

BEFORE THE
PUBLIC SERVICE COMMISSION
OF MARYLAND

In the Matter of the Application)	
Of the Baltimore Gas and Electric Company)	
for a Certificate of Public Convenience and)	Case No. 9600
Necessity for the Key Crossing Reliability)	
Initiative Transmission Line Project)	

DIRECT TESTIMONY OF RICARDO R. AUSTRIA

PUBLIC REDACTED VERSION

ON BEHALF OF THE

MARYLAND DEPARTMENT OF NATURAL RESOURCES

POWER PLANT RESEARCH PROGRAM

Tawes State Office Bldg., B-3

Annapolis, MD 21401

410-260-8691

December 2, 2019

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

2 A. My name is Ricardo Austria and my business address is 4 Automation Lane,
3 Suite 150, Albany, NY 12205.

4 **Q. WHO IS YOUR CURRENT EMPLOYER AND WHAT POSITION DO YOU**
5 **HOLD?**

6 A. I am employed by Pterra, LLC ("Pterra"), an independent consulting firm that
7 specializes in electric power matters. My present title is Executive Principal.

8 **Q. WHAT ARE YOUR RESPONSIBILITIES AS AN EXECUTIVE PRINCIPAL**
9 **AT PTERRA?**

10 A. My responsibilities include applying my technical skills and coordinating other
11 engineers and consultants at Pterra to address planning, operating, engineering,
12 and market issues for transmission and distribution systems in the United
13 States and worldwide.

14 **Q. PLEASE DESCRIBE YOUR EDUCATIONAL BACKGROUND AND**
15 **PROFESSIONAL EXPERIENCE.**

16 A. I received a Master of Engineering Degree in Electric Power Systems from the
17 Rensselaer Polytechnic Institute in Troy, New York in 1988. I have held my
18 present position as Executive Principal since February 2005. Previously, I was
19 Vice President for Transmission Services for EPRI Solutions, Inc. and prior to
20 that, I was employed by Power Technologies, Inc., then a subsidiary of Stone
21 and Webster, Inc., where I was Vice President of Consulting Services. In all
22 these positions, I coordinated the consulting, training and software
23 development services of a team of engineers and consultants in a variety of
24 fields in electric power, including power system dynamics, economics,

1 generation, energy markets, transmission and distribution, planning,
2 operations, engineering and reliability. In that role, I also provided services as
3 an expert witness and industry advisor to utilities, public commissions, private
4 commercial interests, and banks and financial institutions, and as an instructor
5 in a number of courses on topics that included power system reliability,
6 transmission planning, voltage stability and energy markets.

7 **Q. HAVE YOU TESTIFIED BEFORE THIS OR ANY OTHER REGULATORY**
8 **COMMISSION?**

9 **A.** I have not previously testified before this Commission. I have provided written
10 testimony before the Federal Energy Regulatory Commission on the generation
11 interconnection queue improvements in the Midwest Independent System
12 Operator, on the joint application of Northern States Power Company and New
13 Century Energies, Inc. for the approval of merger and reorganization, on
14 transmission projects included in the PJM Interconnection's Regional
15 Transmission Expansion Plan (RTEP) and on the U.S. Department of Energy's
16 proposed designation of transmission corridors. I have also provided
17 testimony before the New York State Public Service Commission, Arkansas
18 Public Service Commission, the Texas Public Utility Commission and the
19 Michigan Public Service Commission, all on matters relating to electric power
20 system reliability, planning and operations.

21 **Q. WHAT IS YOUR PURPOSE IN MAKING THIS TESTIMONY?**

22 **A.** I am providing a technical assessment on behalf of the Power Plant Research
23 Program ("PPRP") of the Maryland Department of Natural Resources on the
24 need for and alternatives to the Key Crossing Reliability Transmission Line
25 Project (the "Key Crossing Project") for which Baltimore Gas and Electric
26 Company ("BGE") has applied for a Certificate of Public Convenience and

1 Necessity ("CPCN"). My assessment is focused on the electric power aspects of
2 the Key Crossing Project, specifically with respect to power system reliability
3 and resiliency, and addresses two main questions:

4 (A) Is there a defined electrical system need to build the Key Crossing
5 Project?

