



same switching facilities found in a typical open air switching station in a much smaller, environmentally and aesthetically pleasing design. Mr. Jacober also explains that PSE&G is proposing an open air switching station in Jefferson, New Jersey. PSE&G is proposing an open air station in Jefferson because the property on which the station is located is very large and remotely located from any residential properties.

1 STATE OF NEW JERSEY  
2 BOARD OF PUBLIC UTILITIES  
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6 IN THE MATTER OF THE PETITION OF :  
7 PUBLIC SERVICE ELECTRIC AND GAS :  
8 COMPANY FOR A DETERMINATION :  
9 PURSUANT TO THE PROVISIONS OF :  
10 N.J.S.A. 40:55D-19 : BPU DOCKET  
11 :  
12 (SUSQUEHANNA-ROSELAND) :  
13 \_\_\_\_\_ :  
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15 PRE-FILED DIRECT TESTIMONY OF RICHARD I. JACOBER ON BEHALF  
16 OF PUBLIC SERVICE ELECTRIC AND GAS COMPANY IN SUPPORT OF  
17 SUSQUEHANNA-ROSELAND TRANSMISSION LINE PROJECT  
18  
19

20 I. BACKGROUND

21  
22 Q. Please state your name and business address.

23 A. My name is Richard I. Jacober. My address is: Black & Veatch Corporation,  
24 11401 Lamar Avenue, Overland Park, KS 66211.  
25

26 DUTIES AND RESPONSIBILITIES

27  
28 Q. By whom are you employed and how long have you been so employed?

29 A. I have been employed by Black & Veatch Corporation for the past 16 years.  
30 Black & Veatch is an engineering and construction company that specializes in  
31 the energy and infrastructure industries.  
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**EXPERIENCE AND EDUCATION**

3

4 **Q. Please describe your professional experience and educational background.**

5 **A.** I have a BSEE in Electrical Engineering from the University of Missouri-Rolla  
6 (1992). I am a Licensed Professional Engineer in seven (7) states, one of which is  
7 the State of New Jersey (NJ PE #GE45708). Upon graduation from the University  
8 of Missouri-Rolla, I joined Black & Veatch and have held various engineering and  
9 management positions related to the design and construction of electric  
10 transmission lines and switching stations.

11 I currently hold a position as a Project Manager in the Black & Veatch's Power  
12 Delivery Business Line. In this role, I am responsible for all aspects of the  
13 conceptual/detailed design, material procurement, and construction of electric  
14 transmission line and switching station projects.

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16

**PURPOSE OF TESTIMONY**

17 **Q. Please describe the purpose of your testimony.**

18 **A.** The purpose of my testimony is to discuss the conceptual design performed for the  
19 PSE&G proposed East Hanover 500kV GIS switching station and the proposed  
20 Jefferson 500kV open-air switching station.

21 **Q. Have you ever provided testimony previously to the New Jersey Board of  
22 Public Utilities?**

23 **A.** No.

24

1 **Q. Have you ever testified as an expert in connection with municipal land use**  
2 **hearings in the State of New Jersey?**

3 **A.** Yes. Specifically, I testified before the Hillsborough Township and Branchburg  
4 Township Zoning Board's in connection with PSE&G's construction of the  
5 Branchburg-Flagtown transmission project in September and October 2008. The  
6 Branchburg-Flagtown Transmission Project involved the construction of a new  
7 four (4) mile 230kV transmission line on an existing transmission right-of-way in  
8 Branchburg and Hillsborough townships in Somerset County, New Jersey.

9 **Q. Are you sponsoring any exhibits?**

10 **A.** Yes. I am sponsoring the East Hanover Switching Station Site Plans and  
11 Elevation Drawings (4 sheets), which are attached hereto as Exhibit RIJ-1 and the  
12 Jefferson Switching Station Site Plans and Elevation Drawings (3 sheets), which  
13 are attached hereto as Exhibit RIJ-2.

