BEFORE THE STATE OF NEW JERSEY
BOARD OF PUBLIC UTILITIES

IN THE MATTER OF THE VERIFIED PETITION OF PUBLIC SERVICE ELECTRIC & GAS COMPANY FOR APPROVAL OF THE CONSTRUCTION OF THE MASON SUBSTATION DAMAGED DURING SUPERSTORM SANDY	)	BPU Dkt. No. EO16080788

DIRECT TESTIMONY OF ROBERT FAGAN
ON BEHALF OF THE
DIVISION OF RATE COUNSEL

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I. STATEMENT OF QUALIFICATIONS

Q. Would you please state your name, position, and business address?

A. My name is Robert Fagan. I am a Principal Associate with Synapse Energy Economics, an energy consulting company located at 485 Massachusetts Avenue, Cambridge, Massachusetts.

Q. On whose behalf are you submitting testimony in this proceeding?

A. I am submitting testimony on behalf of the New Jersey Division of Rate Counsel ("Rate Counsel").

Q. Mr. Fagan, please describe your professional background at Synapse Energy Economics.

A. I am a mechanical engineer and energy economics analyst, and I have analyzed energy industry issues for more than 25 years. My professional activities focus on many aspects of the electric power industry:

- Transmission and distribution system components;
- Economic and technical analysis of electric supply and delivery systems;
- Wholesale and retail electricity provision;
- Energy and capacity market structures;
- Renewable resource alternatives, including on-shore and off-shore wind and solar PV; and
- Assessment and implementation of energy efficiency and demand response alternatives.

I have expertise with respect to the complexities of, and the interrelationships between, the technical and economic dimensions of the electric power industry in the United States and Canada. My areas of focus include: wholesale energy and capacity provision under market-based and regulated structures; transmission use pricing, encompassing congestion management, losses, LMP, and alternatives; financial and physical transmission rights; and transmission asset pricing (e.g., embedded cost recovery tariffs).

My experience includes in-depth knowledge of physical distribution and transmission network characteristics; related generation dispatch/system operation functions; technical and economic attributes of generation resources; regional transmission organization ("RTO") tariff and market rules structures and operation; and Federal Energy Regulatory Commission ("FERC") regulatory policies and initiatives, including those pertaining to RTO and ISO development and evolution. I also have expertise with respect to the assessment of technical and economic dimensions of wind and solar power integration into utility power systems, and in utility demand side management and demand response impacts on the power system.

Of particular note for this proceeding, I was a field engineer and eventually a supervisor of transmission and distribution operations and maintenance (substations) for Narragansett Electric Company (now, National Grid in Rhode Island) during 1981-1984. Part of my responsibilities included provision of "troubleman training" to electric linemen in the interpretation and understanding of substation one-line diagrams, to ensure safety during switching operations.

My resume, which accurately reflects my background and experience, is included herewith as **RF-Exhibit 1.**

Q. Mr. Fagan, please describe your educational background.

A. I hold an MA from Boston University in Energy and Environmental Studies (1992) and a BS from Clarkson University (then Clarkson College) in Mechanical Engineering (1981). I have completed additional course work in wind integration, solar engineering, regulatory and legal aspects of electric power systems, building controls, cogeneration, lighting design and mechanical and aerospace engineering.

Q. Have you previously submitted testimony before the Board of Public Utilities?

A. Yes. In the course of my professional career, I have submitted testimony before the New Jersey Board of Public Utilities (BPU, Board) in dockets GO12070640, GO11070399, EO11050309, ER10100762, ER10040287, ER08050310, EO07040278, and EM05020106.

Q. Mr. Fagan, have you previously testified before utility regulatory agencies?

A. Yes. I have previously testified before regulatory commissions in over 50 proceedings across the United States and Canada.

II. PURPOSE AND SUMMARY

Q. What is the purpose of your testimony in this proceeding?

A. The purpose of my testimony is to review the engineering assumptions of Public Service Electric and Gas Company's ("PSE&G" or "the Company") petition to rebuild the Mason and Building 9 substations ("Mason") and to take ownership of the Mason substation from New Jersey Transit ("NJT"). The fact that I do not

comment on every aspect of the Company's analysis should not be interpreted to mean that I agree with those aspects. I also address certain aspects of the costs of rebuilding the Mason substation and if those costs could be lower under alternative design concepts.

Q. Please summarize your findings and recommendations.

A. My findings and recommendations are summarized as follows:

- It is not evident that the proposed costs for any portion of the proposed substation rebuild should be allocated to PSE&G ratepayers other than the one entity taking service from the substation, NJT.
- From a transmission perspective, the proposed Mason substation would meet the Federal Energy Regulatory Commission's ("FERC") test for direct assignment since the proposed work would be for the sole benefit of a single customer, NJT. Ratepayers should not bear such costs that would benefit a single customer, albeit a public interest entity.
- From a distribution perspective, the proposed Mason substation is analogous to PSE&G's treatment of extension work since the proposed work would be for the sole benefit of a single customer, NJT. Ratepayers should not bear such costs that would benefit a single customer, albeit a public interest entity.
- The proposed micro-grid component of the NJT's Transitgrid project that is funded with federal funds will enable NJT to sell energy into the PJM market. This will require a PJM interconnection request, and any resulting costs of interconnection should not be a component of the costs to be recovered from ratepayers for the proposed Mason substation rebuilding proposal.

- The only claimed benefit for PSE&G ratepayers (besides NJT) stems from a 230 kV switchyard improvement (elimination of single point of failure) whose effect could potentially be obtained with a lower-cost substation upgrade or alternative than the Mason substation rebuild that is proposed by PSE&G.
- PSE&G has not provided any such alternatives analysis to explore this issue, based on the claim that there are no alternatives.[1] Thus there is no definitive way to determine if the proposed project costs to be considered for allocation to PSE&G ratepayers (other than NJT) are excessive without a detailed and independent alternatives analysis. Furthermore, there is no reliability requirement to actually eliminate the single point of failure.
- Should the Board approve PSE&G's request, the proposed $268 million for the raise and rebuild of the Mason substation includes <**Begin Confidential**> [redacted] <**End Confidential**> of work specific to the 230 kV breakers that are transmission-related expenses and thus will be outside the rate-setting purview of the Board. The remaining <**Begin Confidential**> [redacted] <**End Confidential**> appears to be distribution-related and specific to voltages that would only benefit the only customer of the substation, NJT. This latter portion includes transformation from the 230 kV voltage level to the 55 kV voltage level.
- In this case, however, the Board should reject the Company's proposal to include the rebuilding of the Mason substation in distribution rates since PSE&G has not demonstrated that the benefits of the program would accrue to

[1] RCR-ENG-38

other distribution customers other than NJT. The Company's proposed allocation of the transmission-associated costs would also benefit only NJT. The proposed costs of the substation raise and rebuild would be considered a direct assignment under FERC jurisdiction. The proposed substation upgrade costs associated with any future microgrid interconnection should be borne by NJT. Furthermore, PSE&G currently has mechanisms in its tariff that specifically address upgrades or interconnections requests from single customers.

III. BACKGROUND: NEW JERSEY RESILIENCY DOCKETS

Q. What is your understanding of the storm hardening efforts within New Jersey?

A. It is my understanding that after the events of Hurricane Irene, the 2011 October snowstorm, and Superstorm Sandy, the Board sought to improve the ability of New Jersey utilities to respond to storm-related Major Events. Following Hurricane Irene and the 2011 October snowstorm, the Board issued its Hurricane Irene Order that set forth 65 items requiring action by the electric distribution companies to address storm preparation and response.[2] In 2013, the Board issued an Order inviting EDCs to file proposals for "infrastructure upgrades designed to protect that State's utility infrastructure from future Major Storm Events."[3]

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[2] I/M/O the Board's Review of Utilities' Response to Hurricane Irene, BPU Docket No. EO11090543 (Order, January 23, 2013) ("Hurricane Irene Order").

[3] I/M/O the Board's Establishment of a Generic Proceeding to Review Costs, Benefits and Reliability Impacts of Major Storm Event Mitigation Efforts, BPU Docket No. AX 13030197 (Order, March 20, 2013) ("2013 Storm Order"), p. 3.

Q. Is it your understanding that PSE&G has filed a petition to address storm hardening and grid resiliency issues?

A. Yes. In February 2013, Public Service Electric and Gas ("PSE&G") filed its multi-year $1.7 billion Energy Strong petition for its electric distribution service system. Ultimately, this case settled in May 2014 to allow PSE&G to implement an $600 million electric distribution service system investment program.[4]

Q. Why is that pertinent to this proceeding?

A. PSE&G seeks to utilize an Energy Strong-type rate mechanism that was designed to harden distribution substations that serve multiple customers and apply that mechanism for the Mason substation that provides transmission flow-through service and only serves NJT. While NJT provides service to its ridership, NJT is a single customer in the eyes of PSE&G and FERC. To compare the proposed Mason substation cost with the Energy Strong Programs, the substation component of the Energy Strong program allocated $400 million to harden 29 substations which benefitted thousands of PSE&G customers.[5] In this proceeding, the Company is proposing to spend $268 million for just the Mason substation. The proposed cost estimate for the Mason substation is over half of the spending allocated to PSE&G for the entirety of the Energy Strong substation program.

[4] See I/M/O PSE&G, BPU Docket Nos. EO13020155 and GO13020155 (Order, May 21, 2014).

[5] Ibid. page 10.

