



Matt Funk - Kanawha River 345/138kV

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 Matt Funk - Kanawha River 345/138kV new station proposal.
- This proposal is submitted in response to PJM's 2015 Window 1.
- The violations were identified in the peak load voltage analysis and thermal 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 AEP 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 N2-T10, N2-T11, N2-T12, N2-T13, N2-T14, N2-T15, N2-VM65, N2-VM66, N2-VM67, N2-VM68, N2-VM69, N2-VD75, N2-VD76, N2-VD77, N2-VD78, N2-VD79, N2-VD80, N2-VD81, N2-VD82.
- This project should be considered only as a whole.
- The proposed project cost is approximately \$55.7 million base. The expected project duration is 4 years.
- In addition to direct benefits above, the Matt Funk - Kanawha River 345/138kV New Station project will provide an additional source to the Wyoming to Tams Mountain 138kV corridor. It will solve both the low voltage and voltage drop problems caused by the same contingencies in addition to the thermal issues.

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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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Public Outreach

PSE&G has an in-house Public Affairs and Outreach Support Group. Public informational meetings are held to inform the public of the project and obtain their input. Most utility projects do encounter some form of public opposition, however PSE&G is well-versed in navigating both agency and neighboring concerns to produce solutions that accommodate avoidance whenever possible of sensitive receptors or mitigation and best management practices. Our in house staff includes a cadre of public outreach professionals, wildlife biologists, and seasoned construction managers. We have found that a collaborative environment allows us to implement best management practices that will minimize environmental and construction impacts to the area. These practices include:

- Safety and environmental training for all personnel and contractors stepping onto job sites

- Outreach meetings and communication to the regional agencies and local population

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3. Constructability Information

3.1. Scope of Project

The proposal includes the installation of a new 345/138kV station which will intercept the existing 345kV Matt Funk - Kanawha River circuit and the existing Bradley - Poleyard 138kV circuit.

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 a new 345/138kV station which will intercept the existing 345kV Matt Funk - Kanawha River circuit and the existing Bradley - Poleyard 138kV circuit.

3.3.2. Geographic Description

The preferred location is adjacent to the existing right-of-way and in proximity to residential and commercial areas.

3.3.3. Route Description

As part of this project for a new station location, all applicable environmental studies and permits will be filed and procured. Property rights acquisition is anticipated for this project. The proposed Matt Funk -Kanawha River 345/138kV station is to be located next to an Appalachian Power Company 345/138kV transmission line right-of-way.

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.

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This location 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 also maintaining economic and technical feasibility.

3.3.4. Physical characteristics

- **Line and shield conductor type and size:**
For the 345kV tie: 2x795kcmil and 0.646" OD 48 Fiber OPGW
For the 138kV tie: 795kcmil and 0.734" OD 48 Fiber OPGW
- **Overhead or underground/submarine:** Overhead
- **Single or double circuit towers:** Single

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3.3.5. Maps and Supporting Diagrams

3.3.6. Interconnection Location

It is proposed that the existing Matt Funk - Kanawha River 345kV circuit and the Bradley - Poleyard 138kV circuit be intercepted at the New Station as indicated in Figure 2. Proposed One-Line.

3.3.7. Outage Requirements

Outages will be required for construction on the Matt Funk – Kanawha River 345kV circuit and the Bradley - Poleyard 138kV circuit. PSE&G will coordinate with the incumbent transmission owner to determine the length and timing of the outages.

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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 Matt Funk - Kanawha River 345/138kV station will be constructed by PSE&G. Modifications to tapping the existing Kanawha River – Matt Funk 345kV line and Bradley – Poleyard 138kV line he 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 new station configuration is 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: Matt Funk- Kanawha River 345/138kV Station Results.

N-1-1 Voltage Magnitude									
FG #	Bus #	Bus Name	PJM Identified Constraints		New Station Solution		Low Limit	Contingency 1	Contingency 2
			Cont Volt	Base Volt	Cont Volt	Base Volt			
N2-VM65	242747	05PEMBRT	0.9018	1.0073	0.9597	1.0046	0.9203	'5349_B2_TO R2440'	'336_B3_05BR ADL1 138- 1_WOMOAB'
N2-VM66	242818	05STOTES	0.9013	1.0073	0.9662	1.0051	0.9203	'5349_B2_TO R2440'	'336_B3_05BR ADL1 138- 1_WOMOAB'
N2-VM67	242824	05TAMSM1	0.9033	1.0082	0.9723	1.0062	0.9203	'5349_B2_TO R2440'	'336_B3_05BR ADL1 138- 1_WOMOAB'
N2-VM68	242825	05TAMSM2	0.9033	1.0082	0.9723	1.0062	0.9203	'5349_B2_TO R2440'	'336_B3_05BR ADL1 138- 1_WOMOAB'
N2-VM69	247113	05PIERSS	0.9121	1.0121	0.9797	1.0106	0.9203	'5349_B2_TO R2440'	'336_B3_05BR ADL1 138- 1_WOMOAB'

