

BEFORE
THE PUBLIC UTILITIES COMMISSION OF OHIO

In the Matter of the Application Seeking)	
Approval of Ohio Power Company's)	
Proposal to Enter into an Affiliate)	
Power Purchase Agreement)	Case No. 14-1693-EL-RDR
for Inclusion in the Power Purchase)	
Agreement Rider)	
In the Matter of the Application of)	
Ohio Power Company for Approval of)	Case No. 14-1694-EL-AAM
Certain Accounting Authority)	

DIRECT TESTIMONY OF
ROBERT W. BRADISH
IN SUPPORT OF AEP OHIO'S
APPLICATION

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ROBERT W. BRADISH

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BEFORE
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DIRECT TESTIMONY OF
ROBERT W. BRADISH
ON BEHALF OF
OHIO POWER COMPANY

1 **I. PERSONAL DATA**

2 **Q. PLEASE STATE YOUR NAME AND BUSINESS ADDRESS.**

3 A. My name is Robert W. Bradish. I am employed by American Electric Power Service
4 Corporation (AEPSC), one of several subsidiaries of American Electric Power Company,
5 Inc. (AEP). I am currently Vice President - Grid Development for AEPSC. My business
6 address is 700 Morrison Road, Gahanna, Ohio 43230-6642.

7 **Q. PLEASE BRIEFLY DESCRIBE YOUR EDUCATIONAL AND PROFESSIONAL**
8 **BACKGROUND?**

9 A. I received a Bachelor of Science – Electrical Engineering degree in May 1985, and a
10 Master of Science – Electrical Engineering degree in December 1986, both from
11 Clarkson University. I also received a Master of Business Administration degree from
12 The Ohio State University in May 2001. I was employed by AEPSC in 1987 as an
13 assistant engineer and progressed through several engineering grades to the senior
14 engineer level. In 2001, I was promoted to Manager – Power and Transmission Market
15 Analysis. In 2002, I became Director of the same group. In 2003, I was promoted to
16 Vice President – Transmission and Market Analysis. From 2005 to 2010, I was Vice
17 President – Market Operations in AEPSC’s Commercial Operations group. In May 2010,
18 I assumed the position of Managing Director, Transmission Planning and Business

1 Development, where I was responsible for transmission planning and the origination,
2 evaluation, and execution of strategic transmission investment opportunities in support of
3 AEP's transmission business strategy. In January 2012, I assumed my current position. I
4 am also president of Pioneer Transmission, LLC.

5 **Q. WHAT ARE YOUR PRIMARY AREAS OF RESPONSIBILITY?**

6 A. As Vice President - Grid Development, I am responsible for AEP transmission system
7 planning and operations, which includes organizing and managing all activities related to:
8 1) assessing the adequacy of AEP's transmission network to meet the needs of its
9 customers in a reliable, cost effective and environmentally compatible manner; 2) the
10 real-time operation of AEP's transmission assets in compliance with all applicable safety
11 and reliability standards, contractual and tariff obligations and all federal, state and local
12 regulations and laws; and 3) advanced technical/analytical studies in support of planning,
13 engineering, design and operation of the AEP transmission system. I am also responsible
14 for managing/coordinating AEP's Transmission Technology/Research and Development
15 Program.

16 **Q. HAVE YOU PREVIOUSLY SUBMITTED TESTIMONY IN ANY REGULATORY**
17 **PROCEEDINGS?**

18 A. Yes, I have testified before the Arkansas, Indiana, Michigan, Oklahoma and Virginia
19 regulatory commissions.

20 **II. PURPOSE OF TESTIMONY**

21 **Q. WHAT IS THE PURPOSE OF YOUR TESTIMONY?**

22 A. The purpose of my testimony is to describe the results of a transmission planning impact
23 study, which estimates the required transmission upgrades and related costs that would be

1 necessary if certain generating units (PPA Units) owned by AEP Generation Resources
2 (AEPGR) are retired. I will also describe how this study is related to the Purchase Power
3 Agreement (PPA) and its relevance to AEP Ohio customers.

