PJM Generator Interconnection
V4-018 Morrisville 500 kV
425 MW Energy (415 MW Capacity)
Feasibility Study

April 2010
DMS#587915v1

General

Queue V4-018 is a request to interconnect a 425 MW Energy (415 MW Capacity) resource that adds a combustion turbine to a proposed 2x1 combined cycle facility to be located in Warren County, Virginia that will connect into Virginia Electric and Power Company (ITO) facilities. The Interconnection Customer (IC) is tentatively scheduling the generating facility to be commercially available by 3Q2015.

Summary

Queue V4-018 costs and construction schedule estimates assume the facilities for the proposed 2x1 combined cycle facility:

Upgrade Type	Costs	Duration
Attachment Facilities	$500,000	30 months
Direct Connection Network Upgrades	$0	0 months
Non-Direct Connection Network Upgrades	$1,681,000	13 months
Overall V4-018	**$2,181,000**	**30 months**

Network Impacts

The queue V4-018 project was studied as 425 MW Energy (415 MW Capacity) injection into the ITO system. The Point of Interconnection (POI) was modeled at the same point as the proposed combined cycle queue project. Project V4-018 was evaluated for compliance with reliability criteria for summer peak conditions in 2014. Potential network impacts were as follows:

Generator Deliverability

(Single or N-1 contingencies for the Capacity portion only of the interconnection)

No problems identified.

Multiple Facility Contingency

(Double Circuit Tower Line contingencies only for the full energy output. Stuck breaker and bus fault contingencies will be performed for the Impact Study)

No problems identified.

Contribution to Previously Identified Overloads

(This project contributes to the following contingency overloads, i.e. "Network Impacts", identified for earlier generation or transmission interconnection projects in the PJM Queue)

No problems identified.

Short Circuit

Our analysis found seven new breakers, to be over-duty. The new over-duty breakers are listed below:

Bus #	Bus	Breaker	Rating Type	Duty Percent With v4-018 DOM	Duty Percent Without v4-018 DOM	Duty Change	Note
314916	Morrisville 500 kV	H1T573	S	103.20%	99.20%	4.00%	New Over-duty
314916	Morrisville 500 kV	H1T580	S	103.20%	99.20%	4.00%	New Over-duty
314916	Morrisville 500 kV	H2T545	S	103.20%	99.20%	4.00%	New Over-duty
314916	Morrisville 500 kV	H2T569	S	103.20%	99.20%	4.00%	New Over-duty
314917	Mt Storm 500 kV	G3T572	S	100.80%	99.70%	1.10%	New Over-duty
314061	Loudoun 230 kV	L252	S	100.40%	99.00%	1.40%	New Over-duty

Dominion Analysis

ITO assessed the impact of the proposed 415 MW generation Capacity on the ITO transmission system. The system was assessed using the Summer 2014 RTEP Case provided to ITO by PJM, where the proposed generation capacity was injected on the 500kV transmission line between the Meadow Brook and Morrisville substations. This analysis did include the impacts of the generation capacity for all higher order queue generators within the ITO transmission system. When performing a generation analysis, ITO primary analyses were load flow study results under single contingency (both normal and stressed system conditions) and import/export system conditions. ITO criteria consider a transmission facility overloaded if it exceeds 94% of its emergency rating under normal and stressed system conditions. For import/export studies, ITO considers a transmission facility overloaded if it exceeded 100% of its emergency rating. A full listing of ITO planning criteria and interconnection requirements can be found in the ITO Facility Connection Requirements which are publicly available at: http://www.dom.com.

The V4-018 Feasibility Study was performed under the assumption that the PATH line and the MAPP line were in-service. Should either of these lines not be in-service when this facility goes on-line, the V4-018 generation capacity may be constrained due to network congestion.

As part of its generation Feasibility Study analysis ITO routinely evaluates the impact that a proposed new generation resource will have under maximum generation conditions and stressed system conditions. For the V4-018 evaluation three different assessments were conducted.

1) The first being when local generation including the proposed V4-018 facility is operated at their maximum capability. The results of this study indicate that the proposed V4-018 generation did not adversely impact Dominion's Transmission System.

2) The second being a stressed system condition where the largest generator in the area is unavailable. With the V4-018 generator geographically located

in Northern Virginia, Possum Point Unit #5 is considered the most critical generating unit in the area. The impact of V4-018 was studied with the outage of Possum Point Unit #5. The results of this study indicate that the proposed V4-018 generation did not adversely impact ITO transmission system.

3) The third being import and export conditions into and out of the ITO transmission system. Any new facility that is interconnected with the ITO transmission system should not significantly decrement First Contingency Incremental Transfer Capability between utilities. The results of these studies can be found in the following tables.

Import Study Results			
Area	**Summer 2014**	**Summer 2014 with V4-018**	**Limiting Element**
AEP	2000+	2000+	None
APS	2000+	2000+	None
CPL	2000+	2000+	None
PJM	2000+	2000+	None

Export Study Results			
Area	**Summer 2014**	**Summer 2014 with V4-018**	**Limiting Element**
AEP	2000+	2000+	None
APS	2000+	2000+	None
CPL	2000+	2000+	None
PJM	2000+	2000+	None

ITO planning criteria indicate a need to have approximately 2000 MW of import and export capability. The results of these import and export studies indicate that the proposed generation facility will not impact ITO import or export capability.

Attachment Facilities

The proposed layout and Attachment Facilities are illustrated below in Figure A. To interconnect the proposed V4-018 generation with the ITO transmission system it will be necessary to expand the 500kV bus at the IC's proposed combined cycle site and install the necessary metering and protection equipment. The estimated cost of these facilities is $500,000 and is estimated to take 24 to 30 months to complete.

Direct Connection Requirements

No additional Direct Connection Network Upgrades are required beyond those proposed for the 2x1 combined cycle facility.

Non-Direct Connection Requirements

Bus #	Bus	Breaker	Mitigation	Cost	Duration (months)
314916	Morrisville 500 kV	H1T573	Name plate modification	$2000	1
314916	Morrisville 500 kV	H1T580	Replace	$730,000	13
314916	Morrisville 500 kV	H2T545	Name plate modification	$2000	1
314916	Morrisville 500 kV	H2T569	Replace	$730,000	13
314917	Mt Storm 500 kV	G3T572	Name plate modification	$2000	1
314061	Loudoun 230 kV	L252	Replace	$215,000	9

Figure A: Single-Line Diagram