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APPLICATION OF EL PASO ELECTRIC COMPANY TO CHANGE RATES	§	BEFORE THE STATE OFFICE
	§	OF
	§	ADMINISTRATIVE HEARINGS

REBUTTAL TESTIMONY

OF

PAUL M. NORMAND

OF

MANAGEMENT APPLICATIONS CONSULTING, INC.

FOR

EL PASO ELECTRIC COMPANY

NOVEMBER 19, 2021

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EXHIBITS

I. Introduction and Qualifications

Q. PLEASE STATE YOUR NAME AND BUSINESS ADDRESS.

A. My name is Paul M. Normand. I am a Principal with Management Applications Consulting, Inc. ("MAC"), 1103 Rocky Drive, Suite 201, Reading, Pennsylvania 19609.

Q. PLEASE DESCRIBE MAC.

A. MAC is a management consulting firm which provides rate and regulatory assistance including depreciation services for electric, gas and water utilities.

Q. ON WHOSE BEHALF ARE YOU TESTIFYING?

A. El Paso Electric Company ("EPE").

Q. PLEASE SUMMARIZE YOUR BUSINESS AND EDUCATIONAL BACKGROUND.

A. This information is contained in Exhibit PMN-1 which outlines my educational and professional qualifications. Briefly stated, I received a BSEE and MSEE – Power System Analysis from Northeastern University in 1975. Since that time, I have prepared numerous studies on cost of service, rates, and loss analysis presented in numerous jurisdictions.

Q. HAVE YOU PREVIOUSLY PRESENTED TESTIMONY BEFORE UTILITY REGULATORY BODIES?

A. Yes, my Exhibit PMN-2 presents those dockets in which I have submitted testimony including numerous occasions before the Public Utility Commission of Texas.

II. Purpose of Rebuttal Testimony

Q. WHAT IS THE PURPOSE OF YOUR REBUTTAL TESTIMONY?

A. The purpose of my rebuttal testimony is to address the testimonies of Messrs. Jeffry Pollock (for Freeport-McMoRan), Raymond J. Stanley (for Vinton Steel), and Kevin C. Higgins (for TIEC "the lost study intervenor witnesses") with respect to the loss study (Schedule M-3) prepared for EPE by myself.

Q. DO YOU AGREE WITH THE LOSS STUDY INTERVENOR WITNESSES GENERAL COMMENTS THAT PEAK LOSSES SHOULD BE HIGHER THAN ENERGY LOSSES?

A. No, I do not. The main reason for my disagreement is that the arguments of the loss study intervenor witnesses on this topic are rather simplistic and are incorrect for complex transmission networks. Their arguments would only be correct if all supply resources are at one end of a circuit with all loads being served at the other end, i.e., a radial circuit such as distribution primary and secondary circuits. This is not the case for EPE or any other large integrated power network as this relates to EPE's transmission network.

Q. IS EPE'S POWER SYSTEM A RADIAL CIRCUIT?

A. Obviously not. EPE has a very extensive network of transmission circuits (conductors), high voltage transformers, interconnections, numerous generating resources, and multiple voltage levels (345 kV, 115 kV, and 69 kV) of 1,849 miles (loss study, page 15 of 15 – FM1, 1-1). As a result of this extensive power delivery network, a large portion of losses are impacted by hourly loads, and the location of the generating resources that are utilized to meet those loads. The output from some of these generating resources will vary considerably over an annual period of 8,760 hours. As a result, the loss relationship for the entire EPE transmission network is not directly based on an I^2R (squaring) relationship, as incorrectly described by the witnesses. Instead, EPE's system is greatly influenced by its remote base load generation and incremental generation from local resources as the system load increases. This is why the fundamental approach to the derivation of peak and annual energy losses must be more rigorous than the simplistic and flawed approach forwarded by the loss study intervenor witnesses and must consider varying generation and supply resources and load levels by season as we have carefully done in the loss study provided by EPE.

Q. ARE THE ASSUMPTIONS PRESENTED BY THE THREE LOSS WITNESSES WITH RESPECT TO LOSSES APPLICABLE TO ALL ASPECTS OF EPE'S POWER SYSTEM?

A. No. The loss study intervenor witnesses' testimonies relating to losses are end-result oriented. In other words, by referencing distribution loss factors, their preconceived notion is that demand (peak hour) losses should be higher than energy losses. However, the transmission system is an extensive network covering voltages from 345 kV to 69 kV and has very little resemblance to a distribution network. The loss behavior of this distribution system is quite different in that this portion of the power system is essentially radial in nature and for conductors, the loss calculation as presented by each of these witnesses was utilized.

Each functional area (Transmission and Distribution) behaves quite differently from a power loss perspective. This is because on an integrated transmission network, several major factors impact losses, such as the location of generating resources, loading levels, and location of load centers. In contrast, the distribution system is more radial where each electrical circuit delivers energy from each substation along a primary circuit down to secondary voltage levels. Some of these distribution loss levels are more influenced by the fixed losses from facilities installed and energized to deliver energy throughout the year.

Q. COULD YOU PLEASE SUMMARIZE YOUR LOSS RESULTS BY FUNCTIONAL CATEGORY SEPARATED BY FIXED (CONSTANT) AND VARIABLE (I^2R) LOSSES?

