

Exhibit A
Motion for Waivers

6011 Greenwich Windpark, LLC

**BEFORE
THE OHIO POWER SITING BOARD**

In the Matter of the Application of the 6011)
GREENWICH WINDPARK, LLC for a)
Certificate to Site Wind-Powered Electric) Case No. 13-990-EL-BGN
Generation Facilities in Huron County, Ohio)

MOTION FOR WAIVERS

Applicant, 6011 Greenwich Windpark, LLC pursuant to Ohio Administrative Code (“OAC”) Rule 4906-01-03 and Rule 4906-7-12(C), respectfully moves the Ohio Power Siting Board (“Board”) to grant the following waivers on an expedited basis:

- (1) From providing an extensive site selection study to the extent that Applicant is not able to describe all the specific information listed in the site selection criteria as set forth in OAC Rule 4906-17-04(A);
- (2) From providing map of vegetative cover as set forth in OAC 4906-17-05(A)(3)(g), and instead allow the Applicant to provide a general narrative description of the vegetative cover that may be disturbed during construction; and
- (3) From certain requirements relating to cross-sectional views and test borings and maps set forth in OAC 4906-17-05(A)(4), and instead permit Applicant to submit the appropriate test borings prior to construction.
- (4) From providing grade elevations around the turbine pedestals and a map showing modifications in grade elevations during construction as set forth in OAC Rule 4906-17-05(B)(2)(h) and instead to allow Applicant to submit the proposed pedestal grade elevations and contour grade elevations at the time it submits its construction drawings.

Further support for these waiver requests is set forth in the Memorandum in Support below.

MEMORANDUM IN SUPPORT

I. BACKGROUND

6011 Greenwich Windpark, LLC (“Applicant” or “Greenwich”) is wholly owned subsidiary of Windlab Developments USA, Ltd., the parent company of Greenwich.

The proposed wind farm will be spread across approximately 4,600 acres of leased land in Greenwich Township in Huron County. The project itself will consist of approximately 25 turbines, each with a name-plate capacity of approximately 2.4 MW’s, producing up to 60 MW’s of electricity, as well as associated infrastructure (i.e. access roads, electrical collection system, construction staging area, operations and maintenance facilities and substations).

Applicant is seeking waivers from certain requirements of OAC Chapter 4906-17 governing wind applications.

II. EXPEDITED RULING – OAC Rule 4906-7-12(C)

An expedited ruling on this Motion is required in order for Applicant to complete an application in conformance with the applicable requirements in OAC Chapter 4906-17. Applicant plans to file its application by approximately June 2013. Meeting this filing date is necessary to allow Applicant to begin construction by December 31, 2013 so that the project can commence commercial operation by no later than July 2014.

As set forth in this waiver request, and as will be evident in the application itself, Applicant has conducted the requisite analyses and studies and obtained the necessary site commitments so that Applicant can meet its schedule. For these reasons, Applicant asks that the review of its waiver requests be undertaken on an expedited basis and urges the Board or Administrative Law Judge to decide this Motion on that basis.

III. WAIVER REQUESTS

A. OAC Rule 4906-17-04(A): Waiver of an Extensive Site Selection Study

As part of Applicant's application, it will be providing a significant amount of information regarding the company's selection of its site in Huron County, Ohio. Wind resource is extremely limited in Ohio; there are only a handful of project sites with the wind resource necessary to support a utility scale project. The convergence of sufficient wind resources, sufficient transmission capacity, compatible land uses and interested landowners willing to lease their land – all are needed for a viable wind energy project. In order for Ohio utilities to meet the requirements for renewable energy mandated by the Ohio legislature, all viable Ohio wind sites must be considered as potential wind energy project sites. Each specific criterion set forth in OAC Rule 4906-17-04 may not apply even though the site is an appropriate one for a wind energy project.

OAC Rule 4906-17-04 contemplates extensive detail in a site selection study. Applicant will be providing a description of the project boundary; the rationale for selecting the site; a map of the general project area; a list and description of qualitative siting criteria (i.e. constraints such as setbacks, noise, etc.); and a constraint map. Applicant is aware that there is no approved form for a site selection study used in Chapter 4906-17 of the Board's rules. Moreover, as the Board recognized in promulgating the wind application rules, where an applicant limited its study to locations where there are potentially viable wind resources, it would be appropriate for the Board to grant a waiver from filing an extensive site selection study¹. However, in light of the recent Ohio Supreme Court decision in *In re Application of Middletown Coke Company*, (2010) 127 Ohio St. 3d 348; 939 N.E.2d 1210, Applicant will provide sufficient information to support a

¹ *In the Matter of the Power Siting Board's Adoption of Chapter 4906-17 of the Ohio Administrative Code*, Opinion and Order in Case No. 08-1024-EL-ORD issued October 28, 2008 at paragraph 56.

finding that the site represents the minimum adverse environmental impact pursuant to RC 4906.10 (A)(3).

This waiver request is not novel: waivers from this subsection have been granted in a number of recent wind cases. Buckeye Wind LLC, Case No. 08-666-EL-BGN (Entry dated July 31, 2009) (hereinafter "*Buckeye Wind*"); Hardin Wind Energy LLC, Case No. 09-479-EL-BGN (Entry dated July 17, 2009) (hereinafter "*Hardin Wind*"); JW Great Lakes Wind, LLC, Case No. 09-277-EL-BGN (Entry dated September 18, 2009) (hereinafter "*JW Great Lakes*"); Heartland Wind, LLC, Case No. 09-1066-EL-BGN (Entry dated December 11, 2009) (hereinafter "*Blue Creek*"); Paulding Wind Farm LLC, Case No. 09-980 (Entry dated February 23, 2010) (hereinafter *Paulding*) and Case No. 10-369-EL-BGN (Entry dated June 21, 2010) (hereinafter "*Paulding Wind II*"); Black Fork Wind Energy LLC, Case No. 09-546-EL-BGN (Entry dated October 1, 2009) (hereinafter *Blackfork*) and Case No. 10-2865-EL-BGN (Entry dated May 3, 2011) (hereinafter "*Blackfork II*"); Glacier Ridge Wind Farm, LLC, Case No. 11-902-EL-BGN (Entry dated April 6, 2011) (hereinafter "*Glacier Ridge*"); Ashtabula Wind, Case No. 11-2400-E-BGN (Entry dated June 22, 2011) (hereinafter "*Ashtabula*"); Leipsic Wind, Case No. 11-3676-EL-BGN (Entry dated July 25, 2011) (hereinafter "*Leipsic*"); Honey Creek, Case No. 11-4886-EL-BGN (Entry dated November 1, 2011) (hereinafter "*Honey Creek*"); Republic Wind, LLC, Case No. 12-2933-EL-BGN (entry dated January 22, 2013) (hereinafter "*Republic Wind*") and Northwest Ohio Wind LLC, Case No. 13-197-EL-BGN (hereinafter "*Northwest*").

Assuming that Applicant files the site selection information indicated above, Applicant requests a waiver to the extent that each specific factor in OAC Rule 4906-17-04 (A) is not met.

B. OAC 4906-17-05(A)(3)(g): Waiver to Allow Applicant to Provide a General Narrative Description of the Vegetative Cover that May be Disturbed during Construction, Rather than the Required Map.

OAC 4906-13-04(A)(3) requires Applicant to submit a map showing, among other things, the vegetative cover that may be removed during construction. Applicant will provide a general description and provide a drawing of the vegetation that would be cleared in the project area, (i.e., the disturbed area). However, an attempt to provide this detailed information for the massive acreage that comprises the project area (plus a five-mile buffer) would be cost prohibitive and would require cooperation and land access from landowners who are not participants in the project. Additionally, because of the potential for project infrastructure locations and construction methods to change somewhat, prior to construction, a detailed vegetative analysis of the current layout may not reflect the final impacts. In light of the fact that Applicant will provide the vegetation information within the limited disturbance areas, additional data would serve no useful purpose because the Board and its Staff will have the relevant data for the impacted areas. Moreover, the project area is intensely farmed and the vast majority of the surface vegetation consists of corn, soybeans, winter wheat and alfalfa. Therefore Applicant proposes to provide in its application a **general** narrative description of the vegetative cover within the Project area and will estimate the quantity of specific vegetation that may be disturbed or removed during construction.

A similar waiver from this subsection was granted in the *Buckeye Wind, Blue Creek, Glacier Ridge, Ashtabula, Leipsic, Honey Creek, Republic Wind* and *Northwest* cases.

C. OAC 4906-17-05(A)(4): Waiver to Allow Applicant to Submit Information and a Map Relating to Cross-Sectional Views and Test Borings Once it Determines the Final Location of Turbines and Other Structures.

Applicant requests a waiver from the requirement that it provide “maps and corresponding cross-sectional view(s) showing geological features of the proposed project area

and the location of test borings” pursuant to Rule 4906-17-05(A)(4). As part of its application, Applicant will provide a geological desktop study aid and a generalized cross-sectional view based on available information. Applicant proposes defer providing the location of the test borings until after the certificate issues and the final turbine sites have been established.

Applicant plans to perform geological tests (either bores or Cone Penetration Tests) at each of the appropriate final turbine location site once the final sites are determined which cannot be known until the certificate is issued. Applicant proposes to submit the results of the geological tests and cross sections to the Board Staff at a reasonable time prior to construction. This type of waiver with the proposed deferral was granted in *Buckeye Wind, JW Great Lakes, Blue Creek, Paulding Black Fork, Glacier Ridge, Ashtabula, Leipsic, Honey Creek, Republic Wind, Northwest* and *Champaign Wind, LLC*, Case No. 12-160-EL-BGN (Entry dated August 2, 2012) (hereinafter “*Champaign*”).

D. OAC Rule 4906-17-05(B)(2)(h): Waiver To Allow the Proposed Contour Grade Elevations and Grade Elevations around Pedestals To Be Submitted at the Time Applicant Submits Construction Drawings Rather Than Providing a Map Showing Modifications in Grade Elevations and Pedestal Elevations During Construction in the Application.

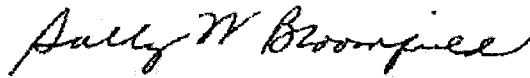
Rule 4906-17-05(B)(2)(h) requires an applicant to describe the layout and construction of the proposed site and a description of proposed major structures power generating site showing the grade elevations where modified during construction. There are several reasons why it is appropriate to delay providing the contour grade elevations with the application. First, the final turbine site locations cannot be known with precision until later in the Board process and will be accurate as the final locations only when the Applicant submits its construction drawings at the preconstruction conference. Thus the grade elevations, if performed on the locations in the application would have to be performed again when the final turbine site locations are known with absolute certainty.

In addition, a wind turbine sits on a relatively small base, generally only 50 to 60 feet in diameter that is different from the situation of a large electric generating plant that rests on a large tract of contiguous acreage property. In the instance of turbine grading, the impact of the grading will be minimal and possibly not known until after construction of the pedestal. Thus, the Applicant requests a waiver of the above referenced rule, but proposes to provide the Staff the grading when it submits the final construction drawings. A similar request for waiver was granted in *Buckeye*, *Paulding Wind*, *Paulding Wind II*, *Glacier Ridge*, *Ashtabula Wind*, *Honey Creek*, *Champaign* and *Northwest*.

IV CONCLUSION

WHEREFORE, Applicant respectfully requests that the Board waive the requirements set forth above and grant such other and further relief to which it may be entitled.

Respectfully submitted on behalf of
6011 GREENWICH WINDPARK, LLC



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in

Case No(s). 13-0990-EL-BGN

Summary: Motion of 6011 Greenwich Windpark, LLC Motion for Waivers and Memorandum in Support electronically filed by Teresa Orahod on behalf of Sally Bloomfield

BEFORE

THE OHIO POWER SITING BOARD

In the Matter of the Application of 6011)
Greenwich Windpark, LLC, for a)
Certificate to Construct a Wind-Powered) Case No. 13-990-EL-BGN
Electric Generation Facility in Huron)
County, Ohio.)

ENTRY

The Administrative Law Judge finds:

- (1) On April 19, 2013, 6011 Greenwich Windpark, LLC (Greenwich or Applicant) filed, with the Ohio Power Siting Board (Board), a preapplication notification letter pursuant to Rule 4906-5-08(A), Ohio Administrative Code (O.A.C.), regarding its intent to file an application for a certificate to construct a wind-powered electric generation facility. According to the Applicant, the project will consist of approximately 25 wind turbine generators, access roads, electrical interconnection, construction staging areas, an operations and maintenance facility, and substation. Each turbine will have a nameplate capacity of approximately 2.4 megawatts (MW), for a total generating capacity of up to 60 MW. The project will be located on approximately 4,600 acres of leased land in Greenwich Township in Huron County, Ohio.
- (2) On April 19, 2013, Greenwich also filed a motion requesting waivers of various provisions contained in Rules 4906-17-04 and 4906-17-05, O.A.C. The Applicant also requests an expedited consideration of its motions to facilitate the submission of its application on or about June 2013, and to facilitate the commencement of construction by December 31, 2013. Based on such timeline, Greenwich expects commercial operation to commence by no later than July 2014. Greenwich's waiver requests are as follows:
 - (a) Greenwich requests a waiver from the requirement that it perform an extensive site selection study as required by Rule 4906-17-04(A), O.A.C., stating that it will provide a significant amount of information regarding Greenwich's selection of its site in Huron County. The

Applicant explains that wind resources are limited in Ohio, as are other resources necessary to site a wind farm. Therefore, only limited viable sites exist to site wind energy projects.

- (b) Greenwich requests a waiver of the requirement that it provide a map showing, among other things, vegetative cover that may be removed during construction, pursuant to Rule 4906-17-05(A)(3)(g), O.A.C., explaining that an attempt to provide this detailed information for the massive acreage that comprises the project area would be cost prohibitive and require cooperation and land access from landowners who are not participants in the project. Instead, Greenwich will provide a general narrative description of the vegetative cover within the project area and an estimate of the quantity of specific vegetation that may be disturbed or removed during construction.
- (c) Greenwich requests a waiver of the requirement that it provide maps and corresponding cross-sectional views showing geological features of the proposed project area and the location of test borings, pursuant to Rule 4906-17-05(A)(4), O.A.C. Greenwich pledges that it will provide a geological desktop study and a generalized cross-sectional view based on available information with its application. Further, Greenwich explains that it plans to perform geological tests at each of the final turbine location sites once the certificate is issued and the final turbine sites are determined. Greenwich will submit the results of the geological tests and cross sections to Staff at a reasonable time prior to construction.
- (d) Greenwich requests a waiver of the requirement that it describe the layout and construction of the proposed site and a description of proposed major structures showing the grade elevation which would be modified during construction, pursuant to Rule 4906-17-06(B)(2)(h), O.A.C., explaining that the final turbine site locations

cannot be known with precision until later in the Board process. Therefore, Greenwich explains that grade elevations, if performed on the locations in the application, would have to be performed again when the final turbine site locations are known with absolute certainty. Greenwich further states that it will provide Staff with the grading information when it submits the final construction drawings.

- (3) Staff filed its response to Greenwich's waiver requests on June 13, 2013. In its response, Staff explains that it does not object to the waiver requests, but reserves the right to require information from Greenwich in areas covered by the waiver requests if Staff determines it is necessary during the course of its investigation. Staff also reserves the right to investigate and contest all other issues presented in the application.
- (4) Upon consideration of Greenwich's waiver requests and Staff's response, the Administrative Law Judge finds that the requests for waivers are reasonable and should be granted.

It is, therefore,

ORDERED, That, in accordance with finding (4), Greenwich's motion for waivers be granted. It is, further,

ORDERED, That a copy of this entry should be served upon all interested persons of record in this proceeding.

