

***Generation Interconnection  
Feasibility Study Report***

***For***

***PJM Generation Interconnection Request  
Queue Position W3-023***

***Frackville-Eldred #2 230kV***

**January 2011**

## Preface

The intent of the feasibility study is to determine a plan, with ballpark cost and construction time estimates, to connect the subject generation 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 120 MW (15.6 MW capacity) wind farm, located in Schuylkill County, Pennsylvania. Queue W3-023 has proposed an in-service date of January 31st, 2014. **This study does not imply a PPL EU commitment to this in-service date.**

### Point of Interconnection

W3-023 will interconnect with the PPL Electric Utilities transmission system via a 230kV switchyard on the line between the Eldred and Frackville substations.

## **Interconnection Customer Scope of Direct Connection Work**

Queue W3-023 Interconnection Customer is responsible for design, construction and costs for all facilities associated with W3-023 on the Interconnection Customer side of the POI (Point of Interconnection) shown in the figure below.

### **Protection equipment**

The Interconnection Customer will need to install suitable protection and control equipment based on PPL EU parallel generation requirements. The protection equipment and schemes will be identified during the Facilities Study. Relaying requirements for 230 kV and above are not posted, however Intertie Protective Relaying (IPR) and Point of Contact (POC) relaying

documents for voltages below 230 kV can be referred to on the PPL EU web site. The website addresses are shown below:

IPR Requirements:

<http://www.pplelectric.com/Business+Partners/Tools+and+Reference+Center/Customer-Owned+Generation/>

POC Requirements:

[http://www.pplelectric.com/NR/rdonlyres/B0937C7E-B6E9-40AD-AE8C-ED3C9558E528/0/point\\_of\\_contact.pdf](http://www.pplelectric.com/NR/rdonlyres/B0937C7E-B6E9-40AD-AE8C-ED3C9558E528/0/point_of_contact.pdf)

### **DTT Relaying Requirements**

A bi-directional fiber-based DTT (Direct Transfer Trip) will be required for communication paths between the W3-023 Substation and the intertie 230 kV switchyard. Matching fiber-based DTT equipment is required.

The DTT scheme is required for protection of the 230 kV line paths to isolate faults under breaker failure conditions.

### **SCADA Requirements**

PPL EU will require the installation of PPL EU approved SCADA equipment that will connect to its existing SCADA system. The PPL EU SCADA will use a dedicated 4 wire analog telephone line. PPL EU will provide detailed specifications and design drawings for this equipment.

### **Telephone Circuit Requirements**

PPL EU will require a communication path for voice and SCADA. PPL EU anticipates that telephone circuits will be required to establish this path. The Interconnection Customer will be responsible to procure a normal dialup telephone line for voice communication as well as the dedicated SCADA telephone line. All installation, maintenance, and monthly lease or billing charges for communications facilities are the responsibility of the Interconnection Customer.

### **Dead End Structure Requirement**

The Interconnection Customer must install a 230 kV structure capable of receiving the 230 kV line coming off the point-of-interconnection dead-end. The structure requirements will be provided during the Facilities Study or CSA stage.

### **Metering Equipment Installation at the Point of Interconnection**

PPL EU will install revenue grade Metering Equipment at the Queue W3-023 Point-of-Interconnection (POI) inside the 230 kV intertie switchyard.

## **Metering / Telemetry for PJM**

Interconnection Customer is also required to provide revenue metering and real-time telemetry data 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.

## **Isolation Breaker and Disconnect Switch Requirement**

Interconnection Customer will have its own isolation breaker. This breaker can be located on either the high or low side of the Interconnection Customer's transformer. A breaker will be required on the high side of the transformer if the transformer is more than two spans away from the new 230 kV switchyard. The isolation breaker will be operated by suitable relaying depending on the final arrangement of the facilities. Typically for short lines, a line differential scheme communicating over fiber optic cable is used, for both primary and backup. This device will NOT be used to synchronize or parallel operating generation to the PPL EU system.