A. The detail results of the loss study are summarized in the loss study on Table 3 which I have shown below (Schedule O-63, page 11 of 50).

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TABLE 3

	DEMAND (PEAK HOUR)			ENERGY (ANNUAL AVERAGE)		
	FIXED	VARIABLE	TOTAL	FIXED	VARIABLE	TOTAL
TRANS	6.84	38.74	45.57	59,883	159,754	219,637
(%)	15.00%	85.00%	100.00%	27.26%	72.74%	100.00%
SUBTRANS	1.05	5.94	6.98	9,176	10,572	19,748
(%)	15.00%	85.00%	100.00%	46.47%	53.53%	100.00%
DIST SUBS	3.87	6.55	10.42	33,874	15,804	49,678
(%)	37.12%	62.88%	100.00%	68.19%	31.81%	100.00%
PRIMARY	4.17	53.93	58.09	36,488	119,781	156,270
(%)	7.17%	92.83%	100.00%	23.35%	76.65%	100.00%
SECONDARY	15.11	12.16	27.27	132,389	24,118	156,507
(%)	55.42%	44.58%	100.00%	84.59%	15.41%	100.00%
TOTAL SYS	27.16	110.75	137.92	237,936	314,226	552,162
(%)	19.69%	80.31%	100.00%	43.09%	56.91%	100.00%
TOTAL DIST	19.28	66.08	85.36	168,878	143,899	312,777
(%)	22.59%	77.41%	100.00%	53.99%	46.01%	100.00%

Q. PLEASE BRIEFLY DISCUSS THE SIGNIFICANCE OF TABLE 3.

A. To begin with, Table 3 summarizes both fixed and variable losses by major areas of equipment utilized for the delivery of energy for the EPE power system. The results have been summarized for transmission and distribution separately to highlight the major differences and the impacts of fixed losses in the loss results.

– DEMAND (PEAK HOUR)

This portion of the results isolates the losses based on EPE's single one-hour peak and the corresponding losses by major electrical categories. This portion of Table 3 shows that during the peak hour, variable losses are the major portion of total losses for both transmission (SUBTRANS – 85%) and distribution (TOTAL DIST – 77.41%) as well as on a total system basis (TOTAL SYS – 80.31%).

– ENERGY (ANNUAL AVERAGE)

This portion of Table 3 reflects the loss calculations representing 8,760 hours of the year as opposed to just a single hour for transmission. As can be noted, the major portion of losses here for distribution are fixed (53.99%) while the fixed portion of transmission losses is much less (27.26%) and subtransmission (46.47%) for a combined transmission component of 28.85%.

In summary, the behavior of losses for one peak hour is very different than the total losses for the year, as shown by TABLE 3 above, the higher level of annual average fixed losses in the distribution system. The fact that demand loss factors for distribution are higher than the energy loss factors has no logical relationship to the derived transmission loss factors simply because the transmission network consists of the dispersed generation on the power system which impacts the calculated transmission losses on an hourly and seasonal basis. The transmission losses for one hour will not determine the overall annual energy losses for all 8,760 hours. The process of calculating losses for the EPE high voltage system (69 kV and greater) is quite different and more rigorous than for EPE's distribution system as described in the loss study (Schedule O-63) at pages 13 and 14. As a result, approaches advocated by loss intervenors will not provide reasonable results.

Q. PLEASE SUMMARIZE WHY EPE'S DETAILED LOSS STUDY IS CORRECT AND THE ASSERTIONS THAT TRANSMISSION ENERGY LOSS FACTORS CANNOT BE HIGHER THAN TRANSMISSION DEMAND LOSS FACTORS IS SIMPLY FLAWED FOR THE TRANSMISSION NETWORK BY THE WITNESSES.

A. The detail hourly loss calculations proposed by EPE for the transmission network correctly capture the higher peak hour losses as well as the higher off-peak losses which were the main contributor to a higher energy loss factor at transmission. This can be noted on the loss study for EPE's high voltage network (Schedule O-6.3, page 28).

Q. DO YOUR LOSS MODELS PROVIDE ALL OF THESE DETAIL CALCULATIONS?

A. Yes they do, along with all of the supporting hourly calculations and workpapers. This study was provided in discovery and provides detail where hourly calculations were derived and could easily be verified. The loss study intervenor witnesses failed to take account of this information and instead relied on their limited simplistic analysis of losses for distribution in arriving at their flawed conclusions for transmission network losses. The most representative calculation of annual energy losses is by calculating each hourly loss as we have done. Attempts to impute distribution assumptions to transmission losses for all hours of the year are simply flawed and misleading.

