

**STATE OF NEW JERSEY
BOARD OF PUBLIC UTILITIES**

**I/M/O THE PETITION OF PUBLIC) BPU Docket Nos. EO13020155 and
SERVICE ELECTRIC & GAS) GO13020156
COMPANY FOR APPROVAL OF)
THE ENERGY STRONG PROGRAM)**

**DIRECT TESTIMONY OF CHARLES P. SALAMONE P.E.
ON BEHALF OF THE DIVISION OF RATE COUNSEL**

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1 **I. STATEMENT OF QUALIFICATIONS**

2 **Q. Please state your name and business address.**

3 A. My name is Charles P. Salamone. I am Owner of Cape Power Systems
4 Consulting, LLC a power systems consulting Company with an address of 23
5 Westerly Drive, Bourne, Massachusetts and I am subcontracting with Synapse
6 Energy Economics, Inc. with an address of 485 Massachusetts Avenue,
7 Cambridge, Massachusetts.

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

9 A. I am submitting testimony on behalf of Division of Rate Counsel.

10 **Q. Please describe your education and professional background.**

11 A. I hold a Bachelor of Science Degree in Electrical Engineering from Gannon
12 University. I joined the Engineering Department of Commonwealth Electric
13 Company in 1973. At that time, I became a Junior Planning Engineer where my
14 primary responsibilities were to assist in the planning, analysis and design of the
15 transmission and distribution systems of Commonwealth Electric Company, later
16 known as NSTAR. I generally followed the normal progression of positions with
17 increasing levels of responsibility within the planning area until taking the
18 position of Director of System Planning at NSTAR in 2000. I held that position
19 until starting Cape Power Systems Consulting, LLC in 2005. During my career
20 with NSTAR in addition to the responsibilities associated with overseeing System
21 Planning I had served as Chair of the New England Power Pool (NEPOOL)
22 Planning Policy Subcommittee (1997-1998), Chair of the NEPOOL Regional

1 Transmission Planning Committee (1998-1999) and Vice Chair of the NEPOOL
2 Reliability Committee (1999-2000). As a consultant I have been providing
3 consulting services to a number of power system industry clients since 2005. I
4 am a Registered Professional Engineer with the Commonwealth of Massachusetts.
5 I am also a member of the Power Engineering Society of the Institute of Electrical
6 and Electronic Engineers. A copy of my resume is attached hereto as Schedule
7 CPS 1.

8

9 **Q. Have you previously testified before utility regulatory agencies?**

10 A. Yes. I have previously testified before the New Jersey Board of Public Utilities,
11 the Federal Energy Regulatory Commission, the Massachusetts Department of
12 Telecommunications and Energy and the Massachusetts Energy Facilities Siting
13 Board on a number of technical matters relating to ratemaking and system
14 planning.

15

16 **II. PURPOSE AND SUMMARY OF TESTIMONY**

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

18 A. The purpose of my testimony is to review engineering aspects of the electric
19 component of Public Service Gas and Electric's (PSE&G or "the Company")
20 "Energy Strong" program that are the subject of this petition. Rate Counsel
21 witness Ed McGee will address the gas delivery component of the Energy Strong
22 petition. Rate Counsel witness David Dismukes will address the economic impact

1 of the Energy Strong petition. In addition, Rate Counsel witnesses Andrea Crane
2 and Matthew Kahal will address other aspects of the Company's proposal.

3

4 My testimony will review the information provided concerning the proposed
5 program and will point out that there remains insufficient information as currently
6 proposed to justify the approval of \$1.7 billion for the electric component of this
7 petition for the next five years. Should the Board approve the Energy Strong
8 petition, the Company's program will take ten years to complete and by its own
9 calculations would only be cost-effective for a Superstorm Sandy type event. For
10 a Hurricane Irene event or 2011 October Snowstorm event, the Company's
11 calculations show that the Energy Strong program would not be cost effective.
12 Furthermore, my testimony will show that the Company is not currently precluded
13 from undertaking any of these capital investments and has undertaken similar
14 projects under its current distribution budgets in order to maintain safe, adequate,
15 and proper service.

16 **Q. What are your findings?**

17
18 A. My findings are summarized as:

- 19
20 1. The Company should conduct the necessary detailed analysis to adequately
21 support the cost-effectiveness of each element of the programs it is proposing to
22 implement before funding is approved. This includes cost-effectiveness analyses
23 of specific projects proposed within each program. The Company should also

1 provide an analysis of the alternatives that were considered and the rationale why
2 the specific proposed solution was chosen.

3 2. The Company should implement a phased approach to sequence work based on its
4 short, medium, and long-term planning process. Projects should not be undertaken
5 unless the Company's planning process determines that the most cost effective
6 solution alternative has been selected and that the investment is justified based on
7 the projected benefits exceeding project costs.

1 **III. SUMMARY OF ENERGY STRONG PROGRAM**

2
3 **Q. Would you summarize your understanding of the Energy Strong Petition?**

4 **A.** The Company is proposing to spend \$3.94 billion dollars over ten years to
5 redesign and build elements of its electric and gas distribution system to
6 ameliorate the impacts of a Superstorm Sandy like event in the future.¹ The
7 Company describes its goal as “system hardening” in order to make its electric
8 and gas infrastructure “less susceptible to storm damage” and “resiliency” to
9 enhance its “ability to recover quickly” from such a storm event.² The Company
10 has already received accolades for its reliability performance, and the proposed
11 Energy Strong program would be incremental to its current distribution capital
12 budgets.³

13 My testimony addresses the electric delivery component of the Energy Strong
14 petition, which is \$1.70 billion over the first sixty months.⁴ Over ten years, the
15 electric delivery component would be \$2.76 billion.

16 **Q. What are the elements of the Energy Strong Program?**

¹ PSE&G. Petition (“Petition”). dated February 20, 2013. A copy of the petition is available at http://www.pseg.com/family/pseandg/tariffs/reg_filings/pdf/EnergyStrong.pdf. Accessed September 23, 2013.

² Petition. Paragraph 8, Page 3

³ RCR-E-10

⁴ Petition. Page 4.

1 A. The following schedule summarizes the costs of the electric delivery component
2 by program for the first five years and the entire ten years as proposed by the
3 Company.

4 **Schedule CPS 2: Chart of Energy Strong Program**
5

Program	Action	Program Years	Cost (first 60 months) (\$millions)	Total Costs (ten years) (\$million)
Station Flood Mitigation	Raising and rebuilding infrastructure, and installing flood walls	10	\$819	\$1,678
Outside Plant Higher Design and Construction Standards	Change outside plant distribution to 13kV	5	\$65	\$65
	Change existing 26kV to 69kV standards	5	\$60	\$60
	Add spacer cable to eliminate open wire to targeted areas	5	\$10	\$10
Strengthening Pole Infrastructure	Accelerate pole replacements	5	\$102	\$102
	Non wood poles	5	\$3	\$3
Rebuild/ Relocate Backyard poles	Rebuild backyard poles (including tree trimming)	5	\$100	\$100
Undergrounding	Convert certain Overhead lines to Underground	5	\$60	\$60
	Replacement with submersible transformers in target areas	5	\$8	\$8
	Replacement with submersible switches	5	\$8	\$8
Relocate Electric and Gas Dispatch operating centers	Relocate critical operating centers	2	\$15	\$15
Advanced Technologies: System Visibility	Expand installation of microprocessor relays and SCADA field equipment	10	\$120	\$250
	Monitoring and visualization of distribution stations	10	\$24	\$50
Advanced Technologies: Communication Network	High speed fiber optic network	10	\$35	\$73
	Pilot satellite program	5	\$3	\$3
	Advanced Distribution Management System	10	\$9	\$15
	Enhanced storm management systems	4	\$50	\$50
	Expanded communication channels	3	\$10	\$10
Reconfiguration Strategies	Establish contingency strategies through smart fuses and redundant loop schemes	5	\$200	\$200
Emergency Generators	Stockpiling emergency generators	1	\$2	\$2
Total			\$1,703	\$2,762
Notes				
Based Attachment 1 of February 20 th Petition and AARP 10				

1 **IV. EXTRAORDINARY INCREASE IN CAPITAL SPENDING**

2

3 **Q. Has the Company provided an estimate of the annual spending for the**
 4 **proposed Energy Strong Program relative to the Company’s normal**
 5 **Distribution capital spending?**

6 **A.** Yes, in response to RCR-ROR-8, the Company provided an estimate of the
 7 projected annual spending for the Energy Strong petition along with the
 8 Company’s proposed distribution capital spending in response to S-PSEG-ES-5
 9 as shown below:⁵

