4906-15-02 JUSTIFICATION OF NEED

(A) Need for the Proposed Facility

(1) Purpose of the Proposed Facility

The Knox Transmission Substation Project ("Project") and the associated East Akron-Sammis 138 kV Transmission Line loop to the Knox Substation is needed to reinforce the existing transmission system serving distribution and customer load from Knox, Bluebell, and Washington–CEC Substations. Further, the Project is needed to insure that the system is operated within PJM Interconnection, LLC ("PJM"), FirstEnergy, and North American Electric Reliability Corporation ("NERC") planning criteria. Knox and Bluebell substations are owned, maintained, and operated by ATSI or other FirstEnergy operating companies. The Washington-CEC Substation is owned by the Carroll Electric Cooperative, Inc. ("CEC") and is a wholesale interconnection between ATSI and the Carroll Electric Cooperative, Inc. Under contingency conditions, bus voltages at Knox and Washington-CEC Substations drop below planning criteria. Burger Generator Units #3, #4 and #5, which previously provided support to the area via the Burger-Knox 138 kV Transmission Line, have been retired and are no longer available to provide support. Looping the East Akron-Sammis 138 kV Transmission Line into the existing Knox Substation will provide support with two additional sources into Knox Substation, one from East Akron and one from Sammis.

The general geographic location of ATSI's facilities in the area of interest is shown in Exhibit 02-1. An electric one-line showing existing conditions is shown in Exhibit 02-2. The proposed future configuration is shown in Exhibit 02-3. Exhibits 02-1, 02-2 and 02-3 contain trade secret and proprietary information and/or critical energy infrastructure information. These Exhibits are being submitted separately to the Board under seal, pursuant to 18 C.F.R. § 388.112 concurrently with the Application. Knox Substation serves two Ohio Edison distribution substations (Fairmont and Lynchburg) and one customer substation (PCC Airfoils Inc.) radially at 69 kV. In addition, there are two networked 69 kV transmission lines between Knox and Bluebell Substations that serve five Ohio Edison distribution substations (Sebring, Westville, Southeast, Rockhill, and Beechwood) and two customer substations (Morgan Real Estate and Alliance Machine). Bluebell Substation also serves load radially at 69 kV, providing service to two Ohio

Edison distribution substations (Lexington and Sawburg) and five customer substations (B&W Research, TFW Acquisition, US Can, SanCap Abrasives and PTC Alliance). Under normal conditions, the entirety of this load is fed from three 138 kV to 69 kV transformers at Bluebell Substation and two 138 kV to 69 kV transformers at Knox Substation.

(2) System Conditions and Local Requirements

The facilities related to this this Application are shown in Exhibit 02-3. Knox Substation has two 138 kV feeds, the Burger-Knox and Bluebell-Knox 138 kV Transmission Lines. Until recently, generator units at Burger Substation provided a strong source to Knox Substation. Bluebell Substation is also a significant area source with four networked 138 kV lines in addition to the Bluebell-Knox 138 kV Transmission Line.

While the Burger generator units were operational, loss of Bluebell 138 kV bus did not severely impact the area served by Knox Substation. However, with the Burger generator units retired, loss of the Bluebell 138 kV bus will remove all of the 138 kV sources and all of the 138 kV to 69 kV transformation at Bluebell Substation. Under these conditions, Knox Substation is served radially out of Burger Substation and the two networked 69 kV transmission lines between Bluebell Substation and Knox Substation feed into the Bluebell 69 kV system in the geographic area surrounding Knox and Bluebell Substations. The total load being served in this pocket is approximately 140 MVA. The Burger-Knox 138 kV Transmission Line is approximately 70 miles long and provides a tapped feed to Washington-CEC Substation. Without the Burger generator units, the only support to Burger Substation is from Cloverdale Substation near Massillon, Ohio. The Burger-Cloverdale 138 kV Transmission Line is approximately 75 miles long. With Knox Substation fed from Burger Substation only, and the 69 kV systems being fed radially from Knox Substation, voltages in the area are depressed well below FirstEnergy Corp.'s planning criteria.

ATSI's evaluation of the requirements necessary to reliably operate and maintain its transmission system and provide adequate energy delivery to local areas is based on FirstEnergy's Transmission Planning Criteria, which are described as follows:

Contingency Planning:

The general contingency planning concept used in ATSI's transmission planning is the "n-1" philosophy, where "n" is the total number of transmission components in the network under study. This is generally referred to as first contingency planning and includes the simulation of removing a transmission component (a transmission line, transformer, or other element of the network) from service. A number of components can be simulated as being removed from service, provided they are removed one at a time. In a network study in which local generation is present, a transmission component outage may be simulated simultaneously with the outage of a local generating unit. Of concern in this power flow simulation are resultant power flows, voltage levels and generating unit stability following the transmission component outage. The computer model of the network under study includes those simultaneous inter-utility system power transactions that have been agreed upon by various transmitting and receiving utilities in the NERC.