III. Specific Comments Relating to Each Witness

Jeffry Pollock

Q. COULD YOU PLEASE SUMMARIZE THE ASSUMPTIONS PRESENTED IN WITNESS POLLOCK'S DIRECT TESTIMONY ON PAGES 18-26?

A. Yes. Witness Pollock's assumption is that highest loads bring about the highest losses (Pollock, p. 20). This is an overly simplistic assumption, which he supports by referencing the distribution system results, but it cannot be further from the truth for any transmission network losses. They should be calculated entirely differently than distribution losses, which he fails to even recognize. This major confusion is one of the major flaws in his assumption of transmission losses. Distribution circuit analyses for demand losses rest primarily with radial line losses (substation supply to load). This approach, however, cannot be applied to EPE's transmission network as we are dealing with an interconnected network of 1,849 miles of higher voltage circuits (loss study O-63, page 35) and associated high voltage transformers. EPE's transmission network also incorporates many generators at various voltages dispersed on the network. As a result, Witness Pollock's flawed assumptions and conclusions are incorrect and misleading for any power system, especially for an integrated network such as EPE's.

Q. DO YOU HAVE ANY OTHER COMMENTS WITH RESPECT TO WITNESS POLLOCK'S COMMENTS ON PAGE 24?

A. Yes. To begin with, the eight detailed power flows established the loss level for each of these load levels. The hourly loss calculations then adjusted each of these losses by the difference with the next level and the resulting change in load level for each hour within the selected load analyses range. In other words, there was a loss calculation for each hour based on the results from EPE for each load level range established by the four load levels in each season.[1] No one hour's losses were used for all hours as Witness Pollock's flawed assumptions indicate. A cursory review of the Excel loss model calculations would have easily verified this for any witness.

Finally, Witness Pollock Testimony suffers from the same confusion as Witness Stanley Testimony in the discussion of the Hoebel equation. The use of the Hoebel factor

[1] As shown in the loss study Schedule O-63 Page 32, Line 1.

and related equation was primarily for the distribution conductors as it was derived as a distribution factor. For EPE's transmission network, we utilized the previously stated eight mathematical simulations (detailed power flows) to calculate each of the 8,760 hours of the year. Mr. Pollock's entire testimony concerning system losses is inaccurate and misleading and should be discounted as simply flawed and not reflective of EPE's entire transmission network.

Raymond J. Stanley

Q. COULD YOU PLEASE SUMMARIZE WITNESS STANLEY'S CONCLUSION BEGINNING ON PAGE 22 OF HIS DIRECT TESTIMONY?

A. Yes. To begin with, his assumption that the losses are the square of the current at maximum load is incorrect and misleading. As I previously stated, we are not calculating the physics of simply one circuit but of almost 1,849 miles of an integrated transmission network with dispersed generation at differing voltage levels. As a result, the loss behavior is not a simple squaring function coupled with the corresponding fixed losses for a transmission network. Witness Stanley's comments are solely attributable with respect to primary circuits where these losses of 92.83% (Table 3) for variable losses closely mirrors a squaring function. For an integrated transmission network, however, this behavior is incorrect as can be noted from the eight detailed power flows prepared by EPE for this filed loss study. When including the various power sources with interconnections, EPE's integrated transmission network and dispersed generation do not exhibit these loss characteristics as can be noted by the eight one-hour loss results representing the high and low load conditions (Schedule O-63, page 32).

Q. DOES THE HOEBEL EQUATION AND CORRESPONDING FACTOR IMPACT THE LOSS ANALYSIS PREPARED BY YOU?

A. No. The Hoebel Coefficient and calculations reflect the load factor of the losses associated with circuit conductors and transformer coils of only the distribution system. This approach was not used for any calculations of the transmission loss factor as losses for all hours were separately derived.

The transmission loss factors are a result of using the detailed calculated loss data for eight separate mathematical models (power flows) which accurately derives all 8,760 hours of load and loss results and therefore annual losses.

Kevin C. Higgins

Q. BASED ON YOUR REVIEW OF WITNESS HIGGINS' TESTIMONY WITH RESPECT TO LOSSES (PAGE 27, LINES 3-10), DO YOU HAVE ANY COMMENTS?

A. Yes, I do. Witness Higgins analysis suffers from the same shortcomings of the other intervenor witnesses I discussed. A brief mention that peak losses should be greater than annual energy losses is not only incorrect but cannot be simply stated for any power system, especially a vertically integrated power system such as EPE's.

IV. Conclusion

Q. COULD YOU PLEASE SUMMARIZE YOUR REBUTTAL TESTIMONY ADDRESSING LOSSES WITH WITNESSES POLLOCK, STANLEY, AND HIGGINS?

A. Each of these witnesses' contention that EPE's loss study is flawed should be rejected. In summary, the extensive EPE transmission network was analyzed in detail and prepared completely separate from the distribution system which was presented in the EPE Loss Analysis (Schedule O-63), in Appendices A and B. The detail calculations in Excel were provided to these witnesses where verification of their flawed assumptions could be identified, and yet, it appears that their proposed assumptions, without analyses, appears to be the most expedient approach, however flawed it may be.

Briefly stated, the EPE loss study process considered the following:

1. Separate transmission hourly analyses of all circuits (1,849 miles) and transformers for 8,760 hours of the calendar year. This was based on mathematical models replicating eight unique load levels and corresponding loss levels. There can be no better analysis of the EPE system as this best represents the power system losses for all hours of the year.