THE OHIO POWER SITING BOARD

s/ Greta See

By: Greta See
Administrative Law Judge

jrj/vrm

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in

Case No(s). 13-0990-EL-BGN

Summary: Administrative Law Judge Entry granting waiver requests; electronically filed by Vesta R Miller on behalf of Greta See, Administrative Law Judge, Ohio Power Siting Board

Exhibit B
Wind Resource Map
6011 Greenwich Windpark, LLC

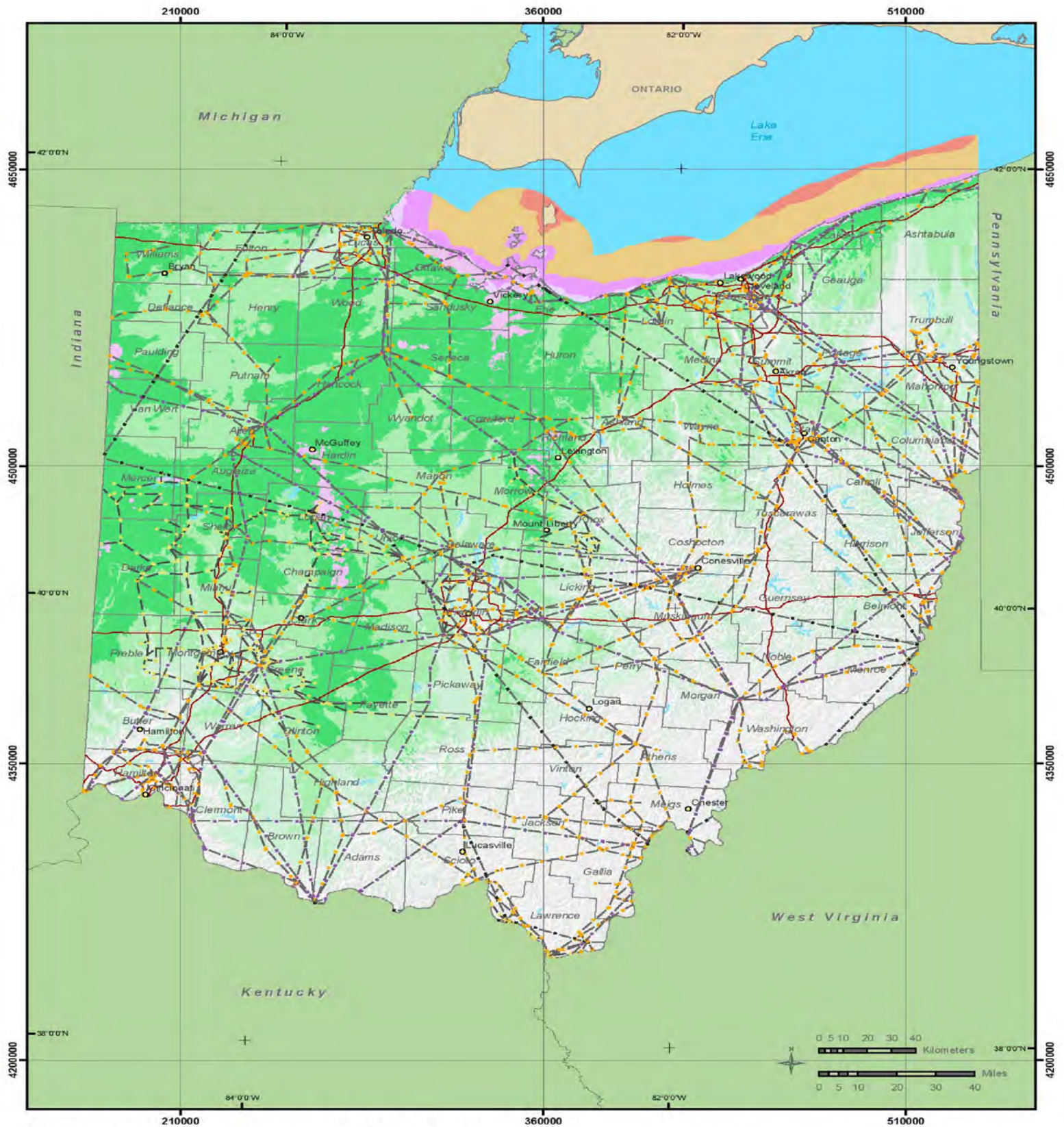


Exhibit C

System Impact Study Report

6011 Greenwich Windpark, LLC

***Generation Interconnection
System Impact Study Report***

For

***PJM Generation Interconnection Request
Queue Position X3-023***

South Greenwich – Willard (Greenwich) 69 kV

November/2013

General

Greenwich Wind LLC proposes to install PJM Project #X3-023, a 60 MW (7.8 MW capacity) Wind generating facility. The proposed Point of Interconnection (POI) is located approximately 15 miles east of the existing Willard 69 kV station (see Figure 3). The proposed generating facility is located in the vicinity of Greenwich, Ohio (see Figure 4).

The original in-service date requested is December 1, 2013.

The objective of this Impact Study is to determine budgetary cost estimates and approximate construction timelines for identified transmission facilities required to connect the proposed generating facilities to the AEP transmission system. These reinforcements include the Attachment Facilities, Local Upgrades, and Network Upgrades required to maintain the reliability of the AEP transmission system.

Attachment Facilities

The proposed generating facility is to be tapped between the Greenwich and the South Greenwich stations on the Willard – South Greenwich 69 kV line. The generating facility will be separated from the tapping point by a circuit breaker. Provision will be needed to expand the facilities at the Point of interconnection in the future. In addition, the Willard 69 kV station configuration must be modified to operate as a ring bus. A transfer trip relaying scheme will be required to open the wind farm breaker when the breakers at the Willard station open the Willard end of the Willard – South Greenwich 69 kV line (see Figure 2).

However, the existing Willard 69 kV station does not have enough space to accommodate the required reconfiguration. To achieve the required space, the Willard 69 kV station will need to be expanded to a dimension of 200' by 200'. To attain the required space for the Willard 69 kV station expansion, a 3 acre plot of land will need to be added in the Northwest direction of the existing Willard 69 kV station. Greenwich Wind LLC is expected to obtain, at their cost, the additional land required to expand the existing Willard 69 kV station.

In addition, the proposed X3-023 Wind generating facility will likely be required to be temporarily removed from service in the event of any facility outage (planned or unplanned) that leaves either of the 69 kV paths from Willard to Carrothers or Willard to Howard open, thereby leaving the Willard-S Greenwich 69 kV line as part of an extended radial path (See Figure 3). To ensure that this removal occurs with minimal delay, AEP Operations must have Supervisory trip control for the X3-023 project breaker. These provisions, and the modification of the Willard station to operate as a ring bus, are needed to reduce the risk that a single contingency would create an island containing customer loads at a level potentially matching the wind farm output.

The point of interconnection is also to include 69 kV metering, SCADA, and associated equipment. Protection relays in the surrounding area will need to be reset to accommodate the addition of the new project.

The following work is required to connect Project X3-023 to the Willard – South Greenwich 69 kV line:

New Switching Station Cost:

- Install a new 69 kV single breaker interconnection switching station laid out to facilitate future conversion to operation in a ring bus configuration with at least 3 breakers. Associated disconnect switches, bus work, and 69 kV revenue metering will also be required.
- AEP is developing plans to extend the Willard-South Greenwich 69 kV line to the south or west. These plans are still conceptual at this time, but are envisioned to be implemented within the next five to seven years. The purpose of this extension will be to create a looped system, thereby increasing service reliability to the customers served from the existing load stations and the proposed wind farm. Some of the 69 kV facilities in the area may also subsequently be upgraded to 138 kV.
- When the upgrade to looped service occurs, the wind farm interconnection station will need to be upgraded to a three breaker ring bus configuration. To facilitate this expansion with minimum impact on the wind farm operation, the site acquired for the interconnection station needs to be at least 3 acres. For similar reasons, AEP also recommends several additional steps:
 - Design and build all facilities with spacing adequate for 138 kV operation, even if 69 kV equipment is installed initially
 - While a single breaker is sufficient for the initial interconnection, when the conversion to ring bus operation occurs, an outage of about 1 month will be required for installation, relay wiring and checkout. Installation of the second breaker during initial construction would significantly shorten this outage duration.

Estimated Cost (2013 Dollars): \$3,200,000. **(n4029)**

- Note that the customer may also wish to consider a dual voltage (138kV & 69 kV) high-side specification for the main transformer.

Protection and Relaying Cost:

Carrier Option

- Protection and relaying including SCADA system Estimated Cost (2013 Dollars): \$ 420,000 **(n4030)**

Fiber Optic Option

- Protection and relaying including SCADA system Estimated Cost (2013 Dollars): \$ 362,000 **(n4031)**

Willard Station Cost:

Carrier Option

- Expand the existing Willard station to facilitate modification into a station initially operated as a 3-breaker ring bus, but physically laid out for eventual expansion to a breaker and a half configuration. 69 kV revenue metering and associated equipment will also need to be installed. Estimated Cost (2013 Dollars): \$ 4,213,400 (**n4032**)

Fiber Optic Option

- Expand the existing Willard station to facilitate modification into a station initially operated as a 3-breaker ring bus, but physically laid out for eventual expansion to a breaker and a half configuration. 69 kV revenue metering and associated equipment will also need to be installed. Estimated Cost (2013 Dollars): \$ 4,745,100 (**n4033**)

Protection and Relaying Cost:

Carrier Option

- Protection and relaying including SCADA system Estimated Cost (2013 Dollars): \$ 294,785 (**n4034**)

Fiber Optic Option

- Protection and relaying including SCADA system Estimated Cost (2013 Dollars): \$ 265,401 (**n4035**)

Network Impacts

AEP has accepted the Impact Study results of PJM. The Queue Project #X3-023 was studied as a 60.0 MW (Capacity 7.8MW) injection connected between the Greenwich and S. Greenwich 69kV stations in the AEP area. Project #X3-023 was evaluated for compliance with reliability criteria for summer peak conditions in 2015. Potential network impacts were as follows:

Generator Deliverability

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

No problems identified

Light Load Analysis

No new problems identified. However, loading issues on the radial feed toward Willard, identified at full Energy output at peak load, may be slightly worse at lower customer load levels.

Multiple Facility Contingency

(Double Circuit Tower Line, Line with Failed Breaker and Bus Fault contingencies for the full energy output)

No problems identified

Short Circuit

No problems 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)

No problems identified

Steady-State Voltage Requirements

No problems identified

Stability and Reactive Power Requirement

To be determined in the Facilities Study

New System Reinforcements

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

See Delivery of Energy Portion of Interconnection Request

Contribution to Previously Identified System Reinforcements

(Overloads initially caused by prior Queue positions with additional contribution to overloading by this project. This project may be allocated partial cost responsibility which will be calculated by PJM.)

No problems identified

Delivery of Energy Portion of Interconnection Request

PJM also studied the delivery of the energy portion of this interconnection request. Any problems identified below are likely to result in operational restrictions to the project under study. The developer can proceed with network upgrades to eliminate the operational restriction at their discretion by submitting a Merchant Transmission Interconnection request.

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 Merchant Transmission Request, a subsequent analysis will be performed which will study all overload conditions associated with the overloaded element(s) identified.

1. The X3-023 TAP-GREENWIC 69 kV line (from bus 910610 to bus 245662 ckt 1) loads from 12.27% to 102.25% (AC power flow) of its normal rating (50 MVA) for non-contingency condition. This project contributes approximately 60.0 MW to the thermal violation.

The overload on this line will expose project X3-023 to curtailment for summer peak conditions. Greenwich Wind LLC can choose to upgrade the equipment to mitigate this overload. Rather than requiring the Greenwich Wind LLC to fix this overload, they could curtail. However, the 69 kV facilities do not currently have SCADA to provide monitoring capability. There is no way to know in real time if the lines in question would be overloaded. We require adding SCADA to the Greenwich 69 kV station. Estimated Cost (2012 Dollars) for the SCADA: \$250,000.

2. The 05FOSTOR-05NEFINZ 138 kV line (from bus 243006 to bus 243054 ckt 1) loads from 101.37% to 103.09% (AC power flow) of its emergency rating (167 MVA) for the single line contingency outage of CONTINGENCY DESCRIPTION ('5248_B2_TOR8651'). This project contributes approximately 3.37 MW to the thermal violation.

CONTINGENCY '5248_B2_TOR8651'

OPEN BRANCH FROM BUS 245749 TO BUS 243004 CKT 1 / 245749
FNDCTREQ 999 243004 05FINDLC 138 1

OPEN BRANCH FROM BUS 243004 TO BUS 243033 CKT 1 / 243004 05FINDLC
138 243033 05MARN Z 138 1

OPEN BRANCH FROM BUS 243005 TO BUS 243006 CKT 1 / 243005
05FNDLYZ 138 243006 05FOSTOR 138 1

OPEN BRANCH FROM BUS 243005 TO BUS 243033 CKT 1 / 243005
05FNDLYZ 138 243033 05MARN Z 138 1

OPEN BRANCH FROM BUS 243005 TO BUS 243057 CKT 1 / 243005
05FNDLYZ 138 243057 05NEWLIB 138 1

OPEN BRANCH FROM BUS 243033 TO BUS 245797 CKT 1 / 243033 05MARN
Z 138 245797 MARION 8 12.0 1

END

The overload on this line will expose project X3-023 to curtailment for summer peak conditions. Developer may choose to upgrade the equipment to mitigate this overload.

3. The GE TIFFI-TIFFIN T 69 kV line (from bus 245619 to bus 245638 ckt 1) loads from 105.69% to 111.96% (AC power flow) of its emergency rating (73 MVA) for the single line contingency outage of CONTINGENCY DESCRIPTION ('5150_B2_TOR709A_MOAB'). This project contributes approximately 5.39 MW to the thermal violation.

CONTINGENCY '5150_B2_TOR709A_MOAB'

OPEN BRANCH FROM BUS 243008 TO BUS 243130 CKT 1 / 243008
05FREMCT 138 243130 05TIFFIN 138 1

END

The overload on this line will expose project X3-023 to curtailment for summer peak conditions. Greenwich Wind LLC can choose to upgrade the equipment to mitigate this overload. Rather than requiring the Greenwich Wind LLC to fix this overload, they could curtail. However, the 69 kV facilities do not currently have SCADA to provide monitoring capability. There is no way to know in real time if the lines in question would be overloaded. We require adding SCADA to the GE Tiffin 69 kV station and the Tiffin 69 kV Tap station. Estimated Cost (2012 Dollars) for the SCADA: \$500,000.

4. The MAULE RD-GE TIFFI 69 kV line (from bus 245648 to bus 245619 ckt 1) loads from 106.59% to 112.87% (AC power flow) of its emergency rating (73 MVA) for the single line contingency outage of CONTINGENCY DESCRIPTION ('5150_B2_TOR709A_MOAB'). This project contributes approximately 5.39 MW to the thermal violation.

CONTINGENCY '5150_B2_TOR709A_MOAB'

OPEN BRANCH FROM BUS 243008 TO BUS 243130 CKT 1 / 243008
05FREMCT 138 243130 05TIFFIN 138 1

END

The overload on this line will expose project X3-023 to curtailment for summer peak conditions. Developer may choose to upgrade the equipment to mitigate this overload.

5. The 02W.FREM-02OTTAWA 138 kV line (from bus 239154 to bus 239030 ckt 1) loads from 112.03% to 113.27% (AC power flow) of its emergency rating (289 MVA) for the single line contingency outage of CONTINGENCY DESCRIPTION ('B_LINE2_WR_034'). This project contributes approximately 4.21 MW to the thermal violation.

CONTINGENCY 'B_LINE2_WR_034' /* SEG 02KY-HS TO
02W.FREM 138 CK 1

DISCONNECT BRANCH FROM BUS 238871 TO BUS 239154 CKT 1 /* 02KY-HS
138.00 02W.FREM 138.00

END

The overload on this line will expose project X3-023 to curtailment for summer peak conditions. Developer may choose to upgrade the equipment to mitigate this overload. FirstEnergy is working to come up with a solution to mitigate this overload.

6. The 05HOWARD-02BRKSID 138 kV line (from bus 243024 to bus 238586 ckt 1) loads from 108.4% to 118.64% (AC power flow) of its normal rating (133 MVA) for non-contingency condition. This project contributes approximately 13.53 MW to the thermal violation.

The overload on this line will expose project X3-023 to curtailment for summer peak conditions. Developer may choose to upgrade the equipment to mitigate this overload. AEP and FirstEnergy are working together to come up with a solution to mitigate this overload.

7. The TIFFIN C-MAULE RD 69 kV line (from bus 245637 to bus 245648 ckt 1) loads from 121.46% to 127.73% (AC power flow) of its emergency rating (73 MVA) for the single line contingency outage of CONTINGENCY DESCRIPTION ('5150_B2_TOR709A_MOAB'). This project contributes approximately 5.39 MW to the thermal violation.

CONTINGENCY '5150_B2_TOR709A_MOAB'

OPEN BRANCH FROM BUS 243008 TO BUS 243130 CKT 1 / 243008
05FREMCT 138 243130 05TIFFIN 138 1

END

The overload on this line will expose project X3-023 to curtailment for summer peak conditions. Developer may choose to upgrade the equipment to mitigate this overload.

8. The 05MELMOR-05FOSTOR 138 kV line (from bus 243039 to bus 243006 ckt 1) loads from 133.17% to 140.44% (AC power flow) of its emergency rating (167 MVA) for the single line contingency outage of CONTINGENCY DESCRIPTION ('5149_B2_TOR709_WOMOAB'). This project contributes approximately 11.92 MW to the thermal violation.

CONTINGENCY '5149_B2_TOR709_WOMOAB'

OPEN BRANCH FROM BUS 243008 TO BUS 243130 CKT 1 / 243008
05FREMCT 138 243130 05TIFFIN 138 1

OPEN BRANCH FROM BUS 243008 TO BUS 245614 CKT 1 / 243008
05FREMCT 138 245614 FREMNT C 69.0 1

OPEN BRANCH FROM BUS 243130 TO BUS 245637 CKT 1 / 243130 05TIFFIN
138 245637 TIFFIN C 69.0 1

OPEN BRANCH FROM BUS 245620 TO BUS 245637 CKT 1 / 245620 GREELY
69.0 245637 TIFFIN C 69.0 1

OPEN BRANCH FROM BUS 245648 TO BUS 245637 CKT 1 / 245648 MAULE
RD 69.0 245637 TIFFIN C 69.0 1

END

The overload on this line will expose project X3-023 to curtailment for summer peak conditions. Developer may choose to upgrade the equipment to mitigate this overload.

Conclusion

Based upon the results of this Impact Study, the construction of the Greenwich Wind LLC (PJM Project #X3-023) project will require the following additional interconnection charges.

New Switching Station Cost:

- Install a new 69 kV single breaker interconnection switching station laid out to facilitate future conversion to operation in a ring bus configuration with at least 3 breakers. Associated disconnect switches, bus work, and 69 kV revenue metering will also be required. Estimated Cost (2013 Dollars): \$3,200,000.