## Transmission Owner (PPL EU) Scope of Direct Connection Work

The total estimated cost of Direct Connection Facilities needed to connect Queue W3-023 to the intertie switchyard on the Eldred-Frackville 230 kV line is **\$1,865,000 (substation cost) + (transmission cost)** (excluding any applicable state or federal taxes). The 230 kV connection estimate is based on the assumptions stated in the following Transmission and Substation Direct Connection Work sections. This estimate will vary depending upon the Queue W3-023 line connection location and orientation. Network impacts and associated upgrade requirements are addressed at the end of the report. **This estimate is based on the assumption that IPP W3-022 is in service.**

The transmission and substation costs given above exclude any applicable state or federal taxes. If at a future date Federal CIAC taxes are deemed necessary by the IRS for this project, both PJM and PPL EU shall be reimbursed by the Interconnection Customer for such taxes.

A further breakdown of the direct connection costs are as follows:

\$ 1,320,000	230 kV Switchyard work (includes new line & terminal and a new breaker)
\$ 500,000	230 kV Transmission Line work to accommodate W3-023
\$ 45,000	Siting/ROW for Transmission Line work
<b>\$ 1,865,000</b>	<b>Total Direct Connection</b>

***Note: Before the Impact Study stage, the exact location of the Interconnection Substation must be identified by the W3-023 developer in order to refine the cost estimate.***

After the PJM three-party Interconnection Service Agreement (ISA) and Interconnection Construction Service Agreement (ICSA) are signed and PPL EU receives written authorization by PJM to begin work, PPL EU will commence the required certification of the transmission line work with the Pennsylvania Public Utility Commission (PUC), engineering design, material purchase, and construction of facilities identified above. The time required for siting for the transmission line work is estimated to be 9 months assuming there are no existing environmental issues. This work could take longer than expected if W3-023 is not the only landowner involved or if unforeseen complications arise.

The typical time needed to complete the transmission siting, design, and construction work is estimated to be approximately 15 to 18 months. All Right-of-Way will need to be acquired prior to the start of construction and before the PUC will certify construction of the transmission line. The substation work may require approximately 20 to 24 months and can be completed simultaneously with the construction of the new 230 kV switchyard. This translates into a **26 to 30 month** project time frame for the direct connection work.

### **230 kV Transmission Tap Direct Connection Work**

\$ 500,000	230 kV Transmission Line work to accommodate W3-023
\$ 45,000	Siting/ROW for Transmission Line work
<b>\$ 545,000</b>	<b>Total Direct Connection</b>

The transmission direct connection work includes raising a section of the Eldred-Frackville and Siegfried-Frackville 230 kV lines to clear the W3-023 230 kV line. This will likely involve replacing several structures with taller poles and rotating the conductors to a horizontal orientation to provide the necessary clearance. The transmission work will be done in the vicinity of grid 417-S-526 at an estimated cost of **\$500,000** and is included in the above estimate.

The lead time required for the transmission line direct connection work is approximately **15 to 18 months** (9 months for the PUC certification and 15 to 18 months for the transmission engineering/construction work, where both can be done concurrently). This estimate assumes that suitable line outages can be scheduled as required to replace the sections of the Eldred-Frackville and Siegfried-Frackville 230 kV lines. Failure to meet a scheduled line outage may result in project delays. All right-of-way must be acquired prior to the transmission line work.

### **PUC Certification, Right-of-Way Acquisition, & Environmental Impact**

The estimated cost of the PUC Certification is \$45,000 and is included in the above estimate. It includes the cost of filing a Letter-of-Notification with the PUC for replacing sections of the Eldred-Frackville and Siegfried-Frackville 230 kV lines. No condemnation costs are included. Costs for threatened and endangered species studies or environmental constraints are also not included.

### **230 kV Substation Direct Connection Work**

\$ 1,320,000	230 kV Switchyard work (includes new line & terminal and a new breaker)
<b>\$ 1,320,000</b>	<b>Total Direct Connection</b>

To accommodate W3-023, a new third bay with a dead-end structure and a new breaker with two motor-operated air-break switches will be installed at the 230 kV intertie switchyard. PPL EU will install revenue grade Metering Equipment at the Queue W3-023 Point-of-Interconnection (POI) inside the 230 kV intertie switchyard. PPL EU will design and supply the required metering equipment but all the installation cost would be borne by the developer and are included in the above estimate. In addition, there will be some new protection equipment and setting changes at the 230 kV switchyard. The estimated total cost for the work at the intertie switchyard is approximately \$1,320,000 and is included in the above estimate.

The lead time required for the substation direct connection work can be performed in tandem with the 230 kV transmission line work.