10 **Schedule CPS 3: Proposed Energy Strong Annual Spending and Electric**
 11 **Distribution Capital Budgets (millions)**

	2013	2014	2015	2016	2017	2018-2023	Total
Energy Strong	\$40	\$183	\$291	\$421	\$415	\$1,412	\$2,762
Electric Distribution Capital excluding New Business Projects	\$200	\$205	\$209	\$219	\$228	NA	\$1,061
Ratio of Energy Strong to Electric Distribution	0.2	0.9	1.4	1.9	1.8		
Notes							
Values may not sum due to rounding							
Taken from RCR-ROR-8, page 5 of 21							
Electric Distribution Capital budgets (2013-2017) from S-PSEG-ES-5							
Electric Distribution Capital budgets include: System Reinforcement Projects, Replace Facilities Projects, Environmental Regulatory Projects, and Utility Operations Services							

12

13 Schedule CPS 3 shows that the proposed Energy Strong program will exceed the
 14 Company’s entire Distribution Capital budget less New Business Projects by
 15 2015. However, the Company has not provided a detailed timeline of specific

⁵ S-PSEG-ES-5

1 individual projects. For the Station Flood and Storm Surge Mitigation program,
2 the largest component of the Energy Strong petition, the Company is currently
3 only in the project initiation phase.⁶ Thus, the annual spending for this component
4 of Energy Strong remains speculative.

5 **Q. Has the Company provided a detailed damage assessment of its electric**
6 **infrastructure to support the Energy Strong petition?**

7 **A.** The Company lists a number of impacts that resulted from Superstorm Sandy and
8 provides additional detail of the damage caused by Superstorm Sandy.⁷ However,
9 the Company did not provide detailed damage reports from the event citing that it
10 was too voluminous.⁸ The Company notes that it believed that its response to
11 Superstorm Sandy was reasonable and prudent, and that the proposed Energy
12 Strong program would be incremental to that response.⁹

13 Additionally, the Company proposes to implement a rate design mechanism that
14 is the subject of Rate Counsel witness Andrea Crane's testimony.

15 **Q. Has the Company indicated if it has completed projects similar to the**
16 **proposed Energy Strong program in the past?**

⁶ S-PSEG-ES-66

⁷ RCR-E-2, RCR-E-7

⁸ RCR-E-28

⁹ RCR-E-114

1 A. Yes, in a series of responses, the Company has identified similar projects
2 completed in the last five years. This is shown in the following schedule.

3 **Schedule CPS 4: Proposed Energy Strong Program Spending Versus Historical**
4 **Spending on Similar Programs**

Program	Proposed Spending First 60 Months	Spending on Similar Projects Last Five Years	Response
Station Flood Mitigation	\$819	\$58	RCR-ECON-29 b(i)
Outside Plant Higher Design and Construction Standards	\$135	\$24	RCR-ECON-30b, 31b
Strengthening Pole Infrastructure	\$105	\$14	RCR-ECON-32b
Rebuild/Relocate Backyard poles	\$100	NA	RCR-ECON-33b
Undergrounding	\$76	\$18	RCR-ECON-34b, 35b(i),36b(i)
Advanced Technologies- System Visibility Microprocessors and Field SCADA	\$120	\$171	RCR-ECON-38a, 39b
Advanced Technologies- System Visibility Distribution Monitoring System (DMS)	\$24		
Advanced Technologies- High Speed Fiber Optics Network	\$35	\$7	RCR-ECON-40b
Advanced Technologies- Pilot Satellite Network	\$3	NA	RCR-ECON-41
Advanced Technologies- Storm Damage Assessment	\$9	NA	RCR-ECON-42
Advanced Technologies- Enhanced Storm Management Systems	\$50	NA	RCR-ECON-43
Advanced Technologies- Enhanced Communications Channels	\$10	NA	RCR-ECON-44
Contingency Reconfiguration Strategies	\$200	\$50	RCR-ECON-45a
Total	\$1,701	\$341	

5

6 **Q. What do you conclude from the schedule above?**

7 A. Schedule CPS 4 shows that the proposed Energy Strong program represents a
8 significant increase in spending to similar programs as identified by the Company.

9 I find that it would be imprudent for the Company to undertake such a significant

1 increase in spending without a detailed planning process to ensure that each
2 project is cost-effective and that all alternatives have been explored.

3 **V. QUANTIFICATION OF BENEFITS**

4
5 **Q. Did the Company provide any documentation of how it arrived at its**
6 **quantification of benefits?**

7 A. The Company provided high level rationales to the reduced number of outages
8 and outage durations associated with the proposed Energy Strong program based
9 on its experience with major events and was not based on any studies or analysis
10 that support the values that were proposed.¹⁰ These values are just the Company's
11 internal estimates regarding the number of customers that would not be
12 interrupted or the reduction in time that customers are without service. On
13 October 7, 2013, the Company provided a copy of a Brattle Group analysis of the
14 proposed Energy Strong program.¹¹ I have propounded discovery on the Brattle
15 Group report but I have not received responses from the Company at this time. As
16 a result, I reserve my right to comment on the report based on responses provided
17 by the Company.

18 **Q. Has the Company provided detailed calculations of how it arrived at its**
19 **reduction in outage numbers and outage durations?**

¹⁰ RCR-E-3

¹¹ RCR-ECON-5, Supplemental

1 A. No, the Company's calculations are provided at the program level without
2 detailed explanations of how it arrived at its estimate of reductions in customer
3 outages and outage durations.¹² As an example, the \$1.6 billion substation
4 program assumes that the program will reduce the number of five day outages by
5 33% and that the duration of customer outages would be reduced from five days
6 to four days.¹³ As noted previously, these estimates are based on PSEG's
7 estimates and not documented studies.¹⁴ These estimates were applied by PSEG
8 across the entire substation program without supporting documentation or detailed
9 substation specific engineering studies.

10 **Q. Has the Company provided a detailed prioritization of the program?**

11 A. No, the Company has only provided general priorities of the program based on
12 budget priorities suggested by Staff.¹⁵ However, the Company has provided a list
13 of prioritized substations.¹⁶

14 **Q. Has the Company undertaken any internal studies to prioritize the capital**
15 **spending associated with the Energy Strong program?**

16 A. No, the Company has indicated that it has not internally vetted any of the
17 proposed Energy Strong programs since the Company claims that the Energy

¹² S-PSEG-ES-2, RCR-E-131

¹³ RCR-E-2

¹⁴ RCR-E-3

¹⁵ S-PSEG-ES-52

¹⁶ S-PSEG-ES-33

1 Strong program falls outside the metrics it has established for reviewing capital
2 projects internally.¹⁷

3 **Q. Has the Company taken the likelihood of storm conditions into account in**
4 **development of the capital spending associated with the Energy Strong**
5 **program?**

6 A. No it has not. The Company has developed its program with the primary objective
7 of addressing a catastrophic event such as Superstorm Sandy and has not included
8 any consideration of the likelihood of this type of event in its assessment.¹⁸
9 Programs that are less costly could potentially be developed that address an
10 objective of reducing customer outages for storm conditions that are far more
11 likely to occur at a substantially lower cost to the customer. I believe that a
12 program that is developed to address more likely storm events would be a more
13 prudent approach and such a program could be used as a better gauge in
14 determining the value of a Superstorm Sandy based program as it would allow for
15 evaluation of the incremental benefits versus the incremental costs. As presented
16 the Company's proposed Energy Strong program offers an all or nothing
17 approach that seeks to expend an astonishingly large amount of customer money
18 to address the most unlikely of events.

¹⁷ RCR-E-86

¹⁸ RCR-E-126

1 **VI. COST EFFECTIVENESS**

2

3 **Q. Has the Company undertaken an evaluation of Cost-Effectiveness of each of**
4 **the projects in the Energy Strong Program?**

5 A. The Company provided an evaluation of the cost-effectiveness of general
6 segments of the Energy Strong Program based on high level estimates of avoided
7 outages for a Superstorm Sandy like event.¹⁹ The Company has not provided a
8 detailed cost benefit analysis for individual elements of the Energy Strong
9 program. There has been no cost benefit analysis for individual projects such as
10 the substation specific projects in the Station Flood and Storm Surge Mitigation
11 program, some of which are estimated to cost in excess of \$67 million. It is
12 significant to note that the Company had not performed any calculations to
13 determine the cost-effectiveness of the Energy Strong Program prior to a
14 discovery request.²⁰

15 **Q. Do you find that fact problematic?**

16 A. Yes, I find it problematic that the Company is requesting \$1.7 billion dollars from
17 its ratepayers for the first five years of the proposed Energy Strong program
18 without conducting any formal cost benefit analysis internally prior to filing its
19 Petition.²¹ In response to an interrogatory regarding if the Company would update

¹⁹ S-PSEG-ES-2

²⁰ AARP-3

²¹ AARP-3

1 its cost benefit analysis if the proposed Energy Strong was approved, the
2 Company referred to a response regarding the timing of the Brattle Group
3 analysis.²² It appears that the Company is still attempting to develop its business
4 case for the petition nearly eight months after filing it.

