PJM Generator Interconnection
W1-029 Winfall 230 kV
39 MW Capacity / 300 MW Energy
Feasibility Study Report

July 2010
DMS #600029v1

Introduction

This Feasibility Study has been prepared in accordance with the PJM Open Access Transmission Tariff, §36.2, as well as the Feasibility Study Agreement between Interconnection Customer (IC), and PJM Interconnection, LLC (PJM), Transmission Provider (TP). The Interconnected Transmission Owner (ITO) is Virginia Electric and Power Company.

Preface

The intent of this Feasibility Study is to determine a plan, with preliminary cost and construction time estimates, to connect the subject generation interconnection project to the PJM network at a location specified by IC. As a requirement for interconnection, IC 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 and the underlying system. All facilities required for interconnection of a generation interconnection project must be designed to meet ITO technical specifications.

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. IC is responsible for its right of way, real estate, and construction permit issues.

General

Queue W1-029 is an IC 39 MW Capacity resource interconnection consisting of a 300 MW wind farm. W1-029 generation will be located near Winfall, North Carolina. Output from the generation will be connected to the 230 kV line between Suffolk and Winfall substations.

Potential PJM Network Impacts

Queue project W1-029 was studied as a 300 MW (39 MW of which was Capacity) injection into ITO's system Winfall 230kV substation. Project W1-029 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)

None.

Short Circuit

No problems identified.

System Stability Analysis

Dynamic studies are part of the System Impact Study.

Potential Congestion due to Local Energy Deliverability

PJM also studied the delivery of the energy portion of the surrounding generation. Any potential 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 Transmission Interconnection request. As a result of the aggregate energy resources in the area, the following violations were identified.

The 6FREDBRG-6CRANES 230 kV line (from bus 314137 to bus 314134 ckt 1) loads from 109.73% to 110.15% (DC power flow) of its emergency rating (637 MVA) for the single line

[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.

contingency ('LN 568'). This project contributes approximately 16.63 MW to cause the thermal violation[2].

ITO Requirements

ITO assessed the impact of the proposed 39 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 230 kV bus at ITO's Winfall 230 kV substation. 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 analysis is load flow study results under single contingency (both normal and stressed system conditions) and import/export system conditions. ITO criteria considers 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.

As part of its generation impact analysis ITO routinely evaluates the impact that a proposed new generation resource will have under maximum generation conditions and stressed system conditions. For the W1-029 evaluation three different assessments were conducted.

The first being when local generation including the proposed W1-029 Facility is operated at their maximum capability. The result of this study is shown below.

No problems indentified.

The second being a stressed system condition where the largest generator in the area is unavailable. With the W1-029 generator geographically located in Eastern North Carolina, Surry Unit #2 is considered the most critical generating unit in the area. The impact of W1-029 was studied with the outage of Surry Unit #2. The result of this study is shown below.

No problems indentified.

[2] ITO performed this study using AC power flow analysis and no problems were identified.

The third being import and export conditions into and out of the ITO system. Any new facility that is interconnected with the ITO system should not significantly decrement First Contingency Incremental Transfer Capability between utilities. The results of these studies can be found in Tables 1 and 2.

Table 1: Import Study Results

Import Study Results			
Area	**Summer 2014**	**Summer 2014 with W1-029**	**Limiting Element**
AEP	2000+	2000+	None
APS	2000+	2000+	None
CPL	2000+	2000+	None
PJM	2000+	2000+	None

Table 2: Export Study Results

Export Study Results			
Area	**Summer 2014**	**Summer 2014 with W1-029**	**Limiting Element**
AEP	2000+	2000+	None
APS	2000+	2000+	None
CPL	2000+	2000+	None
PJM	2000+	2000+	None

ITO planning criteria indicates a need to have approximately 2000 MW of import and export capability. The results of these import and export studies are 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. The interconnection arrangement shown assumes the proposed W1-029 facility is adjacent to the Suffolk to Winfall 230kV transmission line. The Attachment Facilities costs are estimated to be $500,000 (2010 dollars). This cost includes metering, protection equipment and 230kV line work to directly connect the proposed facility with the proposed 230kV switching station. This work will take an estimated time of 24 to 30 months to engineer and construct.