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N-1-1 Thermal									
						PJM Identified Constraints		New Station Solution	
FG #	Fr Bus	Fr Name	To Bus	To Name	Rating	DC Ld(%)	AC Ld(%)	AC Ld(%)	Contingency 2
N2-T10	247004	05GUYAND	242728	05MULLNV	180	119.94	129.65	64	'336_B3_05BRADL1 138-1_WOMOAB'
N2-T11	242680	05ITMANN	242727	05MULLEN	180	109.06	119.06	54	'336_B3_05BRADL1 138-1_WOMOAB'
N2-T12	242728	05MULLNV	242754	05PINNAC	180	118.17	127.78	62	'336_B3_05BRADL1 138-1_WOMOAB'
N2-T13	247113	05PIERSS	242825	05TAMSM2	180	98.33	108.34	44	'336_B3_05BRADL1 138-1_WOMOAB'
N2-T14	242754	05PINNAC	242680	05ITMANN	180	111.17	121.27	56	'336_B3_05BRADL1 138-1_WOMOAB'
N2-T15	242855	05WYOMIN	247004	05GUYAND	205	106.59	115.08	58	'336_B3_05BRADL1 138-1_WOMOAB'

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N-1-1 Voltage Drop										
			PJM Identified Constraints			New Station Solution				
FG #	Bus #	Name	ContV olt	BaseV olt	Vdrop (%)	ContV olt	BaseV olt	Vdrop(%)	Contingency 1	Contingency 2
N2-VD75	242680	05ITMANN	0.9	0.99	12.61	0.9896	1.0132	2.33	'336_B3_05BR ADL1 138-1_WOMOAB'	'5349_B2_TOR 2440'
N2-VD76	242727	05MULLEN	0.8	0.99	14.3	0.9887	1.016	2.69	'336_B3_05BR ADL1 138-1_WOMOAB'	'5349_B2_TOR 2440'
N2-VD77	242747	05PEMBRT	0.8	0.98	18.42	0.9597	1.0046	4.47	'336_B3_05BR ADL1 138-1_WOMOAB'	'5349_B2_TOR 2440'
N2-VD78	242754	05PINNAC	0.9	0.99	10.33	0.9916	1.0105	1.87	'336_B3_05BR ADL1 138-1_WOMOAB'	'5349_B2_TOR 2440'
N2-VD79	242818	05STOTES	0.8	0.98	17.65	0.9662	1.0051	3.87	'336_B3_05BR ADL1 138-1_WOMOAB'	'5349_B2_TOR 2440'
N2-VD80	242824	05TAMS M1	0.8	0.98	17.05	0.9723	1.0062	3.37	'336_B3_05BR ADL1 138-1_WOMOAB'	'5349_B2_TOR 2440'
N2-VD81	242825	05TAMS M2	0.8	0.98	17.05	0.9723	1.0062	3.37	'336_B3_05BR ADL1 138-1_WOMOAB'	'5349_B2_TOR 2440'
N2-VD82	247113	05PIERS S	0.8	0.98	15.86	0.9797	1.0106	3.06	'336_B3_05BR ADL1 138-1_WOMOAB'	'5349_B2_TOR 2440'

Table 2: Matt Funk- Kanawha River 345/138kV Station Results

4.2. Equipment Parameters and Assumptions

- Nominal voltage rating: 345/138kV
- Line MVA normal and emergency rating: 780 MVA/896 MVA
- Grounding design for underground or submarine circuits: Not applicable
- Equipment ratings: 3000A
- Total mileage: Not applicable
- Reactive Devices: Not applicable
- Synchronous Machines: Not applicable
- Line impedances:

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Type	R (pu)	X (pu)	B (pu)
345/138kV transformer	0.00033	0.01492	

Table 3: Matt Funk - Kanawha River Impedances

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4.3. PSS/E iddev Files

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

4.4. Supporting Information

An N-1-1 thermal issue along AEP's 138kV line from Wyoming to Tams Mountain was found in the 2015 RTEP power flow analysis. The voltage issues, N-1-1 voltage drop and N-1-1 low voltage, were seen in the same area due to a contingency that takes out the Hinton – Glen Lyn 138kV line and a contingency that takes out lines connected to Bradley bus 1 in N-1-1 analysis. The proposed tap of the existing Kanawha River – Matt Funk 345kV line to Bradley – Poleyard 138kV line at a new substation with a 345/138 kV transformer will solve both the thermal violation and the low voltage and voltage drop problems by providing another source to the Wyoming to Tams Mountain 138kV corridor.

The 345/138 kV transformer project will solve the thermal violation caused by a combination of two single contingencies. The power flow fits the criteria by a good margin. The solution does not introduce new thermal violations. The voltages around that area also remain within the voltage limits and drop limits.

The 345/138kV transformer project will provide a source of power to the Wyoming to Tams Mountain 138kV corridor. It will also solve the low voltage and voltage drop problems caused by the same contingencies.

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 escalate rate of was used.

5.2. Detailed Breakdown of Cost

5.3. Cost Containment

accompanying cost containment mechanism.

PSE&G will not be submitting an

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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

PSE&G may negotiate agreements to support operations activities.

7.1.3. Maintenance Contracts

PSE&G may negotiate agreements to support maintenance activities.

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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.