PJM Generator Interconnection Request Queue #B9A Burlington 168MW Facilities Study Report

July 2000

Introduction

PSEG Power plans to install four combustion turbines with a total generating capacity of 168MW at Burlington. This project will be replacing 185 MW of capacity from the retired Burlington No. 7 unit.

The new units will be located on the Burlington property north of the existing unit 10 and south of the Cox's Corner-Croydon 230 kV line. The generator step-up transformers, switching equipment and collector bus will be located near the new power plant and will be connected to the Burlington 138kV bus in section No. 9. The interconnection plan consists of constructing a new 138 kV circuit between the generator collector bus and the 138 kV yard. A one-line diagram of the interconnection is shown in Exhibit No. 1.

INSIDE PLANT

PROJECT SCOPE INSTALLATION:

This estimate covers the installation of cost of two (2) 138kV circuit breakers, one (1) 138kV line position and bus extension, four (4) 138kV circuit breaker isolating switches, one (1) 138kV bus isolating switch, one (1) 138kV motor operated line disconnect switch with ground blades, protective relays and all other equipment and materials required to ensure a safe and reliable installation.

An existing slab type foundation will be utilized for one of the new breakers while an existing pier type foundation will be utilized for the other breaker by bridging the piers with a steel frame. Breaker isolating switches will be located on existing steel structures with minor modifications required. The northern most position on the 138kV 'A' Frame will be utilized to accept incoming overhead conductors from Unit # 12. New 138kV dead end assemblies and line drops are required (by Tower Group). A section of the abandoned 138kV East ring bus will be used to connect the new line position to the existing 138kV West ring bus. The existing disconnect switch associated with retired 132-2 transformer banks A & B will be replaced with a new motor operated disconnect switch (with ground blades) with minor modifications required to the existing support structure. New 138kV bus supports are required on both ends of the existing 138kV bus to allow for continuation of the bus to the new line position as well as safe clearance from the abandoned breakers and switches associated with the retired East ring bus. New bus supports and bus disconnect switch foundations and steel structures are required for the bus extension between the existing East ring bus and the new line position. Oversized spread type footings incorporating a geotech stabilizing material will be utilized in lieu of piled type foundations. Where possible, existing piles will be used to help stabilize the new foundations. Minor repair work is also required to approximately six (6) foundations associated with the East ring bus.

Other outdoor work includes modifications to existing 138kV bus work, new 138kV bus work, grounding, lighting, control duct laterals between the new equipment and the existing Trenwa

Trench, new control and power cables between the equipment and the 138kV relay house and fiber optic facilities for protective relay communications between the north side of the 'A' Frame and the 138kV relay house.

Work within the 138kV control house includes the installation of new relay racks associated with breaker controls, line instruments, breaker failure relays and regular and back-up line differential protection relays. Additional modifications are required on several existing racks to allow for the relocation of existing protective circuits associated with Unit # 10 and transformer 132-1.

WORK INCLUDED:

Included within this Conceptual Phase Estimate are all costs associated with equipment and materials, design, engineering, project management and construction supervision.

WORK EXCLUDED:

- Installation of 138kV overhead conductors, steel poles, dead end assemblies and down drops.
- Installation of fiber optic ground wire (fog wire) between Unit # 12 and the 138kV switchyard.
- Removal of the existing 138kV disconnect switches and bus work.
- Removal of the existing 138kV strain bus associated with retired transformer banks 132-2A & 2B.

EQUIPMENT SPECIFICATION

<u>Circuit Breaker 1WSP (Sect. 9-10)</u>
Manuf./Type: ABB, Type 145PM63-30
Amps: 3,000A
Duty: 63kA (with 12,000pF Capacitance)
Voltage: 145kV

<u>Circuit Breaker 1WNP (Sect. 8-9)</u>
Manuf./Type: ABB, Type 145PM63-30
Amps: 3,000A
Duty: 63kA (with 12,000pF Capacitance)
Voltage: 145kV

<u>Breaker 1WSP (Sect. 9-10) Disconnect Switches - 1WSP60 (Sect. 10) & 1WSP70 (Sect. 9)</u>
Manuf./Type: USCO, Type AVR
Amps: 3,000A Cont./120,000 Mom.
Voltage: 138kV Nominal