5 **Q. Did the Company conduct analyses of alternative storm events in reviewing**
6 **the cost-effectiveness of the Energy Strong program?**

7 A. When requested, the Company conducted two sensitivities to the Energy Strong
8 program under (1) Hurricane Irene and (2) 2011 October snowstorm events since
9 these two major events were referenced by the Company in its petition.²³ These
10 two major events resulted in outages for 872,492 customers for Hurricane Irene
11 and 636,898 customers for the 2011 October Snowstorm.²⁴ Schedule CPS 5
12 shows the results of the benefit to cost ratio of Superstorm Sandy and the two
13 sensitivity cases. I note that Schedule CPS 5 presents results differently than how
14 the Company presented its cost-benefit ratio results in its responses to S-PSEG-
15 ES-2. Generally, cost-benefit analyses present the ratio as benefit to cost, so that if
16 benefits exceed costs then the ratio would be greater than one.²⁵ This is how I
17 present the analysis in Schedule CPS 5. In contrast, S-PSEG-ES-2 presents the

²² RCR-E-140, G-POL-83

²³ Petition, Page 1, S-PSEG-ES-2 and RCR-E-131.

²⁴ RCR-E-7

²⁵ The Company uses a cost to benefit ratio. Thus if benefits exceed costs, then the ratio would be less than one.

1 ratios as cost to benefit, so that if benefits exceed costs then the resulting ratio
 2 would be less than one.

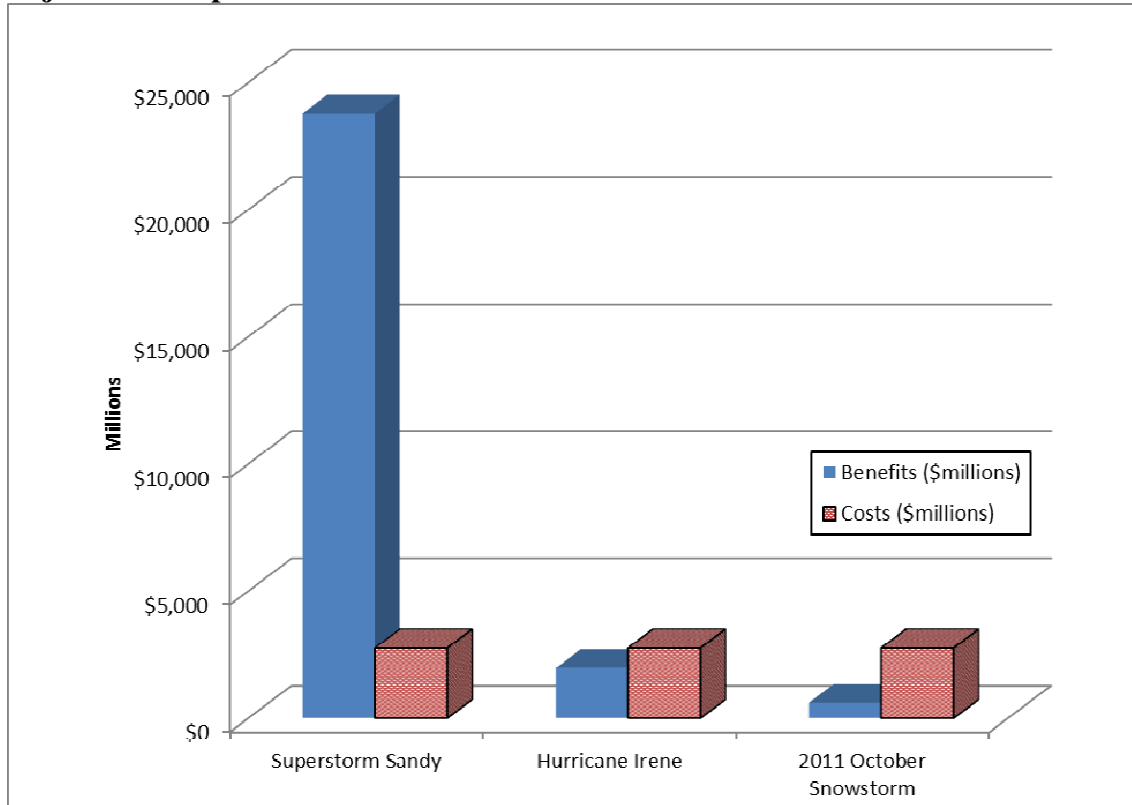
3 **Schedule CPS 5: Energy Strong Benefit Cost Ratios Under Superstorm Sandy,**
 4 **Hurricane Irene and October Snowstorm Outage Inputs**
 5

Program	Action	Superstor m Sandy	Hurricane Irene	2011 October Snowstorm
		B/C	B/C	B/C
Station Flood Mitigation	Raising and rebuilding infrastructure, and installing flood walls	9.4	0.7	0.0
Outside Plant Higher Design and Construction Standards	Change outside plant distribution to 13kV	3.6	0.4	0.3
	Change existing 26kV to 69kV standards	7.5	0.8	0.7
	Add spacer cable to eliminate open wire to targeted areas	8.0	0.8	0.7
Strengthening Pole Infrastructure	Accelerate pole replacements	0.3	0.0	0.0
	Non wood poles	0.3	0.0	0.0
Rebuild/Relocate Backyard poles	Rebuild backyard poles (including tree trimming)	0.0	0.0	0.0
Undergrounding	Convert certain overhead lines to underground	4.0	0.4	0.4
	Replacement with submersible transformers in target areas	5.8	0.6	0.5
	Replacement with submersible switches	N/A	N/A	N/A
Relocate Electric and Gas Dispatch operating centers	Relocate critical operating centers	3.4	N/A	N/A
Advanced Technologies: System Visibility/ Communication Network	Expand installation of microprocessor relays and SCADA field equipment	5.7	0.5	0.4
	Monitoring and visualization of distribution stations			
	High speed fiber optic network	N/A	N/A	N/A
	Pilot satellite program			
Advanced Technologies: Storm Damage Assement	Advanced distribution management system	45.6	4.2	3.5
	Enhanced storm management systems			
	Expand communication channels			
Reconfiguration Strategies	Establish contingency strategies through smart fuses and redudant loop schemes	6.4	0.7	0.6
Generators	Stockpiling of emergency generators	2.0	2.0	2.0
Overall Energy Strong		8.6	0.7	0.2
Notes: Benefit/Cost ratios are based on: S-PSEG-ES-2, S-PSEG-ES-25, and RCR-E-131 for Hurricane Irene and 2011 October Snowstorm				

6

1 Schedule CPS 6 shows the overall benefits and costs associated with the Energy
2 Strong program under the three storm event sensitivities.

3 **Schedule CPS 6: Company Calculated Energy Strong Benefits and Costs Based on**
4 **Major Event Inputs**



5
6 Overall, the Company's analysis of the proposed Energy Strong petition shows a
7 cost benefit ratio of 8.6 based on its inputs and costs for a future Superstorm
8 Sandy like event and values less than one (indicating that they are not cost
9 effective) for the other storm events. For some elements such as the Company's
10 proposed Pole Strengthening and Backyard Pole programs, the Company's
11 analyses indicate that they do not appear cost-effective under any circumstance,
12 including Superstorm Sandy conditions.