Protection and Relaying Cost:

Carrier Option

- Protection and relaying including SCADA system Estimated Cost (2013 Dollars): \$ 420,000

Fiber Optic Option

- Protection and relaying including SCADA system Estimated Cost (2013 Dollars): \$ 362,000

Willard Station Cost:

Carrier Option

- Existing Willard station is expanded to facilitate modification into a station physically laid out for eventual expansion to a breaker and a half configuration initially operated as a 3-breaker ring bus station. 69 kV revenue metering and associated equipment will also need to be installed. Estimated Cost (2013 Dollars): \$ 4,213,400

Fiber Optic Option

- Existing Willard station is expanded to facilitate modification into a station physically laid out for eventual expansion to a breaker and a half configuration initially operated as a 3-breaker ring bus station. 69 kV revenue metering and associated equipment will also need to be installed. Estimated Cost (2013 Dollars): \$ 4,745,100

Protection and Relaying Cost:

Carrier Option

- Protection and relaying including SCADA system Estimated Cost (2013 Dollars):
\$ 294,785

Fiber Optic Option

- Protection and relaying including SCADA system Estimated Cost (2013 Dollars):
\$ 265,401
- SCADA will also be required in the following facilities: Greenwich 69 kV station, General Electric Tiffin 69 kV station, and Tiffin Tap 69 kV station. Estimated Cost (2013 Dollars):
\$750,000 (n4036)

**Total Estimated Cost for Project X3-023 with Fiber Optic Option (2013 Dollars):
\$9,322,501**

Total Estimated Cost for Project X3-023 with Carrier Option (2013 Dollars): \$8,128,185

The estimates are preliminary in nature, as they were determined without the benefit of detailed engineering studies. Final estimates will require an on-site review and coordination to determine final construction requirements.

Phase 2: Willard with MOAB Between Willard and E. Willard Replaced with 69 kV CB

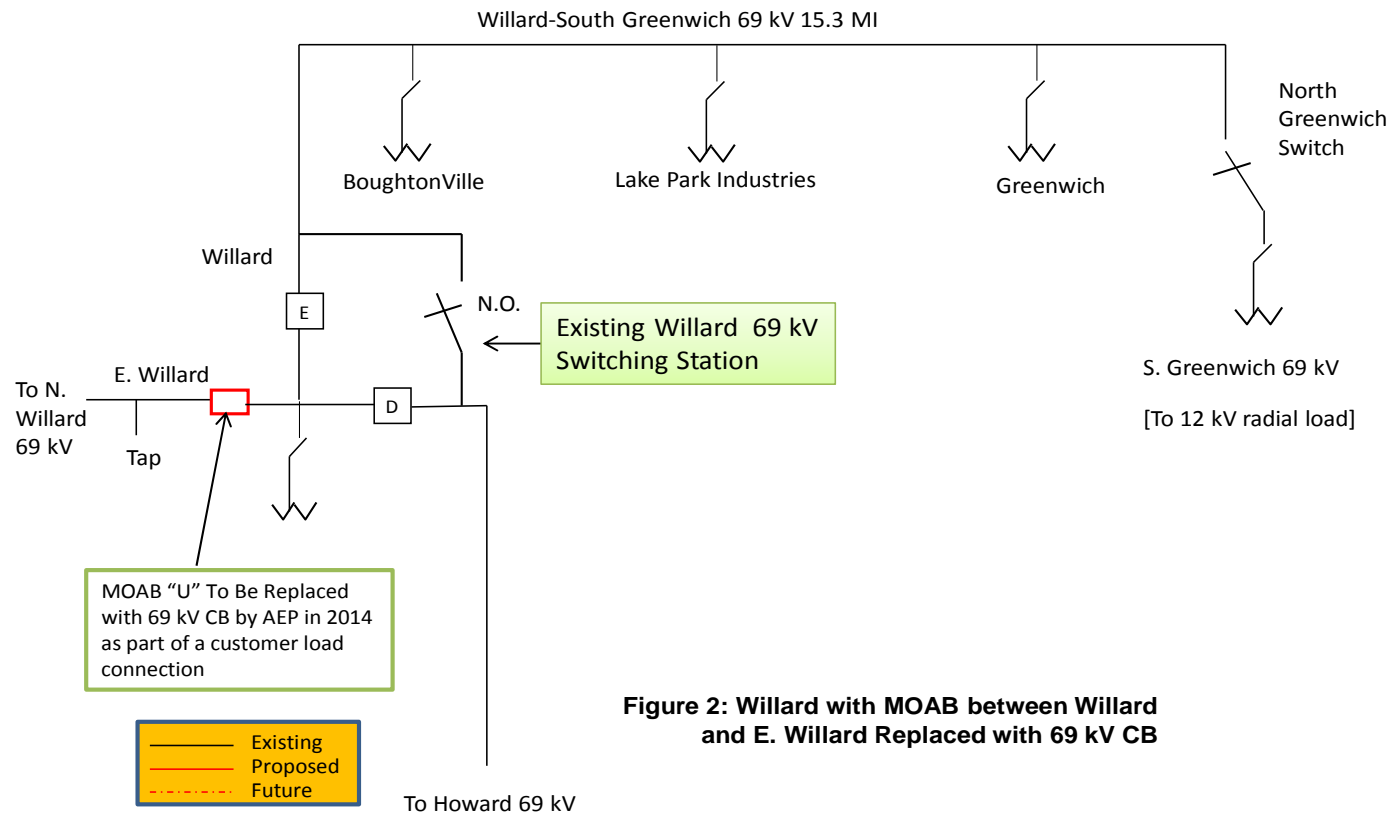


Figure 2: Willard with MOAB between Willard and E. Willard Replaced with 69 kV CB

Phase 3: Expanded Willard with X3-023 Project

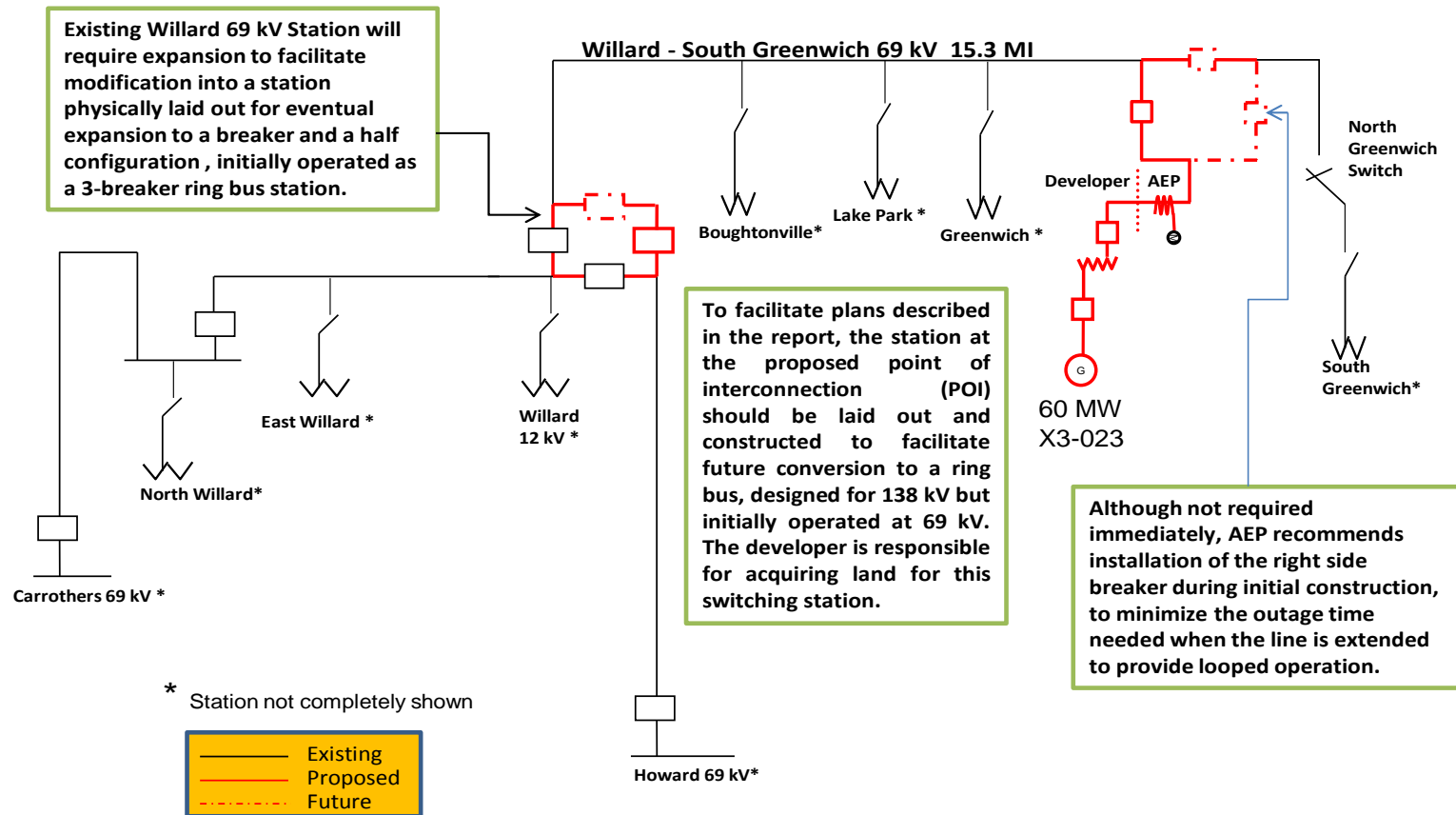


Figure 3: Point Of Interconnection and Willard 69 kV Station Expansion

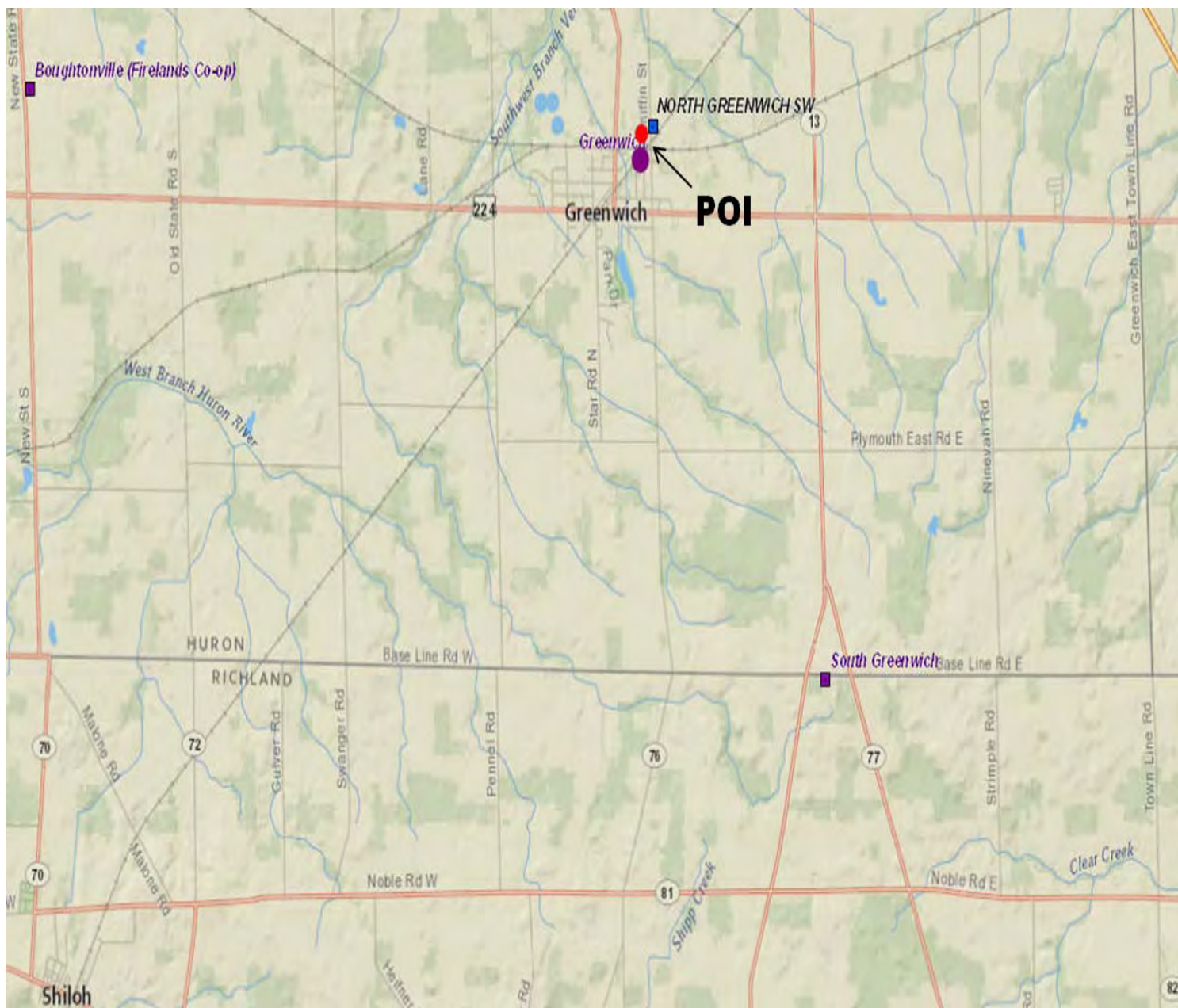


Figure 4: X3-023 Point of Interconnection

Exhibit D

Feasibility Study

6011 Greenwich Windpark, LLC

*PJM Generator Interconnection Request
Queue X3-023
S. Greenwich-Willard (Greenwich Wind
Farm) 69kV
Feasibility Study Report*

March 2012
#688653
Version 2
Version 4

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.

X3-023 S. Greenwich-Willard (Greenwich Wind Farm)

69kV Feasibility Study

General

Greenwich Wind LLC proposes to install PJM Project #X3-023, a 60 MW (7.8 MW capacity) wind generating facility. Two points of interconnection are evaluated in this study. The primary point of interconnection is a new 69 kV 3-breaker ring bus station to be connected to the Greenwich – South Greenwich 69 kV line (Figure 2). The secondary point of interconnection is at the Howard 138 kV station via a single 138 kV breaker (Figure 3). Greenwich Wind LLC will be required to provide the necessary facilities from their collector station to connect to either the Greenwich – South Greenwich 69 kV line or the Howard 138 kV station depending on the point of interconnection selected. The location of the wind generating facility is in Greenwich, Ohio.

The proposed in service date is December 30, 2013.

Direct Connection

Primary Interconnection – Greenwich-S. Greenwich 69kV

The primary point of interconnection is a new 69 kV 3-breaker ring bus station to be connected to the Greenwich – South Greenwich 69 kV line. Greenwich Wind LLC will be required to provide the necessary facilities from their collector station to connect to the Greenwich – South Greenwich 69 kV line. Protection schemes at the remote ends of the line at Greenwich and S. Greenwich will need to be modified and 69 kV metering will need to be installed.

The following work is required to connect to the Greenwich– South Greenwich 69 kV line:

- Install a new 3-breaker 69 kV interconnection station laid out in a breaker and on-half arrangement including associated disconnect switches bus work, SCADA and 69 kV revenue metering. Estimated Cost (2012 Dollars): **\$2,100,000.**
- Modify relaying at Greenwich Station. Estimated Cost (2012 Dollars): **\$100,000**
- Modify relaying at South Greenwich Station. Estimated Cost (2012 Dollars): **\$100,000**

Total Estimated Primary Point of Interconnection Cost (2012 Dollars): **\$2,300,000***

* The estimates are preliminary in nature, as they were determined without the benefit of detailed engineering studies. Final estimates will require an on-site review and coordination to determine final construction requirements.

Secondary Interconnection – Howard 138kV

The secondary point of interconnection is at the Howard 138 kV station via a single 138 kV breaker. Greenwich Wind LLC will be required to provide the necessary facilities from their collector station to connect to the Howard 138 kV station.

The following work is required to connect to the Howard 138 kV station:

- Install a new 138 kV breaker, disconnect switches, protective relaying, SCADA, 138 kV revenue metering, and associated equipment, including 800 feet of underground 138 kV cable for an exit from Howard Station. Estimated Cost (2012 Dollars): **\$2,500,000**.

Total Estimated Secondary Point of Interconnection Cost (2012 Dollars): **\$2,500,000***

It is understood that Greenwich Wind LLC will be responsible for all costs associated with connecting their 60 MW wind generation to the Greenwich – South Greenwich 69 kV line or to the Howard 138 kV station. Note that the Greenwich Wind LLC station facilities and any facilities outside the new station were not included in the cost estimates. These are assumed to be Greenwich Wind LLC's responsibility. The estimates are preliminary in nature, as they were determined without the benefit of detailed engineering studies. Final estimates will require an on-site review and coordination to determine final construction requirements.

It will take approximately 18 months after obtaining the authorization to construct the facilities as outlined above.

Local Network Impacts

The impact of the proposed generating facility on the AEP System was assessed for adherence with applicable reliability criteria. AEP planning criteria require that the transmission system meet single contingency performance criteria in accordance with the AEP FERC Form 715. Therefore, this criterion was used to assess the impact of the proposed facility on the AEP System. The Greenwich Wind LLC project was studied as a 60 MW (7.8 MW capacity) generating facility consistent with the interconnection application. Project #X3-023 was evaluated for compliance with reliability criteria for summer peak conditions in 2015.

Potential network impacts were as follows:

Primary Interconnection – Greenwich-S. Greenwich 69kV

[Normal System \(2015 Summer Conditions Capacity Level\)](#)

- None

Single Contingency (2015 Summer Conditions Capacity Level)

- None

Multiple Contingency (2015 Summer Conditions Capacity Level)

- None

Contribution to Previously Identified Overloads (2015 Summer Conditions Capacity Level)

- None

Normal System (2015 Summer Conditions Full Output)

- Boughtonville (Firelands CO-OP) – Greenwich 69 kV line loads from 22.5% to 109.3% for the base case
 - The overload on this line will expose project X3-023 to curtailment for summer peak conditions. Greenwich Wind LLC can choose to upgrade the equipment to mitigate this overload. Rather than requiring the Greenwich Wind LLC to fix this overload, they could curtail. However, the 69 kV facilities do not currently have SCADA to provide monitoring capability. There is no way to know in real time if the lines in question would be overloaded. AEP suggests adding SCADA to the Greenwich 69 kV Station. Estimated Cost (2012 Dollars) for the SCADA: \$250,000.
- Boughtonville (Firelands CO-OP) – Willard 69 kV line loads from 18.5% to 106.4% for the base case
 - The overload on this line will expose project X3-023 to curtailment for summer peak conditions. Greenwich Wind LLC can choose to upgrade the equipment to mitigate this overload. Rather than requiring the Greenwich Wind LLC to fix this overload, they could curtail. However, the 69 kV facilities do not currently have SCADA to provide monitoring capability. There is no way to know in real time if the lines in question would be overloaded. AEP suggests adding SCADA to the Boughtonville 69 kV Station. Estimated Cost (2012 Dollars) for the SCADA: \$250,000.
- Greenwich – X3-023 69 kV line loads from 12.1% to 114.5% for the base case
 - The overload on this line will expose project X3-023 to curtailment for summer peak conditions. Greenwich Wind LLC can choose to upgrade the equipment to mitigate this overload.

