



Englishtown 500/230kV
New Station
August 4, 2015

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Note: Supporting files (IDev, Case, and Contingency Files) were submitted electronically on July 20, 2015.

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1. Executive Summary

- The proposing entity is Public Service & Electric (PSE&G).
- This report summarizes the conceptual analysis for PSE&G's Englishtown 500/230kV new station proposal.
- This proposal is submitted in response to PJM's 2015 Window 1.
- The violation was identified in the n-1, n-1-1 peak load voltage analysis.
- No additional violations are caused by the solution presented in this proposal. There are no nearby violations not addressed by this proposal.
- The proposed project is located within the JCP&L zone.
- PSE&G intends to construct, own, operate, and maintain the proposed project.
- The following proposes a solution to the voltage violation including flowgates N1-VD1, N1-VM1, N2-VM5, N2-VM6, N2-VM7, N2-VM8, N2-VM10, N2-VM12, N2-VM13, N2-VD2, N2-VD3, N2-VD4.
- This project should be considered only as a whole.
- The proposed project cost is approximately \$45.1 million base. The expected project duration is 4 years.
- The Englishtown 500/230kV station project will provide an additional source into JCP&L's southern transmission region, reducing congestion. Englishtown 500/230kV Station project can also fill the void of power that can occur when Oyster Creek Nuclear Generation retires. Exelon has publicly stated the plant will be by the end of 2019. The stability of any generators in the area will not be negatively impacted as the addition of transmission circuits improves the overall stability in the region.

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2. Company Evaluation

2.1. Contact Information

2.1.1. Headquarters

80 Park Plaza
Newark, New Jersey 07102
(973) 430-7000

2.2. Pre-Qualification

PSE&G's experience was provided in the pre-qualification document submitted June 21, 2013 under PJM ID# 13-07.

2.3. Supplemental Company Information

Public Service Electric & Gas (PSE&G) is pleased to provide this proposal to PJM in response to the 2015 RTEP Proposal Window 1. PSE&G is seeking Designated Entity Status to construct, own, operate, and maintain the proposed project and is committed to executing the Consolidated Transmission Owners Agreement.

PSE&G is among the nation's largest investor-owned electric and gas utilities with more than \$32 billion in assets. PSE&G provides electric and gas service to customers in New Jersey in an area consisting of 2,600-square-miles. PSE&G serves 2.2 million electric customers and 1.8 million gas customers in more than 300 urban, suburban, and rural communities, including New Jersey's six largest cities. PSE&G owns and maintains approximately 900-miles of transmission right-of-way with 1,470-miles of transmission lines over 100kV including more than 460-miles of 500kV transmission lines.

PSE&G at a Glance

- Employees: Approximately 12,700
- Ranked 284 on the Fortune 500 list for 2014
- Total assets (2014): \$35.3 billion
- Total annual revenues (2014): Approximately \$11 billion

PSE&G is financially strong and maintains solid investment grade credit ratings. This allows for consistent access to the capital markets on reasonable terms. Our current senior secured credit ratings from S&P and Moody's are A and Aa3 respectively.

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Outside Industry Recognition—A proven track record of reliability, customer satisfaction, and emergency response and restoration

PSE&G has earned outside industry recognition for operational excellence in these important areas:

PSE&G has won several awards for reliability driven by its design, operation and maintenance practices for the most reliable utility in the Mid-Atlantic. PSE&G's reliability awards include:

- Mid-Atlantic Reliability Award (13th consecutive year)
- America's Most Reliable Electric Utility five out of past 10 years

PSE&G ranks highest in customer satisfaction with business large business electric service and natural gas service in the east, according to J.D. Power. It is the first time in PSE&G's history to rank highest in business customer satisfaction for both electric and gas service.

PSE&G was named to the 2014 FORTUNE List of Most Admired Companies, ranking fourth among electric and gas companies in the United States.

Edison Electric Institute Award for outstanding restoration efforts after Superstorm Sandy in 2012 and Hurricane Irene in 2011, acknowledging PSE&G for restoring power and for its outstanding storm management practices, such as communicating effectively with the public.

Award Winning Storm/Outage Response and Restoration

PSE&G has substantial experience and expertise in emergency preparedness and in responding to storms and other events causing widespread system outages. PSE&G closely monitors the track of all significant storms that are likely to impact the service territory and makes emergency preparations in advance of such storms to address the potential for power outages associated with heavy rain, strong winds, and flooding. The purpose of such preparations is to ensure that the utility is ready to respond to potentially widespread power outages.

