# PJM Generator Interconnection
# ***U2-068 Mt. Storm-Valley 500-kV***
# ***130 MW Energy / 16.3 MW Capacity***
# Feasibility Study

October 2008
DMS #508082v1

## 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).

## Preface

The intent of the 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 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 an 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.

## General

PJM queue project U2-068 was studied as 130 MW Energy and 16.9 MW Capacity injections into the Dominion Virginia Power system. U2-068 was evaluated for compliance with reliability criteria for summer peak conditions in 2012. The primary interconnection point [Option 1] that was evaluated was tapping the existing 500-kV line (Line #550 (Mt Storm – Valley)) which crosses the proposed site. An alternative interconnection [Option 2] was evaluated for injecting the proposed generation capacity into the Timberville Substation, which is located on 115-kV Line #128 (Endless Caverns – Edinburg). An evaluation was also done to determine if any constraints existed that would limit the energy output of the proposed plant.

## Option 1

Potential network impacts of Option 1 (shown in Figure 1) 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, Line with Failed Breaker and Bus Fault contingencies for the full energy output)*

None.

## Short Circuit

(Summary form of Cost allocation for breakers will be inserted here if any)

No over duty breakers were 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.

## 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)*
*(Summary form of Cost allocation for transmission lines and transformers will be inserted here if any)*

None.

## Delivery of Energy Portion of Interconnection Request

*(PJM also studied the delivery of the energy portion of this interconnection request with all earlier queues at their energy output and the system at peak load with all transmission facilities in service. Any problems identified below may result in operational restrictions to the project under study or other PJM generation. There may also be other conditions causing congestion which were not studied. The developer can proceed with network upgrades to eliminate the potential congestion at their discretion by submitting a Merchant Transmission Interconnection request now or in the future. These are not required reliability upgrades.)*

As a result of the aggregate energy resources in the area, the following thermal overloads were identified: The results of these load flow studies for the primary interconnection point are indicating no system deficiencies for the energy or capacity portion of the proposed request.

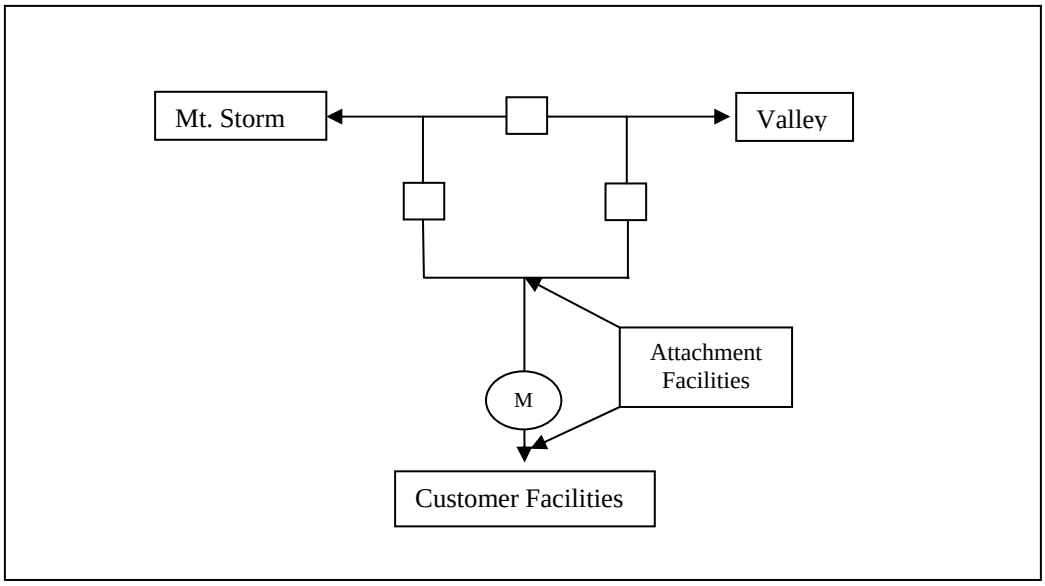
## Dominion Analysis

Dominion assessed the impact on the Dominion Transmission System that the proposed 16.9 MW capacity injection of new generation capacity associated with U2-068 which will be located in Rockingham County, Va. along Cow Knob Road. The system was assessed using the Summer 2012 RTEP case provided to Dominion by PJM for the analysis. This analysis did include the impacts that higher order queue generators may have on the study results. When performing a generation analysis, Dominion main analysis will be load flow study results under single contingency (with local generation dispatched to $P_{(MAX)}$). The primary interconnection point [Option 1] that was evaluated was tapping the existing 500-kV line (Line #550 (Mt Storm – Valley)) which crosses the proposed site. An

alternative interconnection [Option 2] was evaluated for injecting the proposed generation capacity into the Timberville Substation, which is located on 115-kV Line #128 (Endless Caverns – Edinburg).

Dominion concurs with PJM's assessment of the delivery of energy portion with this option.