- Brookside - Howard 138 kV FE-AEP tie line loads from 324.4% to 338.1% for the base case
 - AEP and First Energy are working together to come up with a solution to mitigate this overload.
- Bridgeville - Chandlersville 138 kV line loads from 116.5% to 119.9% for the base case
 - The overload on this line will expose project X3-023 to curtailment for summer peak conditions. Greenwich Wind LLC can choose to upgrade the equipment to mitigate this overload.
- Bethel Church – West Dover 138 kV line loads from 106.2% to 109.6% for the base case
 - The overload on this line will expose project X3-023 to curtailment for summer peak conditions. Greenwich Wind LLC can choose to upgrade the equipment to mitigate this overload.
- Chandlersville – Philo 138 kV line loads from 114% to 117.2% for the base case
 - The overload on this line will expose project X3-023 to curtailment for summer peak conditions. Greenwich Wind LLC can choose to upgrade the equipment to mitigate this overload.
- Hillview – Newcomerstown 138 kV line loads from 131.3% to 134.3% for the base case
 - The overload on this line will expose project X3-023 to curtailment for summer peak conditions. Greenwich Wind LLC can choose to upgrade the equipment to mitigate this overload.
- Newcomerstown – South Coshocton 138 kV line loads from 111.6% to 115.3% for the base case
 - The overload on this line will expose project X3-023 to curtailment for summer peak conditions. Greenwich Wind LLC can choose to upgrade the equipment to mitigate this overload.
- Broken Sword – Nevada (North Central CO-OP) 69 kV line loads from 135.3% to 145.4% for the base case
 - The overload on this line will expose project X3-023 to curtailment for summer peak conditions. Greenwich Wind LLC can choose to upgrade the equipment to mitigate this overload. Rather than requiring the Greenwich Wind LLC to fix this overload, they could curtail. However, the 69 kV facilities do not currently have SCADA to provide monitoring capability. There is no way to know in real time if the lines in question would be overloaded. AEP suggests adding SCADA to both the Broken Sword 69 kV

Station and the Nevada (North Central CO-OP). Estimated Cost (2012 Dollars) for the SCADA: \$500,000.

- Nevada (North Central CO-OP) – Upper Sandusky 69 kV line loads from 130.2% to 140.3% for the base case
 - The overload on this line will expose project X3-023 to curtailment for summer peak conditions. Greenwich Wind LLC can choose to upgrade the equipment to mitigate this overload.

Single Contingency (2015 Summer Conditions Full Output)

- Sycamore Tap – East Tiffin 69 kV line loads from 79.9% to 113% for contingency 5121_B2
 - The overload on this line will expose project X3-023 to curtailment for summer peak conditions. Greenwich Wind LLC can choose to upgrade the equipment to mitigate this overload. Rather than requiring the Greenwich Wind LLC to fix this overload, they could curtail. However, the 69 kV facilities do not currently have SCADA to provide monitoring capability. There is no way to know in real time if the lines in question would be overloaded. We suggest adding SCADA to both the Sycamore Tap 69 kV and the East Tiffin 69 kV station. Estimated Cost (2012 Dollars) for the SCADA: \$500,000.
- Boughtonville (Firelands CO-OP) – Greenwich 69 kV line loads from 18.7% to 110% for contingency 7161_B2
 - The overload on this line will expose project X3-023 to curtailment for summer peak conditions. Greenwich Wind LLC can choose to upgrade the equipment to mitigate this overload.
- Boughtonville (Firelands CO-OP) – Willard 69 kV line loads from 22.7% to 107% for contingency 7161_B2
- Carrothers – St. Stephen (North Central CO-OP) 69 kV line loads from 72% to 103.3% for contingency 5121_B2
 - The overload on this line will expose project X3-023 to curtailment for summer peak conditions. Greenwich Wind LLC can choose to upgrade the equipment to mitigate this overload. Rather than requiring the Greenwich Wind LLC to fix this overload, they could curtail. However, the 69 kV facilities do not currently have SCADA to provide monitoring capability. There is no way to know in real time if the lines in question would be overloaded. We suggest adding SCADA

to the St. Stephen 69 kV station. Estimated Cost (2012 Dollars) for the SCADA: \$250,000.

- Crestline – Howard 69 kV line loads from 99.3% to 105.3% for contingency 7159_B2
 - The overload on this line will expose project X3-023 to curtailment for summer peak conditions. Greenwich Wind LLC can choose to upgrade the equipment to mitigate this overload. Rather than requiring the Greenwich Wind LLC to fix this overload, they could curtail. However, the 69 kV facilities do not currently have SCADA to provide monitoring capability. There is no way to know in real time if the lines in question would be overloaded. We suggest adding SCADA to the Crestline 69 kV station. Estimated Cost (2012 Dollars) for the SCADA: \$250,000.
- Crestline – North Robinson 69 kV line loads from 99.2% to 105.2% for contingency 7159_B2
 - The overload on this line will expose project X3-023 to curtailment for summer peak conditions. Greenwich Wind LLC can choose to upgrade the equipment to mitigate this overload.
- North Robinson – West Galion Tap 69 kV line loads from 99.1% to 105.1% for contingency 7159_B2
 - The overload on this line will expose project X3-023 to curtailment for summer peak conditions. Greenwich Wind LLC can choose to upgrade the equipment to mitigate this overload. Rather than requiring the Greenwich Wind LLC to fix this overload, they could curtail. However, the 69 kV facilities do not currently have SCADA to provide monitoring capability. There is no way to know in real time if the lines in question would be overloaded. We suggest adding SCADA to the North Robinson 69 kV station and the West Galion Tap 69 kV. Estimated Cost (2012 Dollars) for the SCADA: \$500,000.

Multiple Contingency (2015 Summer Conditions Full Output)

- None

Contribution to Previously Identified Overloads (2015 Summer Conditions Full Output)

- Academia – Apple Valley 138 kV line loads from 100.8% to 107.6% of its emergency rating of 251 MVA for contingency 7118_C1

- Contingency '7118' Brookside – Howard 138 kV line, Chatfield – Howard 138 kV line, Howard – North Bellville 138 kV line, Howard – City of Shelby 138 kV line, Howard – U4-001 138 kV line, and U4-001 generator.
 - The 795 ACSR conductor (section 1) is the limiting element for the Academia – Apple Valley 138 kV line.
- Apple Valley – North Lexington 138 kV line loads from 125.7% to 134.1% of its emergency rating of 205 MVA for contingency 7118_C1
 - Contingency '7118' Brookside – Howard 138 kV line, Chatfield – Howard 138 kV line, Howard – North Bellville 138 kV line, Howard – City of Shelby 138 kV line, Howard – U4-001 138 kV line, and U4-001 generator.
 - The 556.5 ACSR conductor (section 1), North Lexington Risers, and North Lexington Bus are the limiting elements for the Apple Valley – North Lexington 138 kV line.
- Fostoria Central – Melmore 138 kV line loads from 122.6% to 127% of its emergency rating of 167 MVA for contingency 7118_C1
 - Contingency '7118' Brookside – Howard 138 kV line, Chatfield – Howard 138 kV line, Howard – North Bellville 138 kV line, Howard – City of Shelby 138 kV line, Howard – U4-001 138 kV line, and U4-001 generator.
 - The 397.5 ACSR conductor section 2 is the limiting element for the Fostoria Central – Melmore 138 kV line.
- Greenlawn – Tiffin 138 kV line loads from 103.6% to 107.6% of its emergency rating of 143 MVA for contingency 7118_C1
 - Contingency '7118' Brookside – Howard 138 kV line, Chatfield – Howard 138 kV line, Howard – North Bellville 138 kV line, Howard – City of Shelby 138 kV line, Howard – U4-001 138 kV line, and U4-001 generator.
 - The Greenlawn relay thermal limit is the limiting element for the Greenlawn – Tiffin 138 kV line.
- Howard – North Lexington 138 kV line loads from 148.2% to 157.9% of its emergency rating of 179 MVA for contingency 7118_C1
 - Contingency '7118' Brookside – Howard 138 kV line, Chatfield – Howard 138 kV line, Howard – North Bellville 138 kV line, Howard – City of Shelby 138 kV line, Howard – U4-001 138 kV line, and U4-001 generator.
 - The Howard Bus, Howard Risers, Howard Switch, 556.5 ACSR conductor (section 1), Howard Wavetrap, North Lexington Risers, and North Lexington Bus are the limiting elements for the Howard – North Lexington 138 kV line.

- Brookside - Howard 138 kV line loads from 285.7% to 296.7% for contingency 7111_C2
 - AEP and First Energy are working together to come up with a solution to mitigate this overload.
- Millwood – North Bellville 138 kV line loads from 104.7% to 111.6% for contingency 5121_B2
 - The overload on this line will expose project X3-023 to curtailment for summer peak conditions. Greenwich Wind LLC can choose to upgrade the equipment to mitigate this overload.
- Chatfield – South Tiffin 138 kV line loads from 101% to 109.4% for contingency 5121_B2
 - The overload on this line will expose project X3-023 to curtailment for summer peak conditions. Greenwich Wind LLC can choose to upgrade the equipment to mitigate this overload.
- Howard – North Bellville 138 kV line loads from 116% to 123% for contingency 5121_B2
 - The overload on this line will expose project X3-023 to curtailment for summer peak conditions. Greenwich Wind LLC can choose to upgrade the equipment to mitigate this overload.
- General Electric Tiffin – Tiffin Tap 69kV line loads from 160.9% to 165.2% for contingency 5150_B2
 - The overload on this line will expose project X3-023 to curtailment for summer peak conditions. Greenwich Wind LLC can choose to upgrade the equipment to mitigate this overload. Rather than requiring the Greenwich Wind LLC to fix this overload, they could curtail. However, the 69 kV facilities do not currently have SCADA to provide monitoring capability. There is no way to know in real time if the lines in question would be overloaded. We suggest adding SCADA at the General Electric Tiffin 69 kV station. Estimated Cost (2012 Dollars) for the SCADA: \$250,000.
- General Electric Tiffin – Maule Road 69kV line loads from 161.8% to 166.1% for contingency 5150_B2
 - The overload on this line will expose project X3-023 to curtailment for summer peak conditions. Greenwich Wind LLC can choose to upgrade the equipment to mitigate this overload.
- Greely – Tiffin Center 69kV line loads from 106.7% to 117.8% for contingency 5121_B2
 - The overload on this line will expose project X3-023 to curtailment for summer peak conditions. Greenwich Wind LLC can choose to

upgrade the equipment to mitigate this overload. Rather than requiring the Greenwich Wind LLC to fix this overload, they could curtail. However, the 69 kV facilities do not currently have SCADA to provide monitoring capability. There is no way to know in real time if the lines in question would be overloaded. We suggest adding SCADA to the Greely and Tiffin Center 69 kV stations. Estimated Cost (2012 Dollars) for the SCADA: \$500,000.

- Riverview – Tiffin Tap 69kV line loads from 143% to 147.4% for contingency 5150_B2
 - The overload on this line will expose project X3-023 to curtailment for summer peak conditions. Greenwich Wind LLC can choose to upgrade the equipment to mitigate this overload.
- Tiffin Center – Maule Road 69kV line loads from 175.5% to 179.8% for contingency 5150_B2
 - The overload on this line will expose project X3-023 to curtailment for summer peak conditions. Greenwich Wind LLC can choose to upgrade the equipment to mitigate this overload.
- Bucyrus Center – Broken Sword 69kV line loads from 148.2% to 156.5% for contingency 5150_B2
 - The overload on this line will expose project X3-023 to curtailment for summer peak conditions. Greenwich Wind LLC can choose to upgrade the equipment to mitigate this overload.
- Broken Sword – Nevada (North Central CO-OP) 69 kV line loads from 237.2% to 251.6% for contingency 5121_B2
 - The overload on this line will expose project X3-023 to curtailment for summer peak conditions. Greenwich Wind LLC can choose to upgrade the equipment to mitigate this overload. Rather than requiring the Greenwich Wind LLC to fix this overload, they could curtail. However, the 69 kV facilities do not currently have SCADA to provide monitoring capability. There is no way to know in real time if the lines in question would be overloaded. We suggest adding SCADA. Estimated Cost (2012 Dollars) for the SCADA: \$250,000.
- Nevada (North Central CO-OP) – Upper Sandusky 69 kV line loads from 231.9% to 246.3% for contingency 5121_B2
 - The overload on this line will expose project X3-023 to curtailment for summer peak conditions. Greenwich Wind LLC can choose to upgrade the equipment to mitigate this overload.

Short Circuit Analysis

- No problems identified.

Stability Analysis

- Not required

Additional Limitations of Concern

- None

Local/Network Upgrades

- The 795 ACSR conductor section 1 is the limiting element for the Academia – Apple Valley 138 kV line. A sag check will be required for the 795 ACSR conductor section 1 to determine if the line section can be operated above its emergency rating of 251 MVA. The results of the sag study could prove that no additional upgrades are necessary, that some upgrades on the circuit are necessary, or that the entire 0.2 mile section of line would need to be rebuilt. Estimated Cost (2012 Dollars) for the sag study: **\$800**.
- The 556.5 ACSR conductor section 1, North Lexington Risers, and North Lexington Bus are the limiting elements for the Apple Valley – North Lexington 138 kV line. A sag check will be required for the 556.5 ACSR conductor section 1 to determine if the line section can be operated above its emergency rating of 205 MVA. The results of the sag study could prove that no additional upgrades are necessary, that some upgrades on the circuit are necessary, or that the entire 13.8 mile section of line would need to be rebuilt. Estimated Cost (2012 Dollars) for the sag study: **\$55,200**. The risers at North Lexington Station will be replaced. Estimated Cost (2012 Dollars) for the line risers: **\$100,000**. The 138 kV bus at North Lexington Station will be replaced. Estimated Cost (2012 Dollars) for the line risers: **\$300,000**.
- The 397.5 ACSR conductor section 2 is the limiting element for the Fostoria Central – Melmore 138 kV line. A sag check will be required for the 397.5 ACSR conductor section 2 to determine if the line section can be operated above its emergency rating of 167 MVA. The results of the sag study could prove that no additional upgrades are necessary, that some upgrades on the circuit are necessary, or that the entire 18.0 mile section of line would need to be rebuilt. Estimated Cost (2012 Dollars) for the sag study: **\$72,000**.
- The Howard Bus, Howard Risers, Howard Switch, 556.5 ACSR conductor section 1, Howard Wavetrap, North Lexington Risers, and North Lexington Bus are the limiting elements for the Howard – North Lexington 138 kV line. A sag check will be required for the 556.5 ACSR conductor section 1 to determine if the line section can be operated above its emergency rating of 200 MVA. The results of

the sag study could prove that no additional upgrades are necessary, that some upgrades on the circuit are necessary, or that the entire 12.5 mile section of line would need to be rebuilt. Estimated Cost (2012 Dollars) for the sag study: **\$50,000**. The risers at North Lexington Station will be replaced. Estimated Cost (2012 Dollars) for the line risers: **\$100,000**. The 138 kV bus at North Lexington Station will be replaced. Estimated Cost (2012 Dollars) for the line risers: **\$300,000**. The risers at Howard Station will be replaced. Estimated Cost (2012 Dollars) for the line risers: \$100,000. The 138 kV bus at Howard Station will be replaced. Estimated Cost (2012 Dollars) for the line risers: **\$300,000**.

- The Greenlawn relay thermal limit is the limiting element for the Greenlawn – Tiffin 138 kV line. An engineering study will need to be conducted to determine if the relay thermal limit settings can be adjusted to mitigate the overload. A new relay package will be required if the relay thermal settings cannot be adjusted. Estimated Cost (2012 Dollars) for the relay package: **\$300,000**.

Contribution to Previously Identified System Reinforcements

None

Secondary Interconnection – Howard 138kV

Normal System (2015 Summer Conditions Capacity Output)

- No problems identified

Normal System (2015 Summer Conditions Full Output)

- Brookside - Howard 138 kV FE-AEP tie line loads from 324.4% to 336.7% for the base case
 - AEP and First Energy are working together to come up with a solution to mitigate this overload.
- Broken Sword – Nevada (North Central CO-OP) 69 kV line loads from 135.3% to 145.8% for the base case
 - The overload on this line will expose project X3-023 to curtailment for summer peak conditions. Greenwich Wind LLC can choose to upgrade the equipment to mitigate this overload. Rather than requiring the Greenwich Wind LLC to fix this overload, they could curtail. However, the 69 kV facilities do not currently have SCADA to provide monitoring capability. There is no way to know in real time if the lines in question would be overloaded. We suggest adding SCADA to both the Broken Sword 69 kV Station and the Nevada (North Central CO-OP). Estimated Cost (2012 Dollars) for the SCADA: \$500,000.