IV. BACKGROUND: MASON SUBSTATION

Q. Please describe your understanding of the Mason substation and its role in NJT and PSE&G operations.

A. I understand that NJT constructed the Mason substation (aka NJT Meadows) between 1980-1983 and the Building 9 substation between 1985 and 1988.[6] The Mason substation provides traction power to all electric trains on its Morris and Essex line rails between the Maplewood Switching station through the Hoboken Terminal.[7] The Building 9 substation provides service for NJT's Meadowlands Maintenance Complex and its nearby Rail Operations Center.[8] NJT owns and operates both substations in addition to 36 other substations that NJT owns.[9, 10] PSE&G witness Jorge Cardenas summarizes the role of the two substations in his testimony.[11] Specifically, the Mason substation transforms 230kV service from the PSE&G transmission network to 55kV and lower voltages for NJT. Because the substation is connected to the PSE&G transmission system, the substation is considered part of the Bulk Electric System ("BES") and therefore needs to meet North American Electric Reliability Corporation ("NERC") guidelines, which is generally all transmission equipment at 100 kV or higher and not used for local distribution.[12, 13]

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[6] RCR-A-2
[7] Ibid.
[8] Ibid.
[9] RCR-A-1
[10] RCR-A-13
[11] Direct Testimony of Jorge Cardenas. November 18, 2016, 3:8-4:5
[12] Direct Testimony of Jorge Cardenas. November 18, 2016, 6:21-7:2
[13] RCR-ENG-23

Q. Do both NJT and PSE&G contend that there are unique circumstances to the substation?

A. Yes. NJT claims that the Mason substation is the only substation in its system that is part of the BES.[14, 15] PSE&G claims that the Mason substation is unique due to the nature of NJT's operation of the substation.[16]

Q. Was the Mason substation affected by Superstorm Sandy in 2012?

A. Yes, the Mason substation suffered storm surge damages from Superstorm Sandy. Witness Cardenas summarized some of the damage to the substation, which consisted primarily of storm surge damage that flooded multiple substation systems with salt-water.[17] In response to RCR-A-5, NJT provided a copy of the confidential damage assessment.[18]

Q. How much did NJT spend on restoration activities for the Mason substation?

A. NJT indicated that it had spent $5.4 million on restoration efforts for the Mason substation.[19] NJT claimed that the spending did not include ongoing repairs to address systemic issues at the substation resulting from Superstorm Sandy.[20] In addition, PSE&G indicated that the Company spent $44,378 on restoration efforts for the substation.[21]

[14] RCR-ENG-55
[15] RCR-A-14
[16] S-PS-7
[17] Direct Testimony of Jorge Cardenas. 5:20-6:3
[18] RCR-A-5
[19] RCR-ET-7
[20] Ibid.
[21] RCR-ENG-39

Q. Is the Mason substation in operation currently?

A. Yes, NJT currently owns, operates, and maintains the substation to provide traction power to its electric trains on the Morris and Essex lines. PSE&G indicates that the substation has not experienced a sustained outage in the last five years since Superstorm Sandy.[22]

V. THE MASON SUBSTATION ONLY SERVES NJT

Q. Please summarize your findings regarding the service that NJT takes from Mason substation.

A. As I noted earlier, NJT is the only customer that takes service from the Mason substation. As such, there are rate recovery mechanisms at both the transmission and distribution level that require NJT to pay for the upgrades proposed by PSE&G. New Jersey ratepayers should not bear the burden of paying for the proposed upgrades in their electric rates.

Q. Has PSE&G indicated that NJT is the sole customer served by the Mason substation?

A. Yes, in response to S-PS-0006, the Company indicated that NJT is the only customer served by the current substation. Upon completion of the proposed rebuilding work, the Mason substation will continue to serve only NJT.[23] This distinction is important since both PJM and PSE&G have rules addressing single customer service upgrades.

[22] RCR-ENG-4
[23] S-PS-0006

Q. Please define Direct Assignment under PJM rules?

A. Under PJM's tariff, the NJT substation would be classified as a Direct Assignment project. PJM defines *direct assignment* as:

> "Direct Assignment Facilities" shall mean facilities or portions of facilities that are constructed for the sole use/benefit of a particular Transmission Customer requesting service under the Tariff. Direct Assignment Facilities shall be specified in the Service Agreement that governs service to the Transmission Customer and shall be subject to Commission approval.[24] (PJM OATT at 1.Definitions)

In addition, the PJM OATT tariff also notes:

> An Eligible Customer shall be obligated to pay for 100 percent of the costs of the Direct Assignment Facilities necessary to accommodate its Completed Application for new transmission service.[25]

As defined under PJM, the proposed Mason substation work should be considered a direct assignment facility under the PJM tariff since NJT is the only customer that takes service from the substation. PSE&G contends that FERC has not classified the station into a specific category.[26.] [27] However, PSE&G has not formally petitioned either PJM or FERC for such a determination.

Q. Why is the Direct Assignment designation important in this proceeding?

A. If the Board finds that some portion of the Mason substation is a transmission level substation, then that portion of the costs of the proposed rebuild would not be included in distribution rates. If FERC finds that the transmission portion of the substation is a direct assignment substation, then NJT would be responsible for the entirety of the costs associated with the substation rebuild. Alternatively, if

[24] PJM. Open Access Transmission Tariff ("OATT"). Page 12. Available at http://www.pjm.com/media/documents/merged-tariffs/oatt.pdf
[25] PJM. OATT. Section 217.2.
[26] RCR-ENG-56.
[27] RCR-A-40

FERC finds that the transmission portion of the substation rebuild is not direct assignment, then those upgraded costs would be included in transmission rates.

Q. Has PSE&G indicated NJT's current rate schedule under the Board's approved tariff?

A. Yes, PSE&G currently classifies NJT as a high tension service-high voltage (HTS-HV) customer.[28]

Q. Earlier you noted that NJT is the only customer serviced by the Mason substation; does PSE&G have a classification for work that benefits a single customer in its distribution tariff?

A. Yes. PSE&G has a designation for new work that benefits a single or limited number of customers as mainline extension work. PSE&G's definition for a mainline extension service is provided in the PSE&G Electric Tariff.[29]

> An Extension means the construction or installation of plant and/or facilities by Public Service used to convey service from existing or new plant and/or facilities to one or more new customers, and also means the plant and/or facilities themselves. An Extension includes all Public Service plant and/or facilities used for electric transmission (non-FERC jurisdictional) and/or distribution, whether located overhead or underground, on a public street or right of way, or on private property or private right of way, and includes the conductors, poles or supports, cable, conduit, rights of way, land, site restoration, handholes, manholes, vaults, line transformers, protection devices, metering equipment and other means of conveying service from existing plant and/or facilities to each unit or structure to be served. An Extension does not include equipment solely used for administrative purposes, such as office equipment used for administering a billing system.

The mainline extension definition should be applied to PSE&G for its proposed Mason substation rebuild. As noted by the Company, PSE&G proposes to take

[28] RCR-AT-8
[29] RCR-ENG-65

ownership of the substation and then rebuild the substation. In effect, PSE&G would be building a "new" substation for the benefit of NJT.

Q. Does PSE&G have a mechanism in place for customers to reimburse the Company for work that is considered "mainline extension" work?

A. Yes. The PSE&G tariff details the need for an Applicant to provide a deposit or contribution. The tariff states:

> Where it is necessary for Public Service to construct an Extension to serve the requirements of an Applicant, Public Service may require a deposit or contribution from the Applicant to cover all or part of the cost of the Extension, which is required to be paid to Public Service prior to any work being performed. Where a large portion of the cost of construction is related to the installation of underground facilities, the costs may be increased if severe conditions, such as excessive rock or other unknown conditions, are found during excavation.[30]

Based on this language, NJT would need to provide PSE&G some assurances to cover its projected $268 million cost of the Mason substation. I understand that Rate Counsel Witness Andrea Crane has identified the annual revenues PSE&G receives from NJT in her testimony. I further understand that these revenues do not appear to be sufficient to cover the proposed $268 million Mason substation raise and rebuild work.

Q. Does PSE&G consider the Mason substation to be a direct assignment under FERC or a mainline extension under its own tariff?

A. No. PSE&G has indicated that its proposed Mason substation project is a distribution facility, and is not a mainline extension or a FERC direct assignment

[30] PSE&G Electric Tariff Original Sheet 15 Available https://www.pseg.com/family/pseandg/tariffs/electric/pdf/electric_tariff.pdf

transmission facility.[31] PSE&G purports that the proposed project "would enhance the reliability and resilience of PSE&G's provision of energy service to a larger region," even though NJT would remain the only customer to take service from the substation.[32]

Q. Has PSE&G requested a contribution or deposit from NJT for the proposed Mason rebuild?

A. PSE&G and NJT have not determined NJT's contribution for the new substation.[33, 34] PSE&G has also noted that it is open to discussion with parties about future contributions that would reduce customer rate impacts.[35]

VI. ELEMENTS OF THE PSE&G DESIGN ARE TRANSMISSION RELATED UPGRADES AND THEREFORE SHOULD NOT BE IN PSE&G DISTRIBUTION RATES

Q. Please summarize your concerns regarding the proposed transmission related work and their applicability on PSE&G distribution related storm resiliency.

A. The Company has claimed that its design will purportedly address a single point of failure along the 230 kV section of the substation that could affect the Athenia and Essex substations.[36] Even if I accept that this design may provide any benefits, those benefits are at the transmission level of investment and therefore

[31] RCR-ENG-66
[32] Ibid.
[33] RCR-AT-9
[34] S-PS-11
[35] RCR-A-43
[36] Cardenas 4:16-19

should not be included in the Company's distribution rates. The Company has identified **<Begin Confidential>** [redacted] **<End Confidential>** million of the total $268 million estimate is associated with the 230 kV switching station portion of the substation project.[37]

Q. Earlier above you referenced a single point of failure. What is the single point of failure identified by the Company?

A. The single point of failure is a circuit breaker identified by the Company as circuit breaker UBTEW which effectively ties together PSE&G's Essex to Athenia 230 kV line.[38]

Q. Has the Company indicated that the single point of failure would result in a reliability criteria violation?

A. No. Instead, the Company has indicated that the current single point of failure does not violate any NERC or PJM Regional Planning or Transmission Owner criteria.[39, 40] As I noted earlier, PSE&G has noted that the substation falls under NERC's definition of bulk electric system ("BES"). However, when asked, the Company indicated that a transmission element failure would not result in a NERC "non-consequential" load failure.[41] As such, this suggests that the elimination of the single point of failure would only benefit NJT as it would avoid the loss of both 230 kV lines that supply Mason substation. It does not provide

[37] Includes risk and contingency for the proposed project. RCR-ENG-58.
[38] RCR-ENG-70
[39] RCR-ENG-51
[40] RCR-ENG-77, "The single point of failure as described in Mr. Cardenas' testimony, although potentially impacting service to customers, would currently not be considered a violation of NERC Standards, Regional Planning Standar4ds, or Transmission Owner filed criteria".
[41] RCR-ENG-48

benefits to any other customer supplied from the transmission system and it is a fix that is not required for any other reliability concern.