2. The distribution system considered all aspects of the delivery system in detail as follows:

   a. Distribution substations

   b. Primary circuits

   c. Secondary voltage transformation

   d. Secondary circuits

   e. Service cables to buildings

The witnesses all mirrored a common theme which would have been readily dispelled by any analyses or review of the loss models provided in discovery. As a result, my experience suggests that each witness expected a result and generated an explanation to arrive at those erroneous and flawed conclusions. Working backwards in loss analyses is a very dangerous path leading to flawed logic.

Q. DOES THIS CONCLUDE YOUR TESTIMONY?

A. Yes, it does.

EXHIBIT PMN-1
RESUME OF PAUL M. NORMAND

PAUL M. NORMAND
Principal

Experience in the electric, gas, and water industry includes project management of various cost analyses, engineering system planning and design functions, detailed electric power loss analyses, as well as cost and contract functions for a manufacturer of nuclear equipment. Also, experienced in the analysis and preparation of economic data, revenue requirements and rate design for presentation before state and federal regulatory agencies. Presented expert testimony on behalf of utilities in over 30 applications before regulatory commissions.

EXPERIENCE:

1984 - Present **MANAGEMENT APPLICATIONS CONSULTING, INC.**
Principal consultant providing consulting services to industry in planning, pricing, and regulation. Extensive experience in analyzing power systems for power loss studies and unbundling issues.

1983 - 1984 **P. M. NORMAND ASSOCIATES**
Independent consultant providing services to the utility industry in cost analyses, rate design and expert testimony.

1976 - 1983 **GILBERT/COMMONWEALTH**, Reading, Pa.
Director, Rate Regulatory Services - Administrative and fiscal responsibility for rate and regulatory services nationally for electric, gas, and water utilities. Additional responsibilities included all marketing, research and development efforts, and contract negotiations for all studies performed by the Regulatory Service Department. Provided consulting service to utilities in project management, personnel staffing, and future development efforts.

Manager, Austin, Texas Office - Responsibility for the overall administrative and business aspects for the department in the Southwest. Duties included the preparation of all aspects of rate cases and PURPA compliance studies.

Senior Management Consultant - Responsibilities included project management of various electric and gas cost-of-service studies and the development of methodologies utilized in the analysis of time-differentiated average and marginal cost studies.

Consulting Engineer - Prepared class and time-differentiated cost-of- service studies, revenue requirements exhibits, and expert testimony for formal rate proceedings before regulatory agencies. Performed forecasted ten-year cost-of-service studies by customer classes. Analyzed and prepared transmission (wheeling) rates based on cost-of-service.

Engineer - Derived system demand and energy loss factors and customer load characteristics required for cost-of-service results and related rate schedules.

1975 - 1976 **WESTINGHOUSE ELECTRIC CORPORATION,** Pittsburgh, PA
Responsible for the procurement of electrical/electronic control equipment and power cables for the nuclear reactor control system. Assisted in the development of procedures for the seismic testing of various electronic equipment related to reactor control.

1971 - 1974 **NEW ENGLAND ELECTRIC SYSTEM,** Westborough, Massachusetts
Experience from various system assignments in conjunction with formal education. Assigned to the Transmission and Distribution Department with responsibilities in several voltage conversion efforts and system planning. Development of network modeling techniques, load flow, and fault study analyses for the system planning department.

1966 - 1970 **U.S. NAVY**
Aviation electronic technician with responsibilities for maintenance and trouble-shooting of electronic communication equipment.

EDUCATION:

B.S.E.E., Electrical Engineering, Northeastern University, 1975
M.S.E.E., Electrical Power Systems, Northeastern University, 1975

Graduate Studies - MBA Program, Lehigh University and Albright College, 1977 to 1980

SOCIETIES:

Institute of Electrical and Electronic Engineers

APPEARANCES AS EXPERT WITNESS:

Federal Energy Regulatory Commission
Arkansas Public Service Commission
Delaware Public Service Commission
Indiana Utility Regulatory Commission
Illinois Commerce Commission
Kansas Corporation Commission
Kentucky Public Service Commission
Louisiana Public Service Commission
Maine Public Utilities Commission
Maryland Public Service Commission
Massachusetts Department of Public Utilities
Missouri Public Service Commission
New Hampshire Public Utilities Commission
New Jersey Board of Public Utilities
New York Public Service Commission
North Carolina Utilities Commission
Ohio Public Utilities Commission
Pennsylvania Public Utility Commission
Rhode Island Public Utilities Commission
Tennessee Public Utility Commission
Texas Public Utilities Commission

PAPERS AND PRESENTATIONS:

"Probability of Dispatch Costing Method for Electric Utility Cost-of-Service Analysis." Co-authored with P. S. Hurley, presented to Edison Electric Institute Rate Research Committee May 4, 1982.

"Costing Strategies under Changing Marketing Goals and Long Term Investment Growth." Presented to Missouri Valley Electric Association (MVEA), Kansas City, MO, November 13, 1991.

