2/29/16

BEFORE THE
PENNSYLVANIA PUBLIC UTILITY COMMISSION

JOINT APPLICATION OF MID-ATLANTIC INTERSTATE TRANSMISSION, LLC ("MAIT"); METROPOLITAN EDISON COMPANY ("MET-ED") AND PENNSYLVANIA ELECTRIC COMPANY ("PENELEC") FOR: (1) A CERTIFICATE OF PUBLIC CONVENIENCE UNDER 66 PA.C.S. §1102(A)(3) AUTHORIZING THE TRANSFER OF CERTAIN TRANSMISSION ASSETS FROM MET-ED AND PENELEC TO MAIT; (2) A CERTIFICATE OF PUBLIC CONVENIENCE CONFERRING UPON MAIT THE STATUS OF A PENNSYLVANIA PUBLIC UTILITY UNDER 66 PA.C.S. §102; AND (3) APPROVAL OF CERTAIN AFFILIATE INTEREST AGREEMENTS UNDER 66 PA.C.S. §2102

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Direct Testimony
of
Jeffrey J. Mackauer

List of Topics Addressed

Overview of the Transmission Planning and Reliability Enhancement Process
Energizing the Future Program and the Need for MAIT
Proposed Projects and Operational Benefits
Other Benefits

DIRECT TESTIMONY
OF
JEFFREY J. MACKAUER

I. INTRODUCTION AND BACKGROUND

Q. Please state your name and business address.

A. My name is Jeffrey J. Mackauer. My business address is 76 South Main Street, Akron, OH 44308.

Q. By whom are you employed and in what capacity?

A. I am employed by FirstEnergy Service Company ("FESC") as Director of Transmission Planning & Protection.

Q. What are your current responsibilities?

A. I oversee all activities related to the development of projects for the ongoing planning and protection of the transmission systems of the FirstEnergy Corp. ("FirstEnergy") transmission-owning entities, including, among others, certain utility operating subsidiaries, namely Pennsylvania Electric Company ("Penelec"), Metropolitan Edison Company ("Met-Ed"), and Jersey Central Power & Light Company ("JCP&L") (collectively, the "Operating Companies"). My department also develops and maintains load flow, short circuit, and dynamic stability models and works with the staff of PJM Interconnection, L.L.C. ("PJM"), the Regional Transmission Operator ("RTO"), to assess transmission system reliability needs.

Q. Please describe your educational and professional background?

A. I received a Bachelor of Science degree in Electronics Engineering Technology from Missouri Institute of Technology in 1979 and have been a registered Professional Engineer in the Commonwealth of Pennsylvania since 1987. I have almost 30 years of

experience with FirstEnergy and its predecessor companies. My work experience is more fully described in my professional biography, which is attached as Appendix A.

Q. Have you previously testified in proceedings before the Pennsylvania Public Utility Commission (the "Commission")?

A. Yes. I testified on behalf of Penelec before Commission in Docket No. P-2008-2020257. I have also testified at FERC on behalf of American Transmission Systems, Incorporated ("ATSI") in Docket No. ER15-303-000.

Q. On whose behalf are you testifying in this proceeding?

A. I am testifying on behalf of Met-Ed and Penelec.

Q. Please describe the purpose of your testimony.

A. As explained in the direct testimony of Steven R. Staub (Joint Applicants' Statement No. 3), Met-Ed and Penelec are requesting Commission approval to contribute their transmission assets to Mid-Atlantic Interstate Transmission, LLC ("MAIT"), a newly-formed subsidiary of FirstEnergy Transmission, LLC ("FET"), in which the Operating Companies will own membership interests (the "Transaction"). MAIT will own and operate the transmission assets and construct, own and operate new transmission facilities in the service areas of the Operating Companies, which will be subject to the jurisdiction of the Federal Energy Regulatory Commission ("FERC"). MAIT will be a member of PJM and will furnish transmission service pursuant to PJM's Open Access Transmission Tariff ("OATT"). As discussed in the direct testimony of Charles V. Fullem (Joint Applicants' Statement No. 1), MAIT is also requesting that the Commission grant it public utility status. The purpose of my testimony is to describe the operational benefits

from a transmission system planning, operations and reliability perspective that will be realized from the Transaction and the future operation of MAIT. I also discuss benefits to the economy of the areas served by the Operating Companies.