- Nevada (North Central CO-OP) – Upper Sandusky 69 kV line loads from 130.2% to 140.6% for the base case
 - The overload on this line will expose project X3-023 to curtailment for summer peak conditions. Greenwich Wind LLC can choose to upgrade the equipment to mitigate this overload.

Single Contingency (2015 Summer Conditions Capacity Output)

- No problems identified

Single Contingency (2015 Summer Conditions Full Output)

- Crestline – Howard 69 kV line loads from 99.3% to 102.4% for contingency 7159_B2
 - The overload on this line will expose project X3-023 to curtailment for summer peak conditions. Greenwich Wind LLC can choose to upgrade the equipment to mitigate this overload. Rather than requiring the Greenwich Wind LLC to fix this overload, they could curtail. However, the 69 kV facilities do not currently have SCADA to provide monitoring capability. There is no way to know in real time if the lines in question would be overloaded. AEP suggests adding SCADA to the Crestline 69 kV station. Estimated Cost (2012 Dollars) for the SCADA: \$250,000.
- North Robinson – West Galion Tap 69 kV line loads from 99.1% to 102.3% for contingency 7159_B2
 - The overload on this line will expose project X3-023 to curtailment for summer peak conditions. Greenwich Wind LLC can choose to upgrade the equipment to mitigate this overload. Rather than requiring the Greenwich Wind LLC to fix this overload, they could curtail. However, the 69 kV facilities do not currently have SCADA to provide monitoring capability. There is no way to know in real time if the lines in question would be overloaded. AEP suggests adding SCADA to the North Robinson 69 kV station and the West Galion Tap 69 kV. Estimated Cost (2012 Dollars) for the SCADA: \$500,000.

Multiple Contingency (2015 Summer Conditions Capacity Output)

- No problems identified.

Multiple Contingency (2015 Summer Conditions Full Output)

- No problems identified.

Contribution to Previously Identified Overloads (2015 Summer Conditions Capacity Output)

- No problems identified.

Contribution to Previously Identified Overloads (2015 Summer Conditions Full Output)

- Academia – Apple Valley 138 kV line loads from 100.8% to 108.7% of its emergency rating of 251 MVA for contingency 7118_C1
 - Contingency ‘7118’ Brookside – Howard 138 kV line, Chatfield – Howard 138 kV line, Howard – North Bellville 138 kV line, Howard – City of Shelby 138 kV line, Howard – U4-001 138 kV line, and U4-001 generator.
 - The 795 ACSR conductor (section 1) is the limiting element for the Academia – Apple Valley 138 kV line.
- Apple Valley – North Lexington 138 kV line loads from 125.7% to 135.4% of its emergency rating of 205 MVA for contingency 7118_C1
 - Contingency ‘7118’ Brookside – Howard 138 kV line, Chatfield – Howard 138 kV line, Howard – North Bellville 138 kV line, Howard – City of Shelby 138 kV line, Howard – U4-001 138 kV line, and U4-001 generator.
 - The 556.5 ACSR conductor (section 1), North Lexington Risers, and North Lexington Bus are the limiting elements for the Apple Valley – North Lexington 138 kV line.
- Bucyrus Center 138 kV – Bucyrus Center 69kV transformer loads from 107.9% to 112.8% of its emergency rating of 113MVA for contingency 7118_C1
 - Contingency ‘7118’ Brookside – Howard 138 kV line, Chatfield – Howard 138 kV line, Howard – North Bellville 138 kV line, Howard – City of Shelby 138 kV line, Howard – U4-001 138 kV line, and U4-001 generator.
 - The Bucyrus Center #1 138/69/13 transformer is the limiting element for the Bucyrus Center 138 kV – Bucyrus Center 69kV transformer.
- Fostoria Central – Melmore 138 kV line loads from 122.6% to 129.7% of its emergency rating of 167 MVA for contingency 7118_C1
 - Contingency ‘7118’ Brookside – Howard 138 kV line, Chatfield – Howard 138 kV line, Howard – North Bellville 138 kV line, Howard – City of Shelby 138 kV line, Howard – U4-001 138 kV line, and U4-001 generator.
 - The 397.5 ACSR conductor (section 2) is the limiting element for the Fostoria Central – Melmore 138 kV line.

- Greenlawn – Melmore 138 kV line loads from 135.4% to 142.8% of its emergency rating of 143 MVA for contingency 7118_C1
 - Contingency ‘7118’ Brookside – Howard 138 kV line, Chatfield – Howard 138 kV line, Howard – North Bellville 138 kV line, Howard – City of Shelby 138 kV line, Howard – U4-001 138 kV line, and U4-001 generator.
 - The Greenlawn relay thermal limit and Greenlawn circuit breaker R are the limiting elements for the Greenlawn – Melmore 138 kV line.

- Greenlawn – Tiffin 138 kV line loads from 103.6% to 110.6% of its emergency rating of 143 MVA for contingency 7118_C1
 - Contingency ‘7118’ Brookside – Howard 138 kV line, Chatfield – Howard 138 kV line, Howard – North Bellville 138 kV line, Howard – City of Shelby 138 kV line, Howard – U4-001 138 kV line, and U4-001 generator.
 - The Greenlawn relay thermal limit is the limiting element for the Greenlawn – Tiffin 138 kV line.

- Howard – North Lexington 138 kV line loads from 148.2% to 159.4% of its emergency rating of 179 MVA for contingency 7118_C1
 - Contingency ‘7118’ Brookside – Howard 138 kV line, Chatfield – Howard 138 kV line, Howard – North Bellville 138 kV line, Howard – City of Shelby 138 kV line, Howard – U4-001 138 kV line, and U4-001 generator.
 - The Howard Bus, Howard Risers, Howard Switch, 556.5 ACSR conductor (section 1), Howard Wavetrap, North Lexington Risers, and North Lexington Bus are the limiting elements for the Howard – North Lexington 138 kV line.

- Howard 138 kV – Howard 1EQ 999 kV (Howard #1 138/69/12 kV transformer) transformer loads from 115.4% to 122.8% of its emergency rating of 120 MVA for contingency 7118_C1
 - Contingency ‘7118’ Brookside – Howard 138 kV line, Chatfield – Howard 138 kV line, Howard – North Bellville 138 kV line, Howard – City of Shelby 138 kV line, Howard – U4-001 138 kV line, and U4-001 generator.
 - The Howard #1 138/69/12 kV transformer is the limiting element for the Howard 138 kV – Howard 1EQ 999 kV transformer.

- Brookside - Howard 138 kV line loads from 285.7% to 297.2% for contingency 7111_C2
 - AEP and First Energy are working together to come up with a solution to mitigate this overload.

- Howard – North Bellville 138 kV line loads from 116% to 122% for contingency 5121_B2
 - The overload on this line will expose project X3-023 to curtailment for summer peak conditions. Greenwich Wind LLC can choose to upgrade the equipment to mitigate this overload.
- Chatfield – Howard 138 kV line loads from 113.6% to 122% for contingency 5121_B2
 - The overload on this line will expose project X3-023 to curtailment for summer peak conditions. Greenwich Wind LLC can choose to upgrade the equipment to mitigate this overload.
- Chatfield – South Tiffin 138 kV line loads from 101% to 109.3% for contingency 5121_B2
 - The overload on this line will expose project X3-023 to curtailment for summer peak conditions. Greenwich Wind LLC can choose to upgrade the equipment to mitigate this overload.
- Millwood – North Bellville 138 kV line loads from 104.7% to 110.6% for contingency 5121_B2
 - The overload on this line will expose project X3-023 to curtailment for summer peak conditions. Greenwich Wind LLC can choose to upgrade the equipment to mitigate this overload.
- Fremont – Stroks Brewery 69 kV line loads from 109.1% to 112.7% for contingency 5250_B2
 - The overload on this line will expose project X3-023 to curtailment for summer peak conditions. Greenwich Wind LLC can choose to upgrade the equipment to mitigate this overload. Rather than requiring the Greenwich Wind LLC to fix this overload, they could curtail. However, the 69 kV facilities do not currently have SCADA to provide monitoring capability. There is no way to know in real time if the lines in question would be overloaded. AEP suggests adding SCADA to the Stroks Brewery 69 kV station. Estimated Cost (2012 Dollars) for the SCADA: \$250,000.
- General Electric Tiffin – Tiffin Tap 69kV line loads from 160.9% to 164.8% for contingency 5150_B2
 - The overload on this line will expose project X3-023 to curtailment for summer peak conditions. Greenwich Wind LLC can choose to upgrade the equipment to mitigate this overload. Rather than requiring the Greenwich Wind LLC to fix this overload, they could curtail. However, the 69 kV facilities do not currently have SCADA to provide monitoring capability. There is no way to know in real time if the lines in question would be overloaded.

AEP suggests adding SCADA at the General Electric Tiffin 69 kV station. Estimated Cost (2012 Dollars) for the SCADA: \$250,000.

- General Electric Tiffin – Maule Road 69kV line loads from 161.8% to 165.6% for contingency 5150_B2
 - The overload on this line will expose project X3-023 to curtailment for summer peak conditions. Greenwich Wind LLC can choose to upgrade the equipment to mitigate this overload.
- Greely – Tiffin Center 69kV line loads from 106.7% to 111.6% for contingency 5121_B2
 - The overload on this line will expose project X3-023 to curtailment for summer peak conditions. Greenwich Wind LLC can choose to upgrade the equipment to mitigate this overload. Rather than requiring the Greenwich Wind LLC to fix this overload, they could curtail. However, the 69 kV facilities do not currently have SCADA to provide monitoring capability. There is no way to know in real time if the lines in question would be overloaded. AEP suggests adding SCADA to the Greely and Tiffin Center 69 kV stations. Estimated Cost (2012 Dollars) for the SCADA: \$500,000.
- Holran – Maple Grove 69kV line loads from 151% to 155% for contingency 5121_B2
 - The overload on this line will expose project X3-023 to curtailment for summer peak conditions. Greenwich Wind LLC can choose to upgrade the equipment to mitigate this overload. Rather than requiring the Greenwich Wind LLC to fix this overload, they could curtail. However, the 69 kV facilities do not currently have SCADA to provide monitoring capability. There is no way to know in real time if the lines in question would be overloaded. AEP suggests adding SCADA to the Holran and Maple Grove 69 kV stations. Estimated Cost (2012 Dollars) for the SCADA: \$500,000.
- Maple Grove – Riverview 69kV line loads from 171.6% to 175.7% for contingency 5150_B2
 - The overload on this line will expose project X3-023 to curtailment for summer peak conditions. Greenwich Wind LLC can choose to upgrade the equipment to mitigate this overload.
- Riverview – Tiffin Tap 69kV line loads from 143% to 146.9% for contingency 5150_B2

- The overload on this line will expose project X3-023 to curtailment for summer peak conditions. Greenwich Wind LLC can choose to upgrade the equipment to mitigate this overload.
- Tiffin Center – Maule Road 69kV line loads from 175.5% to 179.4% for contingency 5150_B2
 - The overload on this line will expose project X3-023 to curtailment for summer peak conditions. Greenwich Wind LLC can choose to upgrade the equipment to mitigate this overload.
- Bucyrus Center – Broken Sword 69kV line loads from 148.2% to 156.3% for contingency 5121_B2
 - The overload on this line will expose project X3-023 to curtailment for summer peak conditions. Greenwich Wind LLC can choose to upgrade the equipment to mitigate this overload.
- Broken Sword – Nevada (North Central CO-OP) 69 kV line loads from 237.2% to 251.3% for contingency 5121_B2
 - The overload on this line will expose project X3-023 to curtailment for summer peak conditions. Greenwich Wind LLC can choose to upgrade the equipment to mitigate this overload.
- Nevada (North Central CO-OP) – Upper Sandusky 69 kV line loads from 231.9% to 246% for contingency 5121_B2
 - The overload on this line will expose project X3-023 to curtailment for summer peak conditions. Greenwich Wind LLC can choose to upgrade the equipment to mitigate this overload.

Short Circuit Analysis

- No problems identified.

Local/Network Upgrades

- The 795 ACSR conductor section 1 is the limiting element for the Academia – Apple Valley 138 kV line. A sag check will be required for the 795 ACSR conductor section 1 to determine if the line section can be operated above its emergency rating of 251 MVA. The results of the sag study could prove that no additional upgrades are necessary, that some upgrades on the circuit are necessary, or that the entire 0.2 mile section of line would need to be rebuilt. Estimated Cost (2012 Dollars) for the sag study: **\$800**.
- The 556.5 ACSR conductor section 1, North Lexington Risers, and North Lexington Bus are the limiting elements for the Apple Valley – North Lexington 138 kV line. A sag check will be required for the 556.5 ACSR conductor section 1 to determine if the line section can be operated above its emergency rating of

205 MVA. The results of the sag study could prove that no additional upgrades are necessary, that some upgrades on the circuit are necessary, or that the entire 13.8 mile section of line would need to be rebuilt. Estimated Cost (2012 Dollars) for the sag study: **\$55,200**. The risers at North Lexington Station will be replaced. Estimated Cost (2012 Dollars) for the line risers: **\$100,000**. The 138 kV bus at North Lexington Station will be replaced. Estimated Cost (2012 Dollars) for the line risers: **\$300,000**.

- The 397.5 ACSR conductor section 2 is the limiting element for the Fostoria Central – Melmore 138 kV line. A sag check will be required for the 397.5 ACSR conductor section 2 to determine if the line section can be operated above its emergency rating of 167 MVA. The results of the sag study could prove that no additional upgrades are necessary, that some upgrades on the circuit are necessary, or that the entire 18.0 mile section of line would need to be rebuilt. Estimated Cost (2012 Dollars) for the sag study: **\$72,000**.
- The Howard Bus, Howard Risers, Howard Switch, 556.5 ACSR conductor section 1, Howard Wavetrap, North Lexington Risers, and North Lexington Bus are the limiting elements for the Howard – North Lexington 138 kV line. A sag check will be required for the 556.5 ACSR conductor section 1 to determine if the line section can be operated above its emergency rating of 200 MVA. The results of the sag study could prove that no additional upgrades are necessary, that some upgrades on the circuit are necessary, or that the entire 12.5 mile section of line would need to be rebuilt. Estimated Cost (2012 Dollars) for the sag study: **\$50,000**. The risers at North Lexington Station will be replaced. Estimated Cost (2012 Dollars) for the line risers: **\$100,000**. The 138 kV bus at North Lexington Station will be replaced. Estimated Cost (2012 Dollars) for the line risers: **\$300,000**. The risers at Howard Station will be replaced. Estimated Cost (2012 Dollars) for the line risers: **\$100,000**. The 138 kV bus at Howard Station will be replaced. Estimated Cost (2012 Dollars) for the line risers: **\$300,000**.
- The Greenlawn relay thermal limit is the limiting element for the Greenlawn – Tiffin 138 kV line. An engineering study will need to be conducted to determine if the relay thermal limit settings can be adjusted to mitigate the overload. A new relay package will be required if the relay thermal settings cannot be adjusted. Estimated Cost (2012 Dollars) for the relay package: **\$300,000**.
- The Greenlawn relay thermal limit and Greenlawn circuit breaker R are the limiting elements for the Greenlawn – Melmore 138 kV line. An engineering study will need to be conducted to determine if the relay thermal limit settings can be adjusted to mitigate the overload. A new relay package will be required if the relay thermal settings cannot be adjusted. Estimated Cost (2012 Dollars) for the relay package: **\$300,000**. Breaker R at the Greenlawn 138 kV Station will be replaced. Estimated Cost (2012 Dollars) for breaker R: **\$550,000**.

- The Bucyrus Center #1 138/69/13 transformer is the limiting element for the Bucyrus Center 138 kV – Bucyrus Center 69kV transformer. Bucyrus Center #1 138/69/13 kV transformer will be replaced. Estimated Cost (2012 Dollars) for the transformer: **\$2,500,000.**
- The Howard #1 138/69/12 kV transformer is the limiting element for the Howard 138 kV – Howard1EQ 999 kV transformer. Howard #1 138/69/12 kV transformer will be replaced. Estimated Cost (2012 Dollars) for the transformer: **\$2,500,000.**

Contribution to Previously Identified System Reinforcements

None

Network Impacts

Queue project X3-023 was studied as a(n) 60.0 MW (7.8 MW of which was Capacity) injection into AEP's system. Project X3-023 was evaluated for compliance with reliability criteria for summer peak conditions in 2015.

Potential transmission network impacts are as follows:

Primary Interconnection – Greenwich-S. Greenwich 69kV

Generator Deliverability

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

- No problems identified.

Multiple Facility Contingency

(Double Circuit Tower Line, Line with Failed Breaker and Bus Fault contingencies for the full energy output)

- No problems identified.

Short Circuit

(Summary form of Cost allocation for breakers will be inserted here if any)

- No problems 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. (AEP) The Greenlawn-Tiffin 138 kV line (from bus 243015 to bus 243130 ckt 1) loads from 121.73% to 127.45% (DC power flow) of its emergency rating (143 MVA) for the tower contingency 'C5-TWL-SR062', outage of the Brookside-Howard, Brookside-Leaside 138kV tower line. This project contributes approximately 8.18 MW to the thermal violation.
2. (FE) The Woodville Tap-Lemoyne 138 kV line (from bus 239176 to bus 238890 ckt 1) loads from 103.30% to 105.21% (DC power flow) of its emergency rating (343 MVA) for the tower contingency 'C5-TWL-WR022', outage of the WEST Fremont-Ottawa & W.Fremont-KH-Ottawa 138kV tower line. This project contributes approximately 6.54 MW to the thermal violation.
3. (AEP) The Tiffin-Fremont Center 138 kV line (from bus 243130 to bus 243008 ckt 1) loads from 112.79% to 117.64% (DC power flow) of its emergency rating (205 MVA) for the tower contingency 'C5-TWL-SR062', Brookside-Howard, Brookside-Leaside 138kV tower line. This project contributes approximately 9.95 MW to the thermal violation.
4. (AEP/FE) The Howard-Brookside 138 kV line (from bus 243024 to bus 238586 ckt 1) loads from 240.62% to 248.22% (DC power flow) of its emergency rating (173 MVA) for the tower contingency 'C5-TWL-CR040', outage of the Davis Besse-Beaver and Davis Besse-Hayes 345KV tower line. This project contributes approximately 13.15 MW to the thermal violation.

