Generation Interconnection Combined Feasibility/System Impact Study Report

For

PJM Generation Interconnection Request Queue Position V3-047

Sutton Dam 69kV

January 2010

Preface

The intent of the Combined Feasibility/System Impact Study is to determine a plan, with approximate 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 or Local Upgrades, which are facility additions, or upgrades to existing facilities, that are needed to maintain the reliability of the PJM or Interconnected Transmission Owner system. All facilities required for interconnection of a generation interconnection project must be designed to meet the technical specifications (on PJM web site) for the appropriate Interconnected 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 System Impact Study is performed.

The Combined Feasibility/System Impact 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. The project developer must secure and convey any property or rights-of-way necessary for the Transmission Owner to construct, operate, and maintain their facilities. This conveyance must be in the form of either a deed or a permanent easement.

General

Brookfield Renewable Power, Inc., the Interconnection Customer (IC), has proposed a 9.9 MW (9.9 MW capacity) hydro powered generating facility to be located at the Sutton Dam in Sutton, Braxton County, West Virginia. The project will consist of three (3) hydro turbine generators. V3-047 was studied as a 9.9 MW (9.9 MW of which was capacity) injection into the Allegheny Power System at the Sutton Hill 138kV substation. The project was studied on a combined feasibility-impact basis which utilizes an AC analysis, and incorporates all contingency types. Project V3-047 was evaluated for compliance with reliability criteria for summer peak conditions in 2014. The current in-service date for the project is December 21, 2010.

Point of Interconnection

V3-047 will interconnect with the Allegheny Power (AP) at the Sutton Hill 138/69kV substation (see Attachment 1).

Direct Connection Requirements

Transmission Owner Scope of Direct Connection Work

The Transmission Owner's (AP) scope of work includes:

Attachment Facilities

Sutton Hill Substation

- Expand the existing yard and fence for an additional area of approximately 20' x 80'. Install ground grid, structures, foundations, and yard stone. Relocate the access road. Install one (1) 69kV initial bay, one (1) 69kV transformer breaker, one (1) 69kV line breaker, twelve (12) 69kV disconnect switches, one (1) 69kV vertical break switch, 69kV metering, fuses, arresters, line trap, and CVT. Install control cables, panels, 138kV and 69kV transfer trip, and associated equipment. Install a new 16' x 20' metal control building for new panels. Assume connection to the Interconnection Customer (IC) is by overhead 69kV line.

  The estimated cost to perform this work is **$1,026,533** in 2013 dollars. (PJM Network Upgrade Number n1814)

Network Upgrades

- Install 69kV Power Line Carrier transfer trip facilities at Buckhannon substation.

  The estimated cost to perform this work is **$114,015** in 2013 dollars. (PJM Network Upgrade Number n1815)

- Install 69kV Power Line Carrier transfer trip facilities at Crooked Fork substation.

  The estimated cost to perform this work is **$112,848** in 2013 dollars. (PJM Network Upgrade Number n1816)

- Install 138kV Power Line Carrier transfer trip facilities at French Creek substation.

  The estimated cost to perform this work is **$50,332** in 2013 dollars. (PJM Network Upgrade Number n1817)

- Install 138kV Power Line Carrier transfer trip facilities at Sutton substation.

  The estimated cost to perform this work is **$50,332** in 2013 dollars. (PJM Network Upgrade Number n1818)

- Install 138kV Power Line Carrier transfer trip facilities at Powell Mountain substation.

  The estimated cost to perform this work is **$50,332** in 2013 dollars. (PJM Network Upgrade Number n1819)

Allegheny Power reserves the right to review the electrical protection design and relay settings for the Interconnecting Customer facilities to ensure that the protective relaying equipment will be compatible with that installed at the new switching station. The relaying package will likely include both primary and backup protection. Allegheny Power personnel must be present at the time of commissioning to witness proper function of the protection scheme and related coordination. The estimated cost to perform this engineering review and field test effort is **$5,000 in 2013 dollars**.

Note: The purchase and installation of protective relaying and associated equipment at the generation site is the responsibility of the interconnecting customer and is not included in this scope of work.

Interconnection Customer Scope of Direct Connection Work

The Interconnection Customer will interconnect V3-047 with the APS system by constructing a customer owned 69kV circuit from their generating site to the Sutton Hill substation (approximately 1 mile). The above cost estimates do not include construction of that line or bus work. Route selection, line design, right-of-way acquisition and construction of such lines will be entirely the responsibility of the Interconnection Customer. It's assumed that the Interconnection Customer's step up transformer will conform to the AP standard with delta on the low side and grounded wye on the high side as illustrated in the AP Facility Connection Manual:

http://www.alleghenypower.com/Bus2Bus/Gen%20Trans%20AP%20Facility%20Connection%20Requirements.pdf

It is assumed that a fiber optic interface will be used for the protection channel between the AP and IC's station. The IC will be required to install metering and telemetry equipment to provide revenue metering and real-time telemetry data to PJM. The requirements for this equipment are listed in Appendix 2, Section 8 of Attachment O to the PJM Tariff, as well as PJM Manuals 01 and 14D. Protective relaying and metering design and installation must comply with the Allegheny Power Applicable Standards.