Q. Please summarize the principal benefits of the proposed Transaction that you will discuss in more detail later in your testimony.

A. As explained by Mr. Staub in Joint Applicants' Statement No. 3, the formation of MAIT and the consummation of the Transaction will provide greater access to capital and lower borrowing costs, which will enable increased and accelerated investment in projects designed to enhance system reliability, customer service, capacity and resiliency for existing and new customers of the Operating Companies' transmission systems. The projects that will be undertaken include constructing new and upgrading existing transmission lines; constructing new and upgrading existing substations; enhancing the communications infrastructure; and modernizing the transmission system including physical and cyber security enhancements. As also explained later in my testimony, these projects will have a direct, beneficial impact on customer service. Additionally, the increased and accelerated levels of investment made possible by the formation of MAIT and the consummation of the Transaction will benefit the economy of Pennsylvania by spurring job creation and supporting vendors, suppliers and service providers in the state.

II. OVERVIEW OF THE TRANSMISSION PLANNING AND RELIABILITY ENHANCEMENT PROCESS

Q. Please explain how transmission investment decisions are made for the Operating Companies' Zones.

A. Transmission investment decisions for the Operating Companies' respective service territories within PJM, referred to as their "Zones," are made through FirstEnergy's Transmission Planning process and Reliability Enhancement process.

Q. Please describe the Transmission Planning process.

A. PJM, in its capacity as the regional Transmission Planning Coordinator, Transmission Planner and Transmission Operator, identifies the need and timing for transmission system upgrades to preserve the reliability of the electricity grid that is under its operational control as the RTO. PJM selects transmission system upgrades using its Regional Transmission Expansion Plan ("RTEP") process, which consists of a comprehensive series of detailed analyses to ensure that PJM's own reliability planning criteria and those of the applicable transmission owners (in this instance, the Operating Companies) are satisfied, which, in turn, satisfies the North American Electric Reliability Corporation ("NERC") and the ReliabilityFirst Corporation ("RF")[1] reliability standards with which the PJM and transmission owner criteria are designed to comply. The activities conducted under the transmission planning process are designed to adhere to good utility practice and ensure compliance with the aforementioned applicable reliability standards. Because its utility subsidiaries are members of PJM, much of FirstEnergy's transmission planning is conducted in coordination with PJM. FirstEnergy's transmission planning supports PJM's planning process while also providing additional analyses to

[1] RF is the organization responsible for enforcing the reliability criteria of the NERC.

confirm the validity of PJM's studies. In this regard, the Transmission Planning process and the RTEP projects selected for construction under that process are required by the applicable reliability and planning criteria and, once approved by PJM, are mandatory. In addition, FirstEnergy identifies transmission needs on the transmission systems of its subsidiaries and plans for future transmission investment through its own Reliability Enhancement process.

Q. Please describe the Reliability Enhancement process.

A. Unlike the Transmission Planning process, the Reliability Enhancement process is not mandated or directed by PJM. Instead, the Reliability Enhancement process is an internal process by which FirstEnergy strategically and proactively identifies transmission projects that are needed throughout the service territories of its utility subsidiaries that furnish transmission service, including the service territories of the Operating Companies, in order to maintain the reliability of the transmission system as a whole. The Reliability Enhancement process complements the preventative maintenance activities that FirstEnergy conducts on its transmission system. The projects that are identified through the Reliability Enhancement process are in addition to those identified in its Transmission Planning process.

III. ENERGIZING THE FUTURE PROGRAM ("EtF")

Q. What is the "EtF" program?

A. Energizing the Future or "EtF" is a FirstEnergy program that has as its goal improving transmission system reliability by building the transmission projects identified by the Transmission Planning and Reliability Enhancement processes. The current EtF program encompassing the Operating Companies' Zones is primarily focused on projects

identified through FirstEnergy's Transmission Planning process. FirstEnergy proposes to expand the EtF program to provide a more targeted focus on projects identified for the Operating Companies' Zones through the Reliability Enhancement process. The formation of MAIT and the consummation of the Transaction will enable the expansion of the EtF program to complete the FirstEnergy Reliability Enhancement process investments in an accelerated manner, which will, in turn, improve the reliability, capacity, operating flexibility and security of the transmission system for existing and new customers in the Operating Companies' Zones. Moreover, the financial benefits that Mr. Staub described in his direct testimony will allow MAIT to complete the transmission projects described later in my testimony sooner and in a more economically efficient manner.