Breaker 1WNP (Sect. 8-9) Disconnect Switches - 1WNP60 (Sect. 9) & 1WNP70 (Sect. 8)
Manuf./Type: USCO, Type AVR
Amps: 3,000A Cont./120,000 Mom.
Voltage: 138kV Nominal

Unit #12 Position - 2LWSP (R-1370) Motor Operated Line Disconnect Switch (2LWSP30) & Ground Switch (2LWSP80)
Manuf./Type: USCO, Type AVR
Amps: 3,000A Cont./120,000 Mom.
Voltage: 138kV Nominal

Unit #12 Position - 2LWSP (R-1370) Line Capacitors
Manuf./Type: ABB
Phases: 1, 2 & 3
Capacitance to Ground: 12,000pF
Voltage: 145kV Nominal

Note: Line Capacitors Installed for Circuit Breaker Rating Purposes

COMMENTS:

- Contractors will be utilized for both the civil work and the electrical work. Rigging of equipment will be part of the electrical scope of work.
- A full-time safety watcher is required during construction.
- Hardware utilized on bolted connections on the 138kV 'A' Frame may require replacement due to oxidation. An evaluation is recommended.

INSIDE PLANT COST ESTIMATE: $752,700

PROJECT SCOPE WITHDRAWAL:

This Conceptual Phase Withdrawal Estimate covers the costs associated with removal of five (5) 138kV disconnect switches and associated bus work, the removal of 138kV bus work located on opposite ends of the 138kV East bus and the removal of the retired 132-2A & 2B strain busses (by Tower Group).

Work required within the 138kV control house includes the removal of abandoned relay racks and cabinets in order to provide sufficient rack space for new relay racks as well as the removal of retired cables.

WORK INCLUDED:

Included within this Conceptual Phase Withdrawal Estimate are all costs associated with the removal of facilities and includes design, engineering, project management and construction supervision.

COMMENTS:

- A contractor will be utilized for the electrical work. Rigging of retired equipment will be part of the electrical scope of work.

- A full-time safety watcher is required during construction.

INSIDE PLANT WITHDRAWAL COST: $20,000

Relaying and Protective Devices - Burlington Line Protection for R-1370 Line Burlington 138kV bus to Burlington #12

The installed relay protection fully complies with the MAAC Protective Relaying Philosophies and Design Standards.

R-1370 is protected by a primary and back-up line differential relay scheme. Communications is accomplished using two fiber optic cables, one overhead and one underground for secure communications. Each line differential scheme also has transfer trip capability for use with stuck breaker/switcher protective schemes. The primary relays are ABB LCBII Line Current Differential Relays with transfer trip and the back-up protection is RFL 9300 Charge Comparison Relays with transfer trip. In addition to basic protection function, the RFL 9300 has oscillography.

The line protection (primary and back-up) will detect faults in the line and trip bus section 8-9 and bus section 9-10 circuit breakers at Burlington Switching Station and Circuit Switchers 121, 122, 123 and 124 at Burlington #12.

Initiation of stuck breaker protection on bus section 8-9 and/or bus section 9-10 breaker(s) in Burlington Switching Station will transfer trip Circuit Switchers 121, 122, 123 and 124 at Burlington #12 via the primary and back-up R-1370 line relays. Stuck switcher protection on Circuit Switchers 121 or 122 or 123 or 124 at Burlington #12 will transfer trip bus section 8-9 and bus section 9-10 breaker(s) in Burlington Switching Station via the primary and back-up R-1370 line relays.

OUTSIDE PLANT

The interconnection plan consists of constructing a new 138 kV circuit between the generator collector bus and the 138 kV yard. The circuit consists of two steel poles set on concrete foundations. The length of the circuit is 1025 feet consisting of 795 kcmil ACSR conductor with a ground wire. The ground wire contains fiber optic circuits used for relay protection and communication between the generating plant and the 138 kV switchyard. The circuit will have a summer normal rating of 430 MVA.