Q. Could the Company implement a different solution than the proposed breaker and half configuration with six bays, 12 positions, and 18 230 kV circuit breakers, to eliminate the single point of failure?

A. Possibly, but it is not clear because PSE&G has not performed alternative analyses of existing substation rebuild options.[42] While the universe of possible 230 kV switchyard upgrade options that would meet both PSE&G and NJT's minimum needs is not clear, one solution to address the single point of failure could be to add another 230 kV air-insulated circuit breaker to the existing station and thereby eliminate that single point of failure, if such a configuration was feasible. I find it highly problematic that the Company did not conduct any alternative analysis to remove the identified single point of failure in the transmission system.[43] PSE&G is suggesting that ratepayers incur <**Begin Confidential**> [redacted] <**End Confidential**> in transmission costs even though no reliability violation exists.

Q. Please describe the Company's estimate on the proposed substation project categorized by voltage class.

A. The Company's detailed estimate for the Mason rebuild is provided in response to RCR-ENG-58 and is broken down into work at different voltages.[44] The following table summarizes the cost estimate between the 230 kV and the

[42] RCR-ENG-38
[43] RCR-ENG-45
[44] RCR-ENG-58

distribution voltages. 230 kV is generally considered transmission voltage, not distribution voltage.

Table 1 Summary of Mason Substation Cost Estimate by Component <Begin Confidential>

[redacted]

<End Confidential>

The table shows that PSE&G estimates **<begin confidential>** [redacted] **<End Confidential>** of the project is associated with the 230 kV portion and as noted in the Company's response this is to address a single point of failure in the *transmission* system.[45]

Q. Why is there a need to make a distinction between the transmission and distribution portion of the proposed Mason substation if the substation only serves NJT?

A. Although the proposed substation will only serve NJT in the future, it is important to make the distinction between transmission and distribution related costs associated with the proposed substation. In this proceeding, the Company has asked the Board to include the entirety of the proposed substation project in PSE&G's distribution rates. As discussed below, I have analyzed elements of the

[45] RCR-ENG-45

substation to determine what components of the proposed rebuild are transmission related and what components are distribution related as shown in the Company's response to RCR-ENG-58. My analysis makes it clear that a portion of the substation should be classified as transmission related costs that should not be included in the PSE&G distribution rates. Further, the portion of substation costs that should be considered in distribution rates still only benefit NJT and therefore those costs should not be borne by PSE&G customers.

VII. FERC SEVEN FACTOR TEST AND THE MASON SUBSTATION

Q. What is the FERC Seven Factor Test and how is it relevant to this proceeding?

A. The FERC seven-factor test is a test that is used to determine the difference between transmission and distribution facilities.

Q. Please summarize your concerns regarding the Company's failure to perform a seven-factor test for components of the Mason substation.

A. Notwithstanding that the proposed work will only benefit NJT, the classification of components of the substation as transmission or distribution is important because it has direct impacts on ratepayers and the rate treatment of the station by the BPU. The classification of the facility by PSE&G and the Board would influence how FERC would view the facility in any future proceedings. As I have noted earlier, there are elements of the proposed project that are transmission related since the Company has claimed that the proposed Mason substation work would provide benefits to the Athenia and Essex substations at the 230 kV

voltage. These are transmission related voltages and should not be included in PSE&G's distribution rates.

Q. Please describe the role of the seven-factor test.

A. The FERC Seven Factor Test may be used to determine if a specific facility should be classified as either distribution or transmission. When FERC issued Order 888 in 1996 that opened the use of transmission facilities to competitive markets for supply, FERC defined the distinction between transmission and distribution facilities. In Order 888, FERC noted that it would defer to state classifications and cost allocations if consistent with FERC rules.[46]

Q. What are the seven factors?

A. The seven factors are:

(1) local distribution facilities are normally in close proximity to retail customers;

(2) local distribution facilities are primarily radial in character;

(3) power flows into local distribution systems, and rarely, if ever flows out;

(4) when power enters a local distribution system, it is not reconsigned or transported on to some other market;

(5) power entering a local distribution system is consumed in a comparatively restricted geographic area;

(6) meters are based at the transmission/local distribution interface to measure flow into the local distribution system; and

(7) local distribution systems will be of reduced voltage.

[46] FERC Order 888 p.438. https://www.ferc.gov/legal/maj-ord-reg/land-docs/rm95-8-00w.txt

Q. Has PSE&G asked FERC for a determination to classify the substation?

A. PSE&G has not asked for a formal classification of the substation from FERC.[47] Nor has the Company explicitly conducted a seven-factor test of the substation.[48] That being said, the Company did make a presentation to FERC staff during the fall of 2016.[49]

Q. Since the Company did not conduct an analysis of the Mason substation, did you conduct an analysis examining the seven-factors?

A. Yes; even though this is not a FERC proceeding, I conducted an analysis that considered whether the 230 kV switchyard portion of the substation might be characterized as local distribution under FERC's construct. The Company asserts that the proposed 230 kV work would provide reliability benefits to the Essex and Athenia substations, which would indicate that those facilities are *not* local distribution facilities, but rather transmission assets. The following material describes my analysis for each of the seven factors.

Q. Please describe your findings for the first factor: *local distribution facilities are normally in close proximity to retail customer.*

A. While the 230 kV switchyard facilities are physically proximate to NJT load, the facilities are closely tied to the rest of PSE&G's system, and the loss of those facilities has an effect on load at other substations. PSE&G states that the 230 kV portion of the substation serves to "flow through" power for the Athenia and

[47] RCR-ENG-56
[48] RCR-ENG-9
[49] RCR-A-11

Essex substations, and for the Kingsland and Cook substations.[50] Under a transmission element failure scenario at the Mason substation, the Company has indicated most of the load interruption of 131 MVA[51] serves other substations with the exception of the 15 MVA serving NJT.[52] The NJT portion of the substation is the only distribution customer that takes service from the 230 kV portion. The Company has noted that the current substation has not been the subject of specific transmission delineation.[53] The existing station only serves NJT and the proposed station will continue to only serve NJT.[54]

Q. Please describe your findings for the second factor: *(2) local distribution facilities are primarily radial in character*.

A. The proposed changes to the 230 kV switchyard portion are not radial in nature. They maintain the connections between the Athenia and Essex stations. As noted by PSE&G, the Mason substation is and remains a flow-through substation in the sense that power enters the Mason substation and continues through to other substations within the PSE&G network.[55] The Company characterizes the substation as connecting directly to the 230 kV network.[56]

[50] RCR-ENG-2
[51] MegaVoltAmpere (MVA), a measure of loading on facilities. MVA and MW are the same if the power factor of the load is 1.0. MVA, or loading, is higher than MW for any load whose power factor is less than 1.0 (either lagging or leading).
[52] RCR-INF-PS-3
[53] Staff-PS-1
[54] Staff-PS-6
[55] RCR-ENG-2
[56] RCR-ENG-26

Q. Please describe your findings for the third factor: (3) power flows into local distribution systems, and rarely, if ever flows out.

A. Power flows both in and out of the 230 kV switchyard facilities. While the 230 kV is proposed to include the ability of a microgrid interconnection, neither the Company nor PSE&G have evaluated how NJT will sell the output from the proposed generation facility.[57] Nor has the Company indicated how the microgrid may impact future revenues for the Company.[58] The microgrid is to be connected at the 230 kV voltage level, and as such there is no source of power at the distribution system level that could "flow out" onto the transmission grid. As noted in the first factor, the 230 kV portion of the substation would be a breaker and half design that would enable PSE&G to maintain power along the Athenia and Essex line.[59] Together with the "flow-through" characterization of the 230 kV portion of the substation, this suggests that most of the power flows through the substation.

Q. Please describe your findings for the fourth factor: (4) *when power enters a local distribution system, it is not reconsigned or transported on to some other market.*

A. There is no indication that any of the power that flows into the NJ Transit distribution system at the Mason substation is consumed by any PSE&G customer other than NJT. The NJT rail traction power, and operations and maintenance

[57] RCR-ENG-75
[58] RCR-INF-PS-16
[59] RCR-ENG-45

center distribution systems do not serve as a conduit for the distribution of power to any other customer.

Q. Please describe your findings for the fifth factor: (5) power entering a local distribution system is consumed in a comparatively restricted geographic area.

A. The power that flows through the Mason substation on through to NJT provides rail traction power and provides power to MMC and Building 9 operations, a comparatively restricted geographic area. Power that flows through Mason substation over the rest of PSE&G's 230 kV system serves a broader geographic area.

Q. Please describe your findings for the sixth factor: *(6) meters are based at the transmission/local distribution interface to measure flow into the local distribution system.*

A. As indicated by the Company, there is limited metering equipment on the current Mason substation.[60] The metering information provides total energy delivered to the Mason and Building 9 substations.[61] NJT consumes on average <**Begin Confidential**> [redacted] <**End Confidential**> of energy flowing through the Mason substation.[62]

[60] RCR-A-25
[61] RCR-AT-15
[62] RCR-A-17 Attachment 1, Confidential

Q. Please describe your findings for the seventh factor: (7) local distribution systems will be of reduced voltage.

A. Voltages below 230 kV serve NJT systems. The 230 kV lines into Mason are part of the transmission grid and continue to the Athenia and Essex substations. The portions serving NJT are at lower voltages.

Q. Please summarize your conclusion regarding the 230 kV portion of the substation.

A. My analysis indicates that the 230 kV portion of the Mason substation that provides the capability for pass-through or flow-through of power (at 230 kV) between Athenia and Essex should be considered transmission facilities since the power flow of that portion of the substation provides service to the Athenia and Essex substations. NJT, the only customer served by the Mason substation, uses a small percentage of the total energy flow over the substation. Therefore, the Board should not include any of the transmission related costs in distribution rates, notwithstanding the fact that the substation only serves NJT.

Q. Is there another test that you considered when analyzing the cost allocation associated with the proposed Mason substation?

A. Yes, I considered applying the five-factor Mansfield test that FERC has used to address cost allocation issues pertaining to radial transmission facilities serving a single customer.[63] I understand that the purpose of the Mansfield test is to help

[63] FERC Initial Decision in Docket EL00-73-001, March 28, 2001. 94 FERC 63,023 Mansfield Municipal Electric Department and North Attleborough Electric Department v. New England Power Company. Available at https://elibrary.ferc.gov/idmws/common/opennat.asp?fileID=3217537.