EXHIBIT PMN-2
LIST OF EXPERT TESTIMONY
PRESENTED BY PAUL M. NORMAND

APPEARANCES AS EXPERT WITNESS
PAUL M. NORMAND

JURISDICTION	DOCKET	COMPANY	YEAR	DESCRIPTION
New Hampshire PUC	DR77-142	Concord Electric	1977	CP/NCP No Generation
FERC	ER78-194	Cleveland Electric Illuminating	1978	12CP
FERC	ER78-417	Kentucky Utilities	1978	12CP
Massachusetts DPU	19920	Bay State Gas Company	1978	
Massachusetts DPU	19991	Boston Edison	1978	Average and Excess
New Hampshire	DR79-91	Exeter & Hampton	1979	CP/NCP No Generation
FERC	ER79-399	Cleveland Electric Illuminating	1979	12CP
Maine PUC	80-108	Bangor Hydro-Electric	1980	Probability of Dispatch
Texas PUC	3473	West Texas Utilities	1980	Probability of Dispatch
Texas PUC	3522	Lower Colorado River Authority	1980	Probability of Dispatch
Arkansas PUC	U-3136	Southwestern Electric Power Co.	1980	Probability of Dispatch
FERC	ER80-488	Cleveland Electric Illuminating	1980	12CP
FERC	ER81-181	Bangor Hydro-Electric	1981	Probability of Dispatch
Texas PUC	3437	Central & Southwest Co.	1981	Capacity Allocation Methods, POD
Texas PUC	3716	Southwestern Electric Power Co.	1981	Probability of Dispatch
Texas PUC	4202	West Texas Utilities	1981	Probability of Dispatch
Louisiana PSC	U-15180	Southwestern Electric Power Co.	1981	Probability of Dispatch
FERC	ER81-387	Central Power & Light Co.	1981	Probability of Dispatch
FERC	ER81-341	Kentucky Utilities	1981	12CP
FERC	ER81-341-001	Kentucky Utilities	1981	Probability of Dispatch
Texas PUC	4400	Central Power & Light Co.	1982	Probability of Dispatch
Illinois CC	81-0600	Central Illinois Light Co.	1982	General Allocations
Ohio PUC	81-1256-EL-A/R	Dayton Power & Light Co.	1982	Probability of Dispatch
FERC	ER82-673	Kentucky Utilities	1982	12CP/Incremental
Texas PUC	4628	Southwestern Electric Power Co.	1982	Probability of Dispatch, Weather Normalization
Texas PUC	4716	West Texas Utilities	1982	Probability of Dispatch
Kentucky PUC	8624	Kentucky Utilities	1983	Probability of Dispatch
Texas PUC	5204	West Texas Utilities	1983	Probability of Dispatch
Texas PUC	5301	Southwestern Electric Power Co.	1983	Probability of Dispatch
Arkansas PUC	83-064-U	Southwestern Electric Power Co.	1983	Probability of Dispatch
FERC	ER-83-656-000	Kentucky Utilities	1983	12CP/Incremental
Arkansas PUC	84-175-U	Southwestern Electric Power Co.	1984	Probability of Dispatch
Arkansas PUC	85-231-U	Southwestern Electric Power Co.	1985	Rate Design and Dispatch
Massachusetts	86-82	The Berkshire Gas Company	1986	Marginal and Accounting Cost of Service, Rate Design
Maine PUC	87-9	Maine Public Service	1988	Probability of Dispatch, Cost of Service, Rate Design
Massachusetts DPU	88-161	Nantucket Electric	1988	Least Cost Financing for Generating Facilities
Massachusetts DPU	88-168	Nantucket Electric	1988	Marginal and Accounting Cost of Services, Rate Design using POD
Texas PUC	8400	Pedernales Electric	1989	Loss Analysis, Voltage Level Differentiation
Texas PUC	8418	Pedernales Electric	1989	Cost/benefit analysis of Transmission Line Project
Massachusetts DPU	89-112	The Berkshire Gas Company	1989	Marginal and Accounting Cost of Service, Rate Design and Dispatching