## Direct Connection Issues

### W3-023 Generator and GSU modeling

Per the W3-023 supplied data, the following was used in modeling the wind turbine generators and GSUs:

#### W3-023 Wind Turbines:

Turbines: 60 units, 2 MW each (2 MVA base), net injected into PPL EU system 120 MW.

#### GSUs:

Generator Step Up Transformers: Sixty 0.69/34.5 kV, 2.35 MVA (2.35 MVA base) transformers with a  $0.0102+j0.1155$  impedance (Given).

#### Intertie Transformers:

Intertie step-up transformer base: One 34.5/230 kV, 167 MVA (167 MVA base) transformer with  $0.002+j0.075$  impedance (Assumed).

The W3-023 Interconnection Customer must provide PPL EU and PJM with the transformer test reports and a model of the wind turbines once they are available in order to perform a more detailed short circuit analysis.

### Generator Harmonic and Flicker Requirements

On the 230 kV system, the total harmonic distortion to the fundamental voltage wave from a single customer is limited to 1.0% of nominal. In addition, no individual harmonic component can exceed 0.7% of the fundamental system voltage.

**If PPL EU discovers that objectionable harmonics in excess of the stated limits are being injected into the system from W3-023's equipment, the Queue W3-023 Interconnection Customer will be responsible for taking corrective measures to mitigate harmonic currents.**

<b>Maximum Allowable Harmonic Voltage Distortion Table (Tariff Rule 33)</b>		
<b>Voltage Level</b>	<b>Total Harmonic Distortion (% System Voltage)</b>	<b>Individual Harmonic (% System Voltage)</b>
230 kV	1.0	0.7

Concerning voltage flicker, the W3-023 customer must limit the severity of their voltage variation to within a level which will not cause objectionable flicker to other customers. A

voltage drop greater than 5% at the point of interconnection is generally not acceptable. The frequency and severity of the voltage variation must be considered when determining whether a customer's equipment is violating PPL EU flicker guidelines. PPL EU uses the General Electric flicker-irritation curve as a guideline to determine if the system is operating within acceptable limits. **PPL EU will require corrective actions by the W3-023 customer if their operation causes flicker that exceeds PPL EU guidelines.** One such correction could be the installation of static var compensators (SVC) to hold a constant voltage.

### **Reactive Support Requirements**

PPL EU load flow studies have indicated that the W3-023 inverters will maintain the required voltage regulation within its required range at the 230 kV point-of-interconnection. The expected voltage schedule for the W3-023 point-of-interconnection is approximately 1.0 pu (230 kV). As specified in Interconnection Service Agreement, Appendix 2, Section 4.7.1.1 of the PJM OATT (Open Access Transmission Tariff), the W3-023 generator shall design its facility to meet the following power factor requirement:

*“For all new wind-powered and other non-synchronous generation facilities, if determined in the system impact study to be required for the safety or reliability of the Transmission System, the Generation Interconnection Customer shall design its Customer Facility with the ability to maintain a composite power delivery at continuous rated power output at a power factor of at least 0.95 leading to 0.95 lagging.”*

## **Preliminary Schedule and Notes / Assumptions**

PPL EU will begin the project only after the PJM 3-party Interconnection Service Agreement (ISA) and Interconnection Construction Service Agreement (ICSA) are fully executed and PPL EU receives a written authorization by PJM to commence activities.

The estimated PPL EU elapsed time to complete the 230 kV **direct connection** transmission and substation upgrades is approximately **26 to 30 months** after the execution of an ICSA.

The schedule for the 230 kV transmission and substation work to accommodate W3-023 would depend on the project start date. The work to accommodate W3-023 will require transmission line outages. PPL EU's outage windows for construction are typically available in the spring and fall of the year. Missing an outage window could result in project delays.

