GENERATOR INTERCONNECTION FACILITIES STUDY REPORT

CLPT-G1

PREPARED ON BEHALF OF
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TRANSMISSION PLANNING

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1 Executive Summary

The Interconnection Facilities Study Report specifies and estimates the cost of the equipment, engineering, procurement and construction work needed to implement the conclusions of the Interconnection System Impact Study to physically and electrically connect a 42 MW wind generation facility to the Happy Jack 115 kV substation near Cheyenne, Wyoming. The proposed project commercial in-service date is the 3rd quarter of 2009. The project may be curtailed due to operational constraints prior to the completion of WAPA's TOT3 expansion project.

The total estimated cost of interconnecting the proposed facility is approximately $10,652. The study concludes that Network Upgrades are not required, therefore the entire $10,652 are Direct-Assigned Customer Costs.

The time required to complete the work noted above to accommodate the interconnection is estimated to be two months after the process is initiated.

2 Introduction

Cheyenne Light Fuel and Power received a request to conduct a Facility Study for interconnecting a 42 MW wind power plant in Laramie County near Cheyenne, Wyoming. The proposed in-service date is in the first quarter of 2010, following the completion of Western's Miracle Mile-Ault TOT3 expansion project.

The purpose of the Interconnection Facilities Study is to identify the electrical switching configuration of the connection equipment, the nature and estimated cost of the Transmission Provider's Interconnection Facilities and Network Upgrades necessary to accomplish the interconnection, and an estimate of the time required to complete the construction and installation of such facilities.

3 Interconnection Facilities

The requirements for interconnection to the CLF&P transmission system can be found in the Technical Requirements For Interconnection To The Black Hills Power Transmission System - Version 1.1, last revised May 8, 2007. The document was developed to describe the general requirements for interconnection with the BHP/CLF&P transmission system, and provides an overview of the technical and reliability requirements to address interconnection requests. The interconnections include facility additions and modifications to accommodate generation, transmission and end-user load facilities which are being connected to or planned to be connected to the BHP/CLF&P transmission system.

The proposed 42 MW wind generation facility will interconnect to a 115 kV bus in the substation of an existing wind plant. The energy from the plants will be transferred to Happy Jack 115 kV substation via a single circuit radial 115 kV transmission path that was constructed as part of the existing 30 MW wind facility. All equipment from the point-of-interconnection (POI) at the Happy Jack substation toward the wind power plants will be

owned, operated, and maintained by the Interconnection Customer. No upgrades will be necessary at the Happy Jack substation POI to accommodate the 42 MW project. Refer to Figure 1 for a detailed representation of the proposed interconnection.

4 Network Upgrades

The only network upgrade identified in the System Impact Study was the Happy Jack-Corlett 115 kV line rebuild to a minimum of 132 MVA. A detailed review of the line equipment and ratings for this study revealed that the line and associated equipment as it is currently constructed can accommodate 132 MVA. However, metering and protection system changes will need to be studied and implemented to accommodate this interconnection.

5 Direct-Assigned Costs

a) Fault Current
BHP conducted a short circuit fault duty evaluation to identify any impacts that could be attributed to the new wind power plant. Any circuit breaker that experiences a fault current greater than 100% of its nameplate interrupt rating is recommended for replacement. There were no fault currents identified that exceeded the fault duty of the existing breakers on the surrounding system as a result of interconnecting the additional generation. Therefore there was no short circuit upgrade costs associated with the 42 MW interconnection.

b) Protection Requirements
Protection coordination and relay settings changes will need to be evaluated and implemented prior to interconnection. This will include engineer and technician time to review and modify current settings along with implementing and testing the new settings. This task will require 48 engineering hours and 40 technician hours for a total cost of $5,776.

c) Communications
Communications to the new interconnection project will be accommodated using the equipment and communications path utilized by the existing 30 MW generating facility.

d) Metering
Meter and current transformer tap settings must be reviewed and possibly changed to accommodate the interconnection. This task will require 10 engineering hours and 6 technician hours for a total cost of $1,068.

e) Outages
No network facilities will require significant outages to accommodate this interconnection.

f) Reactive Power Requirements
The proposed interconnection project is required under current policy to provide power at the POI within the range of ± 95% power factor and be controllable on

voltage. If this power factor requirement is not met, BHP may install power factor correction equipment at the load owner's expense. The project as modeled in the SIS was able to meet these requirements without the need for additional reactive compensation.

g) Project Management
Time needed to address various project related items is estimated to require 40 engineering hours and 16 technician hours for a total cost of $3,808.

6 Cost Estimates and Assumptions

The costs defined above are based on a engineering hourly cost of $72/hour and a technician cost of $58/hour.