System Reinforcements

None

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.)

1. The Greenlawn relay thermal limit is the limiting element for the Greenlawn – Tiffin 138 kV line. An engineering study will need to be conducted to determine if the relay thermal limit settings can be adjusted to mitigate the overload. A new relay package will be required if the relay thermal settings cannot be adjusted. Estimated Cost (2011 Dollars) for the relay package: **\$300,000**.
2. The overload on the Woodville Tap-Lemoyne 138 kV circuit can be alleviated by installing a new 138kV line between the proposed Hayes substation to West Fremont substation. Install a new 138kV loop from future Hayes-WestFremont 138kV line to the proposed Bellevue area substation. Install a new 69kV loop from existing Bellevue-Greenfiled 69kV line to proposed Bellevue area substation. Estimated cost: **\$48,158,300**.

3. The 556 ACSR (section 1) of the conductor is the limiting elements for the Fremont Center – Tiffin 138 kV line. A sag check will be required to determine if the line section can be operated above the emergency rating of 205 MVA. The results of the sag study could prove that no additional upgrades are necessary, that some upgrades on the circuit are necessary, or that the entire 12.7 mile section of line would need to be rebuilt. Estimated Cost (2011 Dollars) for the sag study:
\$50,800
4. FirstEnergy and AEP are working together to come up with an upgrade for the Howard-Brookside 138kV tie line.

One possible solution is listed below:

- Replace Howard switch:
Estimated Cost (2009 Dollars): **\$100,000**
- Reconductor and rebuild the Howard – Brookside 138 kV circuit (8 miles):
Estimated Cost (2009 Dollars): **\$ 12,000,000**
 - This estimate only includes the reconductoring and rebuild of the AEP 8 mile section of the circuit, it does not include First Energy's 13.74 miles.
- Replace Howard line riser:
Estimated Cost (2009 Dollars): **\$50,000**
- Replace Howard wavetrap:
Estimated Cost (2009 Dollars): **\$50,000**
- Replace Howard metering CT:
Estimated Cost (2009 Dollars): **\$100,000**
- Reconductor and rebuild the FirstEnergy portion of the Howard-Brookside 138kV circuit (approximately 13.75 miles).
Estimated cost by PJM: **\$15,000,000**

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.

5. (AEP) The CARROTHR-ST STPH8 69 kV line (from bus 245655 to bus 245674 ckt 1) loads from 111.33% to 147.32% (DC power flow) of its emergency rating (31 MVA) for the operational contingency '5147_B2_TOR707_V1-010A'. This project contributes approximately 11.15 MW to the thermal violation.

```
CONTINGENCY '5147_B2_TOR707_V1-010A'
  OPEN BRANCH FROM BUS 243006 TO BUS 243039 CKT 1      / 243006 05FOSTOR 138 243039
05MELMOR 138 1
  OPEN BRANCH FROM BUS 243015 TO BUS 243039 CKT 1      / 243015 05GREENL 138 243039
05MELMOR 138 1
  OPEN BRANCH FROM BUS 243024 TO BUS 892000 CKT 1      / 243024 05HOWARD 138 243039
05MELMOR 138 1
END
```

6. (AEP) The TIFFIN T-RIVERVIE 69 kV line (from bus 245638 to bus 245628 ckt 1) loads from 99.32% to 100.62% (DC power flow) of its emergency rating (73 MVA) for the operational contingency '5150_B2_TOR709A_MOAB'. This project contributes approximately 5.89 MW to the thermal violation.

```
CONTINGENCY '5150_B2_TOR709A_MOAB'
  OPEN BRANCH FROM BUS 243008 TO BUS 243130 CKT 1      / 243008 05FREMCT 138 243130
05TIFFIN 138 1
END
```

7. (AEP) The ST STPH8-BLOOMVL 69 kV line (from bus 245674 to bus 245650 ckt 1) loads from 104.11% to 140.09% (DC power flow) of its emergency rating (31 MVA) for the operational contingency '5147_B2_TOR707_V1-010A'. This project contributes approximately 11.15 MW to the thermal violation.

```
CONTINGENCY '5147_B2_TOR707_V1-010A'
  OPEN BRANCH FROM BUS 243006 TO BUS 243039 CKT 1      / 243006 05FOSTOR 138 243039
05MELMOR 138 1
  OPEN BRANCH FROM BUS 243015 TO BUS 243039 CKT 1      / 243015 05GREENL 138 243039
05MELMOR 138 1
  OPEN BRANCH FROM BUS 243024 TO BUS 892000 CKT 1      / 243024 05HOWARD 138 243039
05MELMOR 138 1
END
```

8. (AEP) The NEVADA8-U SANDSK 69 kV line (from bus 245709 to bus 245715 ckt 1) loads from 145.51% to 148.41% (DC power flow) of its emergency rating (31 MVA) for the operational contingency '5121_B2_TOR608'. This project contributes approximately 5.55 MW to the thermal violation.

```
CONTINGENCY '5121_B2_TOR608'
  OPEN BRANCH FROM BUS 238586 TO BUS 243024 CKT 1      / 238586 02BRKSID 138 243024
05HOWARD 138 1
END
```


9. (AEP) The South Tiffin-Airco (North Central Co-Op) 138 kV line (from bus 243110 to bus 242953 ckt 1) loads from 158.84% to 166.37% (DC power flow) of its emergency rating (167 MVA) for the operational contingency '5147_B2_TOR707_V1-010A'. This project contributes approximately 12.59 MW to the thermal violation.

```
CONTINGENCY '5147_B2_TOR707_V1-010A'
  OPEN BRANCH FROM BUS 243006 TO BUS 243039 CKT 1      / 243006 05FOSTOR 138 243039
05MELMOR 138 I
  OPEN BRANCH FROM BUS 243015 TO BUS 243039 CKT 1      / 243015 05GREENL 138 243039
05MELMOR 138 I
  OPEN BRANCH FROM BUS 243024 TO BUS 892000 CKT 1      / 243024 05HOWARD 138 243039
05MELMOR 138 I
END
```

10. (AEP) The BROK SWR-NEVADA8 69 kV line (from bus 245687 to bus 245709 ckt 1) loads from 151.97% to 154.86% (DC power flow) of its emergency rating (31 MVA) for the operational contingency '5121_B2_TOR608'. This project contributes approximately 5.55 MW to the thermal violation.

```
CONTINGENCY '5121_B2_TOR608'
  OPEN BRANCH FROM BUS 238586 TO BUS 243024 CKT 1      / 238586 02BRKSID 138 243024
05HOWARD 138 I
END
```

11. (AEP) The BLOOMVL-SYCAMORZ 69 kV line (from bus 245650 to bus 245635 ckt 1) loads from 83.62% to 119.61% (DC power flow) of its emergency rating (31 MVA) for the operational contingency '5147_B2_TOR707_V1-010A'. This project contributes approximately 11.15 MW to the thermal violation.

```
CONTINGENCY '5147_B2_TOR707_V1-010A'
  OPEN BRANCH FROM BUS 243006 TO BUS 243039 CKT 1      / 243006 05FOSTOR 138 243039
05MELMOR 138 I
  OPEN BRANCH FROM BUS 243015 TO BUS 243039 CKT 1      / 243015 05GREENL 138 243039
05MELMOR 138 I
  OPEN BRANCH FROM BUS 243024 TO BUS 892000 CKT 1      / 243024 05HOWARD 138 243039
05MELMOR 138 I
END
```

12. (AEP) The E.TIFF2-GREENLAW 69 kV line (from bus 245646 to bus 245621 ckt 1) loads from 78.90% to 107.5% (DC power flow) of its emergency rating (39 MVA) for the operational contingency '5147_B2_TOR707_V1-010A'. This project contributes approximately 11.15 MW to the thermal violation.

```
CONTINGENCY '5147_B2_TOR707_V1-010A'
  OPEN BRANCH FROM BUS 243006 TO BUS 243039 CKT 1      / 243006 05FOSTOR 138 243039
05MELMOR 138 I
  OPEN BRANCH FROM BUS 243015 TO BUS 243039 CKT 1      / 243015 05GREENL 138 243039
05MELMOR 138 I
  OPEN BRANCH FROM BUS 243024 TO BUS 892000 CKT 1      / 243024 05HOWARD 138 243039
05MELMOR 138 I
END
```

13. (AEP) The Greenlawn-Tiffin 138 kV line (from bus 243015 to bus 243130 ckt 1) loads from 121.27% to 126.99% (DC power flow) of its emergency rating (143 MVA) for the operational contingency '5121_B2_TOR608'. This project contributes approximately 8.18 MW to the thermal violation.

CONTINGENCY '5121_B2_TOR608'

OPEN BRANCH FROM BUS 238586 TO BUS 243024 CKT 1 / 238586 02BRKSID 138 243024
05HOWARD 138 1
END

14. (AEP) The SYCAMORZ-E.TIFF2 69 kV line (from bus 245635 to bus 245646 ckt 1) loads from 99.26% to 135.24% (DC power flow) of its emergency rating (31 MVA) for the operational contingency '5147_B2_TOR707_V1-010A'. This project contributes approximately 11.15 MW to the thermal violation.

CONTINGENCY '5147_B2_TOR707_V1-010A'

OPEN BRANCH FROM BUS 243006 TO BUS 243039 CKT 1 / 243006 05FOSTOR 138 243039
05MELMOR 138 1
OPEN BRANCH FROM BUS 243015 TO BUS 243039 CKT 1 / 243015 05GREENL 138 243039
05MELMOR 138 1
OPEN BRANCH FROM BUS 243024 TO BUS 892000 CKT 1 / 243024 05HOWARD 138 243039
05MELMOR 138 1
END

15. (AEP) The Chatfield-South Tiffin 138 kV line (from bus 242984 to bus 243110 ckt 1) loads from 202.99% to 211.69% (DC power flow) of its emergency rating (167 MVA) for the operational contingency '5147_B2_TOR707_V1-010A'. This project contributes approximately 14.54 MW to the thermal violation.

CONTINGENCY '5147_B2_TOR707_V1-010A'

OPEN BRANCH FROM BUS 243006 TO BUS 243039 CKT 1 / 243006 05FOSTOR 138 243039
05MELMOR 138 1
OPEN BRANCH FROM BUS 243015 TO BUS 243039 CKT 1 / 243015 05GREENL 138 243039
05MELMOR 138 1
OPEN BRANCH FROM BUS 243024 TO BUS 892000 CKT 1 / 243024 05HOWARD 138 243039
05MELMOR 138 1
END

16. (AEP) The Chatfield-South Tiffin 138 kV line (from bus 242984 to bus 243110 ckt 1) loads from 122.29% to 129.11% (DC power flow) of its normal rating (148 MVA) for non contingency condition. This project contributes approximately 10.10 MW to the thermal violation.

17. (AEP) The X3-023 TAP-GREENWIC 69 kV line (from bus 910670 to bus 245662 ckt 1) loads from 11.80% to 108.2% (DC power flow) of its normal rating (50 MVA) for non contingency condition. This project contributes approximately 60.00 MW to the thermal violation.

18. (AEP) The GE TIFFI-TIFFIN T 69 kV line (from bus 245619 to bus 245638 ckt 1) loads from 120.77% to 122.08% (DC power flow) of its emergency rating (73 MVA) for the operational contingency '5150_B2_TOR709A_MOAB'. This project contributes approximately 5.89 MW to the thermal violation.

CONTINGENCY '5150_B2_TOR709A_MOAB'

OPEN BRANCH FROM BUS 243008 TO BUS 243130 CKT 1 / 243008 05FREMCT 138 243130
05TIFFIN 138 1
END

19. (AEP) The MAULE RD-GE TIFFI 69 kV line (from bus 245648 to bus 245619 ckt 1) loads from 121.69% to 122.99% (DC power flow) of its emergency rating (73 MVA) for the operational contingency '5150_B2_TOR709A_MOAB'. This project contributes approximately 5.89 MW to the thermal violation.

CONTINGENCY '5150_B2_TOR709A_MOAB'

OPEN BRANCH FROM BUS 243008 TO BUS 243130 CKT 1 / 243008 05FREMCT 138 243130
05TIFFIN 138 1
END

20. (AEP) The TIFFIN C-MAULE RD 69 kV line (from bus 245637 to bus 245648 ckt 1) loads from 137.18% to 138.49% (DC power flow) of its emergency rating (73 MVA) for the operational contingency '5150_B2_TOR709A_MOAB'. This project contributes approximately 5.89 MW to the thermal violation.

CONTINGENCY '5150_B2_TOR709A_MOAB'

OPEN BRANCH FROM BUS 243008 TO BUS 243130 CKT 1 / 243008 05FREMCT 138 243130
05TIFFIN 138 1
END

21. (AEP) The BUCYRS C-BROK SWR 69 kV line (from bus 245653 to bus 245687 ckt 1) loads from 101.11% to 102.77% (DC power flow) of its emergency rating (54 MVA) for the operational contingency '5121_B2_TOR608'. This project contributes approximately 5.55 MW to the thermal violation.

CONTINGENCY '5121_B2_TOR608'

OPEN BRANCH FROM BUS 238586 TO BUS 243024 CKT 1 / 238586 02BRKSID 138 243024
05HOWARD 138 1
END

22. (AEP) The V1-010 TAP-Melmore 138 kV line (from bus 892000 to bus 243039 ckt 1) loads from 194.36% to 198.06% (DC power flow) of its emergency rating (167 MVA) for the operational contingency '5240_B2_TOR4783_WOMOAB_V1-010B'. This project contributes approximately 6.18 MW to the thermal violation.

CONTINGENCY '5240_B2_TOR4783_WOMOAB_V1-010B'

OPEN BRANCH FROM BUS 242953 TO BUS 243110 CKT 1 / 242953 05AIRCO8 138 243110
05STIFFI 138 1

OPEN BRANCH FROM BUS 242953 TO BUS 243137 CKT 1 / 242953 05AIRCO8 138 243137
 05W.END 138 1
 OPEN BRANCH FROM BUS 892010 TO BUS 243024 CKT 1 / 242984 05CHATFL 138 243024
 05HOWARD 138 1
 OPEN BRANCH FROM BUS 242984 TO BUS 243110 CKT 1 / 242984 05CHATFL 138 243110
 05STIFFI 138 1
 OPEN BRANCH FROM BUS 242984 TO BUS 245656 CKT 1 / 242984 05CHATFL 138 245656
 CHATFIEL 69.0 1
 OPEN BRANCH FROM BUS 243110 TO BUS 245630 CKT 1 / 243110 05STIFFI 138 245630 S
 TIFFIN 69.0 1
 OPEN BRANCH FROM BUS 242953 TO BUS 245602 CKT 1 / 242953 05AIRCO8 138 245602
 AIRCO L8 12.0 1
 OPEN BRANCH FROM BUS 245655 TO BUS 245656 CKT 1 / 245655 CARROTHR 69.0
 245656 CHATFIEL 69.0 1
 OPEN BRANCH FROM BUS 245656 TO BUS 245670 CKT 1 / 245656 CHATFIEL 69.0 245670
 NEWWASH8 69.0 1
 END

23. (AEP) The Tiffin-Fremont Center 138 kV line (from bus 243130 to bus 243008 ckt 1) loads from 112.36% to 117.21% (DC power flow) of its emergency rating (205 MVA) for the operational contingency '5121_B2_TOR608'. This project contributes approximately 9.95 MW to the thermal violation.

CONTINGENCY '5121_B2_TOR608'

OPEN BRANCH FROM BUS 238586 TO BUS 243024 CKT 1 / 238586 02BRKSID 138 243024
 05HOWARD 138 1
 END

24. (AEP) The South Tiffin-S TIFFIN 138/69 kV transformer (from bus 243110 to bus 245630 ckt 1) loads from 103.58% to 104.61% (DC power flow) of its emergency rating (72 MVA) for the operational contingency '5243_B2_TOR4783C_MOAB'. This project contributes approximately 4.61 MW to the thermal violation.

CONTINGENCY '5243_B2_TOR4783C_MOAB'

OPEN BRANCH FROM BUS 242953 TO BUS 243110 CKT 1 / 242953 05AIRCO8 138 243110
 05STIFFI 138 1
 OPEN BRANCH FROM BUS 242953 TO BUS 243137 CKT 1 / 242953 05AIRCO8 138 243137
 05W.END 138 1
 OPEN BRANCH FROM BUS 242953 TO BUS 245602 CKT 1 / 242953 05AIRCO8 138 245602
 AIRCO L8 12.0 1
 END

25. (AEP) The Melmore-Fostoria Central 138 kV line (from bus 243039 to bus 243006 ckt 1) loads from 211.43% to 219.59% (DC power flow) of its emergency rating (167 MVA) for the operational contingency '5149_B2_TOR709_WOMOAB'. This project contributes approximately 13.63 MW to the thermal violation.