6 (B) What electrical alternatives to the Key Crossing Project were
7 considered and what were the determinations for each?

8 **Q. WHAT WERE YOUR RESPONSIBILITIES IN CONNECTION WITH THIS**
9 **TESTIMONY?**

10 A. From the viewpoint of electrical need, I reviewed the materials submitted by
11 BGE in support of the Project. To clarify certain aspects of the materials, I
12 prepared several data requests on behalf of PPRP that were submitted to BGE. I
13 subsequently discussed my observations and findings with PPRP. On July 23,
14 2019, I participated in a meeting with BGE which involved PPRP, PSC Staff and
15 OPC and other State agency representatives to discuss the electrical aspects of
16 the Project. I then prepared this testimony.

17 **Q. PLEASE DESCRIBE THE KEY CROSSING PROJECT WITH RESPECT TO**
18 **ITS PURPORTED ELECTRICAL PURPOSE AND NEED.**

19 A. Five electric submarine cables that cross under the Patapsco River adjacent to
20 the Francis Scott Key Bridge, from Hawkins Point in Baltimore City to Sollers
21 Point in Baltimore County (collectively, the "Harbor Crossing" cables), are at
22 risk of failing.¹ The cables are split into two sets of three and two cables each
23 and provide electrical connections for the double-circuit Brandon Shores-

¹ Munley Direct Testimony, p. 3.

1 Riverside 230 kV line. On the basis of the material condition of the cables,
2 which were installed in 1976, BGE intends to replace them with a new double
3 circuit overhead transmission line that spans the Patapsco River in
4 approximately the same location.² Doing so would “preserve the existing
5 double-circuit line and maintain the integrity of the Bulk Energy System
6 (BES)”³ that is operated by the PJM Interconnection Inc. (“PJM”).

7 **Q. HOW IS THE REST OF YOUR TESTIMONY ORGANIZED?**

8 A. My testimony addresses each of the two specific questions noted earlier in the
9 same sequence and closes with a conclusion.

10 **Electrical Need for Key Crossing Project**

11 **Q. IS THERE A DEFINED ELECTRICAL SYSTEM NEED TO BUILD THE KEY**
12 **CROSSING PROJECT?**

13 A. From an electrical perspective, the need to ensure reliability and stability⁴ are an
14 important consideration for the electric grid should the Harbor Crossing cables
15 fail in a manner that results in the outage of both circuits of the Brandon Shores-
16 Riverside 230 kV transmission line. This scenario is subsequently referred to
17 herein as the “No-Build Alternative”. The need for the Key Crossing Project, or
18 any alternative that involves building new electrical facilities, is contingent on
19 the No-Build Alternative being demonstrated to be either unreliable or leading
20 to unstable performance from the electric grid.

21 **Q. WHAT WAS BGE’S EVALUATION OF THE NO-BUILD ALTERNATIVE?**

² BGE response to Data Request by PSC Staff DR02-17.

³ “Key Crossing Reliability Initiative, Alternatives Analysis” by Century Engineering, Nov 26, 2018, p. I.

⁴ PUA §7-207(e)(2)(i) requires consideration of the effect of an overhead transmission line on the stability and reliability of the electric system.

1 BGE rejected the No-Build Alternative, citing the effects this would have on the
2 capacity and reliability of the Bulk Electric System (BES) operated by the PJM
3 Interconnection ("PJM"), specifically with the resultant interruptions of
4 electrical service to BGE Customers.⁵ In support of this position, BGE reported
5 the results of two load flow studies and a stability study of the No-Build
6 Alternative.