Q. Please explain why the proposed expansion of the EtF program is needed.

A. Through the Reliability Enhancement process, it was determined that significant investment in the transmission facilities within the Operating Companies' Zones is needed to: (i) proactively upgrade or replace transmission lines and substation components that present an increasing risk to reliability; (ii) modernize the Operating Companies' infrastructure by taking advantage of technological advances that will help enhance reliability and promote increased efficiencies; (iii) increase or restore load serving capability; (iv) improve the resiliency of the existing transmission system to better withstand and recover from storms and unusual weather events such as extreme heat and cold; (v) address heightened concerns with cyber and physical security; (vi) reduce increasing maintenance expenses by installing new equipment with real-time monitoring capabilities that will optimize maintenance intervals and reduce maintenance

expenditures; (vii) address the imposition of increasingly more rigorous reliability standards by NERC and RF; and (viii) better address our customers' needs by reducing the duration and frequency of unscheduled outages.

These investment needs are largely driven by increased customer reliability demands. In addition, various changes on the transmission systems, including, among other factors, generation changes (*i.e.*, the retirement of existing generation facilities and the addition of new fossil fuel and renewable generating facilities); changes in load; increased reliance on demand-side resources; and the need for additional operational flexibility, enhanced system performance and/or safer operation of the transmission system have all contributed to the need for advancing these replacements and upgrades. Although some of these factors, such as generation changes, are addressed in the Transmission Planning process, the Reliability Enhancement process will further improve the operational flexibility of the transmission system to accommodate these changes. With regard to improving the resiliency of the existing transmission system, the Operating Companies' Zones are located in a region that has experienced both the severe impacts of significant storm events (such as Hurricane Irene and Superstorm Sandy) and unusual weather events such as the September 2013 Heat Wave and the Polar Vortex in February 2014.

Finally, there has been increasing concern at both the federal and state levels for the cyber and physical security of the transmission system. These concerns were initially triggered by the September 11, 2001 terrorist attacks and subsequently heightened by a physical attack on Pacific Gas and Electric Company's Metcalf substation on April 16, 2013. Due to these concerns, NERC has recently significantly raised its reliability

standards with regard to both cyber and physical security. Completing physical and cyber security projects are necessary to provide and maintain a reliable and secure transmission system.

Q. What is the general nature of the projects encompassed by the proposed expansion of the EtF program?

A. The proposed expansion of the EtF program will increase spending on projects designed to enhance reliability. They will include new, re-conductored, re-insulated, and refurbished transmission lines; new and upgraded substations (*i.e.*, new breakers, power transformers, instrument transformers and capacitors); and the installation of dynamic reactive resources (*i.e.*, new capacitors or static var compensators which quickly regulate system voltage). An enhanced fiber optic communications infrastructure to provide secure remote access to transmission substations will also be constructed. The projects generally fall into one or more of five categories, consisting of: (1) System Condition Projects; (2) System Performance Projects; (3) Operational Flexibility Projects; (4) Transmission Communications Infrastructure, Physical Security Enabling and Cyber Security Projects; and (5) Physical Security Projects. These projects and the benefits they will provide to customers in the Operating Companies' Zones will be discussed in more detail below.

Q. How will MAIT facilitate the expansion of the EtF program?

A. The deregulation of the electric utility industry has precipitated many changes in the way the electric grid is planned and operated. Factors such as PJM's RTEP process, the continuously changing generation mix, advancements in "green" generation technology and other non-traditional generation sources and increasing regulatory requirements are

some examples of forces creating the need for greater levels of grid reliability, security, coordination and flexibility to assure safe and reliable transmission of electricity on a non-discriminatory basis. The creation and expansion of independent RTOs, such as PJM, helps to address some of those challenges by augmenting what previously had been largely a localized planning function performed by individual transmission owners with a more centralized approach aimed at optimizing the performance of the transmission system to provide greater access, capacity, reliability and market efficiency.