APPEARANCES AS EXPERT WITNESS
PAUL M. NORMAND

JURISDICTION	DOCKET	COMPANY	YEAR	DESCRIPTION
Maine PUC	89-68	Central Maine Power	1990	Probability of Dispatch, Power Loss Study
Massachusetts DPU	90-121	The Berkshire Gas Company	1990	Marginal and Accounting Cost of Service, Rate Design, and Dispatching
Philadelphia Gas Commission	------	Philadelphia Gas Works	1990	Cost of Service
Maine PUC	91-010	Bangor Hydro-Electric Company	1991	Power System Loss Study
Massachusetts DPU	91-61	Fall River Gas Company	1991	Marginal and Accounting Cost of Service, Rate Design
Texas PUC	10,035	West Texas Utilities	1991	Electric Power Loss Studies
Maine PUC	91-168	Bangor Hydro-Electric Company	1991	Loss Analysis
Massachusetts DPU	92-26	The Berkshire Gas Company	1992	Weather Normalization
Massachusetts DPU	92-210	The Berkshire Gas Company	1992	Accounting and Marginal Cost of Service, Rate Design
New York PSC	93-E-0082	Orange & Rockland Utilities	1993	Electric Cost of Service and Demand Allocations
New York PSC	95-E-0491	Orange & Rockland Utilities	1995	Electric Cost of Service and Demand Allocations; Base, Intermediate, Peak
Texas PUC	14965	Central Power and Light Company	1995	Probability of Dispatch, Loss Analysis
Massachusetts DPU	96-60	Fall River Gas Company	1996	Accounting and Marginal Cost of Service, Rate Design
Kentucky PSC	96-523	Kentucky Utilities Company	1997	Fuel Clause and Losses
New Jersey BPU	EO97070464	Rockland Electric Company	1997	Electric Unbundling Cost of Service and Rate Design
Pennsylvania PUC	R-00974150	Pike County Light and Power Company	1997	Electric Unbundling Cost of Service and Rate Design
New York PSC	96-E-0900	Orange & Rockland Utilities	1997	Electric Unbundling Cost of Service and Rate Design
New Jersey BPU	EO97070455 & 456	Atlantic City Electric Company	1997	Stranded Costs, Unbundled Rates
Kentucky PSC	96-524A, B & C	Louisville Gas & Electric Company	1999	Review Fuel Adjustment Clauses
FERC	ER98-1438-006	Midwest Independent Transm. System Operator, Inc.	2000	Revised Transmission Loss Factors
Kentucky PSC	2001-333	Louisville Gas & Electric Company	2001	Electric Unbundling Cost of Service and Rate Design
Kentucky PSC	2001-333	Kentucky Utilities Company	2001	Electric Unbundling Cost of Service and Rate Design
Massachusetts DTE	DTE 01-56	The Berkshire Gas Company	2001	Gas Unbundling Cost of Service
New York PSC	01-G-1668	New York State Electric & Gas Corp.	2001	Gas Unbundling Cost of Service and Rate Design
New York PSC	00-M-504	New York State Electric & Gas Corp.	2002	COS Panel
Kentucky PSC	2002-00224	Kentucky Utilities	2002	Electric Loss-Incremental
Kentucky PSC	2002-00225	Louisville Gas and Electric	2002	Electric Loss-Incremental
New York PSC	02-G-0003	Corning Natural Gas Company	2002	Gas Cost of Service and Rate Design
New York PSC	02-G-1275	St. Lawrence Gas Company, Inc.	2002	Gas Cost of Service and Rate Design
Kentucky PSC	2002-00433	LGE Energy	2003	Electric Loss-Incremental
Delaware PSC	03-127	Delmarva Power & Light Company	2003	Gas Cost of Service and Rate Design
New Jersey BPU	ER-02100724	Consolidated Edison/Rockland Electric	2004	Electric T&D Separation Study
New York PSC	05-G-1359	Corning Natural Gas Corporation	2005	Gas COS and Rate Design Recommendations
New York PSC	05-E-1222	New York State Electric & Gas Corp.	2005	Electric Accounting Class COS Study
New York PSC	05-G-1635	St. Lawrence Gas Company, Inc.	2005	Accounting COS, Rate Design, Depreciation Accrual Rates
New Hampshire PUC	05-178	Unitil Energy Systems, Inc.	2005	Depreciation Rate Study
Delaware PSC	05-304	Delmarva Power & Light	2005	Electric Cost of Service/Unbundling