### **Notes / Assumptions:**

- The ISA/ICSA or an Interim Interconnection Service Agreement (IISA) must be signed by the W3-023 Interconnection Customer, PJM, and PPL EU before any PPL EU activities may commence.
- PPL EU recommends that an Interim ISA be completed during the Facilities Study stage to address critical path items, such as long lead-time purchases and any other compressed project schedule issues.
- Long lead-times for leased telephone lines may be encountered. Therefore, the W3-023 Interconnection Customer should investigate the availability of leased telephone facilities to meet its in-service schedule.
- If custom-designed steel transmission poles are required, the current lead-time is approximately **20 to 28 weeks**.
- During construction, if extreme weather conditions or other system safety concerns arise, field construction may need to be rescheduled, which could possibly impact the schedule plan.
- 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. It is also assumed that all right-of-way and easements are secured without impact on anticipated construction start dates.
- This study assumes that IPP W3-022 will be constructing the 230 kV intertie switchyard on the Eldred-Frackville 230 kV line prior to W3-023 going in service. The W3-023 substation work may be coordinated with the W3-022 project reducing costs further. However, W3-022 would then be responsible to design and construct the switchyard

upgrades for W3-023. If the W3-022 and W3-023 projects are coordinated, there will be some savings realized by minimizing PPL EU project staging costs. If W3-022 does not construct the intertie switchyard, IPP W3-023 will need to be restudied (results will be nearly identical to the W3-022 study).

## **Network Impacts**

Queue project W3-023 was studied as a(n) 120.0 MW (15.6 MW of which was Capacity) injection into PPL's system. Project W3-023 was evaluated for compliance with reliability criteria for summer peak conditions in 2014.

Potential transmission network impacts are as follows:

### **Option 1: Tap between Frackville and Eldred 230 kV line**

#### **Generator Deliverability**

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

No violations identified.

#### **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)*

1. (PL) The Frackville Bus-Siegfried Bus 230 kV line (from bus 207973 to bus 208074 ckt 1) loads from 95.53% to 102.1% (DC power flow) of its emergency rating (616 MVA) for the tower contingency 'PL100484'. This project contributes approximately 40.44 MW to the thermal violation.
2. (PL) The Eldred Transformer #1-Sunbury Transformer 23 230 kV line (from bus 207964 to bus 208111 ckt 1) loads from 82.59% to 108.95% (DC power flow) of its emergency rating (455 MVA) for the tower contingency 'PL100389\_W3-022A'. This project contributes approximately 119.92 MW to the thermal violation.

#### **Contribution to Previously Identified Overloads**

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

No violations identified.

#### **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.)*

No issues identified.

### **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.

3. (PECO/BG&E) The Cooper-Graceton 230 kV line (from bus 214089 to bus 220964 ckt 1) loads from 170.22% to 170.4% (DC power flow) of its emergency rating (485 MVA) for the operational contingency 'PJM17'. This project contributes approximately 6.32 MW to the thermal violation.

4. (PL/BG&E) The Otter Creek Switchyard-Conastone 230 kV line (from bus 208048 to bus 220963 ckt 1) loads from 127.50% to 127.56% (DC power flow) of its emergency rating (531 MVA) for the operational contingency 'PJM17'. This project contributes approximately 7.50 MW to the thermal violation.

5. (PJM) The Peach Bottom-Conastone 500 kV line (from bus 200013 to bus 200004 ckt 1) loads from 150.92% to 151.02% (DC power flow) of its emergency rating (2815 MVA) for the operational contingency 'PJM67'. This project contributes approximately 28.75 MW to the thermal violation.

6. (PECO) The Nottingham-Nottingham Reactor 230 kV line (from bus 213844 to bus 213846 ckt 1) loads from 132.45% to 132.58% (DC power flow) of its emergency rating (627 MVA) for the operational contingency 'PJM17'. This project contributes approximately 6.32 MW to the thermal violation.

7. (PL) The Frackville Transformer #3-Frackville Bus 230 kV line (from bus 207975 to bus 207973 ckt 1) loads from 88.01% to 110.69% (DC power flow) of its emergency rating (526 MVA) for the operational contingency 'PL100374'. This project contributes approximately 119.33 MW to the thermal violation.

8. (PECO) The Nottingham Reactor-Peach Bottom 230 kV line (from bus 213846 to bus 213869 ckt 1) loads from 132.45% to 132.58% (DC power flow) of its emergency rating (627 MVA) for the operational contingency 'PJM17'. This project contributes approximately 6.32 MW to the thermal violation.

9. (PL) The W3-022TAP1-Frackville Transformer #3 230 kV line (from bus 903410 to bus 207975 ckt 1) loads from 82.59% to 108.94% (DC power flow) of its emergency rating (455 MVA) for the operational contingency 'PL100374'. This project contributes approximately 119.92 MW to the thermal violation.

