Allegheny Power

Allegheny Power Interconnection Feasibility Study

for

Clipper Windpower

Kelso Gap - Connect 100 MW of WT Generation

Garrett County, Maryland

Queue #70

May 2002

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Appendices

1. Introduction and Background

Clipper Windpower (CW) has requested Allegheny Power (AP) to perform a Feasibility Study to determine the interconnection facilities and local system reinforcements required to connect 67-1.5 MW wind turbines, for a maximum total generating capability of 100 MW (summer) at their Kelso Gap site. CW plans to have the generators in service and producing power by July 1, 2003.

It should be noted that, although this analysis examined the AP transmission system and the required reinforcements assuming a 100 MW injection into the AP transmission system, this study does not guarantee that Transmission Transfer Capability to all possible destinations will exist when CW's generation is placed in service.

2. Description of Project

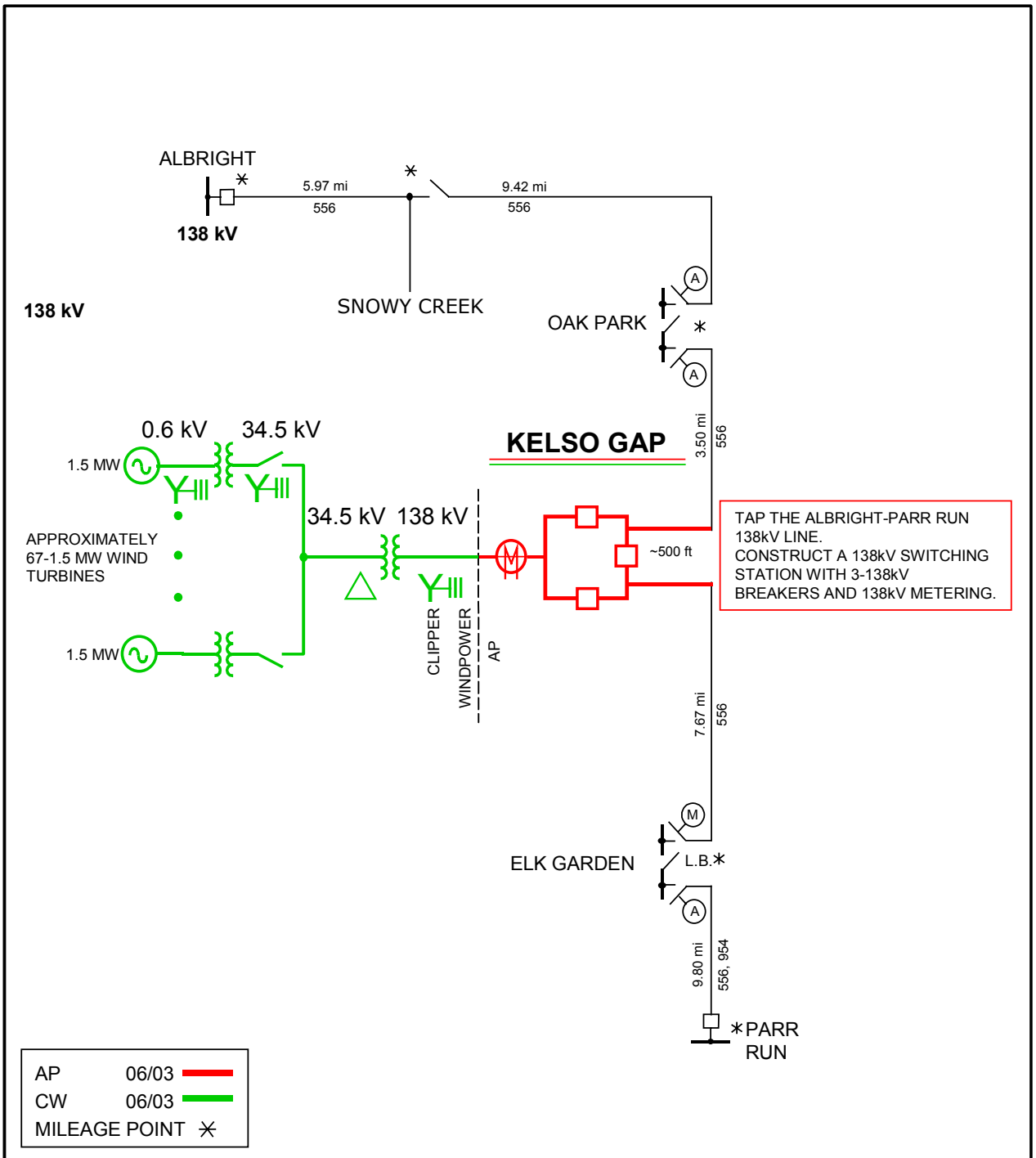
The location for CW's proposed generating facility is in Garrett County, Maryland approximately 3.5 miles east of AP's Oak Park Substation. The generating plant will consist of 67-1.5 MW wind turbine generators.

The customer will interconnect with AP at a new 3-breaker, 138kV ring bus switching station.

There were no system reinforcements identified during this study that will be necessary prior to connection to the AP transmission system.

See Figure 1 for a schematic depiction of the proposed interconnection facilities.