Power Flow Criteria:

ATSI has developed power flow criteria for the elements of its transmission system that define the maximum normal and emergency rating for major pieces of equipment. The criteria for the major equipment is summarized below:

a. Transmission Lines

Normal and emergency conductor thermal ratings should not be exceeded during normal and contingency conditions, respectively. The ultimate transmission circuit capacity may be further limited by other elements such as breakers, switches, relays, or unusual ambient conditions.

b. Bulk Power Transformers

Bulk power transformers on ATSI's system typically have 345 kV high side and 138 kV low side nominal voltages. Normal load ratings for each specific bulk power transformer are developed based on seasonal conditions considering loss of life and thermal stresses and should not be exceeded during normal conditions. The loss of life concept is used to describe the shortening of the useful operating life of the transformer that occurs when transformers are overloaded. Transformers loaded above their rating are likely to become overheated which

results in an acceleration of the breakdown of the insulating materials in the transformer, which shortens the operating life of the transformer. Emergency load ratings specific to each bulk power transformer are also based on seasonal conditions considering loss of life and thermal stresses and should not be exceeded during contingency conditions. The emergency ratings are predicated on the peak permissible loading during the period when the emergency condition may occur and would result in increased transformer loading. Emergency condition time frames considered in this analysis may extend for several months to account for situations where the emergency condition is caused by the failure of another bulk transformer or other critical piece of equipment that would require a lengthy time period to repair or replace. Operating measures may be necessary in order to maintain transformer loadings within emergency ratings and might include interruptions to specific customers.

c. Area Transmission Transformers:

Area transmission transformers on ATSI's system typically have 138 kV high side and 69 kV or less low side nominal voltages. Ratings specific to each area transmission transformer are based on seasonal conditions considering loss of life and thermal stresses and should not be exceeded during normal conditions. Emergency ratings specific to each area transmission transformer are also based on seasonal conditions considering loss of life and thermal stresses and should not be exceeded during contingency conditions. The emergency rating is tolerated for up to 24 hours, assuming a mobile or spare transformer is available and could be installed while awaiting a permanent transformer repair or replacement. Otherwise the emergency rating applied corresponds to the period (months) utilized for bulk transformers. Operating measures may be necessary in order to maintain transformer loadings within emergency ratings and might include certain customer interruptions.

d. Bus Voltage Criteria

Normal substation bus voltages can range from 0.95 per unit to 1.05 per unit of nominal during on-peak and off-peak conditions. The minimum contingency

voltage is 0.92 per unit for all 345 kV, 0.92 per unit for networked 138 kV, and 0.90 per unit for all remaining transmission voltages. The maximum pre-to-post contingency voltage change is 0.08 per unit for 345 kV transmission substations, and 0.10 per unit for the remaining transmission substations.

(3) Load Flow Studies

Upon notification of FirstEnergy Solutions Corp.'s, a subsidiary of FirstEnergy Corp., intent to retire Burger Generator Units #3, #4 and #5, PJM initiated various studies using the PJM 2011 RTEP case, including evaluations of the baseline conditions prior to the unit retirements under normal operation and with various contingencies. ATSI reviewed the results of the studies and verified the results using the same 2011 RTEP case. Conditions following the generator unit retirements were also studied by ATSI under normal and contingency conditions and compared to the baseline. N-1 single element outage contingencies (NERC category B as defined in NERC Standard TPL-002) were considered as loss of two or more transmission elements (NERC category C1, C2, C3 and C5 as defined in NERC Standard TPL-003).

The studies conducted while Burger Generator Units #3, #4, and #5 were still in service indicated that the system operated within planning criteria under normal and contingency conditions in Bluebell/Knox area.

The studies conducted after FirstEnergy Corp. retired Burger Generator Units #3, #4, and #5 indicated that the system operates within criteria under normal conditions. However, if the Bluebell 138 kV bus is lost, low voltages are seen at the Knox and Washington-CEC 138 kV busses as well on the Knox and Bluebell 69 kV busses. The studies are summarized below as well in Table 02-1 provided at the end of this Section.

Exhibit 02-4: Normal System Configuration <u>Without</u> the East Akron- Sammis Transmission Line loop into Knox Substation.