**Figure 1: Proposed Option 1 Interconnection Arrangement**




**Attachment Facilities**

Attachment Facilities include one mile of 500-kV line, metering equipment and other associated facilities with an estimated cost of $2 million dollars.

**Direct Connection Network Upgrades**

This project will require three 500-kV breakers and associated equipment with an estimated cost $4 million dollars. The duration of the Attachment and Direct Connection work will be 24-36 months depending on permitting.

## Option 2

Potential network impacts for Option 2 (shown in Figure 2) 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, Line with Failed Breaker and Bus Fault contingencies for the full energy output)*

None.

**Short Circuit**
(Summary form of Cost allocation for breakers will be inserted here if any)
No over duty breakers were 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.

**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)*
*(Summary form of Cost allocation for transmission lines and transformers will be inserted here if any)*
None.

**Delivery of Energy Portion of Interconnection Request**
*(PJM also studied the delivery of the energy portion of this interconnection request with all earlier queues at their energy output and the system at peak load with all transmission facilities in service. Any problems identified below may result in operational restrictions to the project under study or other PJM generation. There may also be other conditions causing congestion which were not studied. The developer can proceed with network upgrades to eliminate the potential congestion at their discretion by submitting a Merchant Transmission Interconnection request now or in the future. These are not required reliability upgrades.)*
As a result of the aggregate energy resources in the area, the following thermal overloads were identified:

1. **(VAP/VAP)** The 3TIMBERV-3L128 115-kV line's emergency rating is 79MVA. This project's energy portion will exceed the line emergency rating by approximately 60 MW (assuming some VAR loading on the line).

2. **(VAP/VAP)** The 6BREMO-6POWHATN 230-kV line loads from 126.8% to 127.9% (DC power flow) of its emergency rating (637MVA) for the single line contingency outage (LN 553). This project contributes approximately 6.8MW to the congestion.

3. **(VAP/VAP)** The 6POWHATN-6MDLTHAN 230-kV line loads from 119.1% to 120.2% (DC power flow) of its emergency rating (637MVA) for the single line contingency outage (LN 553). This project contributes approximately 6.8MW to the congestion.

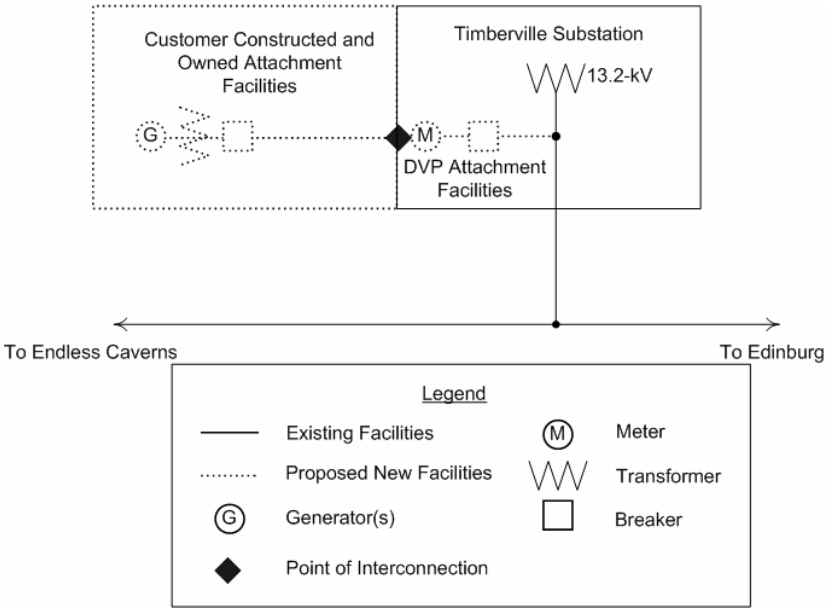
**Short Circuit**
No over duty breakers were identified.

**Dominion Analysis**
Dominion assessed the impact on the Dominion Transmission System that the proposed 16.9 MW capacity injection of new generation capacity associated with U2-068 which will be located in Rockingham County, Va. along Cow Knob

Road. The system was assessed using the Summer 2012 RTEP case provided to Dominion by PJM for the analysis. This analysis did include the impacts that higher order queue generators may have on the study results. The alternative interconnection was evaluated for injecting the proposed generation capacity into the Timberville Substation, which is located on 115-kV Line #128 (Endless Caverns – Edinburg).

The results of these load flow studies for the alternate interconnection points are indicating no system deficiencies for the Capacity portion of the proposed request. For the alternate interconnection point the energy output of the plant will have to be limited to 70 MVA, in alignment with PJM analysis, unless the developer wishes to upgrade transmission facilities. (70 MVA versus 79 MVA to allow for VAR loading).

**Figure 2: Proposed Option 2 Interconnection Arrangement**




## Attachment Facilities

The Attachment Facilities include one 115-kV breaker, metering and associated equipment with an estimated cost of approximately $1 million dollars with duration of 18 to 24 months to procure and install. The developer will construct the attachment facilities between the generator and Timberville Substation.