Figure 1



SOURCE: L. A. HOZEMPA	Allegheny Power PLAN	DRAWN: 22-APR-02 L. A. HOZEMPA	PLAN NUMBER
CAD FILE: KELSO GAP.PPT	KELSO GAP STATION CONSTRUCT 138 kV STATION TO INTERCONNECT WITH CLIPPER WINDPOWER NON UTILITY GENERATION OAKLAND SERVICE CENTER	CHKD	
REVIEWED		SCALE: NS	
APPROVED DATE		AUTHORIZATION	REV

3. Summary of Costs

The total estimated cost to install all of the facilities described individually below is **$1,490,000** in **2003** dollars. The scope of work and estimated cost by project segment are listed under the following bullets:

- The estimated cost to acquire a site, approximately 3.5 miles south of Oak Park Substation, near the Albright-Parr Run 138kV line and construct a three-breaker, three-line, 138kV breaker and a half switching station is **$1,330,000** in **2003** dollars. Major equipment at the new switching station would include, three dead-end structures, six 138kV air-break switches, three 138kV circuit breakers and facilities for 138kV interconnection metering. This station would include a control building to house all relaying, metering and communications equipment required to accommodate the electrical facilities.

- The estimated cost to acquire necessary rights-of-way and construct new facilities required to loop the Albright-Parr Run 138kV line into the proposed new switching station is **$120,000** in **2003** dollars.

- AP will design the protection scheme and provide specifications for all relays to be employed on the interconnection breaker terminal at the generation site to assure that the protective relaying equipment will be compatible with that installed on the interconnection breaker terminal at the new switching station. The relaying package will include both primary and backup protection with primary relays utilizing a fiber optic channel. AP will also have responsibility to test and calibrate all relays and perform all tests deemed necessary to make sure that protective relaying and the communication channel at the generator site are properly installed and functional. The estimated total cost of this engineering and testing effort will be approximately **$35,000** 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.)

- Addition of the proposed new generation will require that protective relaying coordination in the entire area be reviewed and changes will likely be required at one or more area substations. The estimated total cost for AP's Controls Engineering staff to complete the coordination review, develop new settings and for the field technicians to implement the necessary changes to be approximately **$5,000** 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 at the proposed new switching station. Route selection, line design, right of way acquisition and construction of this line will be entirely the responsibility of the customer.

The proposed June 2003 in-service date is a concern. Typical lead time for complete design and construction of a transmission switching station and short line (two spans or less) is 18-24 months, if the interconnection customer is providing a graded site; securing all necessary permits and approvals and taking responsibility for all environmental assessment activities. The time is expected to be between 24 to 30 months if AP is required to secure the property and permits.

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.

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.

A 2007 summer base case was selected to model CW's Kelso Gap generation project. The AP system load in the model was 8692 MW.

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 generators at CW's Kelso Gap site was assumed to stay within the AP system.

CW did not provide generator or GSU data for the proposed installation. The assumptions made for this study are aggregated in the appendices of this document.

5. Results - Summary

Results of the power flow studies indicate that the installation of 100 MW of generation at CW's Kelso Gap site can be accommodated without system reinforcements. The power factor at the interface will be limited to 99% lagging and 99% leading for this station.

Two base cases were run for this study. They include a case without the addition of any additional generation in the Kelso Gap area and a case with the addition of 100 MW at CW's Kelso Gap generating plant. Credible single and double contingency cases were simulated to evaluate the impact of the Kelso Gap generation on the AP system.

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 July 1, 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 CW's Kelso Gap 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 generation from CW's Kelso Gap generating plant.

7. Short Circuit Study Results

Results of the short circuit evaluations for CW's Kelso Gap generator site are tabulated below.

The study focused on determining the maximum short circuit currents at the Kelso Gap, Parr Run, Junction, and Albright Substations.

Shown below are the maximum three-phase and single line-to-ground fault currents at those stations most affected by the inclusion of CW's Kelso Gap generator.

Bus Faults

Fault Location	CW's Kelso Gap In-Service				CW's Kelso Gap Not In-Service			
	Three Phase		Line to Ground		Three Phase		Line to Ground	
	Symmetrical Fault		*Fault*		*Symmetrical Fault*		*Fault*	
	Amps	Angle	Amps	Angle	Amps	Angle	Amps	Angle
Kelso Gap 138kV	7824	-81	7410	-82	6484	-80	6558	-81
Parr Run 138kV	6213	-80	3984	-77	5801	-80	3866	-77
Junction 138kV	8308	-81	5620	-77	8091	-81	5553	-77
Albright 138kV	27250	-83	24746	-83	26552	-83	24359	-83
Kelso Gap 34.5kV	18214	-87	0	0	- - -	- - -	- - -	- - -

The existing circuit breakers at Parr Run, Junction, and Albright Substations were evaluated since they are impacted by the inclusion of CW's Kelso Gap generating plant. None of the breakers evaluated will need to be replaced since the increased fault current does not exceed 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.

The short circuit positive and zero sequence source equivalent impedance representing the AP system at the Kelso Gap 138 kV bus prior to the addition of CW's Kelso Gap generating units is:

Positive Sequence **R+jX**	Zero Sequence **R+jX**
(0.01171+j 0.06345)	(0.00775+j0.06203)

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

8. Issues Beyond the Scope of this Study

CW indicated that the power output from the generators might consist of long-term and short-term Point-to-Point transmission sales. Since CW could not commit to a direction or market for the power output from the Kelso Gap site, no tests were made modeling the power as though it were sold off the AP system. CW should also be aware that the tests performed with this analysis assumed that the new installations were control-area capacity resources. CW, 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 a CW agreement would not only alter these study results, but could force limitations on CW's generation output.

Additionally, CW needs to be aware that in the event that there is congestion on the Eastern Interconnection, generation dispatch out of Kelso Gap at times might be restricted. In that case, PJM will 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 this procedure can be downloaded via the Internet from the NERC website at http://www.nerc.com/. Additionally, CW may choose to implement the NERC Market Re-dispatch or the PJM Security Coordinator might implement the Lake Erie Emergency Re-dispatch (LEER) procedures that could request the units at Kelso Gap to participate. Involvement in either procedure is voluntary. PJM has incorporated these procedures in its OATT. 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.