1 **Q. What are the claimed benefits of the Energy Strong Program in terms of**
2 **reduced outages and outage duration?**

3 A. The results of the Company's calculations indicates that the Energy Strong
4 program would reduce the number of customers who would suffer outages by
5 325,606.²⁶ In Superstorm Sandy, the number of customers affected as reported by
6 the Company was 2,014,516.²⁷ Thus Energy Strong, if fully implemented, would
7 still result in 1,688,910 customer outages for an event such as Superstorm Sandy.
8 The Company also reports that Energy Strong would have the effect of reducing
9 outage durations associated with a Superstorm Sandy-like event. The Company
10 calculated that the fully implemented Energy Strong program would reduce
11 customer outage durations by 62,714,213 hours or 39% of customer outage
12 hours.²⁸ This means that there would still be approximately 99,781,420 customer
13 outage hours for a Superstorm Sandy-like type of event.²⁹

14 **Q. Is the Company's proposed Energy Strong program cost effective under a**
15 **Hurricane Irene-like sensitivity?**

16 A. Under conditions similar to Hurricane Irene, the proposed Energy Strong program
17 is not cost effective by the Company's calculation. In other words the costs of the
18 Energy Strong program would exceed the benefits under Hurricane Irene-like

²⁶ RCR-E-2

²⁷ RCR-E-7

²⁸ RCR-E-2

²⁹ RCR-E-6

1 inputs. Under Hurricane Irene, the Company's customers experienced
2 approximately 16.7 million customer outage hours.³⁰ In its sensitivity
3 calculations, a fully implemented Energy Strong program would reduce outages
4 by 3.7 million customer outage hours or 22%.³¹

5 **Q. Is the Company's proposed Energy Strong program cost effective under the**
6 **2011 October Snowstorm-like sensitivity?**

7 A. Under the 2011 October Snowstorm event, the proposed Energy Strong program
8 is not cost effective by the Company's calculation. In other words the costs of the
9 Energy Strong program would exceed the benefits. Under the 2011 October
10 Snowstorm, the Company's customers experienced approximately 14.0 million
11 customer outage hours.³² In its sensitivity calculations, a fully implemented
12 Energy Strong program would reduce customer outage hours by 379,000 or only
13 about 3%.

14 **Q. What do the Hurricane Irene and 2011 October Snowstorm inputs tell you**
15 **about the proposed Energy Strong program?**

³⁰ Based on RCR-E-131, Storm Characteristics Tab. The Company reports a customer minutes of interruption (CMI) for Hurricane Irene of 1,005,271,263 minutes.

³¹ RCR-E-131

³² Based on RCR-E-131, Storm Characteristics Tab. The Company reports a customer minutes of interruption (CMI) for the 2011 October storm of 841,627,388 minutes.

1 A. In two of the three major events cited by the Company in its Petition to justify its
2 proposed Energy Strong Program, the Company's calculations show that it would
3 not be cost-effective for events that are far more likely than Superstorm Sandy.

4 It is worth noting the significant differences in the likelihood of these events.
5 Based on a USA Today report³³ the likelihood of a hurricane impacting Atlantic
6 City, N.J. is once every 21 years and the likelihood of an extremely severe storm
7 is just once every 83 years. Additionally, a report from the "United States
8 Landfalling Hurricane Probability Project"³⁴ indicates that the likelihood of an
9 "intense" hurricane (which would have winds greater than 115 mph) is five times
10 less likely than an average hurricane for the New Jersey coastal area. Programs
11 that are not cost effective for major events that are four or five times more likely
12 than a Superstorm Sandy-like event should be scrutinized to determine if they are
13 in the best interest of the customers that are impacted by such events.

14 **Q. Did the Company take the likelihood of a future Superstorm Sandy like**
15 **event into consideration?**

³³ <http://usatoday30.usatoday.com/weather/hurricane/history/probabilities-table.htm>

³⁴ <http://www.e-transit.org/hurricane/welcome.html> The United States landfalling hurricane web project has been co-developed by William Gray's [Tropical Meteorology Research Project](#) at [Colorado State University](#) and the [GeoGraphics Laboratory](#) at [Bridgewater State University](#). (viewed 10/17/13).

1 A. No, the Company's response to RCR-E-126 indicated that it had not conducted
2 any assessment of the likelihood of future storm events. The program that is being
3 proposed is based solely on mitigation of storm conditions that are extremely
4 unlikely events and does not attempt to balance the likelihood of occurrence with
5 the cost effectiveness of the program. A comparison can be drawn from the
6 process that electric utilities use for routine reliability planning. The typical utility
7 planning scenario calls for consideration of events such as the loss of two major
8 transmission lines within a thirty minute period based on deterministic criteria.
9 This is an unlikely event but it does occur occasionally just as do major storm
10 events. Utilities design their system to withstand this type of event which is
11 prescribed by the North American Electric Reliability Corporation (NERC). If we
12 were to compare the normal hurricane occurrence for New Jersey to two
13 transmission lines being out at the same time then Superstorm Sandy would be
14 like having eight lines out of service at the same time. This kind of event can
15 happen but it is so rare that the only requirement based on NERC standards is to
16 have corrective actions in place to respond to the outages. There is no expectation
17 that the system should be designed and constructed to withstand such an
18 extremely rare event. The company's program is only cost effective under the
19 extreme conditions of Superstorm Sandy based on their own calculations and
20 attempts to design the system to withstand such an extremely rare event at an
21 extraordinarily high expense.

1 **VII. SUMMARY OF PROGRAMS**

2 **Station Flood and Storm Surge Mitigation**

3

4 **Q. Do you have reservations regarding the proposed Station Flood and Storm**
5 **Surge Mitigation program?**

6 A. The Company has already established a reasonable and more cost effective
7 approach to mitigation of substations related customer outages. By the
8 Company's own internal directive, a plan and study that incorporates addressing
9 flooding concerns at many susceptible substation locations was already conducted
10 after Hurricane Irene.³⁵ The Company has already stated that it will assess the
11 long-term impact of flooding damage from Hurricane Irene and Superstorm
12 Sandy as part of its normal substation inspection and maintenance programs.³⁶
13 The extraordinary upgrades and expenses proposed as part of the Company's
14 Energy Strong program are unwarranted and provide limited benefits for
15 customers only under Superstorm Sandy-like conditions. These concerns are
16 discussed in greater detail in the remainder of my testimony.

17 **Q. Did the Company conduct any engineering studies post Hurricane Irene or**
18 **Superstorm Sandy?**

³⁵ S-PSEG-ES-14

³⁶ S-PSEG-ES-33

1 A. Following Hurricane Irene, the Company commissioned a study to evaluate the
2 feasibility of installing flood walls in its substations.³⁷ However, the Company did
3 not plan to harden its substations as a result of Hurricane Irene.³⁸

4 **Q. Please describe the findings of the study undertaken after Hurricane Irene.**

5 A. The Company commissioned Black and Veatch to conduct a study to investigate
6 installing floodwalls around 12 substations following Hurricane Irene. Black and
7 Veatch completed its study in 2012, which included flood impact studies for ten
8 substations.³⁹ A detailed list of substations damaged by Superstorm Sandy,
9 Hurricane Irene, and are at risk based on floodplain maps are listed in RCR-E-13.

10 **Q. What were the findings of the Black and Veatch study?**

11 A. Black and Veatch concluded that the Company could install flood walls around
12 the ten substations that were included in their assessment at a total cost of \$10.1
13 million in (2012\$) dollars.⁴⁰

14 **Q. Why is the Black and Veatch Study relevant to the Energy Strong Petition?**

15 A. The Black and Veatch study provides an example of the detailed studies that
16 could and should be conducted prior to embarking on a capital intensive process
17 of grid hardening. The results of the study indicate that there are alternatives

³⁷ S-PSEG-ES-14

³⁸ S-INF-3

³⁹ S-PSEG-ES-14

⁴⁰ S-PSEG-ES-14, pgs. 4 & 8 of 233.

1 available to the Company that could achieve the goal of grid hardening at
2 significantly lower costs than as proposed by the Company.

3 **Q. Did the Company conduct a similar assessment of substations impacted by**
4 **Superstorm Sandy?**

5 A. No. The Company did not conduct a flood wall assessment other than its own
6 internal evaluation of upgrades needed at substations impacted by Superstorm
7 Sandy. The Company has not provided detailed engineering assessments for each
8 substation as they have yet to be completed.⁴¹

9 **Q. What alternatives did the Company consider for its proposed substation**
10 **mitigation program?**

11 A. The Company stated that they considered three alternatives when evaluating its
12 substation program. These three approaches, starting from the least costly options
13 as identified by the Company are: (1) Flood Walls, (2) Raise and Replace, and (3)
14 Relocation/Elimination.⁴² The Company also provided a summary of its
15 recommended mitigation strategy and preliminary estimated cost for the 31
16 substations impacted by Superstorm Sandy and Hurrican Irene events.⁴³
17 However, the Company has only provided highly subjective justificaton for the

⁴¹ PSE&G. "Third Monthly Report Pursuant to Order of June 21, 2013" In this docket submitted October 8, 2013.

⁴² EDF-4, page 3 of 7.