As in the case of Superstorm Sandy, emergency preparations included:

- Available personnel were ready to respond.
- Contractors, including tree crews to assist the utility's own skilled workforce.
- Additional supplies, such as poles, transformers and other pole-top equipment were on hand.
- Vehicles were fueled and ready to go.
- Tested generators at utility locations.
- Checked locations for potential flooding and took precautions such as using sandbags to help divert water from substation equipment.
- Coordinated with county Office of Emergency Management for updates on outages and restoration efforts.
- Communicated with the public regarding anticipated storm conditions.
- Both the Primary and Back-Up transmission control centers were fully staffed starting a day before the storm arrived and the Primary control center was staffed with extra personnel.
- PSE&G requested more than 1,300 linemen and 600 tree contractors from utilities in other states to assist our highly skilled crews.
- PSE&G's call center was fully staffed to handle calls from customers. Other employees will assisted with assessing storm damage, keeping the public away from any downed power lines and other functions that supported restoration efforts.
- Transmission
 - o Aerial patrols of selected circuits
 - o Inspected underground pumping stations to ensure normal operations
 - o Procured a second helicopter to support aerial damage assessment

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Once a storm or outage event such as a hurricane has passed, PSE&G immediately deploys its crews to restore the system as quickly as possible. Over the years, PSE&G operations and maintenance personnel have had substantial experience in restoring the system after major events.

Experienced and Qualified Teams Providing Lifecycle Services

PSE&G has developed a team of experienced professionals to support the entire project life cycle of a transmission project: environmental and permitting, project engineering, project management, project controls, construction, public affairs and community outreach, commissioning and regulatory compliance.

As an infrastructure company, PSE&G has completed dozens of projects greater than \$100 million during the past several years. We have an outstanding record of consistently delivering challenging projects within schedule and on budget. We have the experience and confidence to develop the technical scope, detailed cost, and achievable schedules for new transmission and substation projects. PSE&G successfully manages and executes every project within the established performance metrics and goals.

Once the installation is complete, we effectively manage and operate the infrastructure. Our system is recognized as highly reliable and well maintained to meet the customer needs for the long-term.

In the past year, we have completed three large infrastructure projects ahead of PSE&G's schedule and under budget: Susquehanna Roseland (\$790M), Burlington Camden (\$399M), and North Central Reliability Project (\$390M).



Susquehanna Roseland



Burlington Camden



North Central Reliability

A Strong Commitment to Health and Safety

PSE&G's vision is to be increasingly recognized as "a leader for People providing Safe, Reliable, Economic and Green Energy." People come first – and so does their health and safety.

"Our Commitment to Health and Safety" statement unites PSE&G employees, unions and company leaders in achieving an accident free environment where no one gets hurt.

Health & Safety Councils are the backbone of the PSE&G Health and Safety System. Today, a system of employee-led councils at the local, business and company level dedicate their time, effort and expertise to achieving a culture built on:

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Trust – We respect and trust each other’s opinions and decisions and follow through on all health and safety concerns.

Care – We approach each day with the determination to care for ourselves, co-workers, contractors, and the communities we serve.

Knowledge – We have the knowledge and skills to be healthy and safe.

Communication – We communicate in a clear, open and honest manner.

At PSE&G, we believe that safety is a way of life both on and off the job. PSE&G is fully committed to protecting the health and safety of our employees, contractors, and the communities we serve. We believe that operational excellence – with safety first - is the key to long-term success.

Specialized In-house Services

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3. Constructability Information

3.1. Scope of Project

The proposal includes the building a new 500/230kV station which will intercept the existing Deans to Smithburg line at Englishtown.

3.2. Cross-Border Issues

The following proposal is not a solution to Cross-Border issues.

3.3. Proposal Elements

3.3.1. General Description

The proposal includes the building a new 500/230kV station which will intercept the existing Deans to Smithburg line at Englishtown.

3.3.2. Geographic Description

The preferred location is in proximity to residential and commercial areas near the existing Englishtown station.

3.3.3. Route Description

As part of this project all applicable environmental studies and permits will be filed and procured. This project is a proposed new 500/230kV station to be located in Manalapan Township in Monmouth County, New Jersey.

3.3.4. Physical characteristics

- **Line and shield conductor type and size:** 1590kcmil ACSR and two 0.646-in OD 48 Fiber OPGW
- **Overhead or underground/submarine:** Overhead
- **Single or double circuit towers:** Single Circuit

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3.3.5. Maps and Supporting Diagrams

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3.3.6. Interconnection Location

It is proposed that the existing Englishtown station be modified to accommodate an additional line position and associated equipment, the location of which will be decided collaboratively by the incumbent station owner and PSE&G as indicated in Figure 2. Proposed One-Line.

3.3.7. Outage Requirements

Outages will be required for construction at the existing Englishtown station and on the Deans to Smithburg line. PSE&G will coordinate with the incumbent transmission owner to determine the length and timing of the outages.

3.3.8. Cost

The cost for the components of the new station is provided in Table 1: Component Cost.