7 **Q. PLEASE DESCRIBE THE STUDIES THAT WERE CONDUCTED BY BGE**
8 **OF THE NO-BUILD ALTERNATIVE.**

9 A. In the first load flow study, BGE used a model developed by PJM as part of the
10 PJM 2016 RTEP. [REDACTED]

11 [REDACTED]⁶ Starting from this load flow model, BGE's
12 Transmission Planning Group modeled the outage of the two Brandon Shores-
13 Riverside 230 kV circuits, simulating simultaneous failures of the Harbor
14 Crossing cables. Applying no further changes to the load flow model, BGE then
15 tested for performance under contingencies specified in North American
16 Electric Reliability Corporation (NERC) standard TPL-001-4. The results so
17 presented indicated that thermal loading on certain facilities on the East side of
18 BGE's system exceeded their emergency thermal ratings.⁷ [REDACTED]

19 [REDACTED]
20 [REDACTED]
21 [REDACTED]⁸

22 In the second load flow study, [REDACTED]
23 [REDACTED]⁹ As with the first study,

⁵ *Ibid.*

⁶ [REDACTED]

⁷ BGE response to Data Request by PPRP DR02-01 (a).

⁸ [REDACTED]

⁹ [REDACTED]

1 BGE's Transmission Planning Group modeled the outage of the two Brandon
2 Shores-Riverside 230 kV circuits on this load flow case, simulating
3 simultaneous failures of the Harbor Crossing cables. BGE then conducted
4 contingency analysis consistent with PJM's Baseline Reliability Analysis, which
5 includes aspects of NERC TPL-001-4. The results of the second study likewise
6 showed a number of thermal overloads.

7 [REDACTED]
8 [REDACTED]
9 [REDACTED]
10 [REDACTED]
11 [REDACTED]
12 [REDACTED]
13 [REDACTED]¹⁰

14 **Q. WHAT IS YOUR ASSESSMENT OF THE STUDIES CONDUCTED BY BGE**
15 **OF THE NO-BUILD ALTERNATIVE?**

16 A. The stability study shows no stability issues while both load flow studies show
17 significant reliability issues with the No-Build Alternative. All three studies
18 simulate what might happen following a long-term failure of the existing
19 underwater cables with no replacement.¹¹ They are an evaluation of the
20 operational state should simultaneous cable failures occur in the future.

21 This leaves open the question of whether the grid can operate reliably if the
22 retirement of the Harbor Crossing cables is planned for rather than the
23 operational response to the cables' failure. I would refer to this alternative as a
24 "Planned Retirement" of the Harbor Crossing cables.

¹⁰ [REDACTED]

¹¹ BGE response to Data Request by PPRP DR09-01 (c).

1 **Q. HOW SHOULD THE “PLANNED RETIREMENT” ALTERNATIVE BE**
2 **EVALUATED?**

3 A. The entity ultimately responsible for planning the transmission grid is PJM.
4 PJM regularly conducts the type of analysis which prepares for a future where
5 the Harbor Crossing cables may no longer be in service. It has developed an
6 extensive procedural and modeling process for conducting such studies that are
7 in compliance with North American Electric Reliability Corporation (NERC)
8 and its own internally developed standards. [REDACTED]

9 [REDACTED]
10 [REDACTED]¹² [REDACTED]
11 [REDACTED]¹³

12 PJM indicated that if presented with the retirement of the double-circuit
13 Brandon Shores-Riverside 230 kV transmission line, it would conduct a
14 separate sensitivity study to the Baseline Reliability Analysis that uniquely
15 looks at the impact of removing the line from service. The results of such a
16 study would be presented to stakeholders for review and discussion.¹⁴

17 **Q. HAS PJM CONDUCTED A PLANNING STUDY OF THE PLANNED**
18 **RETIREMENT ALTERNATIVE?**

19 A. BGE filed the Key Crossing Project as a Supplemental Project with PJM, and as
20 such, the project does not need to address PJM criteria (system reliability,
21 operational performance or economic).¹⁵ PJM has thus not conducted an RTEP
22 Study without the Key Crossing Project.¹⁶

¹² [REDACTED]
¹³ [REDACTED]

¹⁴ PJM response to Data Request by PPRP DR01-01 (c).