14

15

**DESCRIPTION OF SWITCHING STATIONS**

16 **Q. Please briefly explain your responsibility in connection with the Project.**

17 **A.** Black & Veatch is the engineering/construction company that has been retained  
18 by PSE&G to perform the conceptual design of the proposed East Hanover 500kV  
19 GIS switching station and the proposed Jefferson 500kV open-air switching  
20 station.

21

22

1 **Q. Briefly describe the Jefferson site and the surrounding properties.**

2 **A.** The proposed Jefferson switching station site is located on a large parcel of  
3 property in a remote area that is presently surrounded by trees.

4 **Q. Briefly describe the East Hanover site and the surrounding properties.**

5 **A.** The proposed East Hanover 500kV switching station site is located to the west of  
6 the existing PSE&G Roseland switching station across the Passaic River. The  
7 proposed site is intersected by an existing 230kV transmission line right-of-way.  
8 The properties on the north and south sides of the proposed East Hanover  
9 switching station property are generally single-family homes located in a  
10 residential area.

11 **Q. Please describe the functions a switching station performs.**

12 **A.** Electrical switching stations are the infrastructure within the electrical  
13 transmission grid which allow transmission companies to control and monitor the  
14 flow of electrical power, provide protection of transmission assets in order to  
15 clear system instabilities, provide a location for the safe step-down or step-up of  
16 electrical voltage level of the power system, and provide locations for the safe  
17 interconnection of transmission lines within the transmission grid to form a safe  
18 and reliable power network.

19 **Q. Briefly explain the locations necessary for the two switching stations that are**  
20 **part of the Project.**

21 **A.** The proposed 500kV East Hanover GIS switching station is located at the eastern  
22 end of the Project. This location was chosen to allow for the interconnection of  
23 the transmission line into the PSE&G transmission system at the existing

1 Roseland switching station. A GIS switching station has been proposed on the  
2 East Hanover side of the Passaic River (i) to minimize environmental impacts  
3 associated with developing the proposed 500kV switching station and (ii) to  
4 reflect the fact that there is insufficient land area for the proposed 500kV  
5 switching station on the existing Roseland switching station property.

6 The proposed 500kV Jefferson open-air switching station is located in the general  
7 vicinity of the intersection of the Project and the existing Branchburg – Ramapo  
8 500kV transmission line. This location was chosen to facilitate the required  
9 interconnection of Project with the Branchburg – Ramapo 500kV transmission  
10 line.

11 **Q. Briefly explain GIS technology.**

12 **A.** “GIS” in the context of switching station equipment means Gas Insulated  
13 Switchgear. The technology is used to reduce the size of the footprint required to  
14 install the needed switching station equipment. A GIS switching station can be  
15 installed to have all of the same types of electrical components as an open-air  
16 switching station; however, the footprint size of the GIS switching station will be  
17 smaller. The reason that the GIS switching station can be built in a smaller  
18 footprint is the electrical equipment components (buses, circuit breakers,  
19 disconnect switches, etc.) are enclosed in a tube that is filled with SF6 gas.  
20 Although the GIS technology provides benefits of a reduced footprint, it also is  
21 more costly than open-air equipment.

22

23

1 **Q. Why did PSE&G choose to use GIS technology for the design of the East**  
2 **Hanover switching station?**

3 **A.** The proposed East Hanover switching station site is large enough to  
4 accommodate an open-air switching station design. However, the use of GIS  
5 technology for this installation allows PSE&G to minimize the overall footprint  
6 of the switching station site. The smaller site footprint minimizes the  
7 environmental and visual impacts associated with building the 500kV switching  
8 station on the proposed site.

9 The Jefferson 500kV switching station is proposed as an open-air switching  
10 station design on a section of property that is large enough to accommodate the  
11 specified design. Environmental and visual impacts on the proposed Jefferson  
12 switching station site are minimal and do not warrant the additional cost  
13 associated with the implementation of GIS technology.