3.3.9. Construction Responsibility

The Englishtown 500/230kV station will be constructed by PSE&G. PSE&G is seeking Designated Entity Status to construct, own, operate, and maintain the proposed project.

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4. Analytical Assessment

4.1. Analysis

The breaker one-line diagram showing the station configuration is shown below in Figure 3: Proposed One-Line.

The spreadsheet output of analysis showing the solution to the identified issue was submitted on July 20, 2015 and is provided below in Table: 2: Englishtown 500/230kV Station Results.

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FG #	Bus #	Name	KV	Area	ContVolt	BaseVolt	Vdrop(%)	Cont Type	Contingency	As Is			Englishtown 500/230		
										ContVolt	BaseVolt	Vdrop(%)	ContVolt	BaseVolt	Vdrop(%)
N1-VD1	206304	28ENGLISH	230	228	0.919	1.0012	8.22	Line_FB	C2_JCC-230-34A	0.9295	1.0028	7.33%	1.0207	1.017	-0.37%

FG #	Bus #	Name	KV	Area	ContVolt	BaseVolt	Low Limit	Cont Type	Contingency	ContVolt	BaseVolt		ContVolt	BaseVolt	
N1-VM1	206304	28ENGLISH	230	228	0.9158	1.0023	0.9217	Line_FB	C2_JCC-230-34A	0.9295	1.0028		1.0207	1.017	

FG #	Bus #	Name	KV	Area	ContVolt	BaseVolt	Low Limit	Contingency 1	Contingency 2	ContVolt	BaseVolt		ContVolt	BaseVolt	
N2-VM5	206304	28ENGLISH	230	228	0.9036	1.0034	0.9217	'B2-JCC-115-004'	'B2-JCC-230-011'	0.9170	1.0023		1.0237	1.0169	
N2-VM6	206304	28ENGLISH	230	228	0.9035	1.0034	0.9217	'B2-JCC-115-002'	'B2-JCC-230-011'	0.9167	1.0024		1.0238	1.017	
N2-VM7	206304	28ENGLISH	230	228	0.9153	1.0042	0.9217	'B2-JCC-115-003'	'B2-JCC-230-011'	0.9786	1.0236		1.0242	1.0181	
N2-VM8	206304	28ENGLISH	230	228	0.9075	1.0038	0.9217	'B2-JCC-115-001'	'B2-JCC-230-011'	0.9835	1.0024		1.0212	1.0167	
N2-VM10	206304	28ENGLISH	230	228	0.9182	1.0027	0.9217	'B2-JCC-115-005'	'B2-JCC-230-011'	0.9356	1.0022		1.022	1.0162	
N2-VM12	206304	28ENGLISH	230	228	0.9169	1.0013	0.9217	'B2-JCC-230-030'	'B2-JCC-230-011'	0.9295	0.9989		1.0222	1.0154	
N2-VM13	206304	28ENGLISH	230	228	0.918	0.9974	0.9217	'B_CNJ2-SX-#11A'	'B2-JCC-230-011'	0.9365	0.9972		1.0205	1.0128	

FG #	Bus #	Name	KV	Area	ContVolt	BaseVolt	Vdrop(%)	Contingency 1	Contingency 2	ContVolt	BaseVolt	Vdrop(%)	ContVolt	BaseVolt	Vdrop(%)
N2-VD2	206304	28ENGLISH	230	228	0.9139	1.0034	8.95	'B2-JCC-115-004'	'B2-JCC-230-011'	0.9170	1.0023	8.53%	1.0237	1.0169	-0.68%
N2-VD3	206304	28ENGLISH	230	228	0.9129	1.0034	9.05	'B2-JCC-115-002'	'B2-JCC-230-011'	0.9167	1.0024	8.57%	1.0238	1.017	-0.68%
N2-VD4	206304	28ENGLISH	230	228	0.9183	1.0038	8.55	'B2-JCC-115-001'	'B2-JCC-230-011'	0.9835	1.0024	1.89%	1.0212	1.0167	-0.45%

Table 2: Englishtown 500/230kV Station Results

The shaded cells indicate where PSE&G could not replicate the voltage violations; however, the proposed project further improves voltages for those flowgates.

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4.2. Equipment Parameters and Assumptions

- **Nominal voltage rating:** 500/230kV
- **Line MVA normal and emergency rating:** 800 MVA/1100 MVA
- **Grounding design for underground or submarine circuits:** Not applicable
- **Equipment ratings:** 3000A
- **Total mileage:** Approximately 0.5-miles
- **Reactive Devices:** Not applicable
- **Synchronous Machines:** Not applicable
- **Transformer impedances:**

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R (pu)	X (pu)
0.0003000	0.0020500

Table 3: Englishtown Impedances

4.3. PSS/E iddev Files

PSS/E iddev files submitted electronically on July 20, 2015.