¹⁵ PJM response to Data Request by PSC Staff DR01-05.

¹⁶ PJM response to Data Request by PSC Staff DR01-03 (a).

PJM's chairman of the Reliability Committee has stated that although it does not have the authority or expertise to make asset management decisions or determine when a facility is at the end of its useful life, as such decisions are the responsibility of transmission owners, it may, however, be in the best position to determine cost-effective regional solutions for replacing retired facilities.¹⁷

Given the present classification of the Key Crossing Project as a PJM Supplemental Project, there is no extant process that requires PJM to conduct a study of the Planned Retirement alternative. However, such a study would provide much clarity to the assessment of need for the Key Crossing Project.

Q. WHAT IS YOUR ASSESSMENT OF BGE'S EVALUATION, FINDINGS AND CONCLUSION REGARDING THE NO-BUILD ALTERNATIVE?

A. From the perspective of electric system reliability, BGE has made an effort to study the impact on the electric grid of the simultaneous failure¹⁸ of the Harbor Crossing cables that could lead to the outage of both the Brandon Shores-Riverside 230 kV circuits. The application of contingency analysis following PJM's Baseline Reliability methodology appears sound. The studies do lack detailed documentation of the assumptions, methodology, analysis and conclusions that are needed to provide a comprehensive assessment. Most of the information on which my assessment is made was obtained through the process of Data Requests which is a decidedly cumbersome and inefficient process for collecting the level of detail needed. However, what limited information BGE has provided is consistent with its finding with respect to potential reliability issues associated with the No-Build Alternative. I note

¹⁷ Letter to PJM Committee Members, Dean Ostvig, Chair-Board Reliability Committee, October 4, 2019.

¹⁸ The BGE studies are premised on the outage of both circuits of the Brandon Shores-Riverside 230 kV line. In order for this to occur due to some Harbor Crossing cable failure, at least two of the cables have to fail concurrently and from separate failure events.

1 further that from the perspective of electric system stability, BGE did not find
2 any stability issues associated with the No-Build Alternative.

3 While BGE's analysis of the No-Build Alternative was based on an expected
4 failure of the Harbor Crossing cables and the subsequent operational response
5 by PJM, the Planned Retirement alternative would focus on the planned
6 development of the electric grid to retirement of the Harbor Crossing cables.
7 PJM, as the entity responsible for planning for reliability of the transmission
8 grid and which has already in place a planning process in the form of the RTEP,
9 is in the best position to conduct the study of this alternative. However, such a
10 study has not been conducted and remains a gap in the assessment of the need
11 for the Key Crossing Project.

12 **Consideration of Electrical Alternatives to the Perceived Need**

13 **Q. WHAT ELECTRICAL ALTERNATIVES WERE CONSIDERED AND WHAT**
14 **WERE THE DETERMINATIONS FOR EACH?**

15 A. Through the process of Data Requests, BGE provided information on several
16 electrical alternatives that sought to provide system upgrades or adjustment to
17 address the potential failure of the Harbor Crossing cables. These are of two
18 types: those which require new transmission elements to be built, otherwise
19 referred to as "wires" alternatives, and those that do not require new
20 transmission, or "non-wires" alternatives.

21 **Q. WHAT ELECTRICAL ALTERNATIVES DID BGE CONSIDER THAT**
22 **ACCOUNTED FOR ALTERNATIVE TRANSMISSION, OR "WIRES",**
23 **PROJECTS TO THE KEY CROSSING PROJECT?**

24 A. During the conceptual planning stages of the Key Crossing Project, BGE
25 evaluated alternate transmission projects involving land-only routes. These

alternatives are variously characterized as “high level”, “conceptual” and “preliminary”.¹⁹ Two such alternatives are described as follows: (1), building new 230 kV underground circuits between the Brandon Shores and Riverside substations with no river crossing, referred to as the “No River Crossing” alternative, and (2), a new 500 kV line from Graceton to Northeast substations with supplementary upgrades of affected 115 kV circuits.

