PJM Generator Interconnection

U4-026 Lowmoor - Lexington 230-kV

13 MW Capacity & 100 MW Energy

Feasibility Study

April 2009
DMS #537765v1

Introduction

This Feasibility Study has been prepared in accordance with the PJM Open Access Transmission Tariff §36.2 and the Feasibility Study Agreement between Interconnection Customer (IC) and PJM Interconnection, LLC (PJM) (Transmission Provider).

Preface

The intent of a Feasibility Study is to determine a plan, with cost and construction time estimates, to allow the subject generation interconnection project to inject into the PJM network at a location specified by the Interconnection Customer. As a requirement for interconnection, the Interconnection Customer may be responsible for the cost of constructing Network Upgrades, which are facility additions, or upgrades to existing facilities, that are needed to maintain the reliability of the PJM system. All facilities required for interconnection of a generation interconnection project must be designed to meet the technical specifications for the appropriate transmission owner.

In some instances Interconnection Customer may not be responsible for 100% of the identified network upgrade cost because other transmission network uses, e.g. another generation interconnection or merchant transmission upgrade, may also contribute to the need for the same network reinforcement. The possibility of sharing the reinforcement costs with other projects may be identified in the feasibility study, but the actual allocation will be deferred until the impact study is performed.

The Feasibility Study estimates do not include the feasibility, cost, or time required to obtain property rights and permits for construction of the required facilities. The project developer is responsible for the right of way, real estate, and construction permit issues. For properties currently owned by Transmission Owners, the costs may be included in the study.

Potential Network Impacts

The wind generation queue project, U4-026, was studied as a 100 MW energy (13 MW Capacity) injection into Lowmoor – Lexington 230 kV on the Dominion system. U4-026 was evaluated for compliance with reliability criteria for summer peak conditions in 2013. Potential network impacts were as follows:

Generator Deliverability

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

None.

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)

None.

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)

None.

Steady-State Voltage Requirements

To be determined at the System Impact Study.

Stability and Reactive Power Requirement

To be determined at the System Impact Study.

Delivery of Energy Portion of Interconnection Request

PJM also studied the delivery of the energy portion of this interconnection request. Any problems identified below are likely to result in operational restrictions to the project under study[1]. The developer can proceed with network upgrades to eliminate the operational restriction at their discretion by submitting a Merchant Transmission Interconnection request.

The Conastone - Peachbottom 500kV line (from bus 4 to bus 13 circuit 1) loads from 250.35% to 250.45% (DC power flow) of its emergency rating (2598 MVA) for the single line contingency outage ('PJM24B'). This project contributes approximately 22 MW to the thermal congestion.

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CONTINGENCY 'PJM24B'
 DISCONNECT BRANCH FROM BUS 98127 TO BUS 11 CKT 1   /* JUNIATA KEYSTONE 500 500
END
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Dominion Study Results

Dominion assessed the impact of the proposed U4-026 project's 13MW generation Capacity and additional 87MW generation energy on the Dominion Transmission System. The system was assessed using the summer 2013 RTEP case provided to Dominion by PJM, where the proposed generation capacity and energy was injected on the 230kV Lexington to Lowmoor transmission line. This analysis considered the impacts of the generation capacity for the higher order U-queue generators. The following higher order queue generators were modeled in the case: U2-013, U2-031, U2-056, U2-057, and U2-068. When performing a generation analysis, Dominion's main analysis is a load flow study under single contingency for both normal and stressed system conditions. Dominion criteria consider a transmission facility overloaded if it exceeds 94% of its emergency rating under normal and stressed system conditions. A full listing of Dominion's

[1] Only the most severely overloaded conditions are listed. There is no guarantee of full delivery of energy for this project by fixing only the conditions listed in this section. With a Transmission Interconnection Request, a subsequent analysis will be performed, which will study all overload conditions associated with the overloaded element(s) identified.

Planning Criteria and interconnection requirements can be found in the Company's Facility Connection Requirements which are publicly available at http://www.dom.com/about/elec-transmission/pdf/Facility_Connection_Requirements.pdf .

For the U4-026 evaluation, two different assessments were conducted:

a. The first being when local generation including the proposed U4-026 facility is operated at their maximum capability. This assessment considered the U4-026 generation capacity, the generation capacity and energy, and the generation capacity with the generation capacity for the higher order U-queue generators.