Cost and Timing Summary

While the information in this transmittal is reasonable for the scope of work defined, it should be noted however, that the cost figures are conceptual in nature at this stage, and that an engineering team has not yet been assigned to the project. Any change to the scope of work will require that the estimates be revisited. The costs are a best estimate, but the developer will be charged for actual costs. Any under-runs or over-runs will be reconciled at the conclusion of the project. The cost estimates in this report **do not** include tax gross-up.

The estimated time to provide for the interconnection of this project is **18 months** after the receipt of a fully executed Interconnection Service Agreement and Interconnection Construction Service Agreement.

Network Impacts

Potential network impacts are 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

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.

New System Reinforcements

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

None

Contribution to Previously Identified System Reinforcements

(Overloads initially caused by prior Queue positions with additional contribution to overloading by this project.

None

Stability Analysis

Not required.

Other Supporting Facility Charge

The Other Supporting Facilities Charge may include non-transmission facilities directly assigned and/or a general (rolled-in) facilities charge. The guidelines apply to all wholesale customers and to all generators selling into or through the PJM Market, regardless of capacity, not connected directly to the AP Transmission System.

The Other Supporting Facilities Charge for the V3-047 generator interconnection project has been estimated to be **$5,940/month** in 2010 dollars. The estimate is based on an average (or rolled-in) rate for Monongahela Power's sub-transmission system at a total generating capability of 9.9 MW.

Attachment 1

PJM Queue V3-047

Brookfield Renewable Power Inc.

9.9 MW will be connected to the 69 kV bus (as shown)

Direct Attachment Facilities – Sutton Hill

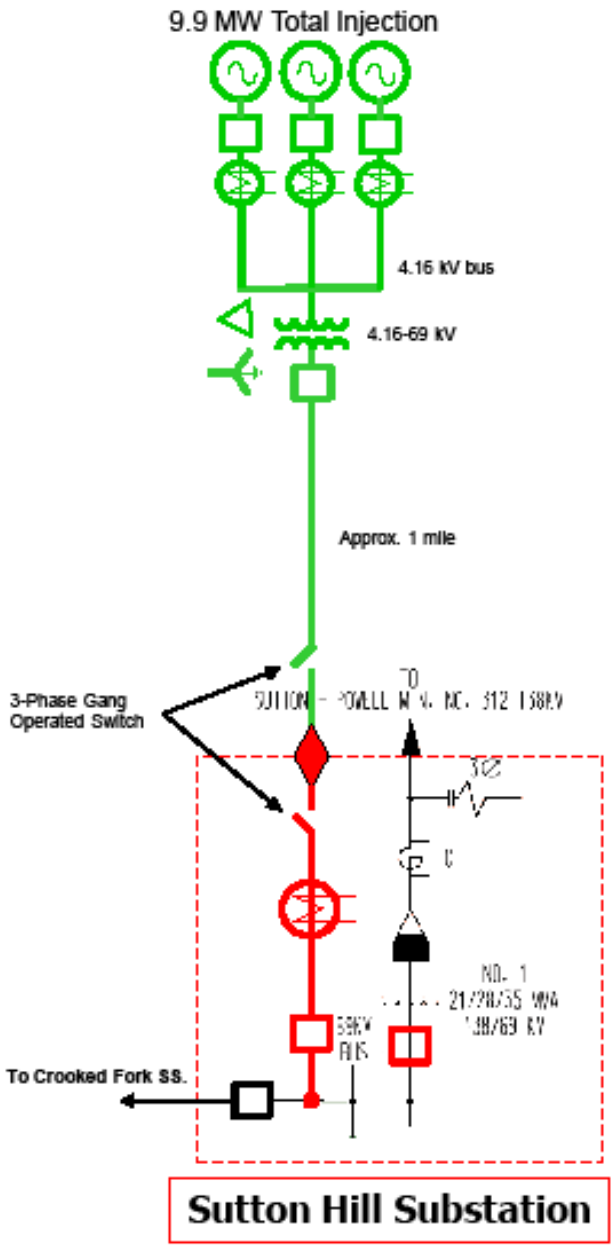
Expand the existing yard and fence for an additional area of approximately 20' x 80' and relocate the access road. Install 1-69kV line breaker, 69kV metering, and associated facilities. Install 1-69kV transformer breaker and 69kV bus differential relaying. Install a new 16' x 20' metal control building for new panels.

Network Upgrades

Install a 69kV and 138kV transfer trip scheme with logic such that the V3-047 GIP shall be taken offline for the loss of both the 138kV system and the 69kV system.

69kV Transfer Trip: Install transfer trip equipment and line traps in Buckhannon, Crooked Fork, and Sutton Hill substations.

138kV Transfer Trip: Install transfer trip equipment in French Creek, Sutton, Sutton Hill, and Powell Mountain substations.



AP

Brookfield Renewable Power Inc.

Existing Equipments

POINT OF INTERCONNECTION

SOURCE	Allegheny Power PLAN	DRAWN 01/18/2010 R. Boyd	PLAN NUMBER
CAD FILE V3-047.ppt	SUTTON HILL SS. PROVIDE INTERCONNECTION FACILITIES FOR BROOKFIELD RENEWABLE POWER INC. GASSAWAY SERVICE CENTERS	CHKD	
REVIEWED		SCALE NS	
APPROVED DATE		FUNDING PROJECT	REV SNS