FERC determine if transmission related costs should be incorporated into network rates or directly assigned to a single customer.

Q. Could the Mansfield test be applied to a portion of the proposed Mason substation?

A. It could, but since this case is before the Board, it would be inappropriate to apply a FERC five-factor cost allocation test in this proceeding. That being said, I believe the Mansfield test would show that the proposed portions of the 230 kV switchyard targeted to resolve the single element failure would be deemed a network component. All other transmission portions of the proposed substation would be allocated directly to NJT. Those costs would be incurred for the benefit of one customer, NJT, and thus they would be considered as direct assignment costs. The proposed Mason substation rebuild, is not required to ensure reliability service to PSE&G's customers other than NJT, such as those served through the Athenia or Essex substations. It is only because NJT and PSE&G are requesting 230 kV switchyard expansion, for service to NJT, that additional costs arise. Distribution components of the proposed station, of course, would not be in FERC's jurisdiction.

VIII. COST ESTIMATES OF THE MASON SUBSTATION ARE TOO HIGH FOR RATEPAYERS TO ABSORB.

Q. Please summarize your concerns regarding the Mason substation rebuild.

A. I am concerned that the cost estimates for the proposed Mason Station rebuild are too high for ratepayers to absorb, given that the benefits of the rebuild would accrue almost fully to one customer, NJT; and that NJT's level of customer

contribution is not likely to cover the rebuild costs.[64] In essence, my concern is that ratepayers will bear an unnecessary cost burden that provides little if any benefit beyond NJT's needs.

Q. Has the Company provided any alternative, lower cost substation designs to PSE&G's proposed $268 million proposal?

A. No. The Company has not provided any alternative substation designs that reflect, for example, a minimum cost to rebuild to meet severe weather concerns while possibly also addressing the "single point of failure" (whose resolution could benefit other PSE&G customers besides NJT, however minimal the actual benefit is). The Company has not provided a benchmark comparison to the $268 million cost of the proposed rebuild.

Q. Why might such a benchmark be important?

A. It could serve to indicate what the minimum costs of upgrading the substation in response to Superstorm Sandy-like flooding concerns might be, separate from NJT's and PSE&G's design elements that significantly expand the capability of the 230 kV switchyard portion of the substation. It could also indicate what would be the minimum 230 kV switchyard additions needed to address the "single point of failure" concern that PSE&G has identified.

[64] NJT customer contribution commitment is unknown at the time of this testimony. See RCR-AT-9.

Q. Have there been any changes to the cost estimates for the proposed substation rebuild?

A. Yes, as they concern NJT's original design and PSE&G's proposed design. The proposed changes in cost of the Mason substation have increased between the two estimates from NJT's estimate of <**Begin Confidential**> [redacted] <**End Confidential**> to PSE&G's estimate of $268 million.[65] Although PSE&G provides an explanation to why the cost estimates have changed, there does not appear to be an independent or alternative option provided by either NJT or PSE&G. When asked, the Company has repeatedly indicated that there are no other options for the Mason substation.[66]

Q. Did NJT determine a cost estimate to rebuild the Mason substation?

A. Yes, in 2014 NJT hired the engineering firm, Gannett Fleming to conduct a cost estimate of the Mason Substation.[67] When PSE&G took over the design, NJT provided a 60 percent conceptual design to PSE&G produced by Gannett Fleming.[68] PSE&G has also retained Gannett Fleming to conduct a cost estimate of the Mason Substation.[69]

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[65] Includes risk and contingency.
[66] RCR-ENG-38
[67] NJ Transit. Task Order Assignment N01 SSRP Revision No. Contract 13-006A. Effective date September 9, 2014. Available at http://nj.gov/comptroller/sandytransparency/contracts/sandyrel/pdf/ssrpexecuted_assignment_gannett_fleming_redacted.pdf.
[68] RCR-ENG-8
[69] RCR-ENG-58

Q. Please summarize elements of the NJT cost estimate.

A. The 2014 scope of work provides the design requirements for the Mason substation.[70] Some of the elements include, but not limited to:

- Reconfigure the substation design to isolate the substation components from PJM grid, with transfer of ownership and responsibility of bulk transmission elements to PSE&G.
- Two of the three 230 kV transformers may be reused in the new design.
- Raise the new substation above flood elevation.
- Include two additional 230 kV transformers to accommodate permanent load transfer from Building 9 substation.
- Evaluate breaker and half or three/ four ring bus schemes.
- Account for six additional feeds into substation.

PSE&G's analysis of the NJT estimate for the Mason substation was <**Begin Confidential**> [redacted] <**End Confidential**> for risk and contingency.[71] In response to a separate discovery request, NJT indicated that the total cost of the project would be $187 million.[72] The Company's analysis does not appear to reconcile with the estimate provided by NJT.

[70] NJ Transit. Contract 13-006A. Page 3.
[71] RCR-A-11 Attachment NJ Transit Mason BPU Cost Summary for 7-26-16 (revised 7-22) Confidential.pdf Slide 13.
[72] RCR-ET-28

Q. Did PSE&G determine a cost estimate to rebuild the Mason substation?

A. Yes, PSE&G provided a cost estimate of $268 million that includes $42 million in risk and contingency for the Mason station raise and rebuild in its petition.[73] This is an increase of approximately <**Begin Confidential**> [redacted] <**End Confidential**> between the two cost estimates.

Q. Is the PSE&G design similar to the NJT design?

A. <**Begin Confidential**> [redacted] <**End Confidential**>

Q. Are there differences between the two designs that may have resulted in the cost differential between the two designs?

A. Yes, there are several differences between the two designs. These differences are summarized below:

<Begin Confidential>

- [redacted]
- [redacted]
- [redacted]
- [redacted]

[73] PSE&G. *In the Matter of the Petition of Public Service Electric and Gas Company for Approval of the Construction of the Mason Substation Damaged During Superstorm Sandy.* Verified Petition. August 12, 2016. Exhibit D.

[74] RCR-A-11 Attachment NJ Transit Mason BPU Cost Summary for 7-26-16 (revised 7-22) Confidential.pdf Slide 9.

- [redacted]

<**End Confidential**>

Q. Would these differences account for the difference in cost estimates between the two designs?

A. It would be difficult to fully examine the approximately <**Begin Confidential**>[redacted]**End Confidential**> cost differential between the NJT and PSE&G estimates without an independent assessment and/or additional bids. The fact that both firms retained the same engineering firm to aid on the cost proposals raises some concerns as to the independence between the two cost proposals. Since the PSE&G design essentially meets the NJT's 2014 design specification, it is difficult to explain why the significant difference in the cost estimate between the two organizations given that both organizations retained the same engineering firm to perform the cost estimate.

Q. Are there other design options that are particularly important to consider given the overall cost and design that has been proposed for the Mason substation, and given the Company's claim that other ratepayers besides NJT might benefit from the proposed rebuild?[75]

A. Yes, design options that resolve the "single point of failure" should have been considered, if only to better examine cost allocation issues. PSE&G claims that even though there is no NERC, PJM, or PSE&G standard requirement to resolve any system-wide reliability concerns associated with the 230 kV lines that feed

[75] See direct testimony of Jorge Cardenas at 4:16-22.

into and out of the Mason substation,[76] there would be a benefit to other customers if the proposed Mason substation was built. That benefit would accrue from reducing the "single point of failure" associated with the current 230 kV breaker quantities and configuration that currently exists at the Mason substation.

Q. Is the proposed Mason substation design the only design that could address such a reduction in the single point of failure?

A. No. To explore this issue, I put aside for the moment any NJT design requirements and focus only on the conceptual nature of 230 kV improvements that could be required to eliminate the "single point of failure" associated with the 230 kV tie breaker that currently exists in the substation.[77] I do this solely to explore cost allocation issues when considering incremental benefit to non-NJT customers. These benefits would arise from elimination of this single point of failure. PSE&G's proposed rebuild of the 230 kV portion of the Mason substation would change the 230 kV breaker quantity and configuration from

a) three 230 kV air-insulated breakers in a simple, two bus arrangement (see Figure 2 below, with existing layout) with a bus tie breaker, with each bus feeding NJT load through separate circuit breakers (three circuit breakers total); to

b) eighteen 230 kV gas-insulated breakers in a 6-bay, 12-line-postion breaker-and-a-half arrangement, that simultaneously eliminates the "single point of failure" while dramatically changing the overall 230 kV switchyard configuration.

[76] Even though there are two lines that feed into the station, the sections of 230 kV circuit between Athenia and Mason (2281) and between Essex and Mason (2216) can also be characterized as a 230 kV line that is tapped into at Mason in order to feed NJT.
[77] RCR-ENG-70

Figure 2 below is the one-line diagram of the current substation with the bus tie circuit breaker UBTEW circled.[78]