Both alternatives, if developed fully, are generally expected to maintain system stability and reliability similar to what would be expected from completion of the proposed Key Crossing Project.²⁰ BGE’s planning level cost estimate for the No River Crossing alternative is in the range of \$490 to \$730 million²¹, while the new Graceton-Northeast 500 kV alternative is estimated to cost \$500 million.²²

Q. WHAT OTHER WIRES ALTERNATIVES WERE AVAILABLE TO BGE TO CONSIDER THAT DID NOT REQUIRE SUBMARINE ROUTES?

A. In a Data Request²³, PPRP asked BGE about the potential of reconfiguring the 115 kV and underlying distribution network. Reconfiguration of the 115 kV system refers to the process of modifying the electrical connections of a grid, in this case, the BGE 115 kV system within the 230 kV loop, in order to eliminate or minimize reliability issues that can lead to customer outages. Reconfiguration is used in many urban systems, primarily to avoid more expensive facility upgrades.

Q. DID BGE CONSIDER A RECONFIGURATION OF THE 115 KV SYSTEM

¹⁹ BGE response to Data Request by PPRP DR01-04 (a).

²⁰ BGE Response to Data Request by PSC Staff DR03-11 (c).

²¹ BGE Response to Data Request by PPRP DR04-01 (b).

²² BGE Response to Data Request by PPRP DR04-01 (e)iii.

²³ BGE Response to Data Request by PPRP DR02-01 (e).

AS AN ELECTRIC ALTERNATIVE TO THE KEY CROSSING PROJECT?

A. BGE considered but did not pursue a reconfiguration of the 115 kV and underlying distribution network.²⁴ [REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]²⁵

Q. DID BGE CONSIDER NON-WIRES ALTERNATIVES TO THE KEY CROSSING PROJECT?

A. BGE states that “(n)on-wires alternatives such as load management and energy storage were not deemed to be conceivable viable alternatives given the extent and severity of the reliability issues identified regarding the Key Crossing Reliability Initiative.”²⁶ BGE also notes, on the use of battery storage to address potential transmission reliability concerns, that “(b)ecause of the extent of the reliability issues identified regarding the Harbor Crossing project, BGE does not believe battery storage is a viable alternative to the preferred solution.”²⁷

Q. DID BGE CONSIDER NEW TECHNOLOGY-BASED ALTERNATIVES TO THE KEY CROSSING PROJECT?

A. During a meeting held on July 23, 2019 in Annapolis, MD, I asked BGE representatives about the use of a technology known as phase angle regulators

²⁴ BGE response to Data Request by PPRP DR02-01 (e).

²⁵ [REDACTED]

²⁶ BGE response to Data Request by PSC Staff DR04-10 (a).

²⁷ BGE response to Data Request by PPRP DR03-03 (b)i.

(PARs) to control the flow of power within the BGE system. I noted that similar urban electrical systems such as those of Consolidated Edison of New York City, Eversource of Boston and Commonwealth Edison/Exelon of Chicago, use this technology to preclude the type of thermal overloads that BGE observed in its load flow analysis. BGE indicated that “(p)hase angle regulators and system reconfiguration were not considered in detail as alternatives to the Key Crossing Project. The results from BGE’s load flow study indicate many different combinations of load flow violations involving many different facilities across the 230 kV and 115 kV networks. Phase angle regulators and reconfiguration of the system would not be feasible, as they would likely cause violations on other facilities due to the redirection of flows and reduced operability margins in other areas.”²⁸

Q. WHAT ALTERNATIVE DID BGE FIND TO BE THE MOST APPROPRIATE FOR THE FAILING HARBOR CROSSING CABLES?

A. BGE identified the Key Crossing Project as the preferred solution to the failing Harbor Crossing cables stating that “(t)he preferred option to install overhead conductors across the Patapsco River addresses the Harbor Crossing cable failure risks without compromising the existing system reliability and performance.”²⁹

[REDACTED]

BGE estimates the capital cost of the Key Crossing Project to be approximately \$232 million.³¹

Q. WHAT IS YOUR EVALUATION OF BGE’S ASSESSMENT OF ELECTRIC

²⁸ BGE response to Data Request by PPRP DR05-03.

