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August 24, 2015

Alice Lippert
Office of Electricity Delivery and Energy Reliability
U.S. Department of Energy
Forrestal Building, Room 1E – 078
1000 Independence Avenue SW., Washington D.C. 20585

Re: Transformer Reserve - FirstEnergy Corp. Comments on DOE's Request for Information (RFI) on the National Power Transformer Reserve

Dear Ms. Lippert:

Please find enclosed FirstEnergy's comments on DOE's RFI on a National Power Transformer Reserve program.

If you have any questions, please contact Mr. Shawn Gehring at 330-384-2598 or email at gehrings@firstenergycorp.com.

Sincerely,

Carl J. Bridenbaugh

Carl Bridenbaugh
Vice President, Transmission
FirstEnergy Corp.

FirstEnergy Corp. Comments on DOE's Request for Information (RFI)
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INTRODUCTION

FirstEnergy (FE) is a diversified energy company dedicated to safety, reliability and operational excellence. Its 10 electric distribution companies form one of the nation's largest investor-owned electric systems, serving customers in Ohio, Pennsylvania, New Jersey, West Virginia, Maryland and New York. Its generation subsidiaries control nearly 17,000 megawatts of capacity from a diversified mix of scrubbed coal, non-emitting nuclear, natural gas, hydro and other renewables.

FE appreciates the opportunity to provide comments on DOE's Request for Information (RFI) on a National Power Transformer Reserve. FE is an active member of the Edison Electric Institute (EEI) and incorporates their comments herein by reference.

QUESTION ONE: PROGRAM NEED

Is there a need for a National Power Transformer Reserve? How would such a reserve affect the reliability and resiliency of the North American bulk power system? Are there alternatives to a power transformer reserve program that can help ensure the reliability, resiliency, and recovery of the bulk power system? Is there a need for a nationally-maintained inventory of large power transformers?

Utilities currently retain spare Large Power Transformers (LPTs) for operational needs (failures, vandalism, weather, etc.). Programs such as the EEI Spare Transformer Equipment Program (STEP), Spare Connect, and the recently announced Grid Assurance Program provide additional LPTs resources for catastrophic events. Additionally, utilities have other resources available from Original Equipment Manufacturers (OEMs), third party transformer vendors, and units removed during ongoing system upgrades or expansions. Given the above, we believe a National Power Transformer Reserve would be duplicative at this time. If the Grid Assurance Program is unsuccessful, a National Reserve concept may need to be revisited.

As background, the STEP program is a pool of LPTs in various voltage classes and sizes (Megavolt-amps or MVA) located at member utilities throughout North America. STEP members have predefined obligations and the ability to obtain LPTs from the STEP pool, or "call rights", under predefined conditions. The Spare Connect Program is less formal, but also provides utilities a mechanism to acquire LTPs. Both programs require that utilities have

physical assets in order to participate. Additional benefits of these programs include, but are not limited to, the following: LPTs are not centralized but strategically located across North America; thus, the strategic locations provide the ability to turn over inventory and maintain modern equipment. Additionally, STEP members continually network with one another, conduct annual meetings, and implement drills/exercises to test the resiliency and responsiveness of the STEP program and to identify gaps. A national power transformer reserve would be an additional program targeted to strengthen the Bulk Power System (BPS), but it is important to consider that the existing programs have been designed to ensure the BPS remains reliable and resilient.

FE does not anticipate that a National Power Transformer Reserve would have a significant positive impact on reliability or resiliency. However, it could result in less reliability if utilities reduce the number of operational spares and rely more on a "national reserve" pool.

As previously discussed, there are other programs already in place that ensure reliability, resiliency, and recovery of the BPS. These include the current EEI STEP and Spare Connect programs as well as the recently announced Grid Assurance Program. Additionally, large utilities have built in capacity on their systems, allowing them, if necessary, to move in-service transformers around as yet another alternative to support resiliency.

Existing industry programs ensure the reliability, resiliency and recovery of the BPS, therefore we do not see a significant need for another program that creates an additional national inventory of LPTs. Should such an additional program be developed, it should support and not replace existing industry programs.

QUESTION TWO: POWER TRANSFORMER CRITERIA

What types and sizes of power transformers should be considered for inclusion in a transformer reserve program versus operational spare capacity? What are the design considerations for replacement transformers to support the bulk power system?