[78] RCR-ENG-003 Confidential

Figure 2 One-Line Diagram of Existing Mason Substation. **<Begin Confidential>**

<End Confidential>

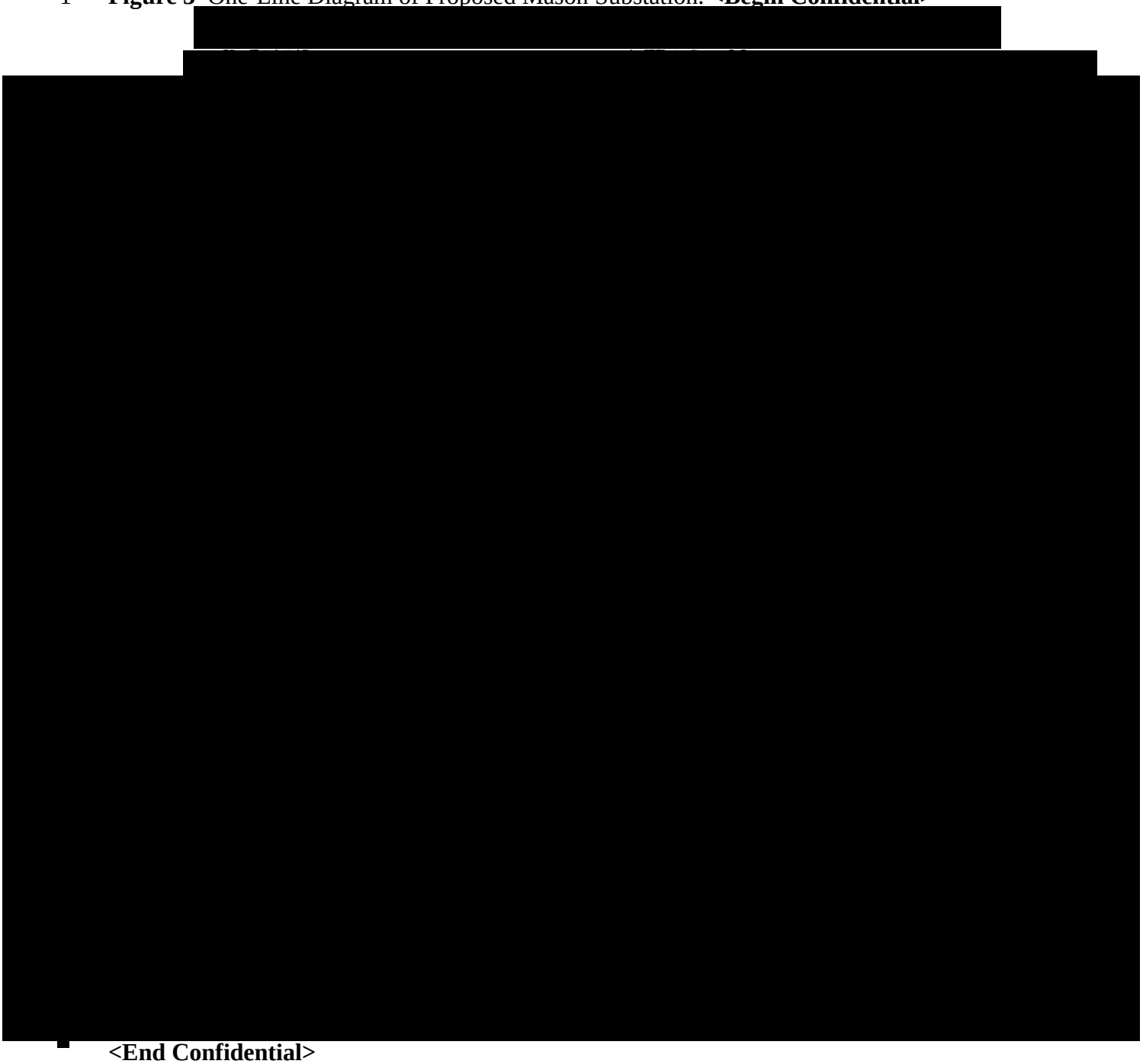
Q. How does the proposed design differ from the existing design?

A. The existing design allows PSE&G's 230 kV feeds into the station (from the Essex and Athenia substations on PSE&G's system) to flow through to either of two 230 kV busses through the "east" or "west" entrance circuit breakers, and on to the transformers that step the voltage down and provide 55 kV traction power for the Morris and Essex lines. The 55 kV power also flows through to existing transformers in the Mason substation yard that step the voltage down further to 27 kV. The 27 kV power source then feeds NJT's Building 9 substation, which includes conversion to 13.2 kV feeds that serve the Meadows Maintenance Complex.

The proposed design dramatically increases the potential use of the 230 kV portion of the substation by expanding the number of bays and circuit breakers compared to the existing arrangement. It has room for 12 "positions" (or infeeds and outflows from the 230 kV busses), which are identified as being used for the PSE&G 230 kV lines in (2 positions), for new supply interconnection (2 positions), for traction power feeds (5 positions), for supply to 230/13.2 kV transformers feeding NJT load (2 positions), and one spare position. The one-line diagram of the proposed Mason substation is provided below that shows the "breaker and a half" arrangement for each of the 12 positions, leading to the eighteen breakers circled.[79]

[79] RCR-ENG-1 Confidential

Figure 3 One-Line Diagram of Proposed Mason Substation. **<Begin Confidential>**



<End Confidential>

Q. Why do you focus on only the conceptual nature of 230 kV improvements, and how can you "put aside" the NJT requirements?

A. I do this in order to demonstrate the difference between i) what would be required in order to add incremental value to PSE&G's ratepayers other than NJT – via elimination of the single point of failure at Mason – and ii) what is required in order to service NJT's service requirements. If PSE&G ratepayers other than NJT are to pay for any portion of the costs of a substation rebuild that serves one customer, because such a rebuild adds value for those ratepayers through elimination of a single point of failure, then it is instructive to ask the question "what would be the costs of obtaining that value", separate from any other costs that might be required to meet a single customer's service needs.

Q. What would be the cost, or at least the design requirement, to obtain the value associated with eliminating the single point of failure at the Mason substation?

A. The cost would be those costs associated with a design that eliminated the single point of failure. The single point of failure could be eliminated notionally with the addition of one more 230 kV breaker at the station. For example, if one more breaker was in-line with the current tie-breaker arrangement at Mason, a single point of failure in the station would not lead to loss of both feeds into Mason. There are likely a number of different ways to implement such an addition, and we would expect that PSE&G is in the best position to consider and analyze such options.

Q. How much would it cost to eliminate this single point of failure?

A. Neither PSE&G nor NJT have provided such a cost estimate.

Q. Is it possible that the costs could be much lower than those associated with the proposed rebuild?

A. Yes, because it is not clear if an upgrade from the existing air-insulated switchgear ("AIS") 230 kV switchyard equipment to more expensive gas-insulated switchgear ("GIS") 230 kV switchyard equipment would be required for the 230 kV switchyard portion of Mason if there was only a need for one more breaker, rather than installing 18 breakers (15 more than currently exist) in a new GIS arrangement, or some other arrangement that still required the move towards GIS. GIS is generally a much more expensive way than AIS to obtain 230 kV switchyard elements.

Q. Are there other elements of the proposed Mason substation rebuild?

A. Yes, Witness Cardenas discusses the possibility of microgrids for the project.[80]

Q. Please describe your understanding of the proposed microgrid.

A. One of the purposes of the proposed NJT microgrid would be to provide limited traction power in the event of a disruption of normal electric distribution service.[81]

[80] Cardenas. 5:2-6
[81] RCR-ENG-15

Q. Would the proposed New Jersey Microgrid be able to sell energy into PJM through the interconnection point at the Mason substation?

A. Yes. PSE&G indicated that the NJT microgrid could sell into PJM.[82] However, PSE&G has not evaluated the ability of NJT to interject into PJM system as a result of microgrid. Should NJT interconnect with the PJM grid, then the portion of the substation rebuild that would allow NJT to interconnect to the rest of the grid should be treated as any other interconnection request. NJT does intend to explore the possibility of selling the output of the microgrid's central power plant into PJM.[83]

Q. Are there concerns about the proposed Microgrid project that should be noted by the Board?

A. Yes, a recent US Government Accountability Office ("GAO") study highlighted its concerns regarding the Federal Transit Administration's ("FTA") accountability in issuing the post-Sandy grants.[84] The GAO undertook the analysis to review the FTA discretionary grant evaluation and selection process. In addition, the GAO reviewed the projects to assess if the selected projects reflected the grant program's policy directives.[85] Specifically, the GAO recommended that:

> Given that FTA has not yet fully obligated funding for most of these projects, determining the extent to which FTA's projects provide duplicative benefits could help ensure that the projects supported by FTA

[82] RCR-ENG-75
[83] RCR-INF-NJT-3
[84] Government Accountability Office. *DOT Discretionary Grants Problems with Hurricane Sandy Transit Grant Selection Process Highlight the Need for Additional Accountability*. GAO-17-20. December 2016. Available at https://www.gao.gov/products/GAO-17-20.
[85] RCR-INF-NJT-3

> are effectively coordinated with other efforts and help identify cases where FTA supported projects may need to be revised or may no longer be needed.

The report did not specifically highlight the NJT Transitgrid project, but referred to the project as one of 40 projects that received FTA grants. The report noted that the Transitgrid does not have its funding $409 million obligated by the FTA, thus there may be risk should Congress proceed with the GAO's recommendation.

Q. Does PSE&G provide a detailed cost estimate of the interconnection points?

A. Not specifically. Witness Cardenas notes that two of the six transformers will be designated for the microgrid.[86] Since neither the Company nor NJT has not provided a detailed cost estimate for the microgrid components, a simplistic method could be used to estimate the cost of the interconnection related work of the project based on the proportionate share of the two transformers to the total 230 kV transformer related costs. This would suggest an allocation of <**Begin Confidential**> [redacted] <**End Confidential**> for the microgrid related costs. However, this assumes that the microgrid interconnection is not the causal event that requires a move towards the more expensive GIS station components, instead of AIS components. PSE&G never provided a breakout of the interconnection costs, and the extent to which it results in a need to move towards GIS instead of a less expensive AIS design.

[86] Cardenas. 9:12-13

IX. SUMMARY AND CONCLUSION

Q. Please summarize your recommendations and findings.

A. My findings and recommendations are summarized as follows:

- From a transmission perspective, the proposed Mason substation would meet the FERC's definition for direct assignment since the proposed work would be for the sole benefit of a single customer, NJT. Ratepayers should not bear such costs that would benefit a single customer, albeit a public interest entity.
- From a distribution perspective, the proposed Mason substation is analogous to PSE&G's treatment of extension work since the proposed work would be for the sole benefit of a single customer, NJT. Ratepayers should not bear such costs that would benefit a single customer, albeit a public interest entity.
- The proposed micro-grid component of NJT's Transitgrid project that is funded with federal funds will enable NJT to sell energy into the PJM market. This will require a PJM interconnection request, and any costs associated with such an interconnection should be the responsibility of NJT.
- Should the Board proceed to approve PSE&G's request, the proposed $268 million for the raise and rebuild of the Mason substation includes <**Begin Confidential**> [redacted] <**End Confidential**> of work specific to the 230 kV breakers that are transmission-related expenses and thus should be outside the rate purview of the Board. The remaining <**Begin Confidential**> [redacted] <**End Confidential**> appears to be distribution related specific to voltages that would only benefit the only customer of the substation, NJT.

- The Company has not conducted any alternatives analysis based on the claim that there are no alternatives. There is no way for the Board to determine if the proposed project costs are reasonable without a detailed and independent alternatives analysis.