⁴³ S-PSEG-ES-79

1 alternatives that it selected. Schedule CPS 7 summarizes the Company's
 2 recommendations for each of the Hurricane Irene damaged substations.

3 **Schedule CPS 7: Hurricane Irene Substations: Black and Veatch's Proposed Flood**
 4 **Mitigation Costs Compared to PSEG Recommended Alternative and Costs**

Substation	Black & Veatch Estimate (millions)	Energy Strong Estimate (millions)	Ratio of Energy Strong to Black and Veatch	Energy Strong Recommended Flood Protection Measure
	a	b	c=b/a	
Belmont	\$0.3	\$3.0	9.4	Flood Wall
Hillsdale	\$1.5	\$17.0	11.1	Rebuild and Raise
Marion	\$1.7	\$25.0	14.6	Rebuild and Raise
Rahway	\$0.7	\$13.0	17.8	Rebuild and Raise
New Milford	\$1.9	\$34.0	17.9	Rebuild and Raise
Somerville	\$0.8	\$17.0	22.7	Rebuild and Raise
Jackson Road	\$1.2	\$30.0	25.6	Rebuild and Raise
Ewing	\$0.6	\$17.0	29.8	Rebuild and Raise
River Edge	\$0.5	\$31.0	68.9	Eliminate
Cranford	\$0.5	\$67.0	127.6	Eliminate
Garfield	\$0.2	\$20.0	133.3	Eliminate
Bayway	\$0.3	\$52.0	167.7	Eliminate
Total	\$10.1	\$326.0	32.2	
Notes				
Black and Veatch cost estimates taken from S-PSEG-ES-14 PSEG recommendations taken from S-PSEG-ES-79]				

5

6 **Q. What does the above schedule show?**

7 **A.** The schedule shows that the Company's recommendations drastically differ and
 8 significantly exceed the estimated flood mitigation costs developed by Black and
 9 Veatch for the Hurricane Irene damaged substations. Overall, the Company's
 10 recommended strategy is 32 times more expensive than Black and Veatch's
 11 estimate for the installation of flood walls at the 12 substations. The Company has
 12 not provided detailed explanations as to why its recommended alternative should

1 be pursued over Black and Veatch's findings of flood wall installation costs. This
2 schedule indicates that the Company does not appear to have identified the least
3 cost alternative.

4 **Q. Has the Company provided support for selecting the substation upgrades it**
5 **has proposed as part of the Energy Strong program?**

6 A. In its response to S-PSEG-ES-79, the Company provided only cursory
7 explanations as justification for its decision to discard lower cost alternatives. The
8 Company's explanation was:

9 Items to consider in choosing mitigation methods include the fact that
10 flood walls require ongoing maintenance (including maintenance of
11 inflatable ballasts at all egress points), active monitoring during a flood
12 event, and ancillary equipment for the life of the station, which in most
13 cases will be several decades.⁴⁴
14

15 This is hardly sufficient justification to support the highly expensive solutions
16 included in the program.

17 Every substation in the Company's system requires ongoing maintenance and a
18 typical utility will schedule maintenance at its substations on a monthly basis.
19 Monitoring of substations is also a standard part of any utility system and there
20 are numerous systems already in place that allow for monitoring of substation
21 equipment such as battery conditions, battery charger status, door intrusions and a

⁴⁴ S-PSEG-ES-79. Page 2 of 23.

1 host of other items that are routinely monitored during both normal and storm
2 conditions. Finally, all substations have ancillary equipment that must operate for
3 decades. Equipment may occasionally need to be replaced during the life of a
4 substation but that is consistent with the general nature of substation design.
5 Substation batteries are a good example of equipment that periodically need to be
6 replaced. The Company's arguments do not provide a convincing case for such
7 expenditures.

8 **Q. Has the Company identified its planning process for the Station Flood and**
9 **Storm Surge Mitigation component of its Energy Strong Petition?**

10 A. Yes, the Company notes in its response to S-PSEG-ES-66 that it follows a
11 Company standardized method of project identification, development, and
12 execution. This process is divided into five phases: (1) Project Initiation, (2)
13 Preliminary Engineering/Design, (3) Detail Engineering/Design, (4) Construction,
14 and (5) Completion. In its response to S-PSEG-ES-86, the Company indicated
15 that it was still at the Project Initiation stage for the substation program thus
16 suggesting that preliminary engineering and design had not been completed.
17 However, there is a stage in the process that has not been fully addressed by the
18 Company. The stage of the process that precedes "Project Initiation" includes
19 clear identification of need and development of alternative solutions. The program
20 associated with substation upgrades is based solely on the revised 100 year FEMA
21 flood level maps. Basically, the Company considered only three alternatives: (1)

1 construction of flood mitigation walls, (2) raise the substation; or (3) replace and
2 remove the substation. The difference between the flood barrier solution and the
3 other two alternatives is considerable. This difference in alternatives is not
4 supported by any clear difference in need. The primary identified need is to
5 address the 100 year flood level concerns. In my opinion there is no supportable
6 basis that would lead to a conclusion that it is prudent to spend on average 32
7 times as much to address this need as shown in Schedule CPS 7. The Board
8 should seriously consider the reasonableness of granting approval for the \$1.7
9 billion Station Flood and Storm Surge Mitigation program in an effort to partially
10 mitigate the impacts of a once in a 100 year event associated with the FEMA
11 flood level maps.

12 **Q. Can you cite a substation where you have found the Company's planning**
13 **problematic?**

14 **A.** The Bayway substation is a good example of the inadequate planning and
15 justification provided by the Company in support of the Energy Strong program.
16 The Company notes that the Bayway substation experienced water intrusion
17 during Superstorm Sandy, Irene and previous water intrusion events.⁴⁵ During
18 Hurricane Irene, the Company used sandbag barriers and pumps to limit water
19 intrusion.⁴⁶ Following Hurricane Irene, Black and Veatch concluded that the

⁴⁵ Petition. Page 9 and 10.

⁴⁶ S-PSEG-ES-14, Page 193 of 233.

1 installation of a sheetpile barrier (i.e. flood wall) at the substation with an
2 estimated cost of \$310,000 in 2012\$ would address the identified need.⁴⁷ This
3 option was proposed in the Company's Petition:

4 In contrast, at Bayway substation, which was impacted by Superstorm
5 Sandy and prior water intrusion events, the installation of flood walls in
6 certain areas has been selected as the most cost effective option, as the
7 site has a smaller foot print than other substation.⁴⁸
8

9 However, the Company is now proposing a much more expensive option with no
10 explanation for the change. In response to S-PSEG-ES-79 dated August 15, 2013,
11 the Company responded:

12 PSE&G believes that the elimination of this station is the most prudent,
13 permanent and effective solution.⁴⁹
14

15 The Company's proposed solution described in the response is estimated to cost
16 \$52,000,000. When asked for the criteria used by the Company to determine its
17 substation recommendations, the Company responded that their current proposal
18 will be evaluated later.⁵⁰

19 **Q. Do you believe the Company's proposed substation flood mitigation program**
20 **is necessary?**

⁴⁷ S-PSEG-ES-14. Page 194 of 233.

⁴⁸ Petition. Page 10

⁴⁹ S-PSEG-ES-79. Page 17 of 23.

⁵⁰ RCR-E-149

1 A. No I do not. The Company acknowledges in its response to RCR-E-13 that it
2 currently has an obligation to implement mitigation measures for its substations
3 based on an internal directive to address the concern. The Company states that it
4 will implement the requirements of the directive as part of the normal course of
5 maintaining and upgrading its substations.⁵¹ However, the Company's Energy
6 Strong program proposal seeks to go well beyond the expectations of the directive
7 attempting to fund and implement a far more aggressive program without any
8 identification of how much of an improvement such a program will provide over
9 what would have been obtained under its own directive. The Company simply
10 states that:

11 Following this directive will only provide incremental improvements in
12 stations over time based upon such equipment failures or assessments.
13 With Energy Strong, PSE&G will complete comprehensive mitigation at
14 the impacted stations in the Program within the term of the Program.⁵²
15
16 There is very little in the way of justification for implementation of any program
17 that goes beyond the expectations that the Company has already set for itself
18 especially given its outage assumptions and inputs that would only result in the
19 reduction of outage durations by 39% and the number of outages by 16% for the
20 entire Energy Strong Program.

⁵¹ RCR-E-13

⁵² RCR-E-13

1 **Strengthening Pole Infrastructure**

2

3 **Q. Has the Company proposed a Strengthening Pole Infrastructure program as**
4 **part of the proposed Energy Strong program?**

5 A. Yes. The Company has proposed replacing poles, adding poles and re-guying
6 poles based on an accelerated pole inspection program.