CONTINGENCY '5149_B2_TOR709_WOMOAB'

OPEN BRANCH FROM BUS 243008 TO BUS 243130 CKT 1 / 243008 05FREMCT 138 243130
 05TIFFIN 138 1
 OPEN BRANCH FROM BUS 243008 TO BUS 245614 CKT 1 / 243008 05FREMCT 138 245614
 FREMNT C 69.0 1

OPEN BRANCH FROM BUS 243130 TO BUS 245637 CKT 1 / 243130 05TIFFIN 138 245637
 TIFFIN C 69.0 1
 OPEN BRANCH FROM BUS 245620 TO BUS 245637 CKT 1 / 245620 GREELY 69.0 245637
 TIFFIN C 69.0 1
 OPEN BRANCH FROM BUS 245648 TO BUS 245637 CKT 1 / 245648 MAULE RD 69.0 245637
 TIFFIN C 69.0 1
 END

26. (AEP) The GREENWIC-BOUGHTN8 69 kV line (from bus 245662 to bus 245651 ckt 1) loads from 18.12% to 101.88% (DC power flow) of its normal rating (50 MVA) for non contingency condition. This project contributes approximately 60.00 MW to the thermal violation.

27. (AEP) The Airco (North Central Co-Op)-West End 138 kV line (from bus 242953 to bus 243137 ckt 1) loads from 150.63% to 158.16% (DC power flow) of its emergency rating (167 MVA) for the operational contingency '5147_B2_TOR707_V1-010A'. This project contributes approximately 12.59 MW to the thermal violation.

CONTINGENCY '5147_B2_TOR707_V1-010A'
 OPEN BRANCH FROM BUS 243006 TO BUS 243039 CKT 1 / 243006 05FOSTOR 138 243039
 05MELMOR 138 1
 OPEN BRANCH FROM BUS 243015 TO BUS 243039 CKT 1 / 243015 05GREENL 138 243039
 05MELMOR 138 1
 OPEN BRANCH FROM BUS 243024 TO BUS 892000 CKT 1 / 243024 05HOWARD 138 243039
 05MELMOR 138 1
 END

28. (AEP/FE) The Howard-Brookside 138 kV line (from bus 243024 to bus 238586 ckt 1) loads from 206.43% to 213.63% (DC power flow) of its emergency rating (173 MVA) for the operational contingency 'B_LINE1_SR_022'. This project contributes approximately 12.47 MW to the thermal violation.

CONTINGENCY 'B_LINE1_SR_022' /* GALION-GM MANSFIELD 138KV LINE OUTAGE
 DISCONNECT BRANCH FROM BUS 238746 TO BUS 238758 CKT 1 /* 02GALION 138.00 02GM
 MAN 138.00
 END

29. (AEP/FE) The Howard-Brookside 138 kV line (from bus 243024 to bus 238586 ckt 1) loads from 249.96% to 259.66% (DC power flow) of its normal rating (133 MVA) for non contingency condition. This project contributes approximately 12.90 MW to the thermal violation.

Secondary Interconnection – Howard 138kV

Generator Deliverability

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

- No problems identified.

Multiple Facility Contingency

(Double Circuit Tower Line, Line with Failed Breaker and Bus Fault contingencies for the full energy output)

1. (FE) The Brookside-Troy 138 kV line (from bus 238586 to bus 239216 ckt 1) loads from 95.71% to 96.31% (DC power flow) of its emergency rating (135 MVA) for the tower contingency 'C5-TWL-CR040', outage of the Davis Besse-Beaver & Davis Besse-Hayes 345KV circuits. This project contributes approximately 5.03 MW to the thermal violation.
2. (FE) The Troy-Brighton 138 kV line (from bus 239216 to bus 239215 ckt 1) loads from 94.05% to 94.65% (DC power flow) of its emergency rating (135 MVA) for the tower contingency 'C5-TWL-CR040', outage of the Davis Besse-Beaver & Davis Besse-Hayes 345KV circuits. This project contributes approximately 5.03 MW to the thermal violation.
3. (FE) The 02CAMDEN-Firelands 138 138 kV line (from bus 239319 to bus 239318 ckt 1) loads from 91.07% to 91.67% (DC power flow) of its emergency rating (135 MVA) for the tower contingency 'C5-TWL-CR040', outage of the Davis Besse-Beaver & Davis Besse-Hayes 345kV circuits. This project contributes approximately 5.03 MW to the thermal violation.

Short Circuit

(Summary form of Cost allocation for breakers will be inserted here if any)

- No problems 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.)

4. (AEP) The Greenlawn-Tiffin 138 kV line (from bus 243015 to bus 243130 ckt 1) loads from 121.73% to 127.4% (DC power flow) of its emergency rating (143 MVA) for the tower contingency 'C5-TWL-SR062', outage of the Brookside-Howard, Brookside-Leaside 138kV tower line. This project contributes approximately 8.10 MW to the thermal violation.
5. (FE) The Woodville Tap-Lemoyne 138 kV line (from bus 239176 to bus 238890 ckt 1) loads from 103.30% to 103.55% (DC power flow) of its emergency rating (343 MVA) for the tower contingency 'C5-TWL-WR022', outage of the West

Fremont-Ottawa & W.Fremont-KH-Ottawa 138kV tower line. This project contributes approximately 5.14 MW to the thermal violation.

6. (AEP) The Tiffin-Fremont Center 138 kV line (from bus 243130 to bus 243008 ckt 1) loads from 112.79% to 116.83% (DC power flow) of its emergency rating (205 MVA) for the tower contingency 'C5-TWL-SR062', Brookside-Howard, Brookside-Leaside 138kV tower line. This project contributes approximately 8.29 MW to the thermal violation.
7. (AEP/FE) The Howard-Brookside 138 kV line (from bus 243024 to bus 238586 ckt 1) loads from 240.62% to 250.42% (DC power flow) of its emergency rating (173 MVA) for the tower contingency 'C5-TWL-CR040', outage of the Davis Besse-Beaver and Davis Besse-Hayes 345KV tower line. This project contributes approximately 16.96 MW to the thermal violation.

System Reinforcements

None

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.)

5. The Greenlawn relay thermal limit is the limiting element for the Greenlawn – Tiffin 138 kV line. An engineering study will need to be conducted to determine if the relay thermal limit settings can be adjusted to mitigate the overload. A new relay package will be required if the relay thermal settings cannot be adjusted. Estimated Cost (2011 Dollars) for the relay package: **\$300,000**.
6. The overload on the Woodville Tap-Lemoyne 138 kV circuit can be alleviated by installing a new 138kV line between the proposed Hayes substation to West Fremont substation. Install a new 138kV loop from future Hayes-WestFremont 138kV line to the proposed Bellevue area substation. Install a new 69kV loop from existing Bellevue-Greenfiled 69kV line to proposed Bellevue area substation. Estimated cost: **\$48,158,300**.
7. The 556 ACSR (section 1) of the conductor is the limiting elements for the Fremont Center – Tiffin 138 kV line. A sag check will be required to determine if the line section can be operated above the emergency rating of 205 MVA. The results of the sag study could prove that no additional upgrades are necessary, that some upgrades on the circuit are necessary, or that the entire 12.7 mile section of line would need to be rebuilt. Estimated Cost (2011 Dollars) for the sag study: **\$50,800**

8. FirstEnergy and AEP are working together to come up with an upgrade for the Howard-Brookside 138kV tie line.

One possible solution is listed below:

- Replace Howard switch:
Estimated Cost (2009 Dollars): **\$100,000**
- Reconductor and rebuild the Howard – Brookside 138 kV circuit (8 miles):
Estimated Cost (2009 Dollars): **\$ 12,000,000**
 - This estimate only includes the reconductoring and rebuild of the AEP 8 mile section of the circuit, it does not include First Energy's 13.74 miles.
- Replace Howard line riser:
Estimated Cost (2009 Dollars): **\$50,000**
- Replace Howard wavetrap:
Estimated Cost (2009 Dollars): **\$50,000**
- Replace Howard metering CT:
Estimated Cost (2009 Dollars): **\$100,000**
- Reconductor and rebuild the FirstEnergy portion of the Howard-Brookside 138kV circuit (approximately 13.75 miles).
Estimated cost by PJM: **\$15,000,000**

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.

8. (AEP) The V1-010 TAP-Chatfield 138 kV line (from bus 892010 to bus 242984 ckt 1) loads from 269.78% to 277.86% (DC power flow) of its emergency rating (167 MVA) for the operational contingency '5147_B2_TOR707_V1-010A'. This project contributes approximately 13.50 MW to the thermal violation.

CONTINGENCY '5147_B2_TOR707_V1-010A'

OPEN BRANCH FROM BUS 243006 TO BUS 243039 CKT 1 / 243006 05F0STOR 138 243039
05MELMOR 138 1

OPEN BRANCH FROM BUS 243015 TO BUS 243039 CKT 1 / 243015 05GREENL 138 243039
 05MELMOR 138 1
 OPEN BRANCH FROM BUS 243024 TO BUS 892000 CKT 1 / 243024 05HOWARD 138 243039
 05MELMOR 138 1
 END

9. (AEP) The V1-010 TAP-Chatfield 138 kV line (from bus 892010 to bus 242984 ckt 1) loads from 170.26% to 177.23% (DC power flow) of its normal rating (138 MVA) for non contingency condition. This project contributes approximately 9.62 MW to the thermal violation.

10. (AEP) The CARROTHR-ST STPH8 69 kV line (from bus 245655 to bus 245674 ckt 1) loads from 111.33% to 113.18% (DC power flow) of its emergency rating (31 MVA) for the operational contingency '5147_B2_TOR707_V1-010A'. This project contributes approximately 3.55 MW to the thermal violation.

CONTINGENCY '5147_B2_TOR707_V1-010A'
 OPEN BRANCH FROM BUS 243006 TO BUS 243039 CKT 1 / 243006 05FOSTOR 138 243039
 05MELMOR 138 1
 OPEN BRANCH FROM BUS 243015 TO BUS 243039 CKT 1 / 243015 05GREENL 138 243039
 05MELMOR 138 1
 OPEN BRANCH FROM BUS 243024 TO BUS 892000 CKT 1 / 243024 05HOWARD 138 243039
 05MELMOR 138 1
 END

11. (AEP) The TIFFIN T-RIVERVIE 69 kV line (from bus 245638 to bus 245628 ckt 1) loads from 99.32% to 100.0% (DC power flow) of its emergency rating (73 MVA) for the operational contingency '5150_B2_TOR709A_MOAB'. This project contributes approximately 3.06 MW to the thermal violation.

CONTINGENCY '5150_B2_TOR709A_MOAB'
 OPEN BRANCH FROM BUS 243008 TO BUS 243130 CKT 1 / 243008 05FREMCT 138 243130
 05TIFFIN 138 1
 END

12. (AEP) The ST STPH8-BLOOMVL 69 kV line (from bus 245674 to bus 245650 ckt 1) loads from 104.11% to 105.96% (DC power flow) of its emergency rating (31 MVA) for the operational contingency '5147_B2_TOR707_V1-010A'. This project contributes approximately 3.55 MW to the thermal violation.

CONTINGENCY '5147_B2_TOR707_V1-010A'
 OPEN BRANCH FROM BUS 243006 TO BUS 243039 CKT 1 / 243006 05FOSTOR 138 243039
 05MELMOR 138 1
 OPEN BRANCH FROM BUS 243015 TO BUS 243039 CKT 1 / 243015 05GREENL 138 243039
 05MELMOR 138 1
 OPEN BRANCH FROM BUS 243024 TO BUS 892000 CKT 1 / 243024 05HOWARD 138 243039
 05MELMOR 138 1
 END

13. (AEP) The Melmore-Greenlawn 138 kV line (from bus 243039 to bus 243015 ckt 1) loads from 113.97% to 117.11% (DC power flow) of its emergency rating (201 MVA) for the operational contingency '5240_B2_TOR4783_WOMOAB_V1-010B'. This project contributes approximately 6.32 MW to the thermal violation.

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CONTINGENCY '5240_B2_TOR4783_WOMOAB_V1-010B'
  OPEN BRANCH FROM BUS 242953 TO BUS 243110 CKT 1      / 242953 05AIRCO8 138 243110
05STIFFI 138 1
  OPEN BRANCH FROM BUS 242953 TO BUS 243137 CKT 1      / 242953 05AIRCO8 138 243137
05W.END 138 1
  OPEN BRANCH FROM BUS 892010 TO BUS 243024 CKT 1      / 242984 05CHATFL 138 243024
05HOWARD 138 1
  OPEN BRANCH FROM BUS 242984 TO BUS 243110 CKT 1      / 242984 05CHATFL 138 243110
05STIFFI 138 1
  OPEN BRANCH FROM BUS 242984 TO BUS 245656 CKT 1      / 242984 05CHATFL 138 245656
CHATFIEL 69.0 1
  OPEN BRANCH FROM BUS 243110 TO BUS 245630 CKT 1      / 243110 05STIFFI 138 245630 S
TIFFIN 69.0 1
  OPEN BRANCH FROM BUS 242953 TO BUS 245602 CKT 1      / 242953 05AIRCO8 138 245602
AIRCO L8 12.0 1
  OPEN BRANCH FROM BUS 245655 TO BUS 245656 CKT 1      / 245655 CARROTHR 69.0
245656 CHATFIEL 69.0 1
  OPEN BRANCH FROM BUS 245656 TO BUS 245670 CKT 1      / 245656 CHATFIEL 69.0 245670
NEWWASH8 69.0 1
END
```

14. (AEP) The NEVADA8-U SANDSK 69 kV line (from bus 245709 to bus 245715 ckt 1) loads from 145.51% to 147.94% (DC power flow) of its emergency rating (31 MVA) for the operational contingency '5121_B2_TOR608'. This project contributes approximately 4.66 MW to the thermal violation.

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CONTINGENCY '5121_B2_TOR608'
  OPEN BRANCH FROM BUS 238586 TO BUS 243024 CKT 1      / 238586 02BRKSID 138 243024
05HOWARD 138 1
END
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15. (AEP) The South Tiffin-Airco (North Central Co-Op) 138 kV line (from bus 243110 to bus 242953 ckt 1) loads from 158.84% to 165.13% (DC power flow) of its emergency rating (167 MVA) for the operational contingency '5147_B2_TOR707_V1-010A'. This project contributes approximately 10.51 MW to the thermal violation.

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CONTINGENCY '5147_B2_TOR707_V1-010A'
  OPEN BRANCH FROM BUS 243006 TO BUS 243039 CKT 1      / 243006 05FOSTOR 138 243039
05MELMOR 138 1
  OPEN BRANCH FROM BUS 243015 TO BUS 243039 CKT 1      / 243015 05GREENL 138 243039
05MELMOR 138 1
  OPEN BRANCH FROM BUS 243024 TO BUS 892000 CKT 1      / 243024 05HOWARD 138 243039
05MELMOR 138 1
END
```

16. (AEP) The BROK SWR-NEVADA8 69 kV line (from bus 245687 to bus 245709 ckt 1) loads from 151.97% to 154.4% (DC power flow) of its emergency rating (31 MVA)

for the operational contingency '5121_B2_TOR608'. This project contributes approximately 4.66 MW to the thermal violation.

CONTINGENCY '5121_B2_TOR608'

OPEN BRANCH FROM BUS 238586 TO BUS 243024 CKT 1 / 238586 02BRKSID 138 243024
05HOWARD 138 1
END

17. (AEP) The Greenlawn-Tiffin 138 kV line (from bus 243015 to bus 243130 ckt 1) loads from 121.27% to 126.93% (DC power flow) of its emergency rating (143 MVA) for the operational contingency '5121_B2_TOR608'. This project contributes approximately 8.10 MW to the thermal violation.

CONTINGENCY '5121_B2_TOR608'

OPEN BRANCH FROM BUS 238586 TO BUS 243024 CKT 1 / 238586 02BRKSID 138 243024
05HOWARD 138 1
END

18. (AEP) The Chatfield-South Tiffin 138 kV line (from bus 242984 to bus 243110 ckt 1) loads from 202.99% to 210.74% (DC power flow) of its emergency rating (167 MVA) for the operational contingency '5147_B2_TOR707_V1-010A'. This project contributes approximately 12.94 MW to the thermal violation.

CONTINGENCY '5147_B2_TOR707_V1-010A'

OPEN BRANCH FROM BUS 243006 TO BUS 243039 CKT 1 / 243006 05FOSTOR 138 243039
05MELMOR 138 1
OPEN BRANCH FROM BUS 243015 TO BUS 243039 CKT 1 / 243015 05GREENL 138 243039
05MELMOR 138 1
OPEN BRANCH FROM BUS 243024 TO BUS 892000 CKT 1 / 243024 05HOWARD 138 243039
05MELMOR 138 1
END

19. (AEP) The Chatfield-South Tiffin 138 kV line (from bus 242984 to bus 243110 ckt 1) loads from 122.29% to 128.79% (DC power flow) of its normal rating (148 MVA) for non contingency condition. This project contributes approximately 9.63 MW to the thermal violation.

20. (AEP) The GE TIFFI-TIFFIN T 69 kV line (from bus 245619 to bus 245638 ckt 1) loads from 120.77% to 121.45% (DC power flow) of its emergency rating (73 MVA) for the operational contingency '5150_B2_TOR709A_MOAB'. This project contributes approximately 3.06 MW to the thermal violation.

CONTINGENCY '5150_B2_TOR709A_MOAB'

OPEN BRANCH FROM BUS 243008 TO BUS 243130 CKT 1 / 243008 05FREMCT 138 243130
05TIFFIN 138 1
END

21. (AEP) The MAULE RD-GE TIFFI 69 kV line (from bus 245648 to bus 245619 ckt 1) loads from 121.71% to 122.38% (DC power flow) of its emergency rating (73 MVA) for

the operational contingency '5150_B2_TOR709A_MOAB'. This project contributes approximately 3.06 MW to the thermal violation.