   The results of this study indicated that the proposed U4-026 generation did not adversely impact Dominion's Transmission System.

b. The second being the stressed system conditions where the proposed U4-026 generation capacity is injected with 4 units at Bath County Pumped Storage Station operating as pumps.

   The results of this study indicated that the proposed U4-026 generation did not adversely impact Dominion's Transmission System.

Interconnection Requirements

The following provides the estimated cost and schedule for the Non-Direct and Direct Connection Network Upgrades and the Attachment Facilities:

Non – Direct Connection Network Upgrades

New System Reinforcements

(Upgrades required to mitigate reliability criteria violations, i.e. "Network Impacts", initially caused by the addition of this project generation)

None.

Contribution to Previously Identified System Reinforcements

(Overloads initially caused by prior Queue positions with additional contribution to overloading by this project. This project may have a % allocation cost responsibility which will be calculated and reported for the Impact Study)

None.

Direct Connection Network Upgrades

Consistent with Dominion Facility Connection Requirements the proposed facility will need to interconnect with the Lexington to Lowmoor 230kV Transmission Line #2084 as shown below in Figure 1.

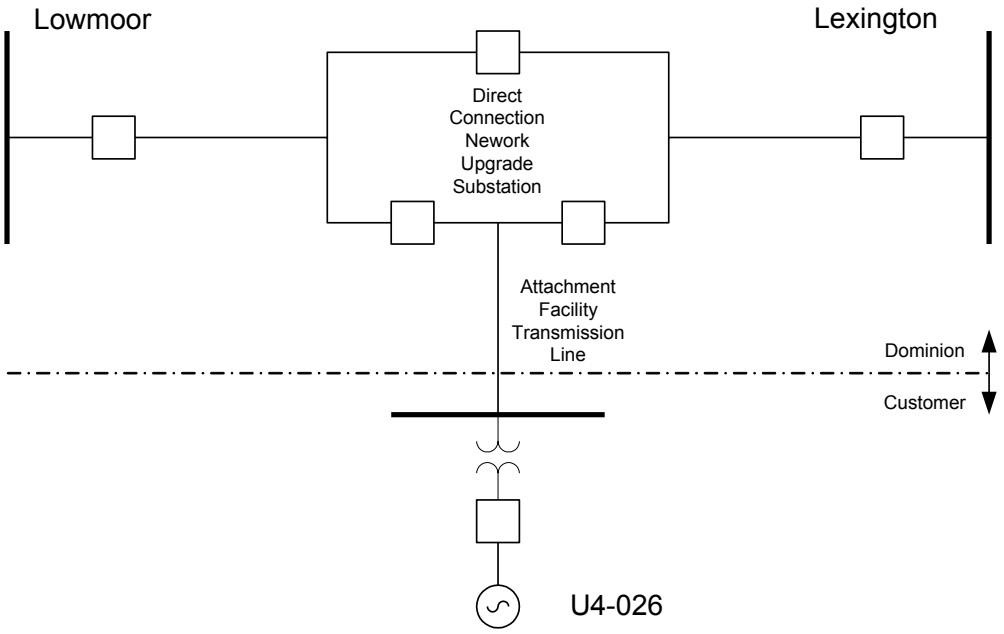

Figure 1: Line Tap – Generation (<500MW) Adjacent to Transmission Line.

The Direct Connection Network Upgrades include the creation of a three breaker ring bus substation. The costs are estimated to be $3,000,000 dollars (2009 dollars) for the proposed 230 kV substation. This cost includes the three 230kV circuit breakers and associated substation equipment. This work will take an estimated time of 24 to 30 months to engineer and construct.

Attachment Facilities

The Attachment Facilities costs are estimated to be $500,000 dollars (2009 dollars). This cost includes the metering, relays and 230 kV line work to directly connect the proposed facility with the proposed 230 kV substation (refer to Figure 1). This work will take an estimated time of 24 to 30 months to engineer and construct.

The interconnection arrangement shown in Figure 1 assumes the proposed U4-026 facility is adjacent to the Lexington to Lowmoor 230kV transmission line. Should the facility be located in remote location (> 1 mile) an additional customer owned 230kV interconnect breaker would be required at the generating facility.