Q. Does this conclude your testimony?

A. Yes. However, I reserve my right to modify my testimony based on additional information provided by the Company.

RF-EXHIBIT 1

Robert M. Fagan, Principal Associate

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SUMMARY

Mechanical engineer and energy economics analyst with over 30 years of experience in the energy industry. Activities focused primarily on electric power industry issues, especially economic and technical analysis of transmission, wholesale electricity markets, renewable resource alternatives and assessment and implementation of demand-side alternatives.

In-depth understanding of the complexities of, and the interrelationships between, the technical and economic dimensions of the electric power industry in the US and Canada, including the following areas of expertise:

- Wholesale energy and capacity provision under market-based and regulated structures; the extent of competitiveness of such structures.
- Potential for and operational effects of wind and solar power integration into utility systems; modeling of such effects.
- Transmission use pricing, encompassing congestion management, losses, LMP and alternatives; transmission rights; and transmission asset pricing (embedded cost recovery tariffs).
- Physical transmission network characteristics; related generation dispatch/system operation functions; and technical and economic attributes of generation resources.
- RTO and ISO tariff and market rules structures and operation, and related FERC regulatory policies and initiatives, including those pertaining to RTO and ISO development and evolution.
- Demand-side management, including program implementation and evaluation; and load response presence in wholesale markets.
- Building energy end-use characteristics, and energy-efficient technology options.
- Fundamentals of electric distribution systems and substation layout and operation.
- Energy modeling (spreadsheet-based tools, industry standard tools for production cost and resource expansion, building energy analysis, understanding of power flow simulation fundamentals).
- State and provincial level regulatory policies and practices, including retail service and standard offer pricing structures.
- Gas industry fundamentals including regulatory and market structures, and physical infrastructure.

PROFESSIONAL EXPERIENCE

Synapse Energy Economics, Inc., Cambridge, MA. *Principal Associate*, 2004 – Present.

Responsibilities include consulting on issues of energy economics, analysis of electricity utility planning, operation, and regulation, including issues of transmission, generation, and demand-side management. Provide expert witness testimony on various wholesale and retail electricity industry issues. Specific project experience includes the following:

- Analysis of New England region electric capacity need issues, including assessment of the effects of energy efficiency and small scale solar resources on net load projections, and implications for carbon emissions based on regional supply alternatives.
- Analysis of California renewable energy integration issues, local and system capacity requirements and purchases, and related long-term procurement policies.
- Analysis of air emissions and reliability impacts of Indian Point Energy Center retirement.
- Analysis of PJM and MISO wind integration and related transmission planning and resource adequacy issues.
- Analysis of Nova Scotia integrated resource planning policies including effects of potential new hydroelectric supplies from Newfoundland and demand side management impact; analysis of new transmission supplies of Maritimes area energy into the New England region.
- Analysis of Eastern Interconnection Planning Collaborative processes, including modeling structure and inputs assumptions for demand, supply and transmission resources. Expanded analyses of the results of the EIPC Phase II Report on transmission and resource expansion.
- Analysis of need for transmission facilities in Maine, Ontario, Pennsylvania, Virginia, Minnesota.
- Ongoing analysis of wholesale and retail energy and capacity market issues in New Jersey, including assessment of BGS supply alternatives and demand response options.
- Analysis of PJM transmission-related issues, including cost allocation, need for new facilities and PJM's economic modeling of new transmission effects on PJM energy market.
- Ongoing analysis of utility-sponsored energy efficiency programs in Rhode Island as part of the Rhode Island DSM Collaborative; and ongoing analysis of the energy efficiency programs of New Jersey Clean Energy Program (CEP) and various utility-sponsored efficiency programs (RGGI programs).
- Analysis of California renewable integration issues for achieving 33% renewable energy penetration by 2020, especially modeling constructs and input assumptions.
- Analysis of proposals in Maine for utility companies to withdraw from the ISO-NE RTO.
- Analysis of utility planning and demand-side management issues in Delaware.

- Analysis of effect of increasing the system benefits charge (SBC) in Maine to increase procurement of energy efficiency and DSM resources; analysis of impact of DSM on transmission and distribution reinforcement need.
- Evaluation of wind energy potential and economics, related transmission issues, and resource planning in Minnesota, Iowa, Indiana, and Missouri; in particular in relation to alternatives to newly proposed coal-fired power plants in MN, IA and IN.
- Analysis of need for newly proposed transmission in Pennsylvania and Ontario.
- Evaluation of wind energy "firming" premium in BC Hydro Energy Call in British Columbia.
- Evaluation of pollutant emission reduction plans and the introduction of an open access transmission tariff in Nova Scotia.
- Evaluation of the merger of Duke and Cinergy with respect to Indiana ratepayer impacts.
- Review of the termination of a Joint Generation Dispatch Agreement between sister companies of Cinergy.
- Assessment of the potential for an interstate transfer of a DSM resource between the desert southwest and California, and the transmission system impacts associated with the resource.
- Analysis of various transmission system and market power issues associated with the proposed Exelon-PSEG merger.
- Assessment of market power and transmission issues associated with the proposed use of an auction mechanism to supply standard offer power to ComEd native load customers.
- Review and analysis of the impacts of a proposed second 345 kV tie to New Brunswick from Maine on northern Maine customers.

Tabors Caramanis & Associates, Cambridge, MA. *Senior Associate*, 1996 – 2004.

- Provided expert witness testimony on transmission issues in Ontario and Alberta.
- Supported FERC-filed testimony of Dr. Tabors in numerous dockets, addressing various electric transmission and wholesale market issues.
- Analyzed transmission pricing and access policies, and electric industry restructuring proposals in US and Canadian jurisdictions including Ontario, Alberta, PJM, New York, New England, California, ERCOT, and the Midwest. Evaluated and offered alternatives for congestion management methods and wholesale electric market design.
- Attended RTO/ISO meetings, and monitored and reported on continuing developments in the New England and PJM electricity markets. Consulted on New England FTR auction and ARR allocation schemes.

- Evaluated all facets of Ontario and Alberta wholesale market development and evolution since 1997. Offered congestion management, transmission, cross-border interchange, and energy and capacity market design options. Directly participated in the Ontario Market Design Committee process. Served on the Ontario Wholesale Market Design technical panel.
- Member of TCA GE MAPS modeling team in LMP price forecasting projects.
- Assessed different aspects of the broad competitive market development themes presented in the US FERC's SMD NOPR and the application of FERC's Order 2000 on RTO development.
- Reviewed utility merger savings benchmarks, evaluated status of utility generation market power, and provided technical support underlying the analysis of competitive wholesale electricity markets in major US regions.
- Conducted life-cycle utility cost analyses for proposed new and renovated residential housing at US military bases. Compared life-cycle utility cost options for large educational and medical campuses.
- Evaluated innovative DSM competitive procurement program utilizing performance-based contracting.

Charles River Associates, Boston, MA. *Associate*, 1992 – 1996.

Developed DSM competitive procurement RFPs and evaluation plans, and performed DSM process and impact evaluations. Conducted quantitative studies examining electric utility mergers; and examined generation capacity concentration and transmission interconnections throughout the US. Analyzed natural gas and petroleum industry economic issues; and provided regulatory testimony support to CRA staff in proceedings before the US FERC and various state utility regulatory commissions.

Rhode Islanders Saving Energy, Providence, RI. *Senior Commercial/Industrial Energy Specialist*, 1987 – 1992.

Performed site visits, analyzed end-use energy consumption and calculated energy-efficiency improvement potential in approximately 1,000 commercial, industrial, and institutional buildings throughout Rhode Island, including assessment of lighting, HVAC, hot water, building shell, refrigeration and industrial process systems. Recommended and assisted in implementation of energy efficiency measures, and coordinated customer participation in utility DSM program efforts.

Fairchild Weston Systems, Inc., Syosset, NY. *Facilities Engineer*, 1985 – 1986.

Designed space renovations; managed capital improvement projects; and supervised contractors in implementation of facility upgrades.

Narragansett Electric Company, Providence RI. *Supervisor of Operations and Maintenance*, 1981 – 1984.

Directed electricians in operation, maintenance, and repair of high-voltage transmission and distribution substation equipment.

EDUCATION

Boston University, Boston, MA
Master of Arts in Energy and Environmental Studies – Resource Economics, Ecological Economics, Econometric Modeling, 1992

Clarkson University, Potsdam, NY
Bachelor of Science in Mechanical Engineering – Thermal Sciences, 1981

ADDITIONAL EDUCATION

- **Utility Wind Integration Group**: Short Course on Integration and Interconnection of Wind Power Plants into Electric Power Systems, 2006
- **University of Texas at Austin**: Short course in Regulatory and Legal Aspects of Electric Power Systems, 1998
- **Illuminating Engineering Society**: courses in lighting design, 1989
- **Worcester Polytechnic Institute and Northeastern University**: Coursework in Solar Engineering; Building System Controls; and Cogeneration, 1984, 1988 – 1989
- **Polytechnic Institute of New York**: Graduate coursework in Mechanical and Aerospace Engineering, 1985 – 1986

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TESTIMONY

Nova Scotia Utility and Review Board (Matter No. 07718): Joint direct testimony of Robert Fagan and Tyler Comings regarding economic analysis of the Maritime Link Project. On behalf of Nova Scotia Utility and Review Board Counsel. April 19, 2017.

Illinois Commerce Commission (Docket No. 16-0259): Direct and rebuttal testimony on Commonwealth Edison Company's annual formula rate update and revenue requirement reconciliation on distribution and business intelligence investments. On behalf of the Office of Illinois Attorney General. June 29, 2016 and August 11, 2016.

Connecticut Siting Council (Docket No. 470): Direct and Surrebuttal Testimony regarding the need for and emissions impact of NTE's proposed 550 MW combined cycle power plant ("Killingly Energy Center"). On behalf of Sierra Club and Not Another Power Plant. November 15, 2016 and December 22, 2016.

Federal Energy Regulatory Commission (Docket No. ER17-284): Affidavit examining and critiquing the Midwest Independent System Operator's (MISO) proposal for a "Competitive Retail Solution (CRS)", a proposed change to the capacity procurement construct for a portion of MISO load. December 15, 2016.

