PJM Generator Interconnection Request
Queue #J6
Bear Creek 69 kV
Feasibility/Impact Study Report

March 2003
DMS# 197709 v2

Bear Creek 69 kV Feasibility Study

General

Global Winds Harvest Inc. has resubmitted its proposal for a wind generation project (queue position J6). This time the project is to be 34 MW. The project was previously submitted as 15.9 MW at queue position E6 and expanded by 10 MW to 25.9 MW with a subsequent request at queue position H23. The turbines are to be installed in Bear Creek Township, Luzerne County, Pennsylvania. The proposed service date for the additional generation is prior to December 31, 2003.

The intent of the feasibility study is to determine ballpark cost and construction time estimates of system reinforcements required to facilitate the addition of the new generating plant to the PJM system. The reinforcements include the direct connection of the generator to the system and any network upgrades necessary to maintain the reliability of the PJM system.

Since this project has had a Facilities Study completed and posted for queue position E6 and subsequent evaluation has not shown any required modification in the direct connection, the costs described below can be taken as having Facilities Study level accuracy.

Direct Connection

The direct connection facilities described below for project J6 are of sufficient capability to permit connection of 34 mw of "energy only" generation.

Transmission Portion: Construct a short two span tap from the Bear Creek 69kv Tap at structure 54138N39394 to Global Wind Harvest's (GWH) dead-end structure. Install one new structure at grid 54149N39403. The work includes line route siting and securing of the necessary right-of-way along the proposed line route.

Substation Portion: At PPL EU's Jenkins 230/69kv substation, install Direct Transfer Trip (DTT) protective equipment and make the necessary modifications to the Harwood #1 (formerly Plymouth) and River #1 control circuits to allow for the connection of Global Wind Harvest Generation. In addition, modify the reclosing circuits at five distribution stations (four PPL EU owned, one Customer Owned) due to the potential for self-excitation by the GWH generation.

Scope of PPL Electric Utilities Corp. Work

- **Direct Connection Work – Transmission:** This work includes siting, R/W acquisition, design/construction of a two span 69kV tap from the PPL Bear Creek Tap to the GWH dead-end structure. Since the two span 69kv tap can not accommodate a disconnect switch, GWH is expected to install a load sectionalizing air break switch on their dead-end structure that is capable of de-energizing their transformer. Specifically, from pole 54138N39394, install a 109 foot span of 3-556.5 ACSR phase conductors and 3/8 inch high strength steel overhead ground wire to new steel structure 54149N39403. From this new steel pole, install a 56 foot span of 3-556.5 ACSR phase conductors and 3/8 inch high strength steel overhead ground wire to Global Wind Harvest's dead end structure**.**

- Cost Estimate: **$130,000**

The estimated total costs, including applicable PA sales tax, are **$ 131,000.**

- **Direct Connection Work – Substation:** This work includes installation of radio based communication equipment to provide Direct Transfer Trip protection and installation of synchrocheck facilities at the Jenkins 69kV station and 5 distribution stations connected to this circuit. Specifically, the following changes will be required:

    1. Provide Direct Transfer Trip (DTT) facilities between GWH and PPL EU's Jenkins substation utilizing Freewave Radio Communication equipment. This equipment will provide the primary trip from PPL EU to GWH, and a blocking signal for PPL reclosing should GWH not isolate from the PPL EU system. It is assumed that the GWH interconnection substation will be located at LAT 41 degrees, 13 minutes, 52.14 seconds North by LONG 75 degrees, 48 minutes, 52.15 seconds West. Since the Freewave system is a "line of site" application, **GWH must confirm the exact latitude and longitude with elevation to ensure this communication system will function as intended.** Any change to the location of the IPP interconnection facility will require PPL to re-evaluate this alternative. PPL EU has elected to utilize a radio system since the traditional phone circuit communication channel may not be available from the local Telephone Company.
    2. Modify the controls of the two 69 kV lines out of Jenkins 230/69 kV substation, Harwood #1 (formerly Plymouth -normal source) and River #1 (alternate source) 69 kV breakers to include line voltage check, and synchronization check functions.
    3. Provisions will be made to transfer the DTT initiate signals between the Harwood #1 (formerly Plymouth) and River #1 breakers depending upon which line is serving GWH.
    4. Modify the control schemes at the Georgetown, River, East Mountain, Wright and the customer owned Fairchild distribution stations that interconnect the Harwood #1 (formally Plymouth) or River #1 circuits to

the remainder of the PPL EU system by installing synchronism check relays and interlocks on the 12kv transformer breakers.