Exhibit 02-4 shows normal transmission system configurations (as calculated during 2011 summer peak) without the East Akron-Sammis Transmission Line loop into Knox Substation. Exhibit 02-4 contains trade secret and proprietary information and/or critical energy infrastructure information. Exhibit 02-4 is being submitted separately to the

Board under seal, pursuant to 18 C.F.R. § 388.112 concurrently with the Application. As shown in Exhibit 02-4, the voltage level on the Knox 138 kV bus is at 135.1 kV (0.97 pu[1]), above the minimum acceptable contingency voltage level of 124.2 kV (0.9 pu). The Knox 69 kV bus is also above the minimum criteria of 62.1 kV (0.9 pu) at 69.3 kV (1.004 pu). Although not shown, the Bluebell 69 kV bus under these conditions is at 69.5 kV (1.007 pu).

Exhibit 02-5: Contingency 1 - Normal System Configuration Without the East Akron-Sammis Transmission Line loop into Knox Substation and an outage of the Bluebell 138 kV bus.

The contingency condition involving the loss of the Bluebell 138 kV bus is shown in Exhibit 02-5. Exhibit 02-5 contains trade secret and proprietary information and/or critical energy infrastructure information. Exhibit 02-5 is being submitted separately to the Board under seal, pursuant to 18 C.F.R. § 388.112 concurrently with the Application. In this scenario, the voltage on the Washington-CEC bus is 120.1 kV (0.87 pu) and the Knox 138 kV bus is 113.9 kV (0.83 pu). The Knox 69 kV bus is at 57.7 kV (0.83 pu). Although not shown the Bluebell 69 kV bus is at 56.0 kV (0.81 pu).

Exhibit 02-6: Normal System Configuration With the East Akron-Sammis Transmission Line loop into Knox Substation.

Exhibit 02-6 shows the base system conditions with the East Akron-Sammis 138 kV loop into Knox Substation. Exhibit 02-6 contains trade secret and proprietary information and/or critical energy infrastructure information. Exhibit 02-6 is being submitted separately to the Board under seal, pursuant to 18 C.F.R. § 388.112 concurrently with the Application. The voltage on the Knox 138 kV bus is 136.6 kV (0.99 pu) and at Bluebell bus is 136.1 kV (0.986 pu). The Knox 69 kV bus voltage is 69.96 kV (1.01 pu) and although not shown, the voltage on the Bluebell 69 kV bus is 69.69 kV (1.01 pu).

[1] Power-system quantities such as voltage, current, power, and impedance are often expressed in per-unit ("pu") or a ratio of actual value divided by a specified base value.

Exhibit 02-7: Contingency 1 - Normal System Configuration With the East Akron-Sammis Transmission Line loop into Knox Substation and an outage of the Bluebell 138 kV bus.

The contingency condition involving the loss Bluebell 138 kV bus with the East Akron-Sammis Transmission Line loop into Knox Substation is shown in Exhibit 02-7. Exhibit 02-7 contains trade secret and proprietary information and/or critical energy infrastructure information. Exhibit 02-7 is being submitted separately to the Board under seal, pursuant to 18 C.F.R. § 388.112 concurrently with the Application. In this scenario, the voltage on the Washington-CEC bus is 136.3 kV (0.988 pu) and on the Knox 138 kV bus is 135.4 kV (0.98 pu). The Knox 69 kV bus is at 68.88 kV (0.998 pu) and although not shown the Bluebell 69 kV bus is at 65.71 kV (0.95 pu). All voltages are within ATSI's Planning Criteria.

Exhibit 02-8: Normal System Configuration Without the East Akron- Sammis Transmission Line loop into Knox Substation and with a capacitor bank at Burger Substation.

The contingency condition involving the loss of Knox end of the Burger-Knox 138 kV Transmission Line shown in Exhibit 02-8. Exhibit 02-8 contains trade secret and proprietary information and/or critical energy infrastructure information. Exhibit 02-8 is being submitted separately to the Board under seal, pursuant to 18 C.F.R. § 388.112 concurrently with the Application. In this scenario, the voltage on the Washington-CEC bus is 145.7 kV (1.056 pu)

Exhibit 02-9: Normal System Configuration Without the East Akron- Sammis Transmission Line loop into Knox Substation and with an outage of the Bluebell-Canton Central 138 kV line.

The contingency condition involving the loss of Bluebell-Canton Central 138 kV line is shown in Exhibit 02-9. Exhibit 02-9 contains trade secret and proprietary information and/or critical energy infrastructure information. Exhibit 02-9 is being submitted separately to the Board under seal, pursuant to 18 C.F.R. § 388.112 concurrently with the Application. In this scenario, the Commerce-Highland 138 kV line loads to 104% of its

Summer Normal rating or 83% of its Summer Emergency rating and cannot be re-dispatched below its normal rating. All voltages are within ATSI's Planning Criteria.

Conclusion

The proposed Project eliminates the Criteria violations at Bluebell, Knox and Washington-CEC Substations and places all voltages and loading well within specified levels.

