 200004 ckt 1) loads from 137.62% to 139.42% (DC power flow) of its normal rating (2490 MVA) for non contingency condition. This project contributes approximately 198.44 MW to the thermal violation.

17. (PL) The Jenkins Transformer #2-Jenkins 230/69 kV transformer (from bus 208001 to bus 211654 ckt 2) loads from 126.77% to 127.99% (DC power flow) of its emergency rating (230 MVA) for the tower contingency 'UGI - MOUNTAIN - SUSQHNA TOWER_SPS'. This project contributes approximately 17.29 MW to the thermal violation.

```
CONTINGENCY 'UGI - MOUNTAIN - SUSQHNA TOWER_SPS'
     /* WITH SPS 8227 TRIP SCHEME
  OPEN BRANCH FROM BUS 208113 TO BUS 234250 CKT 1
     / 208113 SUSQ 230 234250 MOUN-TAP 230 1
  OPEN BRANCH FROM BUS 208120 TO BUS 234251 CKT 1
     / 208120 SU10 230 234251 MOUNT-H1 230 1
  OPEN BRANCH FROM BUS 234251 TO BUS 234252 CKT 1
     / 234251 MOUNT-H1 230 234252 MOUNTAIN 230 1
  OPEN BRANCH FROM BUS 234251 TO BUS 234254 CKT 1
     / 234251 MOUNT-H1 230 234254 MNTN TR1 69.0 1
  OPEN BRANCH FROM BUS 234257 TO BUS 234254 CKT 1
     / 234257 MOUNT 2 69.0 234254 MNTN TR1 69.0 1
  OPEN BRANCH FROM BUS 234256 TO BUS 234254 CKT 1
     / 234256 MOUNT 1 69.0 234254 MNTN TR1 69.0 1
  DISCONNECT BUS 207999
     /* BUS 208000 REPLACED WITH BUS 207999 MAR 3, 2010
  DISCONNECT BRANCH FROM BUS 208095 TO BUS 207999 CKT 2
  DISCONNECT BRANCH FROM BUS 207999 TO BUS 208001 CKT 1
END
```

18. (BG&E) The EMORY GRV230-North West 2326 & 2322 230 kV line (from bus 220400 to bus 220961 ckt 1) loads from 101.25% to 101.59% (DC power flow) of its emergency rating (1800 MVA) for the single contingency 'BG_CKT2322A'. This project contributes approximately 39.09 MW to the thermal violation.

```
CONTINGENCY 'BG_CKT2322A'
     /*CONASTONE TO NORTHWEST CKT #2322
  DISCONNECT BRANCH FROM BUS 220962 TO BUS 220400 CKT 1
     /* CONASTONE TO NORTHWEST CKT #2322
END
```

19. (PJM) The Conastone-EMORY GR500 500 kV line (from bus 200004 to bus 200101 ckt 1) loads from 110.73% to 112.88% (DC power flow) of its normal rating (2338 MVA) for non contingency condition. This project contributes approximately 163.29 MW to the thermal violation.

20. (BG&E) The Conastone-EMORY GRV230 230 kV line (from bus 220963 to bus 220400 ckt 1) loads from 122.33% to 122.8% (DC power flow) of its emergency rating (819 MVA) for the single contingency 'PP1EC'. This project contributes approximately 52.91 MW to the thermal violation.

```
CONTINGENCY 'PP1EC'
     / NO PATH
  OPEN BRANCH FROM BUS 200101 TO BUS 200004 CKT 1
     / 200003 BRIGHTON 500 200004 CNASTONE 500 1
END
```

21. (PL/BG&E) The Safe Harbor Units 3-4 Tap-Graceton 230 kV line (from bus 208071 to bus 220964 ckt 1) loads from 103.36% to 104.84% (DC power flow) of its emergency rating (485 MVA) for the single contingency 'PJM17'. This project contributes approximately 44.54 MW to the thermal violation.

```
CONTINGENCY 'PJM17'
  DISCONNECT BRANCH FROM BUS 200004 TO BUS 200013 CKT 1
```

```
     /* CNASTONE PEACHBTM 500 500
END
```

22. (METED) The Three Mile Island-Jackson 1 230 kV line (from bus 204514 to bus 204502 ckt 1) loads from 106.46% to 107.44% (DC power flow) of its emergency rating (591 MVA) for the single contingency 'PJM17'. This project contributes approximately 35.85 MW to the thermal violation.