14 **Q. Briefly describe the facilities PSE&G is proposing to install at each**  
15 **switching station.**

16 **A.** (a) East Hanover 500kV Switching Station: The proposed East Hanover 500kV  
17 GIS switching station includes a four position, breaker-and-a-half (six breakers)  
18 GIS switchyard configuration that is expandable to a six position, breaker-and-a-  
19 half (nine breakers) switchyard configuration in the future. The GIS switching  
20 station equipment will be located inside of an architectural finished building  
21 located on the proposed East Hanover project site. The four positions in the  
22 proposed 500kV GIS switching station will be used for two (2) 500/230kV  
23 transformer positions, one (1) line termination position for the Project, and one

1 (1) future 500kV line termination position. Other major equipment to be  
2 installed in the proposed East Hanover 500kV switching station include: two (2)  
3 500/230kV power transformer banks, gas-insulated buswork, two 500kV  
4 transmission line termination structures, two 230kV transmission line termination  
5 structures, an emergency diesel generator, control and relaying equipment,  
6 building HVAC equipment, and auxiliary power systems.

7 (b) Jefferson 500kV Switching Station: The proposed Jefferson 500kV open-air  
8 switching station includes a four position, breaker-and-a-half (six breakers) open-  
9 air switchyard configuration. The four positions in the proposed 500kV open-air  
10 switching station will be used for four (4) 500kV line termination positions for  
11 the four (4) 500kV transmission lines intersected by this switching station  
12 (Jefferson – Roseland, Jefferson – Susquehanna, Branchburg – Jefferson, and  
13 Jefferson – Bushkill). Major equipment to be installed as part of the proposed  
14 Jefferson 500kV switching station include circuit breakers, disconnect switches,  
15 instrument transformers, open-air buswork, four (4) transmission line termination  
16 structures, four (4) overhead conductor strain bus structures, a switching station  
17 control enclosure, an emergency diesel generator, control and relaying  
18 equipment, and auxiliary power systems.

19 The facilities to be installed at each station are more clearly shown on the Site  
20 Plans attached hereto as exhibits to my testimony.

21 **Q. What type of foundations will these facilities require?**

22 **A.** Switching station equipment and structures will be installed on either drilled pier  
23 and/or spread footing type foundations that are typical for the construction of

1 switching stations. The size and foundation types used will be determined during  
2 the detailed design phase of the Project.

3

4 **Q. What is the height of these facilities?**

5 **A.** (a) East Hanover 500kV Switching Station – The conceptual design of the  
6 proposed 500kV East Hanover switching station includes the following proposed  
7 structure heights:

- 8 • 500kV Line Termination Structures: 120 feet above grade
- 9 • 230kV Line Termination Structures: 90 feet above grade
- 10 • 500kV GIS Building: 50 feet above grade (Building  
11 height may vary based on GIS equipment chosen)

12

13 (b) Proposed Jefferson 500kV Switching Station – The conceptual design of the  
14 proposed 500kV Jefferson switching station includes the following proposed  
15 structure heights:

- 16 • 500kV Line Termination Structures: 120 feet above grade
- 17 • 500kV Bus Elevations: High Bus: 50 feet  
18 Low Bus = 30 feet
- 19 • Switchyard Control Enclosure: 15 feet above grade

1 The height of all structures are more clearly shown on the elevation drawings  
2 attached hereto as exhibits to my testimony.

3 **Q. What is the size of the layout for each of the stations?**

4 **A. Proposed East Hanover 500kV Switching Station:** The conceptual layout design  
5 of the proposed 500kV East Hanover GIS switching station includes a fenced area  
6 of approximately 630 feet by 360 feet.

7 **Proposed Jefferson 500kV Switching Station:** The conceptual layout design of  
8 the proposed 500kV Jefferson open-air switching station includes a fenced area of  
9 approximately 950 feet by 400 feet.

10

11 **ACCESS AND CONSTRUCTION**

12 **Q. Who will be responsible for construction of the stations?**

13 **A.** PSE&G will subcontract the construction of the switching stations to qualified  
14 contractors and will ultimately be responsible for the construction of the facilities.