7 **Q. Was this program determined to be cost effective by the Company's**
8 **evaluation criteria?**

9 A. No. By the Company's own evaluation criteria this program was not cost effective
10 even under the extremely rare circumstances of a Superstorm Sandy-like event.⁵³

11 **Q. Has the Company provided sufficient support for implementation of this**
12 **program?**

13 A. No. The Company has provided only cursory support for the benefits associated
14 with this program. In its response to S-PSEG-ES-9, which requested a detailed
15 analysis providing evidence on how the program will mitigate against future
16 recovery efforts, the Company offered only a generalized statement suggesting
17 that the upgraded poles and additional guying will:

⁵³ RCR-E-2, RCR-E-131

1 ...allow these facilities to support smaller trees and limbs rather than
2 failing resulting in faster recovery efforts due to fewer downed
3 poles/wires...

4
5 The Company did not provide a detailed analysis. The Company indicated in its
6 cost effectiveness evaluation included in response to S-PSEG-ES-2 that there
7 would be only a 2% reduction in customer outages as a result of low coincidence
8 of possible damage with pole replacements.

9 **Q. Do you believe this program is suitable for funding as a means to address**
10 **reduction in customer outages during storm events?**

11 A. No I do not. This program offers very little in the way of clearly identified and
12 documented benefits. The Company is in the process of evaluating a 2008 EPRI
13 study, but has not conducted its own analysis demonstrating that adding poles, re-
14 guying poles and replacing poles with composite material poles will obtain the
15 benefits that the Company has assumed would occur.⁵⁴ A study should be
16 conducted by the Company clearly documenting the outage reduction benefits of
17 such actions before it is included in any storm resiliency program.

⁵⁴ RCR-E-25

1 **Rebuilding Backyard Pole Lines**

2 **Q. Has the Company proposed a Rebuilding Backyard Pole Lines program as**
3 **part of the Energy Strong program?**

4 A. Yes. The Company has proposed rebuilding existing backyard pole lines to
5 current standards, additional vegetation management, or replacing backyard poles
6 with underground facilities.

7 **Q. Was this program determined to be cost effective by the Company's**
8 **evaluation criteria?**

9 A. No. By the Company's own evaluation criteria this program was not cost effective
10 even under the extremely rare circumstances of a Superstorm Sandy-like event.
11 The program addresses only 20 miles of distribution circuit improvements and
12 reduces outages by little more than 7 hours for less than 2% of the Company's
13 customer base.⁵⁵

14 **Q. Do you believe this program is one that should be funded as part of the**
15 **Energy Strong program?**

16 A. No I do not. The Rebuilding Backyard Pole Lines program is one that should be
17 undertaken by the Company as part of its normal course of business if found to be
18 cost effective. Based on the response to RCR-E-41 this program considers

⁵⁵ RCR-E-41 and AARP-10

1 upgrading less than 5% (20 miles out of 420 miles) of the Company's backyard
2 pole services. It is unclear how the Company determined that addressing 5% of
3 the 420 miles of backyard pole service will reduce three day outages by 50% for
4 all 36,970 customers.⁵⁶ This is hardly a program that warrants expenditure of an
5 estimated \$100,000,000 and clearly is not a cost effective use of resources.

6 **Outside Plant Higher Design and Construction Standards**

7

8 **Q. Has the Company proposed voltage conversions as part of the Energy Strong**
9 **program?**

10 A. Yes. The Company has proposed a program that includes conversion of selected 4
11 kV distribution circuits to 13 kV design standards while still operating at 4 kV
12 and conversion of selected 26 kV distribution circuits to 69 kV design standards
13 while still operating at 26 kV.

14 **Q. Were either of these programs cost effective for storm conditions other than**
15 **Superstorm Sandy like conditions?**

16 A. No they were not. They were only cost effective under the extraordinary
17 circumstances of Superstorm Sandy.⁵⁷

18 **Q. What benefit does the Company suggest will accrue from converting circuits**
19 **to a higher voltage design?**

⁵⁶ RCR-E-2

⁵⁷ RCR-E-2, RCR-E-131

1 A. The Company maintains that in the case of conversion from 26 kV to 69 kV there
2 will be greater separation of phases, higher voltage insulators, larger conductors
3 and larger poles. While these improvements may prove to be of some limited
4 benefit, due to the relatively small increase in phase separation and higher poles
5 they would all still be highly susceptible to wind related damage during a
6 hurricane or superstorm condition. Tree contact is the primary concern under
7 these conditions and except for avoiding some tree contact due to the greater pole
8 height the benefits appear to be overly optimistic.

9 These benefits are even more suspect in the case for conversion from 4 kV
10 designs to a 13 kV design standard. In this case the pole height and phase
11 separation are unchanged and it is only higher voltage insulators and larger
12 conductors that account for any benefit. It is highly unlikely that there will be a
13 benefit that approaches the values suggested by the Company.

1 **Targeted Undergrounding to Mitigate Storm Impacts**

2 **Q. Do you have concerns regarding the Company's proposed Replacement of**
3 **Pad-Mounted Automatic Transfer Switches with submersible devices that is**
4 **part of the Targeted Undergrounding program?**

5 A. Yes, the Company is proposing to spend \$8 million dollars on submersible
6 technology that the Company acknowledges is not commercially available.⁵⁸
7 Although the dollar amount is not large relative to the entire Energy Strong
8 program, the reliance on solutions that are not yet commercially available appears
9 to be overly optimistic. The Company has already indicated that under limited
10 budget scenarios it would not fund this program.⁵⁹ By comparison, the Company
11 estimates that its 75 pad mounted Automatic Transfer Switches serve 75,000
12 customers and would cost approximately \$6.3 million to replace with similar
13 switches in the event of a major storm that results in damage to every switch that
14 is at risk.⁶⁰

15 **Q. Do you have concerns regarding the Company's proposed Replacement of**
16 **Pad-Mounted Transformers that is part of the Targeted Undergrounding**
17 **program with submersible devices?**

18 A. Yes, the Company has proposed to spend \$8 million dollars on submersible
19 transformers that do not exist as a single product since only elements of pad

⁵⁸ Petition, page 21.

⁵⁹ S-PSEG-ES-52

⁶⁰ RCR-E-51, RCR-E-52

1 mounted transformers are submersible.⁶¹ Although the dollar amount is not large
2 relative to the entire Energy Strong program like the submersible pad mounted
3 switches, it appears that the Company has not conducted sufficient planning to
4 evaluate the possible alternatives. Under limited budget scenarios the Company
5 concluded that it would not fund this program.⁶² Although the Company has not
6 identified the transformers to be replaced, the Company also suggests that an
7 alternative to submersible pad mounted transformers would be the installation of a
8 subway-type transformer but that this type of transformer requires a vault and
9 conduit system connection that may not be present in current locations.⁶³ In
10 contrast, using existing technologies, the Company estimates the replacement of
11 the 200 pad mounted transformers would cost \$2.0 million assuming that all 200
12 transformers needed to be replaced as the result of a storm event.⁶⁴ These
13 programs are poorly justified solutions to loosely identify needs that are only cost
14 effective under extreme storm conditions such as Superstorm Sandy.

15

16 **Q. Do you have concerns regarding the Company's proposed Targeted**
17 **Undergrounding to Mitigate Storm Impacts program?**

18 A. Yes, while the Company has provided only general criteria for identifying
19 overhead lines for undergrounding, it also acknowledges that identifying the exact

⁶¹ S-PSEG-ES-67

⁶² S-PSEG-ES-52

⁶³ RCR-E-57, S-PSEG-ES-67

⁶⁴ RCR-E-58

1 circuits for the project is still a work in progress.⁶⁵ Furthermore, the Company
2 provided an EEI report: *Out of Sight, Out of Mind* as one study that was
3 evaluated.⁶⁶ The EEI report indicated that underground facility outages are often
4 complex and time consuming and that underground facilities are more costly to
5 upgrade and replace.⁶⁷ These considerations should be factored into the
6 assessment before proceeding with the decision to underground or not, not after
7 making a decision to underground. The Company has not demonstrated that there
8 is a reasonable benefit associated with undergrounding 20 miles of overhead line
9 under any conditions other than a Superstorm Sandy like event.