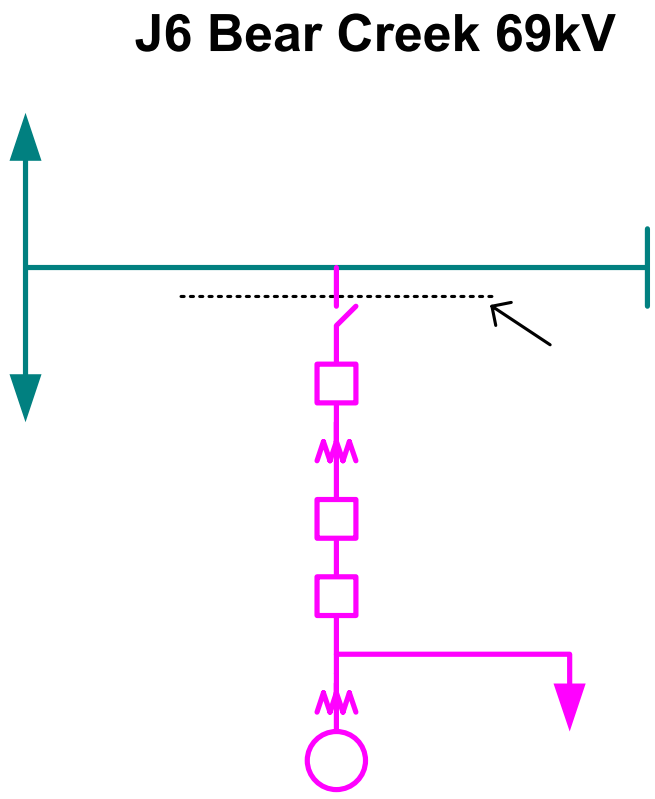
- Cost Estimate – **$437,000**

The estimated total cost, including applicable PA sales tax, is **$445,000** for the substation portion of work.

The total cost for the direct connection of this IPP, including PA sales tax, is estimated to be **$ 576,000.** The above estimate does not include PPL federal CIAC taxes. Based on this particular project's IRS qualifications, if at a future date PPL federal CIAC taxes are deemed necessary by the IRS, PJM/PPL shall be reimbursed by the IPP for such taxes deemed necessary by the IRS.

It is estimated the construction will be complete 1 year after execution of the Interconnection Service Agreement.

Figure #1



Regulation requirements of the generation project:

In order to eliminate expected voltage deviation due to the operation of the generation, the IPP would need to operate at approximately a 97.4% power factor under all MW output levels.

At 34MW the generation project is required to absorb 8MVAR from the transmission system to maintain acceptable voltage levels. This 8MVAR / 34MW ratio (97.4% power factor) shall be automatically maintained by the Interconnection Customer over the full range of wind turbine MW output at the 69kv point of attachment with the Interconnected Transmission Owner. The necessary power factor compensation and automatic control equipment shall be installed by the Interconnection Customer to maintain the specified power factor.

If there is a significant amount of 69kv or lower voltage underground cable installed by the Interconnection Customer, self-excitation of the generators may be a concern. This could lead to additional Transmission Owner interface protection relay requirements and/or installation of circuit breakers rated twice the nominal line voltage. Due to such cable installation, additional power factor compensation and control equipment may be needed to be installed by the Interconnection Customer to maintain the specified power factor over the full range of wind turbine MW operation.

Network Impacts

The Bear Creek **#J6 project was studied as 34 MW Energy** injection at Bear Creek 69 kV substation. Project # J6 was evaluated for compliance with reliability criteria for summer peak conditions in 2006. Potential network impacts were as follows:

Generator Deliverability

Not required.

Multiple Facility Contingency – Tower Line Outages (MAAC Criteria IIC)

No identified problems.

Short Circuit

No identified problems.

New System Reinforcements

None

Contribution to Previously Identified System Reinforcements

None.