4 **III. GENERATION UNIT RETIREMENTS IMPACT ON AEP OHIO TRANSMISSION**

5 **Q. HOW DOES THE RETIREMENT OF GENERATING UNITS IMPACT THE**
6 **TRANSMISSION SYSTEM?**

7 A. The retirement of large, baseload generating resources can significantly change the
8 magnitude and direction of power flows on the transmission system. Specifically, areas
9 that have been historically net exporters of power may now be forced to import power
10 from other areas of the system. These changes in power flows can result in constraints.
11 Additionally, these units provide grid support in the form of spinning reserves and
12 reactive power. The momentum created by the spinning generating units creates
13 resistance to sudden changes caused by system disturbances. The spinning units can
14 quickly react to adjust system voltage, frequency and power factor, which are also
15 ancillary services provided by the generating units to PJM to support system reliability.
16 The transmission grid requires reactive power sources to maintain voltage levels and
17 stability. Since baseload coal generation serves as the primary source of reactive power
18 today, the loss of the PPA Units will also require replacement sources of reactive power.
19 The coal-fired PPA Units can store a substantial amount of fuel on site, which helps
20 maintain transmission grid reliability during adverse weather conditions, such as the
21 Polar Vortex experienced in PJM earlier this year.

22 **Q. ARE THERE TRANSMISSION SOLUTIONS TO MITIGATE THE EXPECTED**
23 **IMPACTS FROM THE RETIREMENT OF THE PPA UNITS?**

1 A. Yes. Upgrading the transmission system can be used to mitigate the impacts from the
2 retirement of the PPA units. By upgrading the transmission system, remaining available
3 generation from within and outside the state of Ohio can serve AEP Ohio's customers.
4 The purpose of the PPA is to avoid the possible closure of certain generating units, and
5 thereby, maintain sufficient generation within Ohio to meet the forecasted load needed to
6 serve AEP Ohio's customers. The focus of my testimony will be to provide an analysis
7 of the transmission upgrades and the associated costs that will be incurred if the PPA
8 Units are retired.

9 **IV. TRANSMISSION PLANNING IMPACT STUDY**

10 **Q. WHAT AEPGR OHIO GENERATING UNITS ARE EXPECTED TO RETIRE**
11 **FOR THE PURPOSE OF YOUR STUDY?**

12 A. AEP Transmission planning performed a preliminary analysis of the scenario in which
13 Cardinal 1, Conesville 4, 5, and 6, Stuart 1, 2, 3, and 4, and Zimmer 1 generating units
14 are assumed retired. Equivalent generation, with signed interconnection or facility study
15 agreements, needed to make up for the loss of the retired units was modeled based on the
16 PJM interconnection queue. The analysis was performed on PJM RTEP Cases using
17 Siemens PTI PSS/E and PowerGem TARA software. PJM Interconnection, LLC (PJM)
18 is the regional transmission organization (RTO) with operational control of the eastern
19 AEP transmission system. It should be noted that all PJM generating units proposed to
20 retire in mid-2015 have also been retired in the case, and the related transmission system
21 upgrades approved by PJM in 2012 are modeled in-service.

22 **Q. WHAT ASSUMPTIONS WERE USED TO ASSESS THE IMPACT OF THE**
23 **GENERATION RETIREMENTS ON THE TRANSMISSION SYSTEM?**

1 A. The same power flow models, assumptions, and methodology utilized by PJM to evaluate
2 the reliability performance of the regional transmission system were utilized in the AEP
3 study. Load flow analysis to determine potential overloads included single and common
4 mode contingencies (N-1), Generation Deliverability, and N-1-1 assessments on the 2019
5 PJM RTEP summer peak case and similar analyses on the 2017 PJM light load case.
6 The 2019 summer peak case was also used to evaluate voltage performance under the
7 same conditions. AEP and PJM planning criteria, which are based on NERC planning
8 standards, were the basis for determining reliability violations that would require
9 mitigation.