15 **Q. How will PSE&G access the stations in order to construct the facilities?**

16 **A. (a) Proposed East Hanover 500kV Switching Station:** The conceptual design of  
17 the proposed East Hanover 500kV GIS switching station includes an access road  
18 that approaches the station from the southeast corner of the station property. This  
19 road will be used to provide site access for vehicles and equipment required to  
20 construct the switching station.

21 **(b) Proposed Jefferson 500kV Switching Station:** The conceptual design of the  
22 proposed Jefferson 500kV open-air switching station includes the upgrade of the  
23 existing right-of-way access road to access the proposed switching station site

1 from the east side. This road will be used to provide site access for vehicles and  
2 equipment required to construct the switching station.

3 **Q. Please briefly describe the construction process for the switching stations.**

4 **A.** The construction process to be followed for both the East Hanover 500kV GIS  
5 switching station and the Jefferson 500kV open-air switching station will be very  
6 similar and comprised of the following major activities:

- 7 • Implement site grading and soil erosion control measures
- 8 • Install equipment and building foundations
- 9 • Install below grade grounding and raceway facilities
- 10 • Install GIS building (East Hanover site only)
- 11 • Install site surfacing material (crushed stone)
- 12 • Install switching station steel structures
- 13 • Install switching station equipment
- 14 • Install switching station control enclosure (Jefferson site only)
- 15 • Install control and relay equipment
- 16 • Pull and terminate control and auxiliary power cable
- 17 • Test and commission switching station

18 **Q. How long will it take to complete construction?**

19 **A.** The estimated construction duration for both the East Hanover 500kV GIS  
20 switching station and the Jefferson 500kV open-air switching station is  
21 approximately 18 months.

22

1 **Q. Will PSE&G notify adjacent property owners prior to beginning**  
2 **construction?**

3 **A.** Yes, PSE&G will notify adjacent property owners prior to the beginning of  
4 construction and will work to minimize impacts to adjacent property owners  
5 throughout the construction process.

6 **Q. Will the proposed facilities create a noise? If yes, please explain.**

7 **A.** The proposed facilities at both the East Hanover and Jefferson sites will act as a  
8 source of noise at times. Both of the switching stations will contain switchyard  
9 equipment that will make noise when operated. For example, a circuit breaker  
10 will emit an impulse noise when operated (opened or closed). Both of the  
11 proposed switching station sites will be designed to include an emergency diesel  
12 (or propane) generator to supply emergency station power for the proposed  
13 facilities. The emergency generators will only run in emergency situations, and  
14 for short periods of time during normal daytime hours once a month, to ensure  
15 proper operation and maintenance of the system. The East Hanover site will  
16 contain two 500/230kV transformer banks that will emit a steady state humming  
17 noise when in operation.

18 In the case of the proposed East Hanover site, the GIS switching station  
19 equipment will be installed indoors in an architectural type of building. The  
20 building will buffer the noise emitted by the GIS switching station equipment,  
21 resulting in only a negligible level of noise detected on the outside of the building.  
22 The transformers to be installed at the proposed East Hanover site will be  
23 installed between firewalls on the East (Roseland) side of the building away from

1 the residential areas. The presence of the building and firewalls will buffer the  
2 noise emitted by the transformers, thus minimizing the noise at the East Hanover  
3 switching station property line to levels that are below New Jersey State noise  
4 requirements.

5 The proposed Jefferson switching station site is located on a large parcel of  
6 property in a remote area that is presently surrounded by trees. The sources of  
7 noise associated with the Jefferson switching station are described above and are  
8 normal to switching station installations. Noise levels at the Jefferson switching  
9 station will also be below New Jersey State noise requirements.

10 **Q. Will the operation of either station cause a danger to any of the surrounding**  
11 **properties?**

12 **A.** The proposed designs of both the East Hanover and Jefferson switching stations  
13 are in accordance with National Electric Safety Code (NESC) requirements and  
14 are consistent with Good Utility Practice. Therefore, if the proposed switching  
15 stations are properly operated in accordance with the proposed designs, there  
16 should be no danger posed to any of the surrounding properties.

17 **Q. Does this conclude your direct testimony?**

18 **A.** Yes, it does.

19