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

23. (PECO) The Peach Bottom-Cooper 230 kV line (from bus 213869 to bus 214089 ckt 1) loads from 126.48% to 127.76% (DC power flow) of its emergency rating (485 MVA) for the single contingency 'PJM17'. This project contributes approximately 43.54 MW to the thermal violation.

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

24. (BG&E) The EMORY GRV230-North West 2311 & 2310 230 kV line (from bus 220400 to bus 220962 ckt 1) loads from 101.29% to 101.62% (DC power flow) of its emergency rating (1800 MVA) for the single contingency 'BG_CKT2310A'. This project contributes approximately 39.23 MW to the thermal violation.

```
CONTINGENCY 'BG_CKT2310A'
     /* CONASTONE TO NORTHWEST CKT #2310
  DISCONNECT BRANCH FROM BUS 220961 TO BUS 220400 CKT 1
     /* CONASTONE TO NORTHWEST CKT#2310
END
```

25. (PJM/METED) The Three Mile Island-Three Mile Island 500/230 kV transformer (from bus 200016 to bus 204514 ckt 2) loads from 112.79% to 113.82% (DC power flow) of its emergency rating (1072 MVA) for the single contingency 'PJM17'. This project contributes approximately 69.25 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 generation.)

None required.

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.)

None required.

Short Circuit

(Report over-dutied breakers.)

None required.

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.

26. (PL/METED) The Brunner Island Bus-Yorkana 230 kV line (from bus 207922 to bus 204515 ckt 1) loads from 145.92% to 146.48% (DC power flow) of its emergency rating (617 MVA) for the operational contingency 'PJM17'. This project contributes approximately 46.69 MW to the thermal violation.

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

27. (PENELEC) The Blairsville East-Blairsville 115/138 kV transformer (from bus 200740 to bus 200763 ckt 1) loads from 117.32% to 118.37% (DC power flow) of its normal rating (130 MVA) for non contingency condition. This project contributes approximately 8.51 MW to the thermal violation.

28. (FE) The Ashtabula No. 8 Tr 345/-Ashtabula Bus 3 345/138 kV transformer (from bus 239082 to bus 238544 ckt 8) loads from 96.78% to 97.74% (DC power flow) of its emergency rating (370 MVA) for the operational contingency 'DQE_161'. This project contributes approximately 22.00 MW to the thermal violation.

```
CONTINGENCY 'DQE_161'
     /* "LINE 02AT TO 02PERRY 345 CK 1"
  DISCONNECT BRANCH FROM BUS 238547 TO BUS 239036 CKT 1
END
```

29. (PL) The Lycoming #1 @Elimsport-Elimsport Bus 230 kV line (from bus 207969 to bus 207968 ckt 1) loads from 13.56% to 103.61% (DC power flow) of its emergency rating (752 MVA) for the operational contingency 'PL100460_X2-012B'. This project contributes approximately 881.11 MW to the thermal violation.

30. (NYISO/PENELEC) The FALCONER-Warren 115 kV line (from bus 135277 to bus 200579 ckt 1) loads from 85.05% to 85.95% (DC power flow) of its emergency rating (118 MVA) for the operational contingency 'B_PN230-SX-#17_W3-099A'. This project contributes approximately 6.62 MW to the thermal violation.

```
CONTINGENCY 'B_PN230-SX-#17_W3-099A'
     /* ERIE EAST - ERIE SOUTH (ESEE) 230 KV
  DISCONNECT BRANCH FROM BUS 200819 TO BUS 903980 CKT 1
END
```

31. (PL) The X2-012 TAP-Lycoming #1 @Elimsport 230 kV line (from bus 909080 to bus 207969 ckt 1) loads from 0.04% to 120.31% (DC power flow) of its emergency rating (752 MVA) for the operational contingency 'PL100460_X2-012B'. This project contributes approximately 905.00 MW to the thermal violation.