²⁹ BGE response to Data Request by PPRP DR01-04 (a).

³⁰ [REDACTED]

³¹ BGE response to Data Request by PPRP DR05-04 (a).

ALTERNATIVES TO THE KEY CROSSING PROJECT?

A. I offer the following summary table of the characteristics of the various alternatives to address the potential failure of the Harbor Crossing cables. For each alternative I have identified the implementation cost of the alternative and the potential impact on reliability and stability of the electric grid. Lastly, I have included any other electric factors that may characterize the alternative further.

Alternative	Implementation Cost	Reliability	Stability	Other electric factors
Key Crossing Project	\$232 million	No reliability issues	No stability issues or violations	
No-Build Alternative	None	Potential interruption to customers upon failure of Harbor cables	No stability issues or violations	
Planned Retirement	Not determined	Not tested	Not tested	
No River Crossing Alternative	\$490 to \$730 million	No expected reliability issues	No expected stability issues or violations	
New 500 kV Graceton to Northeast line	Over \$500 million	No expected reliability issues	No expected stability issues or violations	
Reconfiguration of 115 kV	Not determined	Not tested	Not tested	Last resort method for operators to use during emergency conditions
Use of Phase angle regulators	Not determined	Not tested but BGE believes will likely cause violations on other facilities	Not tested	Common solution applied by other utilities
Non-wires alternatives	Not determined	Will not be sufficient to address the reliability issues of the No-Build alternative	Not tested	

The following alternatives have been shown to be in compliance with PUA §7-207(e)(2)(i) with regards to the effect of an overhead transmission line on the stability and reliability of the electric system. These alternatives are the proposed Key Crossing Project, the No River Crossing alternative and the new

1 Graceton-Northeast 500 kV line. Of the three compliant alternatives, BGE
2 estimates show that the Key Crossing Project would require the lowest
3 implementation cost at \$232 million compared to around \$500 or more for each
4 of the other two compliant alternatives.

5 Four other electric alternatives are expected to have reliability issues. These are
6 the No-Build Alternative, 115 kV reconfiguration, use of phase-angle regulators
7 and non-wires alternatives.

8 I note that details on the alternatives were offered by BGE on the basis of ad hoc
9 responses to Data Requests. There are no detailed reports documenting the
10 data, assumptions, analysis and conclusions of BGE's assessment of the various
11 electrical alternatives. Furthermore, there are no third-party, independent
12 assessments of electric alternatives submitted as part of the filing. I am thus
13 limited in my review to what BGE has provided as part of the filing and what
14 BGE has provided in response to Data Requests.

15 Furthermore, one important alternative, the Planned Retirement alternative,
16 was not evaluated.

17 **Conclusion**

18 **Q. CAN YOU SUMMARIZE YOUR CONCLUSIONS AT THIS POINT?**

19 A. Yes. Over the course of several months, I closely reviewed the electrical aspects
20 of BGE's CPCN application, including one opportunity to meet face-to-face
21 with BGE representatives. The two main questions that I sought answers to
22 were: (A) "Is there a defined electrical system need to build the Key Crossing
23 Project?" and (B) "What electrical alternatives to the Key Crossing Project were
24 considered and what were the determinations for each?"

1 On the question of electrical need, I considered the reliability and stability of
2 the electric grid should the Harbor Crossing cables either fail (the “No-Build
3 Alternative”) or are retired (the “Planned Retirement” alternative). From this
4 perspective, the need for the Key Crossing Project, or any alternative that
5 involves building new electrical facilities, is indicated only if both the No-Build
6 and Planned Retirement alternative are established to be unreliable or lead to
7 unstable electric grid performance. BGE provided information and study
8 results that indicate that the No-Build Alternative will decrease electric system
9 reliability following the Harbor Crossing cables’ failure, while no impact is
10 anticipated with respect to electric system stability. I concur with BGE’s finding
11 with respect to the potential reliability impacts of the No-Build Alternative.
12 With regards to the Planned Retirement alternative, there are no study results
13 or assessments available that I can address. Based solely on the assessment of
14 the No-Build Alternative, I conclude that there is a need to address the
15 reliability impacts ensuing from a failure of the Harbor Crossing cables.