APPEARANCES AS EXPERT WITNESS
PAUL M. NORMAND

JURISDICTION	DOCKET	COMPANY	YEAR	DESCRIPTION
Maryland PSC	9062	Chesapeake Utilities Corporation	2006	Gas COS, Rate Design
Indiana URC	43111	Vectren Corp., Southern Indiana Gas & Electric Co.	2006	Depreciation Rate Study @ 12/31/05
Massachusetts DTE	07-46	New England Gas Company, Fall River Gas Company, North Attleboro Gas Company	2006	Depreciation Study @ 12/31/05
Delaware PSC	06-284	Delmarva Power & Light	2006	Gas Cost of Service
Maryland PSC	9092, 9093	Delmarva Power & Light	2006	Electric Cost of Service
Delaware PSC	07-186	Chesapeake Utilities Corporation	2007	Depreciation Study @ 12/31/05
Maryland PSC	9062, Phase II	Chesapeake Utilities Corporation	2007	Depreciation Study @ 12/31/05
New York PSC	07-G-0772	Corning Natural Gas Corporation	2007	Accounting Cost of Service, Rate Design Recommendations
Kansas Corporation Commission	08-MDWE-594-RTS	Midwest Energy, Inc.	2007	Depreciation Study @ 12/31/06
Maine PUC	2007-215	Central Maine Power Company	2008	Depreciation Study @ 12/31/06
Maryland PSC	9145	Easton Utilities Commission	2008	Electric COS and Rate Design
New Hampshire PUC	DG 08-009	EnergyNorth Natural Gas, Inc. d/b/a National Grid NH	2008	Depreciation Study @ 12/31/06
North Carolina UC	G-9, Sub 550	Piedmont Natural Gas Company, Inc.	2008	Gas Cost of Service
Missouri PSC	ER 2009-0089	Kansas City Power & Light Company	2008	Electric Cost of Service
Massachusetts DPU	08-35	New England Gas Company, Fall River Gas Co., North Attleboro Gas Co.	2008	Depreciation Study @ 12/31/07
New York PSC	08-G-1137	Corning Natural Gas Corporation	2008	Accounting Cost of Service, Rate Design Recommendations, Depreciation Study @ 12/31/06
PUC of Texas	36025	Texas-New Mexico Power Company	2008	Depreciation Study @ 12/31/07
Maryland PSC	9205	Easton Utilities Commission	2009	Gas COS, Rate Design, and Cash Working Capital
Massachusetts DPU	09-30	NiSource/Bay State Gas Company	2009	Gas Accounting Cost of Service and Marginal Cost Study
Illinois Commerce Commission	09-0309 – 09-0311	Ameren/Central Illinois Light Company	2009	Accounting Cost of Service and Rate Design
New York PSC	09-E-0715 09-G-0716	New York State Electric & Gas Corporation	2009	Electric and Gas Embedded Cost of Service Studies
New York PSC	09-E-0717 09-G-0718	Rochester Gas & Electric Corporation	2009	Electric and Gas Embedded Cost of Service Studies
Kansas Corporation Commission	10-KCPE-415-RTS	Kansas City Power & Light Company	2009	Accounting Class Cost of Service
Missouri PSC	ER-2010-0355	Kansas City Power & Light Company	2010	Accounting Class Cost of Service
Missouri PSC	ER-2010-0356	KCP&L Greater Missouri Operations Co.	2010	Accounting Class Cost of Service
New Hampshire PUC	DG 10-017	EnergyNorth Natural Gas, Inc. /National Grid NH	2010	Cost of Service and Rate Design, Cash Working Capital
New Hampshire PUC	DE 10-055	Unitil Service Corp/Unitil Energy Systems, Inc.	2010	Depreciation Study @ 12/31/09, Cost of Service and Rate Design
Massachusetts DPU	DPU 10-55	National Grid – Massachusetts/Boston Gas Co., Essex Gas Co. and Colonial Gas Co.	2010	Depreciation Study @ 12/31/08, Cash Working Capital
Massachusetts DPU	DPU 11-01	Unitil Service Corp./Fitchburg Gas & Electric Light Co., Electric Division	2011	Depreciation Study @ 12/31/08, Accounting and Marginal COS, Rate Design, and Lead-Lag Studies
Massachusetts DPU	DPU 11-02	Unitil Service Corp./Fitchburg Gas & Electric Light Co., Gas Division	2011	Depreciation Study @ 12/31/08, Accounting and Marginal COS, Rate Design, and Lead-Lag Studies
FERC	ER-11-3643-000	PacifiCorp	2011	Transmission Loss Study
New York PSC	11-G-0280	Corning Natural Gas Corporation	2011	Accounting Cost of Service and Rate Design

APPEARANCES AS EXPERT WITNESS
PAUL M. NORMAND

JURISDICTION	DOCKET	COMPANY	YEAR	DESCRIPTION
New Hampshire PUC	DG 11-069	Unitil Service Corp/Northern Utilities	2011	Depreciation Study @ 12/31/10, Accounting and Marginal COS, Rate Design, and Lead-Lag Study
Maine PUC	2011-92	Unitil Service Corp/Northern Utilities	2011	Depreciation Study @ 12/31/10, Accounting and Marginal COS, Rate Design, and Lead-Lag Study
FERC	ER-12-909-000	Westar Energy, Inc.	2012	Transmission Loss Study
Missouri PSC	ER-2012-0174	Kansas City Power & Light Company	2012	Accounting Class Cost of Service
Missouri PSC	ER-2012-0175	KCP&L Greater Missouri Operations Company	2012	Accounting Class Cost of Service
PUC of Texas	40094	El Paso Electric Company	2012	Loss Study
Massachusetts DPU	DPU 12-25	NiSource/Columbia Gas of Massachusetts	2012	Long-Run Marginal Cost Study
Maryland PSC	9285	Pepco Holdings/Delmarva Power & Light	2012	Cost of Service Rebuttal
Maryland PSC	9286	Pepco Holdings/Potomac Electric Company	2012	Cost of Service Rebuttal
Rhode Island PUC	4323	National Grid/Narragansett Electric Company Rhode Island Gas Division	2012	Accounting COS and Rate Design
Kansas Corporation Commission	12KCPE-764-RTS	Kansas City Power & Light Company	2012	Accounting Class Cost of Service
FERC	ER-13-553-000	Louisville Gas and Electric Company Kentucky Utilities Company	2012	Transmission Loss Analysis
Maine PUC	2013-00133	Unitil Service Corp./Northern Utilities	2013	Accounting & Marginal COS, Rate Design
New Hampshire PUC	DG 13-086	Unitil Service Corp./Northern Utilities	2013	Accounting & Marginal COS, Rate Design
North Carolina UC	G-9, Sub 631	Piedmont Natural Gas Company, Inc.	2013	Lead-Lag study, Cash Working Capital
Massachusetts DPU	DPU 13-90	Unitil Service Corp./Fitchburg Gas & Electric Light Company	2013	Accounting & Marginal COS, Rate Design
Maine PUC	2013-1168	Central Maine Power Company	2013	Marginal COS and Loss Study, Rate Design
FERC	ER13-2428-000	Kentucky Utilities Company	2013	Analysis of System Losses
Maryland PSC	9350	Sandpiper Energy, Inc.	2014	Gas Depreciation Study Rebuttal
Kansas Corporation Commission	15-KCPE-116-RTS	Kansas City Power & Light Company	2015	Accounting Class Cost of Service
Massachusetts DPU	DPU 15-50	NiSource/Columbia Gas of Massachusetts	2015	Marginal Cost Study
Massachusetts DPU	DPU 15-75	Liberty Utilities/New England Natural Gas Company	2015	Gas Depreciation Study
Massachusetts DPU	DPU 15-80 / 15-81	Unitil Service Corp./Fitchburg Gas & Electric Light Company	2015	Gas and Electric Accounting & Marginal COS, Rate Design, and Depreciation Study
New York PSC	15-G-0382	Enbridge/St. Lawrence Gas Company, Inc.	2015	Gas Depreciation Study, Cost of Service, Rate Design
PUC of Ohio	15-1830-EL-AIR 15-1831-EL-AAM 15-1831-EL-ATA	The Dayton Power and Light Company	2015	Electric Depreciation Study, Loss Study
New York PSC	16-G-0058	KeySpan Gas East Corp. d/b/a/ National Grid	2015	Gas Depreciation Study
New York PSC	16-G-0059	The Brooklyn Union Gas Company d/b/a National Grid NY	2015	Gas Depreciation Study
PUC of Texas	44941	El Paso Electric Company	2016	Loss Study
New Hampshire PUC	DE 16-384	Unitil Service Corp/Unitil Energy Systems, Inc.	2016	Lead-Lag Study
New York PSC	16-W-0259	New York American Water Company, Inc.	2016	Depreciation Study
New York PSC	16-G-0369	Corning Natural Gas Corporation	2016	Depreciation Study, Accounting COS, Rate Design
Wyoming PSC	13-035-184	PacifiCorp	2016	6-State Transmission Loss Analysis
Montana PSC	D2016.9.68	NorthWestern Energy	2016	Phase One: Lead-Lag Study
Montana PSC	D2016.9.68	NorthWestern Energy	2016	Phase One: Cost Allocation of A&G and Common Plant (rebuttal) – Gas
Montana PSC	D2016.9.68	NorthWestern Energy	2016	Phase Two: Accounting and Marginal Cost Studies and Rate Design – Gas