32. (PL) The FrackVille Bus-Siegfried Bus 230 kV line (from bus 207973 to bus 208074 ckt 1) loads from 91.67% to 96.46% (DC power flow) of its emergency rating (616 MVA) for the operational contingency 'PJM69'. This project contributes approximately 182.90 MW to the thermal violation.

```
CONTINGENCY 'PJM69'
  DISCONNECT BRANCH FROM BUS 200021 TO BUS 200009 CKT 1
     /* SUNBURY JUNIATA 500 500
  DISCONNECT BRANCH FROM BUS 200021 TO BUS 200022 CKT 2
     /* SUNBURY SUSQHANA 500 500 / CKT 1 -> 2
  DISCONNECT BRANCH FROM BUS 200021 TO BUS 208109 CKT 24
     /* SUNBURY SUNBURY 500 230
END
```

33. (PL) The W3-022 TAP-FrackVille Transformer #3 230 kV line (from bus 903340 to bus 207975 ckt 1) loads from 82.45% to 84.68% (DC power flow) of its emergency rating (455 MVA) for the operational contingency 'PJM69'. This project contributes approximately 62.81 MW to the thermal violation.

```
CONTINGENCY 'PJM69'
  DISCONNECT BRANCH FROM BUS 200021 TO BUS 200009 CKT 1
     /* SUNBURY JUNIATA 500 500
  DISCONNECT BRANCH FROM BUS 200021 TO BUS 200022 CKT 2
     /* SUNBURY SUSQHANA 500 500 / CKT 1 -> 2
  DISCONNECT BRANCH FROM BUS 200021 TO BUS 208109 CKT 24
    /* SUNBURY SUNBURY 500 230
END
```

34. (PL/BG&E) The Safe Harbor Units 3-4 Tap-Graceton 230 kV line (from bus 208071 to bus 220964 ckt 1) loads from 145.84% to 146.29% (DC power flow) of its emergency rating (485 MVA) for the operational contingency 'PJM17'. This project contributes approximately 52.35 MW to the thermal violation.

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

35. (PL) The X2-012 TAP-Montour Switchyard 230 kV line (from bus 909080 to bus 208040 ckt 1) loads from 0.04% to 120.31% (DC power flow) of its emergency rating (752 MVA) for the operational contingency 'PL100460_X2-012A'. This project contributes approximately 905.00 MW to the thermal violation.

36. (METED) The Three Mile Island-Jackson 1 230 kV line (from bus 204514 to bus 204502 ckt 1) loads from 103.16% to 104.31% (DC power flow) of its emergency rating (591 MVA) for the operational contingency 'PJM17'. This project contributes approximately 42.14 MW to the thermal violation.