Massachusetts Electric Facilities Siting Board (Docket 15-06): Direct and Supplemental Direct Testimony regarding the impact of Exelon's proposed Canal 3 power plant on compliance with the Global Warming Solutions Act and estimation of emissions avoided with its operation. On behalf of Conservation Law Foundation. July 15, 2016 and September, 2016.

Rhode Island Public Utilities Commission (Docket No. 4609): Pre-Filed Direct Testimony examining reliability need for the proposed Clear River Energy Center in Burrillville, RI. Testimony filed on behalf of Conservation Law Foundation, June 14, 2016.

California Public Utilities Commission (Docket No. A.15-04-012): Testimony examining San Diego Gas & Electric's Marginal Energy Costs and LOLE Allocation among TOU Periods. Jointly, with Patrick Luckow. On behalf of the California Office of Ratepayer Advocate. June, 2016.

Massachusetts Electric Facilities Siting Board (Docket 15-1): Testimony regarding the impact of Exelon's proposed Medway power plant on compliance with the Global Warming Solutions Act. On behalf of Conservation Law Foundation. November 13, 2015.

California Public Utilities Commission (Docket No. A.14-06-014): Testimony examining Southern California Edison (SCE) proposals for Marginal Energy and Capacity Costs in Phase 2 of its 2015 General Rate Case (GRC). On behalf of the California Office of Ratepayer Advocate. Jointly, with Patrick Luckow. February 13, 2015.

California Public Utilities Commission (Docket No. A.14-11-014): Testimony examining Pacific Gas and Electric's Marginal Energy Costs and LOLE Allocation among TOU Periods. Jointly, with Patrick Luckow. On behalf of the California Office of Ratepayer Advocate. May 1, 2015.

California Public Utilities Commission (Docket No. A.14-11-012): Testimony reviewing Southern California Edison 2013 local capacity requirements request for offers for the western Los Angeles Basin, specifically related to storage. On behalf of Sierra Club. March 25, 2015.

California Public Utilities Commission (Docket No. A.14-01-027): Testimony examining San Diego Gas & Electric's proposal to change time-of-use periods in its application for authority to update its electric rate design. Jointly, with Patrick Luckow. On behalf of the California Office of Ratepayer Advocate. November 14, 2014.

California Public Utilities Commission (Docket No. R.12-06-013): Rebuttal testimony regarding the relationship between California investor-owned utilities hourly load profiles under a time-of-use pricing and GHG emissions in the WECC regions in the Order Instituting Rulemaking on the Commission's Own Motion to Conduct a Comprehensive Examination of Investor Owned Electric Utilities' Residential Rate Structures, the Transition to Time Varying and Dynamic Rates, and Other Statutory Obligations. On behalf of the California Office of Ratepayer Advocate. October 17, 2014.

California Public Utilities Commission (Docket No. R.13-12-010): Direct and reply testimony on Phase 1a modeling scenarios in the Order Instituting Rulemaking to Integrate and Refine Procurement Policies and Consider Long-Term Procurement Plans. On behalf of the California Office of Ratepayer Advocate. August 13, 2014, October 22, 2014, and December 18, 2014.

New York State Department of Environmental Conservation (DEC #3-5522-00011/000004; SPDES #NY-0004472; DEC #3-5522-00011/00030; DEC #3-5522-00011/00031): Direct, rebuttal, and surrebuttal testimonies regarding air emissions, electric system reliability, and cost impacts of closed-cycle cooling as the "best technology available" (BTA), and alternative "Fish Protective Outages" (FPO), for the Indian Point nuclear power plant. On behalf of Riverkeeper. February 28, 2014, March 28, 2014, July 11, 2014, June 26, 2015, and August 10, 2015.

California Public Utilities Commission (Docket No. RM.12-03-014): Reply and rebuttal testimony on the topic of local reliability impacts of a potential long-term outage at the San Onofre Nuclear Power Station (SONGS) in Track 4 of the Order Instituting Rulemaking to Integrate and Refine Procurement Policies and Consider Long-Term Procurement Plans. On behalf of the California Office of Ratepayer Advocate. September 30, 2013 and October 14, 2013.

Nova Scotia Utility and Review Board (Matter No. 05522): *Filing to the Nova Scotia Utility and Review Board on Nova Scotia Power's October 15, 2014 Integrated Resource Plan, Key Planning Observations and Action Plan Elements*. On behalf of Board Counsel to the Nova Scotia Utility and Review Board, October 20, 2014. With Rachel Wilson, David White and Tim Woolf.

Nova Scotia Utility and Review Board (Matter No. 05419): Direct examination regarding the report *Economic Analysis of Maritime Link and Alternatives: Complying with Nova Scotia's Greenhouse Gas Regulations, Renewable Energy Standard, and Other Regulations in a Least-Cost Manner for Nova Scotia Power Ratepayers* jointly authored with Rachel Wilson, Nehal Divekar, David White, Kenji Takahashi, and Tommy Vitolo. In the Matter of The Maritime Link Act and In the Matter of An Application by NSP

MARITIME LINK INCORPORATED for the approval of the Maritime Link Project. On behalf of Board Counsel to the Nova Scotia Utility and Review Board. June 5, 2013.

Prince Edward Island Regulatory and Appeals Commission (Docket UE30402): Jointly filed expert report with Nehal Divekar analyzing the Proposed Ottawa Street – Bedeque 138 kV Transmission Line Project in the matter of Summerside Electric's Application for the Approval of Transmission Services connecting Summerside Electric's Ottawa Street substation to Maritime Electric Company Limited's Bedeque substation. Oh behalf of the City of Summerside. November 5, 2012.

New Jersey Board of Public Utilities (Docket No. GO12070640): Direct testimony regarding New Jersey Natural Gas Company's petition for approval of the extension of the SAVEGREEN energy efficiency programs. On behalf of the New Jersey Division of the Ratepayer Advocate. October 26, 2012.

California Public Utilities Commission (Docket No. RM.12-03-014): Direct and reply testimony regarding the long-term local capacity procurement requirements for the three California investor-owned utilities in Track 1 of the Order Instituting Rulemaking to Integrate and Refine Procurement Policies and Consider Long-Term Procurement Plans. On behalf of the California Office of Ratepayer Advocate. June 25, 2012 and July 23, 2012.

California Public Utilities Commission (Docket No. A.11-05-023): Supplemental testimony regarding the long-term resource adequacy and resource procurement requirements for the San Diego region in the Application of San Diego Gas & Electric Company (U 902 3) for Authority to Enter into Purchase Power Tolling Agreements with Escondido Energy Center, Pio Pico Energy Center, and Quail Brush Power. On behalf of the California Office of Ratepayer Advocate. May 18, 2012.

New Jersey Board of Public Utilities (Docket No. GO11070399): Direct testimony in the matter of the petition of Pivotal Utility Holdings, Inc. D/B/A Elizabethtown Gas for authority to extend the term of energy efficiency programs with certain modifications and approval of associated cost recovery. On behalf of New Jersey Division of Rate Counsel. December 16, 2011.

New Jersey Board of Public Utilities (Docket No. EO11050309): Direct testimony regarding aspects of the Board's inquiry into capacity and transmission interconnection issues. October 14, 2011.

Federal Energy Regulatory Commission (Docket Nos. EL11-20-000 and ER11-2875-000): Affidavit regarding reliability, status of electric power generation capacity, and current electric power procurement policies in New Jersey. On behalf of New Jersey Division of Rate Counsel. March 4, 2011.

New Jersey Board of Public Utilities (Docket Nos. GR10100761 and ER10100762): Certification before the Board regarding system benefits charge (SBC) rates associated with gas generation in the matter of a generic stakeholder proceeding to consider prospective standards for gas distribution utility rate discounts and associated contract terms. On behalf of New Jersey Division of Rate Counsel. January 28, 2011.

New Jersey Board of Public Utilities (Docket No. ER10040287): Direct testimony regarding Basic Generation Service (BGS) procurement plan for service beginning June 1, 2011. On behalf of New Jersey Division of Rate Advocate. September 2010.

State of Maine Public Utilities Commission (Docket 2008-255): Direct and surrebuttal testimony regarding the non-transmission alternatives analysis conducted on behalf of Central Maine Power in the Application of Central Maine Power Company and Public Service of New Hampshire for a Certificate of Public Convenience and Necessity for the Maine Power Reliability Program Consisting of the Construction of Approximately 350 Miles of 345 and 115 kV Transmission Lines, a $1.55 billion transmission enhancement project. On behalf of the Maine Office of the Public Advocate. January 12, 2009 and February 2, 2010.

Virginia State Corporation Commission (CASE NO. PUE-2009-00043): Direct testimony regarding the need for modeling DSM resources as part of the PJM RTEP planning processes in the Application of Potomac-Appalachian Transmission Highline (PATH) Allegheny Transmission Corporation for CPCN to construct facilities: 765 kV proposed transmission line through Loudoun, Frederick, and Clarke Counties. On behalf of Sierra Club. October 23, 2009.

Pennsylvania Public Utility Commission (Docket number A-2009-2082652): Direct and surrebuttal testimony regarding the need for additional modeling for the proposed Susquehanna-Roseland 500 kv transmission line in portions of Luckawanna, Luzerne, Monroe, Pike, and Wayne counties to include load forecasts, energy efficiency resources, and demand response resources. On behalf of the Pennsylvania Office of Consumer Advocate. June 30, 2009 and August 24, 2009.

Delaware Public Service Commission (Docket No. 07-20): Filed the expert report *Review of Delmarva Power & Light Company's Integrated Resource Plan* jointly authored with Alice Napoleon, William Steinhurst, David White, and Kenji Takahashi In the Matter of Integrated Resource Planning for the Provision of Standard Offer Service by Delmarva Power & Light Company Under 26 DEL. C. §1007 (c) & (d). On behalf of the Staff of Delaware Public Service Commission. April 2, 2009.

New Jersey Board of Public Utilities (Docket No. ER08050310): Direct testimony filed jointly with Bruce Biewald on aspects of the Basic Generation Service (BGS) procurement plan for service beginning June 1, 2009. On behalf of the New Jersey Division of the Ratepayer Advocate. September 29, 2008.