4.4. Supporting Information

A voltage issue around JCP&L's Englishtown switching stations was found in the 2015 RTEP peak load voltage analysis. The voltage issues, voltage drop and low voltage, was seen at the Englishtown 230kV switching station due to a stuck breaker at Smithburg 230kV, taking out the Smithburg – Atlantic 230kV and Smithburg – Englishtown 230kV lines in N-1 analysis, or one of the Raritan River to Deep Run to Englishtown 115kV line and the Smithburg – Englishtown 230kV lines in n-1-1 analysis. The proposed tap of the existing Deans – Smithburg 500kV and a transformer connecting to JCP&L's Englishtown 230kV substation will solve both the low voltage and voltage drop problems by providing another source to Englishtown.

The Englishtown 500/230kV Station project will solve the voltage issue caused by either a stuck breaker or a combination of two single contingencies. Both the voltage and the voltage drop fit the respective criteria by a good margin. The voltage on the 345kV stations around that area also remain within the voltage limits and drop limit, thus not needing a project to fix those violations.

The Englishtown 500/230kV Station project will provide a source of power into the JCP&L's southern transmission region, reducing congestion. Englishtown 500/230kV transformer project can also fill the void of power that can occur when Oyster Creek Nuclear Generation retires. Exelon has publicly stated the plant will be by the end of 2019. The stability of any generators in the area will not be negatively impacted as the addition of transmission circuits improves the overall stability in the region.

4.5. Proposal Template Spreadsheet

A final RTEP Proposal Template spreadsheet (in excel format) is provided electronically under separate cover.

4.6. Market Efficiency

This section is not applicable to this proposal.

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5. Cost

5.1. Cost Estimate

5.1.1. Total Cost

The total cost of the project is:

5.1.2. Yearly Cash Flow

The yearly cash flow including escalation, taxes, and financing costs is presented in Table 4: Yearly Cash Flow below:

5.1.3. Escalation Rates

An escalation rate of was used.

5.2. Detailed Breakdown of Cost

5.3. Cost Containment

PSE&G is providing a Guaranteed Maximum Price (GMP) for the construction of the new Englishtown 500/230kV station.

6. Schedule

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7. Operations/Maintenance

7.1. Overview

As an infrastructure company, PSE&G follows Operations and Maintenance procedures and practices. The purpose of these procedures and practices is to implement the necessary operations and maintenance activities that help ensure the safe, reliable and cost-effective operation of electrical equipment. PSE&G utilizes standard time and condition-based practices, along with constant focus on safety, customer service and cost control, to optimize the utilization and minimize the down time of equipment that is critical to the delivery of electric power. PSE&G monitors equipment condition and applies the resources to improve the condition and extend the useful life of electric distribution equipment, thereby maximizing the value of its investment in these facilities. It is used whenever necessary preventive or corrective maintenance is performed. The process is implemented to ensure the safe and reliable operation of the electrical equipment.

7.1.1. Previous Experience

PSE&G owns, operates, and maintains approximately 900-miles of transmission right-of-way with 1,470-miles of transmission lines over 100kV including more than 460-miles of 500kV transmission lines.

PSE&G's Transmission Construction and Maintenance organization is responsible for planning and performing all required corrective maintenance (CM) and planned maintenance (PM) on PSE&G transmission facilities.

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7.1.2. Intentions for Control Center

The proposed facilities will be operated through PSE&G's Electric System Operations Center (ESOC) is responsible for the operation of the PSE&G Bulk Electric System in accordance with PJM, NERC and Reliability *First* rules and reliability standards.

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7.1.3. Maintenance Contracts

PSE&G's Transmission Construction and Maintenance organization will maintain the proposed facilities; no maintenance contracts are planned.

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8. Assumptions

8.1. General

- This project proposal was prepared based on a data/information review, technical analyses, and cost estimates that could reasonably be completed within 2015 PJM Open Window 1.

- This project may encounter transmission line crossings.

- Purchase of right-of-way, easements, or other acquisitions are included.

8.2. Permitting

- Permits are available and can be acquired to

8.3. Project Duration

- The estimated duration is a conservative, high-level estimate of the project duration from kickoff to energization.

- lack of available construction resources could impact project durations.

- The incumbent Transmission Owner schedule will align with

8.4. Cost

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Please note that the cost estimates provided herein are dependent upon the various underlying assumptions, inclusions, and exclusions utilized in developing them. Actual project costs will differ, and can be significantly affected by factors such as changes in the external environment, the manner in which the project is implemented, and other factors which impact the estimate basis or otherwise affect the project. Estimate accuracy ranges are only projections based upon cost estimating methods and are not a guarantee of actual project costs.

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