Table 1: Direct-Assigned Costs

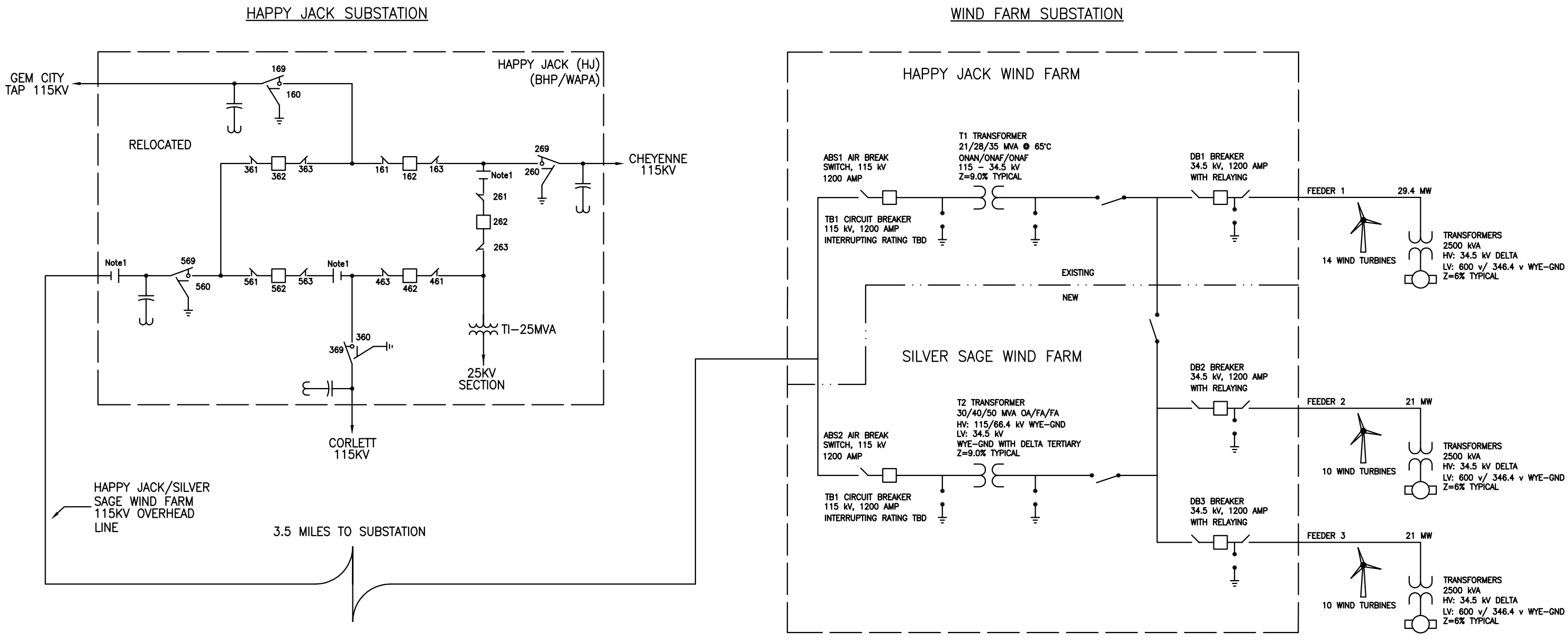
CLPT-G1 Interconnection Requirements		
Task	**Description**	**Cost ($)**
Meter & CT Tap Review	• Verify full load and fault settings of existing current transformer taps. • Check and change metering full load settings.	$1,068
Relaying Review, Changes & Testing	• Verify/modify protection settings and change. • Change relay settings and test.	$5,776
Project Management & Review	• Costs related to managing and scheduling items noted above.	$3,808
	Total cost estimate for upgrade:	**$10,652**

7 Completion Schedule

The tasks noted above can be completed within two months of final approval to complete the work.

APPENDIX A

PRELIMINARY ONE-LINE DIAGRAM
OF
PROPOSED
WIND FACILITY


HAPPY JACK SUBSTATION
WIND FARM SUBSTATION
GEM CITY TAP 115KV
HAPPY JACK (HJ) (BHP/WAPA)
RELOCATED
169
160
361
362
363
161
162
163
Note1
261
262
263
269
260
CHEYENNE 115KV
Note1
569
560
561
562
563
Note1
463
462
461
TI-25MVA
360
369
25KV SECTION
CORLETT 115KV
HAPPY JACK/SILVER SAGE WIND FARM 115KV OVERHEAD LINE
3.5 MILES TO SUBSTATION
HAPPY JACK WIND FARM
ABS1 AIR BREAK SWITCH, 115 kV 1200 AMP
T1 TRANSFORMER 21/28/35 MVA @ 65°C ONAN/ONAF/ONAF 115 - 34.5 kV Z=9.0% TYPICAL
DB1 BREAKER 34.5 kV, 1200 AMP WITH RELAYING
TB1 CIRCUIT BREAKER 115 kV, 1200 AMP INTERRUPTING RATING TBD
FEEDER 1
29.4 MW
14 WIND TURBINES
TRANSFORMERS 2500 kVA HV: 34.5 kV DELTA LV: 600 v/ 346.4 v WYE-GND Z=6% TYPICAL
EXISTING
NEW
SILVER SAGE WIND FARM
DB2 BREAKER 34.5 kV, 1200 AMP WITH RELAYING
FEEDER 2
21 MW
10 WIND TURBINES
TRANSFORMERS 2500 kVA HV: 34.5 kV DELTA LV: 600 v/ 346.4 v WYE-GND Z=6% TYPICAL
T2 TRANSFORMER 30/40/50 MVA OA/FA/FA HV: 115/66.4 kV WYE-GND LV: 34.5 kV WYE-GND WITH DELTA TERTIARY Z=9.0% TYPICAL
ABS2 AIR BREAK SWITCH, 115 kV 1200 AMP
TB1 CIRCUIT BREAKER 115 kV, 1200 AMP INTERRUPTING RATING TBD
DB3 BREAKER 34.5 kV, 1200 AMP WITH RELAYING
FEEDER 3
21 MW
10 WIND TURBINES
TRANSFORMERS 2500 kVA HV: 34.5 kV DELTA LV: 600 v/ 346.4 v WYE-GND Z=6% TYPICAL