Wisconsin Public Service Commission (Docket 6680-CE-170): Direct and surrebuttal testimony in the matter of the alternative energy options available with wind power, and the effect of the MISO RTO in helping provide capacity and energy to the Wisconsin area reliably without needed the proposed coal plant in the CPCN application by Wisconsin Power and Light for construction of a 300 MW coal plant. On behalf of Clean Wisconsin. August 11, 2008 and September 15, 2008.

Ontario Energy Board (Docket EB-2007-0707): Direct testimony regarding issues associated with the planned levels of procurement of demand response, combined heat and power, and NUG resources as part of Ontario Power Authority's long-term integrated planning process in the Examination and Critique

of Demand Response and Combined Heat and Power Aspects of the Ontario Power Authority's Integrated Power System Plan and Procurement Process. On behalf of Pollution Probe. August 1, 2008.

Ontario Energy Board (Docket EB-2007-0050): Direct and supplemental testimony filed jointly with Peter Lanzalotta regarding issues of congestion (locked-in energy) modeling, need, and series compensation and generation rejection alternatives to the proposed line of in the matter of Hydro One Networks Inc.'s application to construct a new 500 kV transmission line between the Bruce Power complex and the town of Milton, Ontario. On behalf of Pollution Probe. April 18, 2008 and May 15, 2008.

Federal Energy Regulatory Commission (Dockets ER06-456, ER06-954, ER06-1271, ER07-424, EL07-57, ER06-880, et al.): Direct and rebuttal testimony addressing merchant transmission cost allocation issues on PJM Regional Transmission Expansion Plan (RTEP) Cost Allocation issues. On behalf of the New Jersey Division of the Ratepayer Advocate. January 23, 2008 and April 16, 2008.

State of Maine Public Utilities Commission (Docket No. 2006-487): Pre-file and surrebuttal testimony on the ability of DSM and distributed generation potential to reduce local supply area reinforcement needs in the matter of the Analysis of Central Maine Power Company Petition for a Certificate of Public Convenience and Necessity to Build a 115 kV Transmission Line between Saco and Old Orchard Beach. On behalf of Maine Office of the Public Advocate. February 27, 2007 and January 10, 2008.

Minnesota Public Utilities Commission (OAH No. 12-2500-17037-2 and OAH No. 12-2500-17038-2; and MPUC Dkt. Nos. CN-05-619 and TR-05-1275): Supplemental testimony and supplemental rebuttal testimony on applicants' estimates of DSM savings in the Certificate of Need proceeding for the Big Stone II coal-fired power plant proposal In the Matter of the Application by Otter Tail Power Company and Others for Certification of Transmission Facilities in Western Minnesota and In the Matter of the Application to the Minnesota Public Utilities Commission for a Route Permit for the Big Stone Transmission Project in Western Minnesota. On behalf of Fresh Energy, Izaak Walton League of America – Midwest Office, Wind on the Wires, Union of Concerned Scientists, Minnesota Center for Environmental Advocacy. December 8, 2006 and December 21, 2007.

Pennsylvania Public Utility Commission (Docket Nos. A-110172 *et al*.): Direct testimony on the effect of demand-side management on the need for a transmission line and the level of consideration of potential carbon regulation on PJM's analysis of need for the TrAIL transmission line. On behalf of the Pennsylvania Office of Consumer Advocate. October 31, 2007.

Iowa Public Utilities Board (Docket No. GCU-07-01): Direct testimony regarding wind energy assessment in Interstate Power and Light's resource plans and its relationship to a proposed coal plant in Iowa. On behalf of Iowa Office of the Consumer Advocate. October 21, 2007.

New Jersey Board of Public Utilities (Docket No. EO07040278): Direct testimony on certain aspects of PSE&G's proposal to use ratepayer funding to finance a solar photovoltaic panel initiative in support of the State's solar RPS. September 21, 2007.

Indiana Utility Regulatory Commission (Cause No. 43114): Direct testimony on the topic of a proposed Duke – Vectren IGCC coal plant and wind power potential in Indiana. On behalf of Citizens Action Coalition of Indiana. May 14, 2007.

British Columbia Utilities Commission: Pre-filed evidence regarding the "firming premium" associated with 2006 Call energy, liquidated damages provisions, and wind integration studies In the Matter of BC Hydro 2006 Integrated Electricity Plan and Long Term Acquisition Plan. On behalf of the Sierra Club (BC Chapter), Sustainable Energy Association of BC, and Peace Valley Environment Association. October 10, 2006.

Maine Joint Legislative Committee on Utilities, Energy and Transportation (LD 1931): Testimony regarding the costs and benefits of increasing the system benefits charge to increase the level of energy efficiency installations by Efficiency Maine before in support of an Act to Encourage Energy Efficiency. On behalf of the Maine Natural Resources Council and Environmental Defense. February 9, 2006.

Nova Scotia Utility and Review Board: Direct testimony and supplemental evidence regarding the approval of the installation of a flue gas desulphurization system at Nova Scotia Power Inc.'s Lingan station and a review of alternatives to comply with provincial emission regulations In The Matter of an Application by Nova Scotia Power Inc. for Approval of Air Emissions Strategy Capital Projects and The Public Utilities Act, R.S.N.S., 1989, c. 380, as amended. On behalf of Nova Scotia Utility and Review Board Staff. January 30, 2006.

New Jersey Board of Public Utilities (BPU Docket EM05020106): Joint direct and surrebuttal testimony with Bruce Biewald and David Schlissel regarding the Joint Petition Of Public Service Electric and Gas Company And Exelon Corporation For Approval of a Change in Control Of Public Service Electric and Gas Company And Related Authorizations. On behalf of New Jersey Division of the Ratepayer Advocate. November 14, 2005 and December 27, 2005.

Indiana Utility Regulatory Commission (Cause No. 42873): Direct testimony addressing the proposed Duke – Cinergy merger. On behalf of Citizens Action Coalition of Indiana. November 8, 2005.

Indiana Utility Regulatory Commission (Causes No. 38707 FAC 61S1, 41954, and 42359-S1): Responsive testimony addressing a proposed Settlement Agreement between PSI and other parties in respect of issues surrounding the Joint Generation Dispatch Agreement in place between PSI and CG&E. On behalf of Citizens Action Coalition of Indiana. August 31, 2005.

Illinois Commerce Commission (Dockets 05-0160, 05-0161, 05-0162): Direct and rebuttal testimony addressing wholesale market aspects of Ameren's proposed competitive procurement auction (CPA). On behalf of Illinois Citizens Utility Board. June 15, 2005 and August 10, 2005.

Illinois Commerce Commission (Docket 05-0159): Direct and rebuttal testimony addressing wholesale market aspects of Commonwealth Edison's proposed BUS (Basic Utility Service) competitive auction procurement. On behalf of Illinois Citizens Utility Board and Cook County State's Attorney's Office. June 8, 2005 and August 3, 2005.

State of Maine Public Utilities Commission (Docket No. 2005-17): Joint testimony with David Schlissel and Peter Lanzalotta regarding an Analysis of Eastern Maine Electric Cooperative, Inc.'s Petition for a Finding of Public Convenience and Necessity to Purchase 15 MW of Transmission Capacity from New Brunswick Power and for Related Approvals. On behalf of Maine Office of the Public Advocate. July 19, 2005.

Indiana Utility Regulatory Commission (Cause No. 38707 FAC 61S1): Direct testimony in a Fuel Adjustment Clause (FAC) proceeding concerning the pricing aspects and merits of continuation of the Joint Generation Dispatch Agreement in place between PSI and CG&E, and related issues of PSI lost revenues from inter-company energy pricing policies. On behalf of Citizens Action Coalition of Indiana. May 23, 2005.

Indiana Utility Regulatory Commission (Cause No. 41954): Direct testimony concerning the pricing aspects and merits of continuation of the Joint Generation Dispatch Agreement in place between PSI and CG&E. On behalf of Citizens Action Coalition of Indiana. April 21, 2005.

State of Maine Public Utilities Commission (Docket No. 2004-538): Joint testimony with David Schlissel and Peter Lanzalotta regarding an Analysis of Maine Public Service Company Request for a Certificate of Public Convenience and Necessity to Purchase 35 MW of Transmission Capacity from New Brunswick Power. On behalf of Maine Office of the Public Advocate. April 14, 2005.

Nova Scotia Utility and Review Board (Order 888 OATT): Testimony regarding various aspects of OATTs and FERC's *pro forma* In The Matter of an Application by Nova Scotia Power Inc. for Approval of an Open Access Transmission Tariff (OATT). On behalf of the Nova Scotia Utility Review Board Staff. April 5, 2005.

Texas Public Utilities Commission (Docket No. 30485): Testimony regarding excess mitigation credits associated with CenterPoint's stranded cost recovery in the Application of CenterPoint Energy Houston Electric, LLC. for a Financing Order. On behalf of the Gulf Coast Coalition of Cities. January 7, 2005.

Ontario Energy Board (RP-2002-0120): Filed testimony and reply comments reviewing the Transmission System Code (TSC) and Related Matters, Detailed Submission to the Ontario Energy Board in Response To Phase I Questions Concerning the Transmission System Code and Related Matters. On behalf of TransAlta Corporation. October 31, 2002 and November 21, 2002.

Alberta Energy and Utilities Board (Application No. 2000135): Filed joint testimony with Dr. Richard D. Tabors in the matter of the Transmission Administrator's 2001 Phase I and Phase II General Rate Application pertaining to Supply Transmission Service charge proposals. On behalf of Alberta Buyers Coalition. March 28, 2001.

Ontario Energy Board (RP-1999-0044): Testimony critiquing Ontario Hydro Networks Company's Transmission Tariff Proposal and Proposal for Alternative Rate Design. On behalf of the Independent Power Producer's Society of Ontario. January 17, 2000.

Massachusetts Department of Public Utilities (Docket # DPU 95-2/3-CC-I): Filed a report (Fagan R., G. Watkins. 1995. *Sampling Issues in Estimating DSM Savings: An Issue Paper for Commonwealth Electric*. Charles River Associates). On behalf of COM/Electric System. April 1995.

Massachusetts Department of Public Utilities (Docket # DPU 95-2/3-CC-I): Filed initial and updated reports (Fagan R., P. Spinney, G. Watkins. 1994. *Impact Evaluation of Commonwealth Electric's Customized Rebate Program*. Charles River Associates. Updated April 1996). April 1994 and April 1995.

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