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

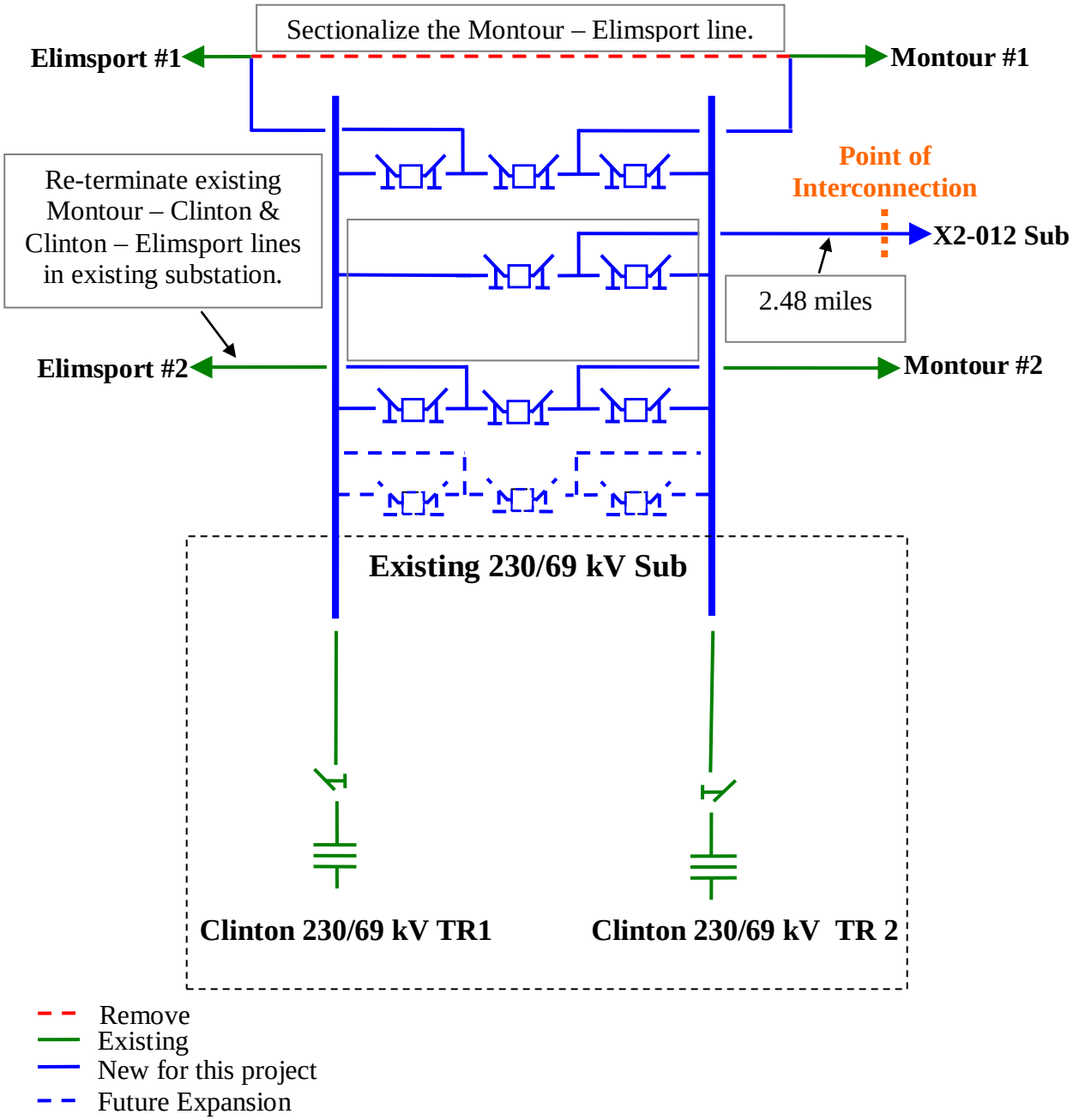
37. (PENELEC) The Shade Gap-Roxbury 115 kV line (from bus 200522 to bus 200520 ckt 1) loads from 112.75% to 113.7% (DC power flow) of its normal rating (111 MVA) for non contingency condition. This project contributes approximately 6.53 MW to the thermal violation.

38. (PJM/METED) The Three Mile Island-Three Mile Island 500/230 kV transformer (from bus 200016 to bus 204514 ckt 2) loads from 132.23% to 134.02% (DC power flow) of its emergency rating (1072 MVA) for the operational contingency 'PJM17'. This project contributes approximately 81.39 MW to the thermal violation.