10

11 **Q. Should the Company consider additional vegetation management as an**
12 **alternative to many elements of the Energy Strong Program?**

13

14 A. While additional vegetation management will not address flooding or tidal surge
15 damage, vegetation management will provide benefits from reducing tree limb
16 contacts both for major events like hurricanes but also normal less severe events.
17 Vegetation management was clearly part of the Company's preparation for

⁶⁵ RCR-E-98

⁶⁶ RCR-E-99

⁶⁷ Edison Electric Institute. "Out of Sight Out of Mind 2012: An Updated Study on the Undergrounding of Overhead Power Lines." January 2013. Page V. Available at <http://www.eei.org/issuesandpolicy/electricreliability/undergrounding/Documents/UndergroundReport.pdf>

1 Superstorm Sandy. Starting on October 24, 2012 the Company made daily
2 requests for tree trimming personnel in anticipation of the storm.⁶⁸

3

4 From 2000-2012, the Company's Annual System Performance Indices indicate
5 that trees outages accounted between 16 to 28% of the Company's customer hour
6 outages.⁶⁹ Increased vegetation management could also reduce tree related
7 outages for non-major events. When asked about its evaluation of enhanced
8 vegetation management practices as an alternative to Energy Strong, the
9 Company response referred to two responses both of which described a pilot
10 program with municipalities.⁷⁰

11 A reasonable and more cost effective alternative to a number of the elements in
12 the Company's Energy Strong program may be simply enhancing the Company's
13 vegetation management programs in anticipation of major storm events.

14 **Advanced Technologies Program**

15

16 **Q. Do you have concerns regarding the Company's proposed System Visibility
17 and Communications Network program?**

18 A. Yes I do. The Company proposes to install microprocessor relays, remote
19 terminal units (RTU) on its 4 kV, 13 kV and 26 kV systems, and installation of its
20 own fiber optic communication network in an effort to improve system

⁶⁸ RCR-E-124, page 64.

⁶⁹ RCR-E-124, page 20 of 214.

⁷⁰ RCR-E-113, RCR-E-82, S-PSEG-ES-61

1 monitoring and the reliability of communications during extreme conditions such
2 as Superstorm Sandy. The Company's justification of the need for the program is
3 based on concern over distribution system information and communication
4 system reliability under catastrophic conditions. The Company maintains that the
5 program is the most cost effective solution yet has failed to show that the program
6 has a positive benefit to cost ratio for any condition other than a Superstorm
7 Sandy like event.

8 **Q. Has the Company provided a detailed benefit to cost analysis for the**
9 **proposed Advanced Technologies program?**

10 A. No. The Company has only provided a cursory assessment of the benefits
11 associated with this \$451 million program based on its own estimates concerning
12 the reduction in customer outage durations. It should be noted that the
13 Communications Network elements do nothing to reduce customer outages and
14 only offers some opportunity to reduce outage durations through availability of
15 information collected by the more sophisticated relay protection equipment,
16 which is transmitted back to the Company over the proposed high speed fiber
17 optic communication systems.

18 The Company provides an example of a case where access to such information
19 would have been beneficial and uses this example as justification for the value to
20 customers. The example provided discussed a case where a determination was
21 made that an outage was caused by a transient event and that this determination

1 avoided the need to patrol a circuit.⁷¹ The explanation appears to be highly
2 suspect and very poorly supports justification for such an extraordinary expense.
3 There has been no analysis determining the number of events that are transient in
4 nature versus equipment damage events. Any outage event other than a transient
5 one would still require the manual efforts that are purported to be avoided.
6 Secondly, many of the Company's circuits are already equipped with reclosing
7 devices. These devices are designed to automatically deal with transient events by
8 attempting to re-energize a circuit following a fault condition. Transient events
9 are typically cleared by such devices. Additionally, these reclosing devices are
10 coordinated so as to operate before any station relay device would operate so such
11 events would not be seen by the station relays. The Company's proposed
12 microprocessor relay information network is only useful in a limited number of
13 cases for a limited number of events. I believe that if a more rigorous analysis of
14 the benefits proposed for this program along with the necessary high speed
15 communication systems to support them were to be conducted it would likely
16 reveal that there is a much more limited improvement in customer outage
17 durations than the Company estimates. Given that the program is only cost
18 effective for catastrophic events such as Superstorm Sandy and that the purported
19 benefits are suspect, I believe it would be imprudent to support such a program
20 without the benefit of a full and detailed program analysis.

⁷¹ Petition. Cardenas, page 25.

1 **Contingency Reconfiguration Strategies Program**

2
3 **Q. Do you have concerns regarding the Company's proposed Contingency**
4 **Reconfiguration Strategies program?**

5 A. Yes I do. This program proposes to install addition reclosers on existing 13 kV
6 loop circuits. The objective is to break up circuits into smaller sections to reduce
7 the number of customers that are out of service due to a permanent fault. The
8 program assumes that it would be applied to 167 circuits.⁷² However, the
9 Company notes that it has not conducted any analysis to determine which circuits
10 or how many circuits would benefit from such a change in configuration.⁷³ The
11 Company maintains that the program is cost effective but has failed to show that
12 the program has a positive benefit to cost ratio for any condition other than a
13 Superstorm Sandy-like event.

14 **Q. Has the Company provided a detailed benefit to cost analysis for the**
15 **proposed Contingency Reconfiguration Strategies program?**

16 A. No. The Company has only provided a cursory assessment of the benefits
17 associated with this \$200 million program based on the Company's internal
18 estimates concerning the reduction in customer outages.⁷⁴ The benefits assumed
19 by the Company as indicated in its response to AARP-10 include a 10% reduction
20 in all customer outages and a 10% improvement in customer restoration time. The
21 explanation provided by the Company states that for those sections that have an

⁷² AARP-10

⁷³ RCR-E-76

⁷⁴ AARP-10

1 additional recloser installed there would be a 33% reduction in one section of a
2 circuit of the number of customers that would be out due to a sustained outage.
3 Even in the example the Company cited in its petition the reduction in customer
4 outages for the circuit was approximately 8% and there was no discussion
5 concerning reduction in customer outage durations.⁷⁵ While there may be a
6 reduction in customer outages, the values that are used in deriving the associated
7 benefits bare no relationship to the proposed program. The Contingency
8 Reconfiguration Strategy program may reduce the number of customers that will
9 be out depending on the location of the fault and does nothing to reduce the
10 outage duration for the outage condition itself. There has been no detailed
11 analysis produced that supports the Company's determination of benefits and
12 there has not even been an analysis of which circuits or how many customers
13 would actually benefit from the program. This is another example of a "back-of-
14 the-envelope" analysis for development of a \$200 million program and
15 determination of its benefits to customers. Even with this light handed assessment
16 of the program, it is only cost beneficial for catastrophic events such as
17 Superstorm Sandy. I believe that, as with many of the programs proposed by the
18 Company, a detailed analysis should be conducted that determines a far more
19 accurate level of benefits as well as costs prior to approval for a program that is as
20 extraordinarily expensive as this one.

⁷⁵ AARP-10

1 **Supplemental Investment Program**

2

3 **Q. Do you have concerns regarding the Company's proposed emergency**
4 **generator stockpiling element of the Supplemental Investment Program?**

5

6 A. The Company is still in the process of working with stakeholders in identifying
7 what facilities are critical for emergency services for a major event.⁷⁶ First and
8 foremost, the role of the Company should be to restore service to its customers
9 following a major event. The Company should not be in the business of
10 stockpiling and distributing generators. Many critical services already have
11 emergency generator back up equipment installed and the proposal for use at gas
12 stations raises concerns over the selection criteria that will be an important aspect
13 of the program. Other important details regarding quick connection allocation,
14 installation security issues and liability also remain unanswered at this point.⁷⁷ In
15 addition, the Company has indicated that there may be additional costs to the
16 proposed program.⁷⁸ I have concerns that the distribution of generators after a
17 major event may also divert resources from focusing on restoring service since it
18 is unclear how its resources would be deployed to distribute and/or maintain
19 generators to critical facilities.