The proposed Transaction is also designed to address the kinds of challenges to the transmission system that I summarized above. Specifically, the formation of MAIT and the consummation of the Transaction will consolidate the transmission assets of the three Operating Companies in one entity that has a singular focus on efficiently and effectively operating, maintaining and, where necessary, expanding, its transmission system. Additionally, as Mr. Staub explains, consolidating the Operating Companies' transmission assets in MAIT is expected to improve MAIT's credit metrics as compared to those of the Operating Companies and, in that way, permit MAIT to increase and accelerate its investment in the kinds of transmission projects described later in my testimony.

IV. PROPOSED PROJECTS AND OPERATIONAL BENEFITS

Q. Please describe the types of System Conditions Projects that MAIT plans to undertake.

A. MAIT plans to undertake substation and transmission line projects designed to upgrade and modernize the existing transmission system equipment to better respond to current demands and changing transmission system conditions.

Identifying needed projects begins with a condition-based assessment of FirstEnergy's transmission assets that examines the criticality, health, and risk of failure to determine which in-service and spare equipment assets should be replaced or enhanced. The assessment considers factors such as equipment reliability, maintenance program findings, age, the availability of technical support from the equipment manufacturer, spare parts availability, and high maintenance costs. While age alone is not a determinative factor in the assessment process, it is considered in conjunction with these other factors listed above. FirstEnergy evaluates the condition of transmission assets to determine whether replacement would improve reliability, decrease customer outage time, reduce maintenance costs, or provide some combination of these benefits. Assets are considered for replacement based on safety, reliability and whether the equipment can be maintained.

Assets that are at or near the end of their expected service lives are targeted for potential replacement, especially if they are currently experiencing higher than expected maintenance costs. Additionally, equipment that is no longer manufactured or supported by vendors will also be targeted for potential replacement, since it may not be possible to replace the equipment quickly if it fails. Replacing these types of assets improves operating performance and streamlines maintenance procedures.

Additionally, projects designed to modernize the existing grid can include replacing analog, digital, or electromechanical equipment with microprocessor equipment when doing so will provide maintenance or operational benefits.

Typical System Condition Projects include:

(a) **Replacing older vintage oil-insulated and gas-insulated breakers**. These types of breakers are having condition problems such as leaks and issues with mechanism malfunctions. The lack of available spare parts requires FirstEnergy to make substantial expenditures on costly remanufactured parts. Proactively replacing these types of breakers under MAIT will improve reliability and reduce maintenance expenses. In addition, these breaker replacements will offer a more environmentally friendly medium utilizing small amounts of gas instead of the thousands of gallons of oil required by existing oil-filled breakers and, in the case of existing gas-insulated breakers, avoiding the leaks to which they are prone, particularly in cold weather.

(b) **Replacing transformers**. Older vintage oil-cooled transformers often develop leaks from heating and cooling cycling caused by loading and seasonal weather patterns. This exposes the oil to moisture and oxygen, which accelerates the deterioration of the dielectric and thermal capabilities of the oil. When this occurs, the transformers run hotter, which lowers their capacity and makes them more susceptible to failure. Replacement transformers offer on-line monitoring of the oil chemistry and use improved gasket materials to better seal the unit. These improvements make the transformers more reliable and less likely to be de-rated, which reduces system capacity and creates various operational problems.

(c) **Upgrading and rebuilding transmission lines**. Over the past several years, a few transmission lines have tripped multiple times throughout the year and no obvious reason was found notwithstanding the extensive aerial and foot

patrols that were conducted to examine the lines. FirstEnergy believes that batches of line insulators purchased at certain times in the past are the likely cause and that all the insulators in those batches should be proactively replaced.

Another transmission line issue has been attributed to the legacy design of older transmission lines. This older design sometimes results in one phase conductor contacting another phase conductor, the static ground wire, or an off right-of-way tree during high wind events. This results in multiple outages per year, which directly affects thousands of customers. MAIT will proactively re-design and/or re-construct transmission lines experiencing these types of issues from the increased debt financing capability associated with the Transaction, which will improve customer service and make the transmission system more resilient.

