



Englishtown to East Windsor 230kV
New Transmission Line
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 to East Windsor 230kV New Transmission Line Proposal.
- This proposal is submitted in response to PJM's 2015 Window 1.
- The violation was identified in the peak load n-1 and n-1-1 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 JCPL zone.
- PSE&G is seeking Designated Entity Status 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 \$34.7 million base. The expected project duration is 4 years.
- In addition to direct benefits above, the Englishtown to East Windsor 230kV New Transmission Line proposal separates the two existing 500-230kV East Windsor transformers by two breakers so that a stuck breaker does not cause loss of both transformers. 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 station 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 installation of an approximately 12-mile 230kV overhead transmission line from the existing Englishtown station to the existing East Windsor station.

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 installation of an approximately 12-mile 230kV overhead transmission line from the existing Englishtown station to the existing East Windsor station.

3.3.2. Geographic Description

The preferred route includes several terrain types. The majority of the route is flat and runs along state highways. The route is in proximity to residential areas and farmland. The Englishtown station is in proximity to residential and areas. The East Windsor station is in proximity to preserved farmland.

3.3.3. Route Description

As part of this project all applicable environmental studies and permits will be filed and procured. Property rights acquisition is anticipated for this project.

PSE&G has years of experience in undertaking the various processes necessary to secure certificates of public convenience and necessity and in acquiring the necessary right-of-way needed to site facilities, including experience in exercising eminent domain authority.

PSEG has extensive in-house expertise to handle acquisition of property for large transmission projects.

The Englishtown to East Windsor proposed right-of-way begins at the existing Englishtown station. The station is located in Manalapan Township, Monmouth County, New Jersey. The property is owned and operated by JCP&L (FirstEnergy)

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This route was determined as it offered the most identified benefits by providing reliable electrical power transmission and also minimized the overall effects to the social and natural environment (ecology, sensitive land uses, and cultural features) when compared with other alternatives while maintaining economic and technical feasibility.

3.3.4. Physical characteristics

- **Line and shield conductor type and size:** 3-1192.5kcmil ACSS and two 0.551-in OD 24 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

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.

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It is proposed that the existing East Windsor 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 and East Windsor stations. 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 transmission line is provided in Table 1: Component Cost.

3.3.9. Construction Responsibility

The Englishtown to East Windsor 230kV transmission line will be constructed by PSE&G. Modifications to the existing Englishtown and East Windsor stations are assumed to be constructed by the incumbent transmission owner. 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 substation configuration is shown below in Figure 3: Proposed One-Line.

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

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| FG # | Bus # | Name | KV | Area | Cont Type | Contingency | Pre-Solution | | | Englishtown -E. Windsor | | |
|---------|--------|-----------|-----|------|------------------|------------------|--------------|----------|----------|-------------------------|----------|----------|
| | | | | | | | ContVolt | BaseVolt | Vdrop(%) | ContVolt | BaseVolt | Vdrop(%) |
| N1-VD1 | 206304 | 28ENGLISH | 230 | 228 | Line_FB | C2_JCC-230-34A | 0.919 | 1.0012 | 8.22 | 0.991 | 1.0051 | 1.41% |
| N1-VM1 | 206304 | 28ENGLISH | 230 | 228 | Line_FB | C2_JCC-230-34A | 0.9158 | 1.0023 | | 0.991 | 1.0051 | |
| FG # | Bus # | Name | KV | Area | Contingency 1 | Contingency 2 | ContVolt | BaseVolt | | ContVolt | BaseVolt | |
| N2-VM5 | 206304 | 28ENGLISH | 230 | 228 | 'B2-JCC-115-004' | 'B2-JCC-230-011' | 0.9036 | 1.0034 | | 0.9937 | 1.0048 | |
| N2-VM6 | 206304 | 28ENGLISH | 230 | 228 | 'B2-JCC-115-002' | 'B2-JCC-230-011' | 0.9035 | 1.0034 | | 0.9938 | 1.0049 | |
| N2-VM7 | 206304 | 28ENGLISH | 230 | 228 | 'B2-JCC-115-003' | 'B2-JCC-230-011' | 0.9153 | 1.0042 | | 0.9988 | 1.0062 | |
| N2-VM8 | 206304 | 28ENGLISH | 230 | 228 | 'B2-JCC-115-001' | 'B2-JCC-230-011' | 0.9075 | 1.0038 | | 0.9964 | 1.0048 | |
| N2-VM10 | 206304 | 28ENGLISH | 230 | 228 | 'B2-JCC-115-005' | 'B2-JCC-230-011' | 0.9182 | 1.0027 | | 0.9932 | 1.0041 | |
| N2-VM12 | 206304 | 28ENGLISH | 230 | 228 | 'B2-JCC-230-030' | 'B2-JCC-230-011' | 0.9169 | 1.0013 | | 0.9927 | 1.0034 | |
| N2-VM13 | 206304 | 28ENGLISH | 230 | 228 | 'B_CNJ2-SX-#11A' | 'B2-JCC-230-011' | 0.918 | 0.9974 | | 0.9865 | 0.9988 | |
| FG # | Bus # | Name | KV | Area | Contingency 1 | Contingency 2 | ContVolt | BaseVolt | Vdrop(%) | ContVolt | BaseVolt | Vdrop(%) |
| N2-VD2 | 206304 | 28ENGLISH | 230 | 228 | 'B2-JCC-115-004' | 'B2-JCC-230-011' | 0.9139 | 1.0034 | 8.95 | 0.9937 | 1.0048 | 1.11% |
| N2-VD3 | 206304 | 28ENGLISH | 230 | 228 | 'B2-JCC-115-002' | 'B2-JCC-230-011' | 0.9129 | 1.0034 | 9.05 | 0.9938 | 1.0049 | 1.11% |
| N2-VD4 | 206304 | 28ENGLISH | 230 | 228 | 'B2-JCC-115-001' | 'B2-JCC-230-011' | 0.9183 | 1.0038 | 8.55 | 0.9964 | 1.0048 | 0.84% |

Table 2: Englishtown to East Windsor 230kV Line Results

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4.2. Equipment Parameters and Assumptions

- Nominal voltage rating: 230kV
- Line MVA normal and emergency rating: 721 MVA/850 MVA
- Grounding design for underground or submarine circuits: Not applicable
- Equipment ratings: 3000A
- Total mileage: Approximately 12-miles
- Reactive Devices: Not applicable
- Synchronous Machines: Not applicable
- Line Impedances:

| Englishtown to East Windsor | | |
|-----------------------------|-----------|-----------|
| R (pu) | X (pu) | B (pu) |
| 0.0013580 | 0.0169050 | 0.0361860 |

Table 3: Englishtown to East Windsor Impedances

4.3. PSS/E iddev Files

PSS/E iddev files were 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, were 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 taking out one of the Raritan River to Deep Run to Englishtown 115 kV line and the Smithburg – Englishtown 230kV lines in N-1-1 analysis. The proposed Englishtown to East Windsor 230kV line will solve both the low voltage and voltage drop problems by providing another source to Englishtown.

The Englishtown to East Windsor 230kV transmission line 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 configuration proposed at East Windsor would not necessitate a reconfiguration of the station as it is proposed to use a vacant position and add a breaker in an existing bus section. Adding a breaker in this way will create a minimal of two (2) breakers between the 500/230kV transformers. Thus, this configuration could remove the present-day condition, when a stuck breaker at East Windsor 230kV can take out both East Windsor 500/230kV transformers. 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

The 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 to East Windsor 230kV line.

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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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