If an additional National Reserve Program were to be implemented, transformers in the most common and widely used voltage classes and MVA ratings (capacity) would be a good starting point. The focus should target large Extra High Voltage (EHV) auto-transformers (345 kV and

above) that tend to be larger and require greater care during transporting, assembly, commissioning, and testing. Generator Step Up (GSU) transformers should be excluded from this program. GSU transformers are not transmission assets and are typically not owned or controlled by transmission owners.

There are various design considerations, with the most critical being voltage, MVA rating (capacity), physical size, and impedance. Greater flexibility in designs may be acceptable for transformer(s) only being used for "temporary" recovery from high impact low frequency (HILF) events and not for long term operation.

QUESTION THREE: OWNERSHIP AND ECONOMICS

What would be an appropriate structure for procuring and inventorying power transformers? How, and by whom, should a program of this type be administered? How would a transformer reserve be funded?

Local utilities should retain ownership and administration of any such program and have the ability to receive full cost recovery for the procurement and ongoing maintenance under any required program(s) that create a national reserve of LPTs. Since local utilities have both the operational and technical understanding of their BPS, including loading, operations, maintenance, response time, etc., they should control these resources, specifically LPT spares. Additionally, any such programs would have to provide benefits to the local utilities' customers who ultimately bear the associated costs.

QUESTION FOUR: TECHNICAL CONSIDERATIONS

Is it technically feasible to develop a reserve of large power transformers when most are custom engineered? Is additional research and development (R&D) necessary to develop suitable replacement transformers that can be rapidly deployed from inventory in the event of an emergency?

LPTs are engineered to optimize the performance of the local electric system within voltage classes and designs are typically standardized within a utility's fleet. Transformers in the EEI STEP and Spare Connect programs have demonstrated that it is technically feasible to share transformers within voltage classes. The development of an additional transformer reserve program needs to consider technical and operational issues, concerns of member utilities, an understanding of the risks being mitigated, and limitations of such a program.

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The development of suitable replacement transformers would require further discussion on design, applications, transportation, expected recovery times, costs, and partnerships with the industry. The development of transformers for "temporary" recovery from high impact, low frequency (known as "HILF") events and not as "final solutions" may be technically feasible and capable of being deployed in less time. It is important to note that any such transformers would have very limited applications, would be less efficient, result in sub-optimization of the BPS, require larger footprints, and be more costly to purchase, own, and operate.

QUESTION FIVE: PROCUREMENT AND MANAGEMENT
How should procurement, maintenance and management of the reserve power transformers be conducted? For example, should manufacturers be pre-qualified, and if so, according to what criteria?

If such a program were to be implemented, member utilities need to receive full cost recovery for development and ongoing maintenance. Agreement among member utilities is paramount in establishing standards and oversight. FE pre-qualifies its vendors based on design knowledge, quality and capabilities of manufacturing facilities, workmanship, delivery schedules, costs, and warranty and has a large vendor base for various LPTs. Any such program should establish similar parameters.

QUESTION SIX: SUPPLY CHAIN
What are the critical supply chain components for the manufacture and delivery of large power transformers (e.g., electrical steel, copper, silicone, high voltage bushings, etc.)? Are there shortages or other considerations that could necessitate using the Defense Production Act Priority Ratings to ensure sufficient parts are available in a time of need? Are there related skilled workforce issues?

Presently, FE is not experiencing any critical supply chain issues with our LPT vendors or skilled workforce issues. However, there are potential areas of concern. One area of concern is the increase in demand for electric core steel, which is used not only for LPTs, but also in the small distribution and pole/pad mounted transformer markets. The other area is availability/lead times for new or replacement bushings, which tend to be specific to each transformer.

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QUESTION SEVEN: MANUFACTURING

Is there adequate manufacturing capacity to support a transformer reserve program? What is the lead time for engineering, manufacture, and delivery of large power transformers? Are there approaches that could help to speed manufacture and delivery of large power transformers?

There is adequate manufacturing capacity to support a transformer reserve program. Manufacturing capacity worldwide and in North and South America has not been an issue. In addition, more transformer manufacturers have or are in the process of increasing national manufacturing capacity.

In regard to lead times for engineering, manufacturing, and delivery of LPTs, nominal lead times range from 9 to 18 months dependent on voltage rating and size (MVA).