10. (PL/BG&E) The Safe Harbor Units 3-4 Tap-Graceton 230 kV line (from bus 208071 to bus 220964 ckt 1) loads from 114.94% to 115.02% (DC power flow) of its emergency rating (485 MVA) for the operational contingency 'PJM17'. This project contributes approximately 6.89 MW to the thermal violation.

11. (PECO) The Peach Bottom-Cooper 230 kV line (from bus 213869 to bus 214089 ckt 1) loads from 171.23% to 171.4% (DC power flow) of its emergency rating (485 MVA) for the operational contingency 'PJM17'. This project contributes approximately 6.32 MW to the thermal violation.

## **Option 2: Tap between Frackville and Siegfried 230 kV line**

### **Generator Deliverability**

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

No violations identified.

### **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.)*

1. (PL) The W3-022TAP1-Siegfried Bus 230 kV line (from bus 903410 to bus 208074 ckt 1) loads from 102.26% to 114.58% (DC power flow) of its emergency rating (616 MVA) for the

tower contingency 'PL100484'. This project contributes approximately 75.92 MW to the thermal violation.

2. (BG&E) The BAGLEY13-Raphael Road 230 kV line (from bus 220999 to bus 220980 ckt 1) loads from 149.95% to 150.07% (DC power flow) of its emergency rating (674 MVA) for the tower contingency 'CNSTN\_NWEST'. This project contributes approximately 6.80 MW to the thermal violation.

### **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.)*

No issues identified.

### **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.*

3. (PL) The W3-022TAP1-Siegfried Bus 230 kV line (from bus 903410 to bus 208074 ckt 1) loads from 94.44% to 108.66% (DC power flow) of its normal rating (514 MVA) for non contingency condition. This project contributes approximately 73.09 MW to the thermal violation.

4. (PECO/BG&E) The Cooper-Graceton 230 kV line (from bus 214089 to bus 220964 ckt 1) loads from 170.24% to 170.42% (DC power flow) of its emergency rating (485 MVA) for the operational contingency 'PJM17'. This project contributes approximately 6.74 MW to the thermal violation.
5. (PL/BG&E) The Otter Creek Switchyard-Conastone 230 kV line (from bus 208048 to bus 220963 ckt 1) loads from 127.50% to 127.56% (DC power flow) of its emergency rating (531 MVA) for the operational contingency 'PJM17'. This project contributes approximately 7.67 MW to the thermal violation.
6. (PJM) The Peach Bottom-Conastone 500 kV line (from bus 200013 to bus 200004 ckt 1) loads from 151.02% to 151.12% (DC power flow) of its emergency rating (2815 MVA) for the operational contingency 'PJM67'. This project contributes approximately 29.87 MW to the thermal violation.
7. (PJM) The Peach Bottom-Conastone 500 kV line (from bus 200013 to bus 200004 ckt 1) loads from 154.21% to 154.33% (DC power flow) of its normal rating (2490 MVA) for non contingency condition. This project contributes approximately 30.57 MW to the thermal violation.
8. (PECO) The Nottingham-Nottingham Reactor 230 kV line (from bus 213844 to bus 213846 ckt 1) loads from 132.46% to 132.6% (DC power flow) of its emergency rating (627 MVA) for the operational contingency 'PJM17'. This project contributes approximately 6.74 MW to the thermal violation.
9. (PECO) The Nottingham Reactor-Peach Bottom 230 kV line (from bus 213846 to bus 213869 ckt 1) loads from 132.46% to 132.6% (DC power flow) of its emergency rating (627 MVA) for the operational contingency 'PJM17'. This project contributes approximately 6.74 MW to the thermal violation.
10. (PL/BG&E) The Safe Harbor Units 3-4 Tap-Graceton 230 kV line (from bus 208071 to bus 220964 ckt 1) loads from 114.95% to 115.03% (DC power flow) of its emergency rating (485 MVA) for the operational contingency 'PJM17'. This project contributes approximately 7.15 MW to the thermal violation.
11. (PECO) The Peach Bottom-Cooper 230 kV line (from bus 213869 to bus 214089 ckt 1) loads from 171.25% to 171.43% (DC power flow) of its emergency rating (485 MVA) for the operational contingency 'PJM17'. This project contributes approximately 6.74 MW to the thermal violation.