(d) **Installation of real time transformer and circuit breaker monitoring.** When circuit breakers operating at voltages of 345 kV and above and power transformers are replaced, circuit breaker and transformer monitoring is installed along with the new equipment, thereby modernizing the transmission infrastructure. Transformer monitors provide on-line monitoring of bushings, pumps, fans, the presence of gas in the cooling oil, and oil and winding temperatures, and they use advanced algorithms to determine how much load the transformer can carry. Monitoring for the types of circuit breakers described above provides on-line gas pressures, the timing of the closing and opening of the mechanism, interrupter wear and the operations count (i.e.,

how many times the breaker opens and closes). This information will provide the ability to know remotely when there is a minor problem with these assets while they are still in service and to take action earlier to repair the minor problem before it becomes a major problem.

(e) **Replacing older vintage relays.** There are numerous older vintage relays that are in-service but are no longer supported by the manufacturer and, therefore, replacement parts are not available. When preventative maintenance is conducted, these relays are difficult to calibrate and to maintain within their specifications. New digital microprocessor relays incorporate advanced technology features that give protection engineers the ability to view fault record events and relay settings remotely, and reduce maintenance requirements. Replacing older vintage relays with modern relays will improve reliability by eliminating the potential for relay malfunctions.

(f) **Replace Coupling Capacitor Voltage Transformers ("CCVTs").** When CCVTs fail, they tend to do so violently and typically clear the substation bus on which they are monitoring the voltage. This results in increased numbers of unscheduled outages that impact multiple transmission lines and transformers (i.e. customer service). Additionally, collateral damage to other equipment can occur that would lengthen outages. Industry recommendations suggest considering the replacement of CCVTs that are 25 years old and older because at that age they tend to exhibit higher failure rates. Proactively replacing CCVTs that have reached the recommended threshold for

replacement will improve reliability and safety by decreasing the risk of failure and collateral damage.

Q. How will System Condition Projects benefit customers?

A. These projects are designed to enhance reliability by reducing the frequency and/or duration of customer outages. They can also reduce maintenance costs, saving customers' money, or address environmental concerns. The transmission infrastructure will be renewed by the addition of increased automation and the addition of new analytic monitoring systems. These projects will also provide increased control and flexibility in operations that, in turn, will contribute to improved reliability through faster response times and shorter outages.

Q. Please describe the types of System Performance Projects that MAIT plans to undertake.

A. System Performance Projects are designed to enhance transmission system performance by increasing automation in order to provide more visibility into the status of the system. Increased visibility will increase the speed at which operators can respond to system conditions and restore service in the event of outages. FirstEnergy evaluates transmission lines that serve larger numbers of customers and higher amounts of load to determine the need for additional or enhanced facilities to reduce the frequency and/or duration (i.e. restoration time) of outage events.

Typical System Performance Projects include:

(a) **Installing Supervisory Control and Data Acquisition ("SCADA") to switching devices.** FirstEnergy plans to add more automation to transmission

switches to provide remote sectionalizing capability in order to facilitate faster restoration of service to customers after an outage event.

(b) **Strategically installing breakers or automatic sectionalizing switches at tapped substations**. An outage of a transmission line serving one or more tapped substations would cause the loss of power to all of the tapped substations served from that line. When breakers are installed at a tapped substation along that line, those breakers convert a single long line into two shorter lines. As a result, an outage on one of the shorter lines will not cause the tapped substation with breakers to lose power because the other shorter line will supply the load. Also, other customers served on one of the shorter lines will also experience fewer outages because they will be affected only by an outage of the shorter line that serves them. When automatic sectionalizing switches are installed at a tapped substation along that line, the automatic sectionalizing switches convert a single long line into two shorter line segments. As a result, an outage on one of the shorter line segments will only cause the tapped substation with automatic sectionalizing switches to lose power for less than one minute until the automatic sectionalizing scheme can determine which of the shorter line segments will supply the load. Also, other customers served on one of the shorter line segments will also experience fewer outages (greater than one minute) because they will be affected only by an outage of the shorter line segment that serves them.