The following table contains more detailed information about the ampere rating of the circuit:

R-1360	Burlington 12 - Burlington 138 kV A-Frame	(Line)

Amperes per Conductor - 795 kcmil 54/7 ACSR
140 Deg C Maximum Conductor Temperature

Planning and Design Ratings:

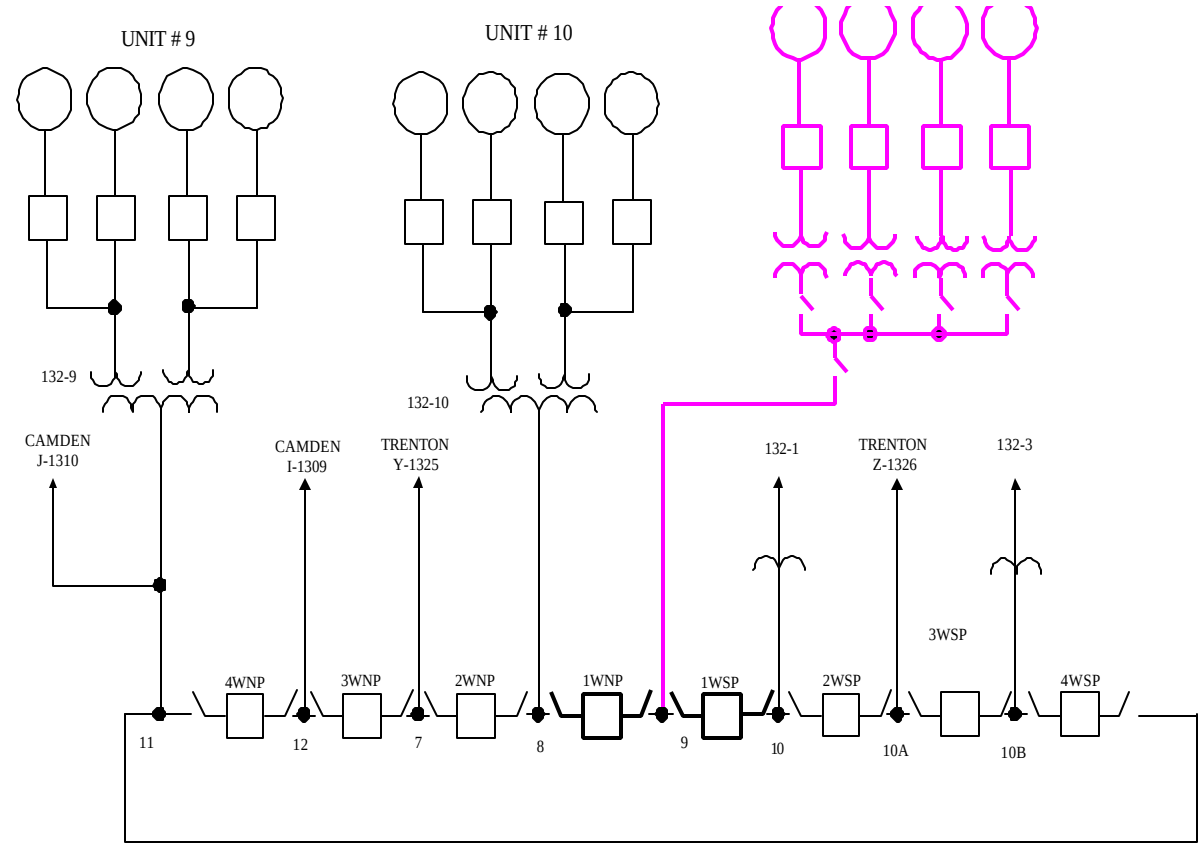
Summer Normal	1101
Summer Emergency	1384
Winter Normal	1240
Winter Emergency	1530

Operating Ratings - Ambient Variant:

Ambient, C	-5	0	5	10	15	20	25	30	35	40
Day Normal	1316	1291	1266	1240	1213	1186	1159	1130	1101	1071
Day Emergency	1609	1583	1557	1530	1503	1474	1445	1415	1384	1352
Night Normal	1374	1350	1326	1301	1276	1250	1224	1197	1170	1142
Night Emergency	1656	1632	1606	1580	1554	1526	1498	1469	1439	1408

OUTSIDE PLANT COST ESTIMATE: $750,000

Exhibit 1
Burlington #B9A



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By: T. Perkins (9/29/99)

Exhibit 2
Burlington No. 12 Project

Generator Specifications

Fuel Type	Natural Gas
Rated MVA base	71
Power Factor	.85
Rated kV	13.8
Summer gross MW output	42
Summer net MW output	41.5
Winter gross MW output	49
Rated MVAR Lag	37
Rated MVAR Lead	25

Unit Step-Up Transformer Specifications

MVA base	45
Rated High Voltage - kV	138
Rated Low Voltage - kV	13.8
Tap Setting - kV	138
Impedance % at 60 MVA	9.5%
Taps and Step size	5 / 2.5%