10 **Q. PLEASE DESCRIBE THE PRELIMINARY ASSESSMENT AS A RESULT OF**
11 **THE STUDY.**

12 A. AEP's preliminary assessment has determined that both thermal overloads and low
13 voltage conditions result following the retirement of the generating units. In some cases,
14 the power flow models did not converge, which is an indication of severe system
15 reliability concerns. Since the AEP transmission system serves as a thoroughfare for
16 PJM, power flows change significantly in magnitude and direction, depending on the
17 conditions modeled. For example, under peak conditions the AEP transmission system is
18 typically utilized to transport power from areas in the west to areas north and east of the
19 AEP system. Under light load conditions, power flows primarily from west to east and
20 south of the AEP system as a result of increased wind generation, pump loads at hydro
21 storage facilities, and reduced natural gas generation during off-peak hours. The
22 variability of these factors, combined with the loss of centrally located base load

1 generation sources, create vastly different stresses that must be accounted for in
2 maintaining a reliable transmission system.

3 The results are indicative of the thermal overloads and voltage issues that are
4 anticipated in the PJM analyses. Thermal overloads were found in different areas across
5 the transmission system, demonstrating the broad impact of these units to regional
6 reliability. The low voltage conditions that persisted indicate the resulting impact of the
7 loss of major reactive power sources. The most serious conditions are in Ohio, as would
8 be expected given the location of the generating units. Multiple facilities at 765 kV, 345
9 kV, 138 kV, and lower voltages are affected. Additionally, facilities on neighboring
10 utilities' transmission systems were similarly impacted.

11 **V. AEP OHIO TRANSMISSION MITIGATION REQUIREMENTS**

12 **Q. WHAT TRANSMISSION UPGRADES WOULD BE NECESSARY TO**
13 **MITIGATE THE IMPACT OF THE GENERATION UNIT RETIREMENTS?**

14 A. To mitigate these impacts, AEP would need to modify and upgrade its transmission
15 system in Ohio and surrounding states. While some additional rigor is required to
16 determine what solutions would ultimately be developed, AEP tested several upgrades
17 that would mitigate the reliability issues. The upgrades include a new 765 kV line,
18 several 765 kV and 345 kV substations, rebuild of existing 138 kV lines, and addition of
19 new reactive power sources such as capacitor banks and Static Var Compensators
20 (SVCs).

21 **Q. WHAT IS THE ESTIMATED COST OF THE TRANSMISSION UPGRADES?**

22 A. The estimated cost for the minimum upgrades required is \$1.6 billion. This cost does not
23 include any upgrades to neighboring utilities' transmission systems, so it can be expected

1 that the eventual cost for all required upgrades will be higher. Approximately \$850
2 million of the upgrades are expected to be at voltages 345 kV and below, the cost of
3 which will be borne directly by customers in the AEP zone. Fifty percent of the
4 remaining \$750 million may be shared with other PJM members if 765 kV options are
5 approved as baseline upgrades.

6 **Q. ARE THERE OTHER FACTORS THAT COULD IMPACT THE**
7 **TRANSMISSION UPGRADE REQUIREMENTS?**

8 A. Yes. This analysis only considered the impacts resulting from the specific units listed
9 above. As studies showed from the last round of generation retirements in 2012, the
10 combined impact of retiring AEPGR generating plants and neighboring utilities' plants
11 creates a more severe scenario. The impact of the combined retirements in the PJM
12 region announced to date has required nearly \$3 billion in upgrades. Similarly, it is
13 expected that the collective impact of additional at-risk generation would require
14 upgrades beyond those considered in an analysis that considers the specific AEP units in
15 isolation.

16 **Q. PLEASE SUMMARIZE HOW THE GENERATION UNIT RETIREMENTS IN**
17 **THIS STUDY WILL IMPACT AEP OHIO'S CUSTOMERS.**

18 A. The primary impact to AEP Ohio's customers from the continued retirement of
19 generating units in Ohio is the future cost and reliability of electric service. Without a
20 PPA, the retirements of the PPA Units identified in the aforementioned transmission
21 upgrade study could occur, in addition to the generation units already scheduled for
22 retirement in mid-2015. The PPA would keep the PPA Units operating to hedge the
23 potential cost volatility of market-based electricity. In addition, the continued retirement

1 of generating units in Ohio would necessitate construction of costly transmission
2 upgrades to maintain transmission system reliability and enable importation of
3 replacement power to serve AEP Ohio's customers.

4 **Q. DOES THIS CONCLUDE YOUR DIRECT TESTIMONY?**

5 A. Yes it does.

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Summary: Testimony -Direct Testimony of Robert W. Bradish electronically filed by Mr. Steven T Nourse on behalf of Ohio Power Company