Q. **How will System Performance Projects benefit customers?**

A. These projects are designed to increase operational visibility into system status and conditions (i.e. improve situational awareness) through the use of more SCADA equipment. Increased visibility will aid in analyzing and responding to system events. The addition of breakers or automatic sectionalizing switches at tapped substations will provide reliability benefits by increasing the speed of system restoration and reducing the frequency and duration of outages experienced by customers.

Q. Please describe the types of Operational Flexibility Projects that MAIT plans to undertake.

A. Operational Flexibility Projects are designed to improve reliability for existing customers and increase capacity to accommodate the loads of both existing and new customers. FirstEnergy reviews the existing configuration of radial-feed transmission lines that are subject to more frequent outages and outages of longer duration than those that are loop fed to determine if the radial lines should be looped to the rest of the network. FirstEnergy also reviews long, critical or three terminal transmission lines to determine if they should be re-configured.

FirstEnergy reviews the existing transmission facilities in areas of the system where it has been unable to quickly accommodate increased or new load or where it anticipates increased or new load will be added in the future. Improvements that can enable the transmission system to meet anticipated customer demands are assessed.

Typical Operational Flexibility projects include:

(a) **Converting radially fed substations to be network fed substations.** These types of projects provide redundant sources of power into the substation, decreasing the duration and frequency of customer outages. In addition, these

projects allow for maintenance to be performed on the transmission line, transmission line breakers, substation bus, etc. without an interruption of service to the customers. This will also add load serving capability and increase the system operating margin.

(b) **Converting a three terminal transmission line to two independent transmission lines.** This type of project will improve reliability by eliminating a three terminal transmission line with its potential for protective relay malfunctions. Such malfunctions are an industry-recognized concern. By converting the transmission line to two transmission lines, the potential risk exposure for customers directly fed from the lines and for sources feeding lower voltage systems will be proportionally reduced.

Q. How will Operational Flexibility Projects benefit customers?

A. These projects will add operational flexibility to the transmission system and provide the following benefits:

(a) More flexibility with outage scheduling and switching during scheduled maintenance periods. The increase in flexibility will create additional operational alternatives for addressing transmission outages.

(b) Enhanced ability to address future unexpected shifts in generation, increased system loading and/or uncertainties in generation availability by increasing the robustness of the system. These types of projects will enable faster and more efficient responses to economic development needs for additional capacity, and will foster the building of transmission facilities in advance of known loads to support load growth.

Q. Please describe the Transmission Communications Infrastructure, Physical Security Enabling and Cyber Security Projects that MAIT will undertake.

A. The Transmission Communications Infrastructure, Physical Security Enabling and Cyber Security Projects consist of targeted investments to upgrade legacy transmission network communication equipment, improve the reliability and capability of critical transmission communications (*e.g.*, SCADA equipment), enable increased physical security automation, and provide increased cyber security protection for vital transmission assets.

Reliable transmission system operations depend on fully capable and reliable communications systems. Risks to communications equipment include exposure to system-wide events, growing security threats, rapid escalation of costs, and decreasing reliability associated with leased line circuits and obsolescence. The projects in this category will enhance the existing communications infrastructure to make it more adaptable to changing demands in capacity, reliability, and/or security. The projects will further reduce dependence on leased communication circuits, which are still used to communicate to the SCADA equipment in many of the Operating Companies' more critical substations, thereby reducing the likelihood of extended outages due to factors outside the control of MAIT.

Typical projects in this area include:

(a) **Transmission Communications Infrastructure.** To support a further integration of the transmission substation network, fiber optics and digital microwave systems will be expanded whenever possible to key locations to reduce dependence on third-party legacy communication services such as leased two and four wire communication circuits. Since third-party legacy

communication services are quickly becoming obsolete and have degrading reliability, they are being phased-out by telecommunications carriers. Remote Terminal Units at selected transmission substations will be upgraded to the latest technology standard in order to improve the reliability of this SCADA equipment as well as to provide diversity (*i.e.*, redundancy) in the communication path back to the FirstEnergy transmission control center via the SCADA system.