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

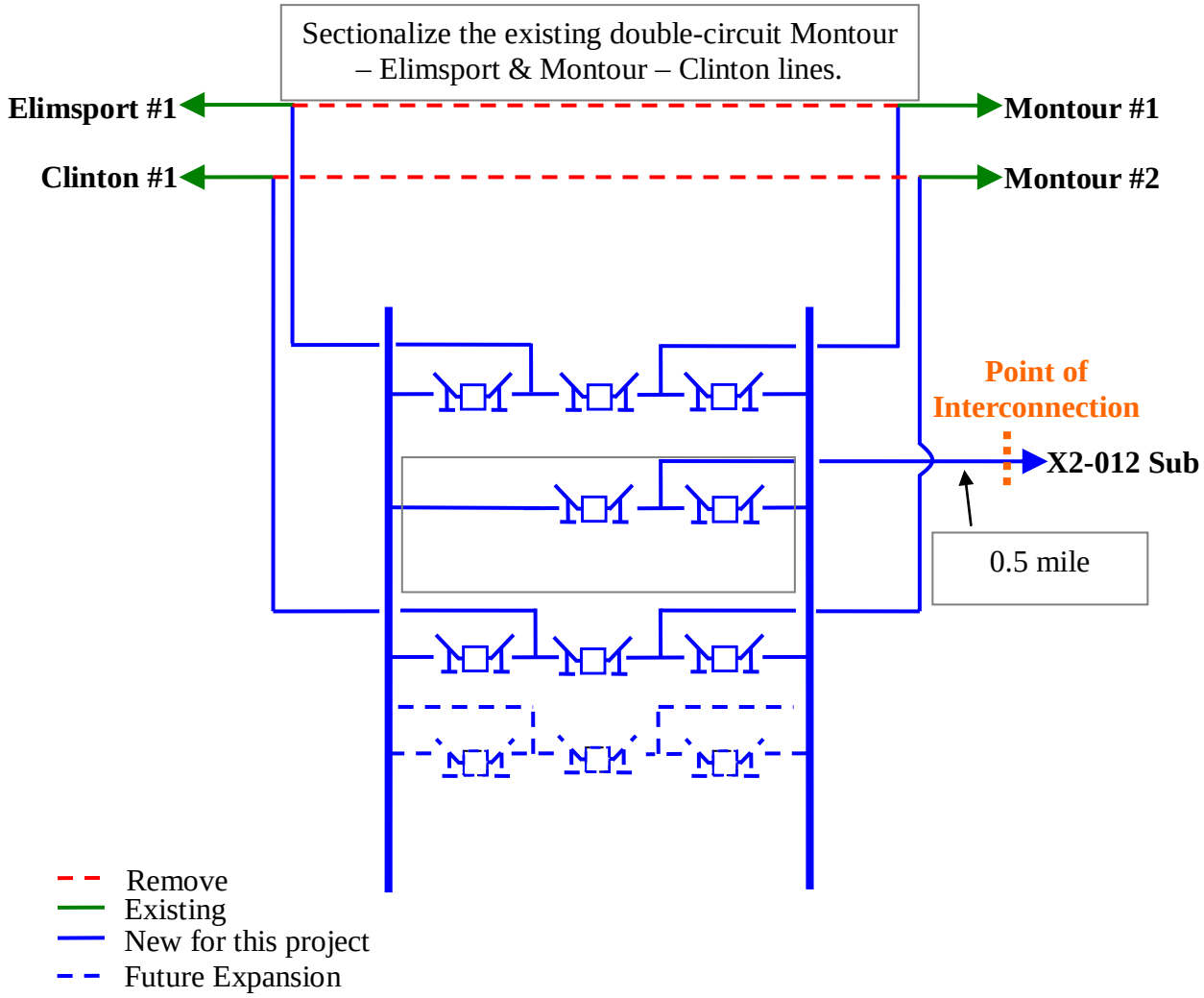
Attachment A

Single Line Diagram for Option 1 – Existing Clinton 230kV Substation



Attachment B

Single Line Diagram for Option 2 – New 230kV Switchyard Near Customer



Attachment C
Aerial View