16 On the question of electrical alternatives, two wires alternatives, the No River
17 Crossing alternative and a new 500 kV Graceton to Northeast line offer
18 potentially reliable and stable future systems as the Key Crossing Project.
19 However, these two alternatives are projected to cost approximately two to
20 three times that of the Key Crossing Project. BGE states that these electrical
21 alternatives it has considered are inferior to the proposed Key Crossing Project,
22 and I find no cogent basis, from the limited information supplied, to disagree
23 with this finding. It would be helpful, in the future that detailed studies that
24 document assumptions, data, methodology and analysis, be provided as part of
25 this type of filing to ensure a comprehensive assessment.

26 In conclusion, on balance of what I have reviewed of information provided by
27 BGE, I recommend approval of the Key Crossing Project.

1 Q. DOES THIS CONCLUDE YOUR TESTIMONY?

2 A. Yes.

Attachment A

Ric Austria

Executive Principal

Email: ricaustria@pterra.us

Mr. Austria is a founder of Pterra, LLC. He has over 35 years experience in electric power transmission planning, operations, voltage simulation and analysis, design and engineering, and brings this knowledge to help clients worldwide in the power industry.

He is a renowned expert in the specialized fields of system reliability, transmission planning, voltage stability and system analysis. He has provided expert testimony in these areas in filings with the FERC, state and local public commissions. He has led and conducted transmission studies in all US interconnections and over 25 national networks worldwide; each of which have determined major investment in transmission, substations, underground and undersea cables, power conditioning equipment and application of new analytical methodologies and technologies. Mr. Austria has spoken at numerous conferences, authored articles and participated in working groups on the subject of electric power transmission.

Mr. Austria was formerly Vice President of Consulting at Power Technologies, Inc. (Schenectady, New York), Vice President of transmission studies at EPRI Solutions, Inc. and Senior Specialist at the National Power Corporation. In these various roles, he was responsible for developing new approaches to providing for reliability in competitive power industry environments.

Mr. Austria is a senior member of the IEEE and its Power Engineering Society and past chair of the Schenectady Section.

Areas of Focus

Transmission planning; voltage control and reactive power planning and design; power system analysis; power system stability; power system reliability; transmission reliability; operations planning; software development; technology roadmapping; planning and operations training; energy markets.

Selected Project Experience

FERC Docket ER17-1138 on PJM Interconnection, L.L.C.'s ("PJM") proposal to change its Tariff and Reliability Assurance Agreement to implement more stringent requirements for External Capacity to be qualified to sell capacity into the PJM market.

FERC Docket EL14-000 on complaint by Consolidated Edison Company of New York regarding the proposed cost allocations by PJM Interconnection.

FERC Docket Nos. EL15-37-000 and ER16-120-000 New York Independent System Operator, Inc. (NYISO) to submit tariff revisions governing the retention of and compensation to generating units needed for reliability, including procedures for designating such resources, the rates, terms, and conditions for reliability must run (RMR) service, provisions for the allocation of costs of RMR service, and a pro forma agreement for RMR service.

Designation of Competitive Renewable Energy Zones, PUC Texas. FPL Energy, AES Seawind and Invenergy. Expert witness and testimony services in docket 33672.

FERC Docket ER06-880-003 on transmission projects included in PJM expansion plan. PSEG, PHI, PPL and FirstEnergy companies in the PJM footprint. Expert witness and testimony services.

STATE OF NEW YORK PUBLIC SERVICE COMMISSION, Case No. 06-T-0650, Application of New York Regional interconnect, Inc. for a Certificate of Environmental Compatibility and Public Need Pursuant to Article VII of the Public Service Law, Expert witness and testimony services.