APPEARANCES AS EXPERT WITNESS
PAUL M. NORMAND

JURISDICTION	DOCKET	COMPANY	YEAR	DESCRIPTION
Maryland PSC	9441	Easton Utilities	2017	Electric Cost of Service and Rate Design
Maryland PSC	9441	Easton Utilities	2017	Gas Cost of Service and Rate Design
Massachusetts DPU	DPU 17-170	National Grid – Massachusetts/Boston Gas Co. and Colonial Gas Co.	2017	Depreciation Study @ 12/31/15
New Hampshire PUC	DG 17-048	Liberty Utilities/EnergyNorth Natural Gas Company	2017	Depreciation Study @ 12/31/15
Maine PUC	2017-00065	Unitil Service Corp./Northern Utilities	2017	Accounting & Marginal COS, Rate Design, Depreciation Study @ 12/31/16
New Hampshire PUC	DG 17-070	Unitil Service Corp./Northern Utilities	2017	Accounting & Marginal COS, Rate Design, Depreciation Study @ 12/31/16
Rhode Island PUC	4770	National Grid/Narragansett Electric Company Rhode Island Gas Division	2017	Accounting COS, Rate Design
FERC	ER18-1418-000	Westar Energy, Inc.	2018	Transmission Loss Study
Montana PSC	D2018.2.12	NorthWestern Energy	2018	Allocated COS, Rate Design, Lead-Lag Study – Electric
Massachusetts DPU	DPU 19-131	Unitil Service Corp./Fitchburg Gas & Electric Light Company	2019	Accounting & Marginal COS, Rate Design
Maine PUC	2019-00092	Unitil Service Corp./Northern Utilities	2019	Accounting & Marginal COS, Rate Design
New York PSC	19-G-0310	KeySpan Gas East Corp. d/b/a/ National Grid	2019	Gas Depreciation Study
New York PSC	19-G-0309	The Brooklyn Union Gas Company d/b/a National Grid NY	2019	Gas Depreciation Study
FERC	ER20-54-000	Sunflower Electric Power Cooperative and Mid-Kansas Electric Company, Inc.	2019	Transmission Loss Study
FERC	ER20-1150-000	Dayton Power & Light Co.	2020	Electric Transmission Depreciation Study
New York PSC	20-G-0101	Corning Natural Gas Corporation	2020	Accounting COS, Rate Design, Depreciation Study
Tennessee PUC	20-00086	Piedmont Natural Gas Company, Inc.	2020	Embedded COS, Rate Design, Lead-Lag Study
Pennsylvania PUC	R-2020-3022134	Pike County Light & Power Company	2020	Gas Embedded COS and Rate Design
Pennsylvania PUC	R-2020-3022134	Pike County Light & Power Company	2020	Electric Embedded COS and Rate Design
New York PSC	21-G-0394	Corning Natural Gas Corporation	2021	Accounting COS, Rate Design, and Depreciation Study