CONTINGENCY '5150_B2_TOR709A_MOAB'
OPEN BRANCH FROM BUS 243008 TO BUS 243130 CKT 1 / 243008 05FREMCT 138 243130
05TIFFIN 138 1
END

22. (AEP) The SYCAMORZ-E.TIFF2 69 kV line (from bus 245635 to bus 245646 ckt 1) loads from 99.26% to 101.11% (DC power flow) of its emergency rating (31 MVA) for the operational contingency '5147_B2_TOR707_V1-010A'. This project contributes approximately 3.55 MW to the thermal violation.

CONTINGENCY '5147_B2_TOR707_V1-010A'
OPEN BRANCH FROM BUS 243006 TO BUS 243039 CKT 1 / 243006 05FOSTOR 138 243039
05MELMOR 138 1
OPEN BRANCH FROM BUS 243015 TO BUS 243039 CKT 1 / 243015 05GREENL 138 243039
05MELMOR 138 1
OPEN BRANCH FROM BUS 243024 TO BUS 892000 CKT 1 / 243024 05HOWARD 138 243039
05MELMOR 138 1
END

23. (AEP) The TIFFIN C-MAULE RD 69 kV line (from bus 245637 to bus 245648 ckt 1) loads from 137.18% to 137.86% (DC power flow) of its emergency rating (73 MVA) for the operational contingency '5150_B2_TOR709A_MOAB'. This project contributes approximately 3.06 MW to the thermal violation.

CONTINGENCY '5150_B2_TOR709A_MOAB'
OPEN BRANCH FROM BUS 243008 TO BUS 243130 CKT 1 / 243008 05FREMCT 138 243130
05TIFFIN 138 1
END

24. (AEP) The BUCYRS C-BROK SWR 69 kV line (from bus 245653 to bus 245687 ckt 1) loads from 101.11% to 102.5% (DC power flow) of its emergency rating (54 MVA) for the operational contingency '5121_B2_TOR608'. This project contributes approximately 4.66 MW to the thermal violation.

CONTINGENCY '5121_B2_TOR608'
OPEN BRANCH FROM BUS 238586 TO BUS 243024 CKT 1 / 238586 02BRKSID 138 243024
05HOWARD 138 1
END

25. (AEP) The V1-010 TAP-Melmore 138 kV line (from bus 892000 to bus 243039 ckt 1) loads from 194.36% to 203.32% (DC power flow) of its emergency rating (167 MVA) for the operational contingency '5240_B2_TOR4783_WOMOAB_V1-010B'. This project contributes approximately 14.96 MW to the thermal violation.

CONTINGENCY '5240_B2_TOR4783_WOMOAB_V1-010B'
OPEN BRANCH FROM BUS 242953 TO BUS 243110 CKT 1 / 242953 05AIRCO8 138 243110
05STIFFI 138 1


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OPEN BRANCH FROM BUS 242953 TO BUS 243137 CKT 1      / 242953 05AIRCO8 138 243137
05W.END 138 1
OPEN BRANCH FROM BUS 892010 TO BUS 243024 CKT 1      / 242984 05CHATFL 138 243024
05HOWARD 138 1
OPEN BRANCH FROM BUS 242984 TO BUS 243110 CKT 1      / 242984 05CHATFL 138 243110
05STIFFI 138 1
OPEN BRANCH FROM BUS 242984 TO BUS 245656 CKT 1      / 242984 05CHATFL 138 245656
CHATFIEL 69.0 1
OPEN BRANCH FROM BUS 243110 TO BUS 245630 CKT 1      / 243110 05STIFFI 138 245630 S
TIFFIN 69.0 1
OPEN BRANCH FROM BUS 242953 TO BUS 245602 CKT 1      / 242953 05AIRCO8 138 245602
AIRCO L8 12.0 1
OPEN BRANCH FROM BUS 245655 TO BUS 245656 CKT 1      / 245655 CARROTHR 69.0
245656 CHATFIEL 69.0 1
OPEN BRANCH FROM BUS 245656 TO BUS 245670 CKT 1      / 245656 CHATFIEL 69.0 245670
NEWWASH8 69.0 1
END

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26. (AEP) The Tiffin-Fremont Center 138 kV line (from bus 243130 to bus 243008 ckt 1) loads from 112.36% to 116.4% (DC power flow) of its emergency rating (205 MVA) for the operational contingency '5121_B2_TOR608'. This project contributes approximately 8.29 MW to the thermal violation.

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CONTINGENCY '5121_B2_TOR608'
OPEN BRANCH FROM BUS 238586 TO BUS 243024 CKT 1      / 238586 02BRKSID 138 243024
05HOWARD 138 1
END

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27. (AEP) The South Tiffin-S TIFFIN 138/69 kV transformer (from bus 243110 to bus 245630 ckt 1) loads from 103.58% to 104.64% (DC power flow) of its emergency rating (72 MVA) for the operational contingency '5243_B2_TOR4783C_MOAB'. This project contributes approximately 4.73 MW to the thermal violation.

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CONTINGENCY '5243_B2_TOR4783C_MOAB'
OPEN BRANCH FROM BUS 242953 TO BUS 243110 CKT 1      / 242953 05AIRCO8 138 243110
05STIFFI 138 1
OPEN BRANCH FROM BUS 242953 TO BUS 243137 CKT 1      / 242953 05AIRCO8 138 243137
05W.END 138 1
OPEN BRANCH FROM BUS 242953 TO BUS 245602 CKT 1      / 242953 05AIRCO8 138 245602
AIRCO L8 12.0 1
END

```

28. (AEP) The Melmore-Fostoria Central 138 kV line (from bus 243039 to bus 243006 ckt 1) loads from 211.43% to 217.63% (DC power flow) of its emergency rating (167 MVA) for the operational contingency '5149_B2_TOR709_WOMOAB'. This project contributes approximately 10.35 MW to the thermal violation.

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CONTINGENCY '5149_B2_TOR709_WOMOAB'
OPEN BRANCH FROM BUS 243008 TO BUS 243130 CKT 1      / 243008 05FREMCT 138 243130
05TIFFIN 138 1
OPEN BRANCH FROM BUS 243008 TO BUS 245614 CKT 1      / 243008 05FREMCT 138 245614
FREMNT C 69.0 1

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OPEN BRANCH FROM BUS 243130 TO BUS 245637 CKT 1      / 243130 05TIFFIN 138 245637
TIFFIN C 69.0 1
OPEN BRANCH FROM BUS 245620 TO BUS 245637 CKT 1      / 245620 GREELY 69.0 245637
TIFFIN C 69.0 1
OPEN BRANCH FROM BUS 245648 TO BUS 245637 CKT 1      / 245648 MAULE RD 69.0 245637
TIFFIN C 69.0 1
END

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29. (AEP) The Airco (North Central Co-Op)-West End 138 kV line (from bus 242953 to bus 243137 ckt 1) loads from 150.63% to 156.92% (DC power flow) of its emergency rating (167 MVA) for the operational contingency '5147_B2_TOR707_V1-010A'. This project contributes approximately 10.51 MW to the thermal violation.

```

CONTINGENCY '5147_B2_TOR707_V1-010A'
OPEN BRANCH FROM BUS 243006 TO BUS 243039 CKT 1      / 243006 05FOSTOR 138 243039
05MELMOR 138 1
OPEN BRANCH FROM BUS 243015 TO BUS 243039 CKT 1      / 243015 05GREENL 138 243039
05MELMOR 138 1
OPEN BRANCH FROM BUS 243024 TO BUS 892000 CKT 1      / 243024 05HOWARD 138 243039
05MELMOR 138 1
END

```

30. (AEP/FE) The Howard-Brookside 138 kV line (from bus 243024 to bus 238586 ckt 1) loads from 206.43% to 215.78% (DC power flow) of its emergency rating (173 MVA) for the operational contingency 'B_LINE1_SR_022'. This project contributes approximately 16.19 MW to the thermal violation.

```

CONTINGENCY 'B_LINE1_SR_022' /* GALION-GM MANSFIELD 138KV LINE OUTAGE
DISCONNECT BRANCH FROM BUS 238746 TO BUS 238758 CKT 1 /* 02GALION 138.00 02GM
MAN 138.00
END

```

31. (AEP/FE) The Howard-Brookside 138 kV line (from bus 243024 to bus 238586 ckt 1) loads from 249.96% to 262.57% (DC power flow) of its normal rating (133 MVA) for non contingency condition. This project contributes approximately 16.78 MW to the thermal violation.

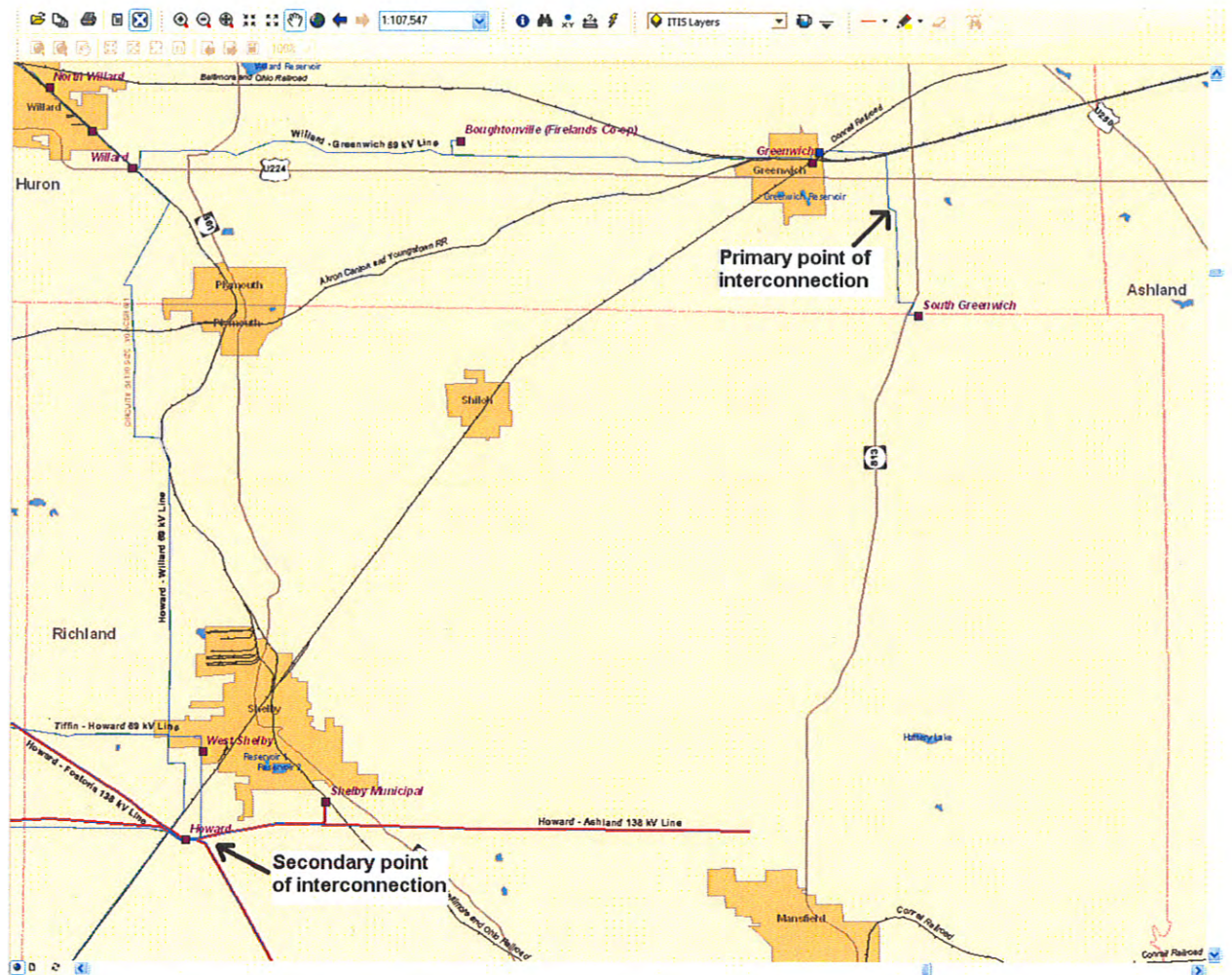


Figure 1: X3-023 Point of Interconnections

IPP X3-023

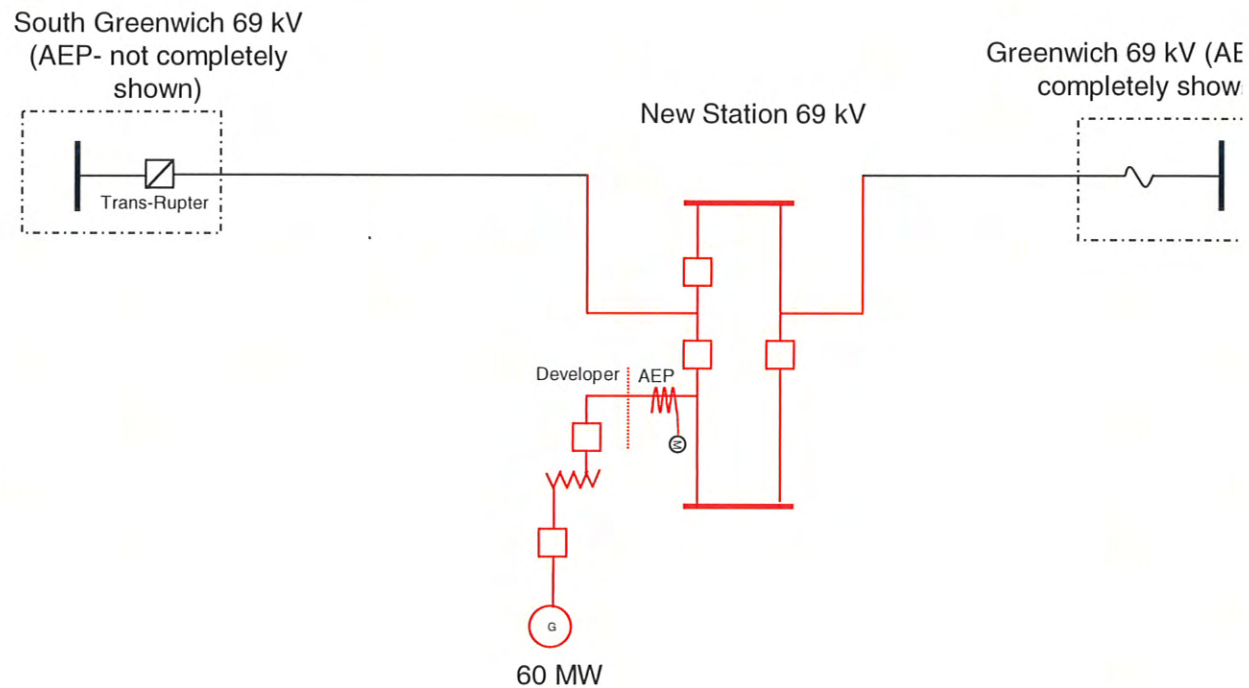


Figure 2: Simplified diagram of the primary point of interconnection

Future Howard 138 kV Station (Not Completely Show

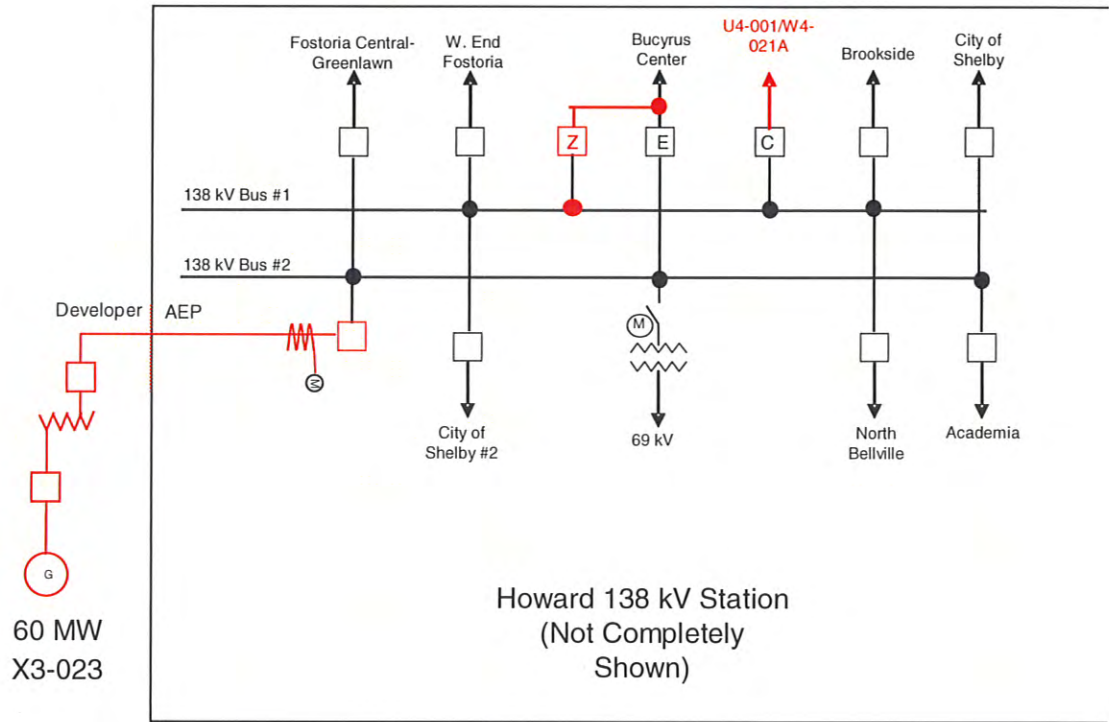


Figure 3: Simplified diagram of the secondary point of interconnection

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Summary: Application of 6011 Greenwich Windpark, LLC – Exhibits A, B, C and D
electronically filed by Teresa Orahod on behalf of Sally Bloomfield