(b) **Transmission Physical Security Enabling**. MAIT will extend high bandwidth communications capability to equipment at critical sites enabling substation equipment such as high-definition/infrared cameras and/or asset health monitors to be viewed remotely.

(c) **Transmission Cyber Security**. MAIT will enhance the use of firewalls, data encryption and monitoring/event correlation on multiple cyber systems using advanced technologies for additional infrastructure modernization and to eliminate/minimize vulnerabilities to ever evolving physical and cyber-attacks.

Q. How will Transmission Communications Infrastructure, Physical Security and Cyber Security Projects benefit customers located in the Operating Companies Zones?

A. These projects will improve the reliability, security, and capability of the communications systems that are required to monitor, control, and protect the transmission system. The resulting increased bandwidth will enable future security camera feeds at key locations to proactively identify possible physical attacks at critical

substations and deploy law enforcement before damage is done. Upgrading equipment, as discussed above, will also reduce maintenance costs and save customers money because it reduces overtime callouts for failed communications equipment as well as repair costs. Modernizing the communications infrastructure will mitigate the increasing frequency of failures.

Q. Please describe the Physical Security Projects that MAIT will undertake.

A. Physical Security Projects are being undertaken to maintain or enhance the physical security of transmission assets. To proactively address safety (perimeter security), copper theft, vandalism and other mischievous acts at substations, an increased level of physical security is needed. Better situational awareness in the substation environment requires integrated security management systems. Therefore, security technology will be incorporated in substation design to deter, detect, delay, monitor, communicate and respond to potential physical threats and vulnerabilities at a substation's perimeter taking into account the history and sensitivity of the asset being protected.

Typical Physical Security Projects include:

(a) Upgrading or replacing chain-link fencing;

(b) Installing physical key locks;

(c) Installing motion or heat actuated camera systems that electronically alert and monitor security personnel of the need for immediate response and investigation;

(d) Installing video analytics cameras (thermal and high definition) at more critical facilities;

(e) Utilizing technology advances such as card access systems; and

(f) Installing physical protection upgrades such as "no cut/no climb" perimeter fencing, gate locking systems, latch monitoring hardware, and other protective barriers.

Q. How will MAIT's investment in Physical Security Projects benefit customers located in the Operating Companies' Zones?

A. In addition to enhancing reliability, Physical Security Projects will provide enhanced situational awareness and alerting on potential threats to critical substation assets. This program further safeguards the public from electrical hazards and deters criminal activity with the presence of security systems. These security system investments enable faster detection of events and implementation of measures to deter or slow attackers so that impacts can be minimized or prevented by much quicker law enforcement response. The formation of MAIT establishes a mechanism to encourage greater investment in the transmission system, with the accompanying benefits that result from hardened physical security protections and monitoring for those transmission assets. The goal is to establish upgraded communications, which would enable greater use of technology for physical security such as high-definition cameras that require higher bandwidth.

Q. Can you please summarize the principal benefits of the proposed projects that MAIT will undertake and which you have discussed in your testimony?

A. Yes. The projects that will be undertaken include constructing new and upgrading existing transmission lines and substations; enhancing the communications infrastructure; and modernizing the transmission system including physical and cyber security enhancements. As I explained in my testimony, the projects generally fall into one or more of five categories and will have a direct beneficial impact on customer service.

System Condition Projects will serve to enhance system reliability. Some will reduce the frequency and/or duration of customer outages (*i.e.*, improving customer service). Others will reduce maintenance costs, increase safety, modernize the system or address environmental concerns.

System Performance Projects will help to increase operational visibility into system status and conditions (*i.e.*, improve situational awareness), which will enable quicker analysis and response to system events. The addition of breakers or automatic sectionalizing switches at tapped substations will provide reliability benefits to customers by increasing the speed of system restoration and, more importantly, will reduce the frequency and duration of outages (*i.e.*, improving customer service).

Operational Flexibility Projects will provide more flexibility and reliability with both scheduled and unscheduled outages. They will also add load serving capability and increase the system operating margin to better respond to future unexpected shifts in generation and/or system loading through a more robust transmission system.