⁷⁶ S-PSEG-ES-25

⁷⁷ S-PSEG-ES-36, S-PSEG-ES-38, RCR-E-80

⁷⁸ RCR-ECON-26

1 **VIII. SUMMARY**

2 **Q. Please summarize your conclusions and recommendations regarding the**
3 **Company's Petition.**

4 My review and analysis shows that the Company has provided insufficient detail,
5 insufficient studies and analysis, and insufficient justification to embark on what
6 could ultimately be a \$3.94 billion process to dismantle and rebuild significant
7 elements of the Company's distribution system. The programs proposed are at
8 best justifiable only under what can be considered as an extraordinarily rare event.
9 Even under such exceedingly rare conditions there are over \$200,000,000 of
10 proposed expenditures that are not cost effective by the Company's own
11 calculations. Most significantly, based on the Company's metrics, none of the
12 programs proposed are cost effective for major storm events that are likely to
13 occur in the New Jersey area far more often than an event of the magnitude of
14 Superstorm Sandy. I believe it to be highly questionable that funding the proposed
15 Company program can be found to be reasonable and prudent based on the
16 information provided. As an alternative, I recommend that the Board undertake
17 the following recommendations:

- 18 1. The Company should conduct the necessary detailed analysis to adequately
19 support the cost-effectiveness of each element of the programs it is proposing to
20 implement before funding is approved. This includes cost-effectiveness analyses
21 of specific projects proposed within each program. The Company should also

1 provide clear identification of the needs that are being addressed, an analysis of
2 the alternatives that were considered and the rationale why the specific proposed
3 solution was chosen.

4 2. The Company should implement a phased approach to sequence work based on its
5 short, medium, and long-term planning process. Projects should not be undertaken
6 unless the Company's planning process determines that the investment is justified
7 and the benefits of the project exceed costs.

8 3. The Company should develop a program that is aimed at addressing more likely
9 storm events. This could lead to the development of a far less costly program that
10 has much greater benefits. It may also serve as a basis for consideration of the
11 incremental benefits versus the incremental costs of designing a program that is
12 aimed at addressing catastrophic storm conditions such as those that occurred
13 with Superstorm Sandy versus designing one that addresses more likely storm
14 conditions.

15 **Q. Do you have any recommendation for the Board to consider?**

16 A. Yes, I recommend that the Board order the Company to investigate least cost
17 alternatives that will meet its stated goals of preparing the Company to ameliorate
18 the effects of future reasonably foreseeable major storm events. In addition, the
19 Board should direct the Company to implement a phased approach to integrate
20 future work into its existing distribution construction budgets. The phased
21 approach should be categorized by projects to meet short-term priorities, medium-

1 term priorities, and long-term priorities. In addition, projects should undergo a
2 rigorous internal review process similar to the Company's Investment Evaluation
3 Scorecard in place for the Company's distribution projects. This would insure that
4 the Company prioritizes projects and identifies solutions at the least cost. For
5 example, this may include re-examining the installation of flood walls for specific
6 substations with the goal of working with federal and state agencies to minimize
7 upstream impacts. Finally, I recommend that the Board review each element of
8 the Company's proposed program on an element by element basis once the
9 appropriate analysis and detailed supporting justification can be provided. Only if
10 a project or element proves to be cost-effective for likely storm events and at least
11 cost should it be approved.

12 **Q. Do you have any other recommendations for the Board?**

13 A. Yes. Energy Strong represents an attempt to plan for the next Superstorm Sandy.
14 Even if the Energy Strong program is fully implemented, the Company
15 acknowledges that it cannot eliminate outages.⁷⁹ The currently proposed Energy
16 Strong program does not reflect adequate planning and the benefits are limited to
17 Superstorm Sandy events that the Company has not forecasted and that are highly
18 unlikely events.

⁷⁹ Petition. Page 2.

1 **Q. Does this conclude your testimony?**

2 A. Yes. However, I reserve the right to supplement my testimony subject to further
3 updates to discovery and information provided by Public Service and Electric.

4

SCHEDULE CPS-1- CS Resume



Charles P. Salamone P.E.

Profession: Power systems analysis and assessment, with a special emphasis on transmission planning, performance and design

Nationality: U.S. Citizen

Years of Experience: 40 years

Education B.S.E.E, Power System Engineering, 1973
Gannon University, Erie, PA

Position: Owner/Manager, Cape Power Systems Consulting

Web/Email: www.CapePowerSystems.com csalamone@capepowersystems.com

Contact Number: 774-271-0383

Summary: Mr. Salamone provides professional services based on his 40 years of experience in the areas of Transmission Planning, Substation Planning, Distribution Planning, ISO-New England Planning Procedures, New England Power Pool Procedures, Congestion Management, Generator Interconnections, Planning/Capital Budget Management, Meter Engineering, and State (Mass DPU and New Jersey Rate Council) and Federal (FERC) Regulatory Agency Filing Development and Expert Witness Testimony

Experience:

2005- Pres. Cape Power Systems Consulting

Established a power system design, analysis, planning and assessment consulting company to work directly with diverse power system stakeholders.

- Worked with a number of clients for the development of analysis, reports and presentations in support of regulatory and technical review/approval process for transmission and distribution projects
- Provided technical assistance for transmission planning activities for an Independent System Operator including support for major transmission system expansion programs and development of a 10 year transmission plan
- Worked with a large Massachusetts Utility as an expert witness in support of State regulatory reviews for the siting of a major transmission system upgrade plan



Charles P. Salamone P.E.

- Worked with state regulatory agencies in support of electric utility rate case proceedings including expert witness testimony and assessment of electric utility performance
- Worked with multiple state regulatory agencies in support of review of electric utility smart grid initiatives including review of the technical performance, system benefits and viability of proposed electric utility programs
- Developed and conducted a comprehensive training program for implementation of an Energy Management System (EMS) based transmission system security assessment application for a large Massachusetts utility
- Worked with Massachusetts Technology Collaborative providing technical support concerning electric utility design and analysis activities

1979-2005 NSTAR (Previously Boston Edison and Commonwealth Electric)

2000-2005 *Director System Planning*

NSTAR (Previously Boston Edison and Commonwealth Electric) Boston, MA

- Responsible for long term planning of Company transmission, substation and distribution systems
- Successfully managed the studies, design, internal and external review and regulatory approval for a \$250M 345 kV underground transmission expansion project serving the greater Boston area
- Managed numerous generator interconnection studies, design and approvals
- Successfully managed studies, design and approval for congestion mitigation plans and expansion project
- Oversaw transmission and distribution planning efforts to establish a comprehensive 10 year \$300 million system expansion plan
- Served as Company representative on NEPOOL Reliability Committee and the New England Transmission Expansion Advisory Committee
- Served as Company expert witness for system planning related regulatory proceedings at both the state and federal levels.
- Supervised a staff of 10 senior engineers

1989-1999 *Manager, System Planning and Meter Services*

Commonwealth Electric Company, Wareham, MA

- Develop risk based prioritized \$10 million construction budget procedures
- Supervise a staff of 6 professional engineers and 4 analysts
- Served as chair of the NEPOOL Regional Transmission Planning Committee (currently the NEPOOL Reliability Committee)
- Process billing determinant and interval data for all major system customers
- Lead implementation of first MV90 meter data processing system
- Develop annual performance analysis reports for all transmission and major distribution systems



Charles P. Salamone P.E.

- Manage multiple FERC tariff based transmission customer and generation developer system impact studies
- Served as expert Company witness in State and FERC regulatory proceedings
- Implemented a risk index for prioritization of all transmission and major distribution construction projects
- Implemented automated electronic processing of major customer billing data, which significantly reduced time needed to generate bills
- Served as lead member on information technology company merger team
- Implemented process and equipment to perform all tie line, generator and wholesale customer meter testing
- Served as chair of the NEPOOL Planning Process Subcommittee, which established numerous NEPOOL policies for transmission/generator owners
- Served as Vice-Chair of the NEPOOL Reliability Committee

1984-1989 ***Meter Engineer***

Commonwealth Electric Company, Plymouth, MA

- Designed and supervised installation of 15 generator meter data recorders
- Developed customer load plotting and analysis software
- Developed meter equipment order data processing system for four remote offices
- Implemented PC control of meter test boards, which significantly reduced processing and record keeping time
- Managed programming of all electronic meter registers to insure accurate data registration

1979-1984 ***Computer Application Engineer***

Commonwealth Electric Company, Wareham, MA

- Implemented numerous technical and analytical software applications for engineering analysis
- Served as member of decision team for implementation of a new SCADA system

1978-1979 ***San Diego Gas & Electric, Planning Engineer***

San Diego Gas & Electric Company, San Diego, CA

- Performed extensive stability analysis for a new 230 kV transmission interconnection with Mexico
- Performed transmission design and performance analysis for a new 250 mile 500 kV line from San Diego to Arizona

1973-1978 ***New England Gas & Electric Association, Planning Engineer***

New England Gas & Electric Association, Cambridge, MA

- Performed extensive stability analysis for a new 560 MW generating plant on Cape Cod
- Developed transmission plan for a new 345 kV transmission line on Cape Cod
- Developed plans for design and siting of new 115 / 23 kV substations on Cape Cod