Direct Connection Network Upgrades Required

To reliably interconnect the proposed generation with the ITO transmission system it will be necessary to create a three breaker 230kV ring bus at the IC site. At this new 230kV switching substation, three 230kV breakers and associated equipment will be installed. The estimated cost of this work is $3.0 million dollars (2010 dollars) and is estimated to take 24 to 30 months to engineer and construct.

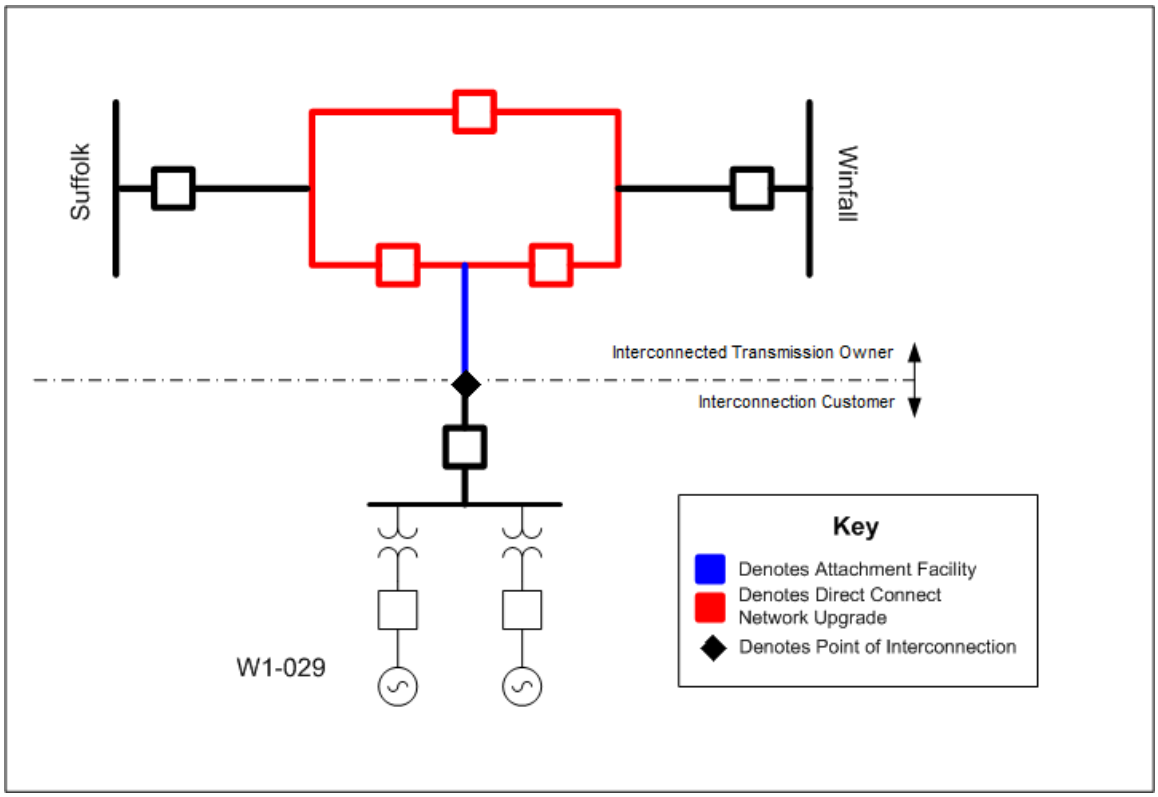

Figure A: W1-029 Layout

Non-Direct Connection Network Upgrades

As a result of the addition of the new three breaker substation, ITO will modify the remote relay protection system at Suffolk and Winfall. The costs are estimated at $400,000 and will be coordinated with the completion of the new substation.