There may be some opportunities to improve manufacturing and delivery times of LPTs through more standardization between and/or with transformer manufacturers and their suppliers as well as the railroads.

QUESTION EIGHT: TRANSPORT AND DEPLOYMENT

What specialized transport infrastructure would be necessary to ship large power transformers from manufacturing site to storage locations, and from storage locations to field site in the event of an emergency? What should be the number and location of transformer storage sites? What are feasible delivery times for LPTs that reside in a reserve to an affected site?

Permitting by state and local agencies and the aging infrastructures (roads and bridges) are some of the biggest challenges when moving LPTs. Other challenges include the availability of specialized rail cars and viable rail sidings as well as shipments by rail, especially when LPTs must be moved across multiple rail lines. EEI, in conjunction with utilities, has initiatives underway to strengthen relationships with the major railroads in order to expedite the movement of transformers in an emergency. We have received support and cooperation from the rail industry including evaluating their capabilities and priority access to rail equipment necessary for the transport of LPTs.

Spare LPTs should be stored within close proximity of their intended use and not at distant location(s) or warehouse(s).

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During an emergency, spare LPTs stored within a utility's footprint can typically be delivered within 5 to 10 days, depending on location, size, weight and mode of transportation (truck vs rail and/or barge). LPTs at reserve sites and/or outside a utility's footprint could easily take 10 days or longer depending on origin, challenges associated with transportation and permitting, rail or barge access, and general coordination and logistics between multiple parties/owners.

QUESTION NINE: FIELD ENGINEERING AND INSTALLATION
Are there adequate domestic engineering and installation resources available throughout the United States to install multiple bulk power transformers simultaneously? What additional resources would be necessary?

Yes, there are adequate domestic engineering and installation resources available throughout the United States to rig, move and install multiple bulk power transformers simultaneously. This has not been an issue or bottleneck.

No additional resources are necessary.

QUESTION TEN: CRITERIA FOR DEPLOYING TRANSFORMERS
What criteria should be used for activating and deploying transformers from the reserve? How would deployment be funded?

Transformers in any reserve locations or warehouses should have their inventory turned over periodically. However, if the spare inventories are specialty transformers designed for greater flexibility in an emergency, but not necessarily suitable for long term (permanent) use, inventory turning will be problematic and likely lead to the spares being less reliable when ultimately needed for the system in an emergency.

Funding for the deployment should be the responsibility of the receiving utility. Call rights (defined process for requesting LPTs) should be for pre-defined emergencies/events and restricted from supporting operational needs. Since utilities already maintain spare LPTs to support their operational needs (mitigate equipment failures/forced outages, storm damage, vandalism, GMD's planning growth, etc.) and have the EEI STEP, Spare Connect, and Grid Assurance programs available for catastrophic events, a "National Reserve" of power

transformers should complement and support existing industry programs and not displace or negate current or planned investments.

QUESTION ELEVEN: ADDITIONAL COMMENTS
Are there additional concerns regarding a National Power Transformer Reserve Program that need to be considered?

LPTs are critical components of the bulk power system (BPS). FE, along with other utilities, have long standing experience in maintaining spare LPTs to ensure the reliability and resiliency of the BPS and recovery from single or multiple LPT failures/events. Additionally, the BPS is designed and operated conservatively and capable of performing reliably even with the loss of one or more LPTs.

Not all LPTs within a voltage class or location have the same criticality. Utilities continually monitor, identify, and mitigate the potential risks associated with those critical assets to ensure grid reliability and resiliency. The NERC CIP-014and TPL-007 reliability standards are programs that already address potential risks to LPTs from physical security and geomagnetic disturbances. In addition, the STEP, Spare Connect, and Grid Assurance programs address resiliency issues and concerns in addition to the programs/policies utilities already have in place. The creation of a "National Reserve" of LPTs could be duplicative of existing programs and could add to transportation challenges associated with the moving of LPTs longer distances, further delaying restoration and recovery times and creating yet another expensive "non-standard" class of transformers with limited long-term application.

There may be some opportunities for programs or partnerships that explore: standardization of design and manufacturing, targeting voltage class and sizes at highest risk, R&D for new "temporary" or flexible rapid deployment high voltage transformers, and government support in addressing transportation and infrastructure deficiencies or challenges.

Finally, any additional spare transformer programs resulting in the centralized collection and storage of information about utility infrastructure could present a potential risk to the BPS.