

Allegheny Power Interconnection Feasibility Study

McConnellsburg - 285 MW Generation Project

Fulton County, Pennsylvania

Queue #71
July 2002

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1. Introduction and Background

The developer has requested Allegheny Power (AP) to perform a Feasibility Study to determine the interconnection facilities and local system reinforcements required to interconnect 285 MW at the developer's McConnellsburg site (on the Guilford-McConnellsburg 138 kV line). The developer plans to have the generators in service and producing power by June 2003.

It should be noted that although this analysis examined the AP Transmission system and the required reinforcements assuming a 285 MW injection into the AP transmission system, this study does not guarantee that Transmission Transfer Capability to all possible destinations will exist when the developer's generation is placed in service.

2. Description of Project

The location for the developer's proposed generating plant is Fulton County, Pennsylvania near the city of McConnellsburg. The generating plant will consist of 285 MW

AP will construct a 138 kV switching station in a ring-bus configuration with three 138 kV breakers, a 138 kV meter and other necessary facilities to provide an interconnection point. Other system reinforcements identified during this study that will be necessary prior to interconnection are as follows:

Reconductor 138 kV Lines:

- Guilford – McConnellsburg NUG 138 kV
- Ringgold – Catocin 138 kV
- Bedington – Shepherdstown 138 kV

Replace 138 kV Breakers:

- Reid SS: RI-2 and RGU
- Ringgold SS: RWA1, #4 Transformer, RCMO, RCM1, Bus Tie, and #3 Transformer.

It should be noted that stability or transient analysis studies are not a part of the Feasibility Study process, and no studies of this type have been performed. No corrective actions to problems that may be identified in such studies, or resulting financial obligations, have been identified at this time.

3. Summary of Costs

The total estimated cost to install all of the facilities described individually below is **\$8,680,000 in 2003 dollars**.

Scope of work and estimated cost by project segment are listed as follows:

- The estimated cost to acquire a site and construct a three-breaker, three-line, 138kV breaker and a half switching station is **\$1,450,000 (in 2003 dollars)**.
- The estimated cost to acquire necessary right of way and construct new facilities required to loop the McConnellsburg-Guilford 138kV line into the proposed switching station is **\$130,000 (in 2003 dollars)**.
- The estimated total cost to upgrade the Bedington-Shepherdstown 138 kV line (2.15 miles) and the Catoctin-Ringgold 138 kV line (9.57 miles) to accommodate 954 kcmil ACSR conductor is **\$2,700,000 (in 2003 dollars)**.
- The estimated cost to rebuild the McConnellsburg – Guilford 138 kV line (17.0 miles) with 1272 kcmil ACSR conductor is **\$3,100,000 (in 2003 dollars)**.
- The estimated cost to replace the RI-2 and RGU 138kV circuit breakers at Reid and the RWA1, RCMO, RCM1, 138kV bus tie, # 3 transformer and #4 transformer circuit breakers at Ringgold is **\$1,250,000 (in 2003 dollars)**.
- While AP cannot mandate that our personnel install protective relaying and communications equipment at the generator site, AP is responsible for designing the protection scheme and providing specifications for all relays. The relaying package will include both primary and backup protection with primary relays utilizing a fiber optic channel. The total cost of engineering and testing is approximately **\$40,000 (in 2003 dollars)**.
Note: Purchase and installation of protective relaying and associated equipment at the generation site is not included in this scope of work. This phase of work is the responsibility of the customer.
- The proposed new generation will require that protective relaying coordination in the area be reviewed and changes will likely be required at one or more area substations. The estimated total cost for Controls Engineering staff to complete the coordination review, develop new settings and implement the necessary changes is approximately **\$10,000 (in 2003 dollars)**.

These figures **do not** include construction of the 138kV line required to interconnect the customer's proposed new generating facilities with the AP system grid at the proposed new switching station.

Also, the proposed 6/2003 in-service date is a concern. Lead-time for delivery of 138kV breakers is now running around 48 weeks from order. Obtaining the required breakers in time to meet the 6/2003 in-service date could be a problem. Further, our typical lead time for complete design and construction of a transmission switching station and short line (two spans or less) is 18-24 months from authorization to proceed, if the interconnection customer is providing a graded site; securing all necessary permits and approvals and taking responsibility for all environmental assessment activities and 24 to 30 months if AP is required to secure the property and permits. Of course, "typical lead times" can vary based on workload and equipment lead times.

Requests by generation interconnection customers with more ambitious schedules (such as this one) will be treated as accelerated schedule projects and subject to premium services cost adders. Our E&C management team is always willing to sit down with any potential interconnection customer to discuss the possibilities.

4. Assumptions

All studies that look into the future require assumptions concerning the load, facility additions and transmission sales within and external to the AP system. This analysis is no exception.

The 2007 summer base case was selected to model the developer's McConnellsborg generation project.

As in all studies, some type of generation dispatch needs to be used. For the purposes of the base study, a single economic-type dispatch was used. Study results which appeared to be somewhat generation dispatch sensitive, had alternative dispatches considered.

AP facility additions were assumed to be those as planned in the present series of cases that followed the present AP Planning Guide. The Bulk Power facility additions modeled for other utilities used in this study are those that have been included in the MMG (Multi-regional Modeling Group) base case by the other utilities. Transmission sales modeled for the study year are those sales that are known at the time the base case was created and include only confirmed, firm transmission service reservations.