(4) Base Case Model Data

The base case model used in this study is PJM's 2013 RTEP case with loads scaled to forecasted 2011 load levels based on the PJM December 2009 load forecast. The model was based on the 2007 MMWG series load flow model. The format is in General Electric's Positive Sequence Load Flow data. An electronic copy of the base case is provided under separate cover to the OPSB Staff.

(5) Base Case Data for Natural Gas Transmission Line

As the proposed project is an electric substation project, this section does not apply.

(B) Expansion Plans

(1) Long-Term Forecast

The proposed project is described on pages 159-160 of the confidential portion of FirstEnergy Corp.'s 2012 Long-Term Forecast Report (LTFR) submitted to the Public Utility Commission of Ohio on April 16, 2012. The projected need date for the East Akron-Sammis Loop into Knox Substation in the LTFR is 2013 and is currently projected to be placed in-service by June 1, 2013.

The proposed Project is part of the PJM Regional Transmission Expansion Plan (PJM RTEP #b1692).

(2) Gas Transmission Lines and Associated Facilities

This application is for an electric substation. Therefore this section is not applicable.

(C) System Economy and Reliability

The proposed Project is necessary to ensure electricity system reliability in the Project Area. As a reliable electric system has a positive impact on quality of life and regional development, the Project is anticipated to have a positive impact on regional development.

(D) Alternate Analysis

The only practical alternative to the proposed Project was to install a capacitor bank at Burger to provide voltage support to Knox Substation when the 138 kV source from Bluebell Substation is lost. This solution relieved the low voltages on the 138 kV busses at Knox and Washington-CEC Substations, but it did not maintain 69 kV voltages within specified planning criteria. Additionally, at peak loads, a 138 kV cap bank is expected to cause a high voltage criteria violation at Washington-CEC Substation for the loss of the Knox end of the Burger-Knox 138 kV Transmission Line.

(E) Facility Selection Rationale

The installation of the proposed East Akron-Sammis 138 kV Transmission Line loop into Knox Substation Project will provide the needed reinforcement of ATSI's transmission system to maintain voltages within criteria even under contingency. The proximity of the East Akron-Sammis 138 kV Transmission Line to the Knox Substation makes it the best cost effective and least disruptive option to serve the local electric needs.

(F) Facility Schedule

(1) Schedule Bar Chart

The Applicants have developed a project schedule for the Preferred Site which is depicted on Exhibit 02-10. As reflected on that schedule, the Applicants propose to begin construction on the Project as early as December 1, 2012 and bring the Project on-line by not later than June 1, 2013.

(2) Delays

Delaying this project will result in potential low voltage conditions in the area of the Bluebell-Knox 69 kV system and the Washington-CEC 138 kV Substation. There are no operating procedures other than shedding load that will relieve the undervoltage condition.

Table 02-1

Area Evaluation for the Proposed East Akron-Sammis Transmission Line Loop into Knox Substation

Base Case	Condition/Contingency	Voltage/Loading Problems
Exhibit 02-4: Normal System Configuration Without the East Akron- Sammis Transmission Line loop into Knox Substation.	Normal Condition	All voltages and loading are well within acceptable levels
Exhibit 02-5: Contingency 1 - Normal System Configuration Without the East Akron- Sammis Transmission Line loop into Knox Substation and an outage of the Bluebell 138 kV bus.	Loss of the Bluebell 138 kV bus	Low Voltage: Washington CEC 138 kV – **120.1 kV** Knox 138 kV – **113.9 kV** Knox 69 kV – **57.7 kV** Bluebell 69 kV – **56.0 kV**
Exhibit 02-6: Normal System Configuration With the East Akron- Sammis Transmission Line loop into Knox.	Normal Condition	All voltages and loading are well within acceptable levels)
Exhibit 02-7: Contingency 1 - Normal System Configuration With the East Akron-Sammis Transmission Line loop into Knox Substation and an outage of the Bluebell 138 kV bus.	Loss of the Bluebell 138 kV bus	All voltages and loading are well within acceptable levels.
Exhibit 02-8 Normal System Configuration Without the East Akron- Sammis Transmission Line loop into Knox Substation and with a capacitor bank at Burger Substation	Loss of Knox end of the Burger-Knox 138 kV line	High voltage Washington-CEC 138 kV – 1.085 kV
Exhibit 02-9: Normal System Configuration Without the East Akron- Sammis Transmission Line loop into Knox Substation.	Loss of Bluebell-Canton Central 138 kV line	Commerce-Highland 138 kV line loads to 104% of SN 83% of SE and cannot be re-dispatched below its normal rating.

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Summary: Application Section 2 (File 2 of 18) electronically filed by Mr. Robert J Schmidt on behalf of American Transmission Systems Inc.