Transmission Communications Infrastructure, Physical Security Enabling and Cyber Security Projects will improve the reliability, security, and capability of the communications systems required to monitor, control, and protect the transmission system. Such improvements will also help to reduce maintenance costs, overtime callouts and the frequency of failures.

Physical Security Projects will both enhance reliability and situational awareness by enabling earlier identification of potential threats to critical substation assets. This will further safeguard the public from electrical hazards and deter criminal activity with the presence of security systems through faster detection of events and quicker response

measures. These projects will also result in hardening of transmission system physical security protections and monitoring for transmission assets.

VI. OTHER BENEFITS

Q. What are MAIT's transmission capital investment plans?

A. As explained by Mr. Staub (Joint Applicants' Statement No. 3), MAIT plans to invest in its existing transmission infrastructure between $ 2.5 to $ 3.0 billion over the next five to ten years.

Q. Will the increased and accelerated levels of investment by MAIT create jobs in the Met-Ed and Penelec Zones?

A. Yes. The increased and accelerated levels of transmission investment that MAIT will enable will benefit the economy of Pennsylvania by creating jobs and by supporting vendors, suppliers and various service providers. Initial assessments of the additional engineering, material management, project management and construction services to implement the expanded EtF transmission program outlined above estimate the need for over 200 jobs for qualified personnel in the states covered by the Operating Companies' Zones.

Q. Does this conclude your testimony?

A. Yes, it does, at this time.

APPENDIX A

Biography

Jeffrey J. Mackauer

Director of Transmission Planning & Protection

Mr. Mackauer is Director of Transmission Planning & Protection at FirstEnergy Service Company, a direct, wholly-owned subsidiary of FirstEnergy Corp. ("FirstEnergy"), a position he has held since 2012. In this role, he oversees activities related to the development of projects for the ongoing planning and protection of the transmission systems of FirstEnergy's transmission-owning entities, which include Pennsylvania Electric Company, Metropolitan Edison Company, and Jersey Central Power & Light Company. His group develops and maintains load flow, short circuit, and dynamic stability models and works with the PJM Interconnection, L.L.C. ("PJM") staff to assess transmission system reliability needs. His group also ensures compliance of these activities with the North American Electric Reliability Corporation ("NERC") and Reliability*First* Corporation ("RF"), for purposes of ensuring electric reliability under rules administered by the Federal Energy Regulatory Commission ("FERC").

Prior to his current position, Mr. Mackauer was a General Manager/Manager of Transmission Planning at FirstEnergy from 2006 to 2012, the Manager of Transmission System Operations from 2004 to 2006, and a Manager/Consultant of the Energy Management System ("EMS") from 2002 to 2004. From 1985 to 2001, he was employed by GPU, Inc. gaining experience in most areas of the EMS (including several years in Power Network Applications) working up to the position of Engineer Senior II. He was a Substation Relay Engineer at the City of Dover (Delaware) Electric Department in 1984. He started his career with the Florida Power and Light Company, from 1979 to 1983 as a field engineer in the System Protection group installing and maintaining protective relays.

Mr. Mackauer's involvement in the industry has included, among other things: PJM committees (*i.e.* Planning, Transmission Expansion Advisory Committee and Operating); PJM sub-committees (*i.e.* System Information and Data Management); and Reliability*First* (*i.e.* Reliability Committee Vice Chair and Special Protection System review team). He served as Chapter Director for the Reading Chapter of the Pennsylvania Society of Professional Engineers and as Chairman of the Siemen's Advanced Applications Working Group. He has had two articles published in the *Transmission & Distribution* magazine: "RTU Programmable Test Instrument Proves To Be Valuable And Versatile," published in 1991, and "Integrated Substation Automation System Design," published in 2000. He also co-authored a paper titled "The Dispatcher Training Simulator for Metropolitan Edison Company" in 1995.

Mr. Mackauer holds a Bachelor of Science degree in Electronics Engineering Technology from Missouri Institute of Technology. He has been a Registered Professional Engineer in the state of Pennsylvania since 1987.

Mr. Mackauer has prepared and presented testimony in the following regulatory proceedings:

I. REGULATORY AGENCY	Docket No.
Pennsylvania Public Utility Commission	P-2008-2020257
FERC	ER15-303-000