The generation output from the proposed generation at McConnellsborg was assumed to stay within the AP system.

5. Results - Summary

Two base cases were run for this study. They include a case with and a case without the developer's generation at McConnellsborg. Credible single and double contingency cases were simulated to evaluate the impact of the McConnellsborg generating facility on the AP system.

Results of the power flow studies indicate that the installation of 285 MW of generation at the McConnellsborg site cannot be accommodated without system reinforcements. System reinforcements identified during this study that will be necessary prior to interconnection to the AP transmission system include:

Reconductor 138 kV Lines:

- Guilford - McConnellsburg 138 kV 17 miles
- Ringgold - Catoctin 138 kV 9.57 miles
- Bedington - Shepherdstown 138 kV 2.15 miles

138 kV Breaker Replacement:

- Reid SS: RI-2 and RGU
- Ringgold SS: RWA1, #4 Transformer, RCMO, RCM1, Bus Tie, and #3 Transformer

Further discussion can be found in the *Study Methodology and Analysis* section of this report.

6. Study Methodology and Analysis

Methodology

The in-service date for the proposed generator installation is projected to be June 2003. Based on this date, a 2007 summer base model was selected with loads in the study area adjusted to represent 2007 summer conditions. A summer base case was chosen because line capacity in the summer months is more critical than that in winter. The assumptions previously stated in the section titled *Assumptions* regarding forecasted control area loads, maintenance schedules, confirmed Firm Point-to-Point Transmission reservations and generation dispatch were all used in the Feasibility Study.

Power flow cases were created and contingency tests were evaluated based upon the AP planning criteria reported in FERC Form 715, Part 4 which is available to the general public for a nominal fee. These criteria were applied to studies using the 2007 summer model to evaluate the effect the power output from the developer's McConnellsburg project might have on AP transmission facilities.

Analysis

Two base cases were run for this study. The first was run to evaluate the system as it currently is planned and is expected to perform, without the inclusion of any new generating plants. The second was run to evaluate the system with the inclusion of the developer's McConnellsburg generating plant.

7. Short Circuit Study Results

Results of the short circuit evaluations for the McConnellsburg generation are tabulated below.

The study focused on determining the maximum short circuit currents at McConnellsburg, Guilford, Reid, Ringgold, and Cherry Run Substations.

Shown below are the maximum three-phase and single line-to-ground fault currents at those stations most affected by the inclusion of the developer's McConnellsburg generation.

Bus Faults

Fault Location	McConnellsburg In-Service				McConnellsburg Not In-Service			
	Three Phase		Line to Ground		Three Phase		Line to Ground	
	<i>Symmetrical Fault</i>		<i>Fault</i>		<i>Symmetrical Fault</i>		<i>Fault</i>	
	Amps	Angle	Amps	Angle	Amps	Angle	Amps	Angle
Guilford 138 kV	14140	-83	11322	-82	11736	-83	9485	-82
Reid 138 kV	20090	-84	12852	-78	18829	-84	12258	-79
Ringgold 138 kV	22182	-84	15143	-79	21332	-84	14736	-80
Cherry Run 138 kV	8801	-83	5675	-78	7972	-83	5014	-78
McConnellsburg 138 kV	13045	-86	12941	-86	5886	-82	3782	-78
McConnellsburg NUG 138 kV	13517	-87	13916	-87	5918	-82	3811	-78

The existing circuit breakers at Cherry Run, Guilford, McConnellsburg, Reid, and Ringgold Substations were evaluated since they are impacted by the inclusion of the McConnellsburg generating plant. Two breakers at Reid Substation and six breakers at Ringgold Substation will need to be replaced since the increased fault current exceeds the maximum interrupting capacity of these breakers. No further investigations concerning symmetrical values or asymmetrical values were conducted. A more thorough analysis will be done as part of the System Impact Study.

Positive Sequence
R+iX

(0.00936 + j0.07008)

Zero Sequence
R+iX

(0.05120 + j0.18129)

These values are in per unit on a 100 MVA base.

8. Issues Beyond the Scope of this Study

The developer has not indicated how the power output from the generators will be sold. Since the developer could not commit to a direction or market for the power output from its McConnellsburg site, no tests were made modeling the power as though it were sold off system. The developer should also be aware that the tests performed with this analysis assumed that the new installations were control-area capacity resources. The developer, by not providing a direction or market, has assumed the risk that Transmission Transfer Capability may not be available when the project comes on line. Any firm transmission reservations made by other marketers or developers prior to an agreement with the developer would not only alter these study results, but could force limitations on the developer's generation output.

Additionally, the developer needs to be aware that in the event that there is congestion on the Eastern Interconnection, generation dispatch out of McConnellsburg at times might be restricted. In that case, PJM, as the operator of the AP transmission system, could invoke their congestion management system, or follow the North American Electric Reliability Council's (NERC) Transmission Line Loading Relief Procedure (TLR) and the guidelines set forth within that procedure. A copy of these procedures can be downloaded via the Internet from the PJM website at <http://www.pjm.com/>. Additionally, the developer may choose to implement the NERC Market Re-dispatch or the Lake Erie Emergency Re-dispatch (LEER) procedures. Involvement in either procedure is voluntary. More information on the NERC market re-dispatch procedure can be obtained from the NERC website at <http://www.nerc.com/>. Information on the LEER can be obtained from the FERC-filed LEER procedure.