Confidential Client. Provided expert advice on method and conclusions derived by Southern Company regarding Client's voltage and closing angle stability impacts on the output of a proposed coal plant in southern Tennessee. Identified aspects of analysis that required further review and alternative solutions to constraints on the proposed plants.

Conjunction, LLC, Empire Transmission Line Project. Identified transmission feasibility of various configurations for interconnecting Upstate NY with New York City through DC and AC lines. Developed models for simulating network response with the project in service. Provided expert witness services during public and private meetings and hearings with interested local and industry parties. Conducted System Reliability Impact Study, approved and accepted by TPAS in 2004.

Old Dominion Electric Cooperative, Analysis of High Locational Prices in PJM. Performed electric transmission system analyses to diagnose causes of high locational prices and evaluated remedies to reduce the prices in the area of concern. Identified problem areas. Analyzed the existing transmission system and determined the causes of the high locational prices and provided an estimate of the duration and magnitude of exposure to high prices. Specified a solution to a voltage control problem which was influencing LMPs. (Implemented by ODEC). Identified solutions for congestion costs in the Upper Peninsula.

Oklahoma Gas and Electric Company, Support of Arkansas Market Power Proceeding. Developed TTCs between control areas and control area-to-control area TDFs in the vicinity of the OG&E. Studied the transmission topography of the OG&E system to identify constraints that could impact a market power assessment. Identified realignment of the OG&E area which reflects these constraints. Provided expert testimony to support market power filing in the State of Arkansas.

Review of Transmission Plans Submitted to the Michigan Public Service on behalf of the PSC. Reviewed non-common components of transmission plans submitted by Michigan utilities to the Commission in response to state requirements. Conducted analytical verification of specific bases for the plans. Provided expert testimony to the Commission on the assumptions, procedures and conclusions relating to the submitted plans.

New Jersey Board of Public Utilities. Audited reliability related practices and recent operations of New Jersey electric utilities as part of a forensic investigation of events of July 3-8, 1999. Determined that near voltage collapse event occurred on July 6, 1999 that New Jersey utilities and PJM were not adequately prepared for.

California ISO Trust and Trust Advisory Committee, Operating Reliability Requirements Study. Identified requirements for reliable initial operation of the California ISO. This phase involved the aspect of location-dependent or "must-run" generation and ancillary services, and was completed within a three-month study period. Clarified the issue of "must-run" contracts for the Cal ISO's own task force on Transmission Reliability, as well as all other participants in the nascent ISO and power exchange. Reviewed existing criteria and proposed criteria to maintain or exceed existing transmission service reliability. Identified location-dependent conditions and dispatches, with measures of effectiveness to help formulate alternative reliability-based dispatches.

BC Hydro, Canada, Methodology to Calculate Benefits from Generation-Related Transmission. Developed a methodology to calculate benefits from transmission connecting hydro projects to a power grid. Provided support for expert testimony.

Training Instructor Experience

Voltage Control and Reactive Power Planning Course - principles of voltage control and reactive supply planning in transmission and distribution systems. Covers equipment characteristics, load modeling, planning criteria, voltage stresses, bulk system operations, reactive planning and analytical modeling.

Advanced Transmission Planning - principles of transmission planning. Covers analytical methods and tools, planning methodologies, planning criteria, industry structures, least cost techniques and a complete case study.

Reliability Assessment Methods - principles of reliability assessment for generation, transmission and distribution systems. Covers outage modeling, reliability criteria, regulatory and industry organizations, mathematical and analytical models, performance measures and composite indices.

Control Center Technologies – hardware, software, processes and operator requirements and roles in modern power system control centers.

Other courses: Optimal Power Flow, Improving Reliability of Large Interconnected Systems, Competitive Markets, Dynamic Simulation for Power Systems, Locational Marginal Pricing Basics.

Publications

1. "Automatic Load Shedding in the Luzon Grid," presented at the 5th IECEP Conference, Manila, Philippines, November 1984, (co-author: F.C. Leynes).
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Education

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