Final Interconnection Facilities Study Report
Request # GI-2007-12
Revision 1

250 MW Wind Farm, Near Calhan, Colorado

Public Service Company of Colorado
Transmission Planning

September 8, 2011

I. Executive Summary

[This study report was updated to include language that defines the Point of Ownership Change at the interconnection point. It also includes an updated estimate.]

This Interconnection Facilities Study Report summarizes the analysis performed by Public Service Company of Colorado (PSCo) to specify and estimate the cost of the siting, engineering, equipment procurement and construction needed to interconnect a 250 MW wind turbine generation farm near Calhan, Colorado. The new wind generation is proposed to interconnect to the existing Jackson Fuller Substation near Colorado Springs, Colorado (see Figure 1). The interconnection location is the north side of the substation. This substation is jointly owned by Colorado Springs Utilities, Tri-State Generation & Transmission, and PSCo. The wind generating facilities are located approximately 24 miles from the interconnection point and would be connected via a customer owned radial 230 kV line. Originally the requested commercial in-service date was December 31, 2010. However, the customer indicated in their comments on the Draft Facilities Study report that the in-service date is now December 20, 2011.

The total estimated cost for the facilities required for interconnection is $2.697 million[1] and includes two (2) 230kV gas circuit breakers, switches, bus work, metering, communications and transmission line bus tie connection.

- $1.077 million for Customer-Funded Interconnection Facilities
- $1.620 million for PSCo Network Upgrades for Interconnection

The estimated time required to site, engineer, procure and construct the facilities described above is at least 18 months from the date the Customer meets all applicable Milestones as agreed to in any future LGIA. Therefore, the requested in service date may be achievable depending on the date of execution of the LGIA.

A proposed Station One-Line diagram for the Jackson Fuller Switchyard is shown in Figure 2.

There are no PSCo Network Upgrades for Delivery required for this Interconnection. However, the System Impact Study Restudy 1 identified transmission facilities in the Tri-State Generation & Transmission (TSG&T) system with overload concerns.

The following TSG&T facility was found to be overloaded:

- Jackson Fuller 230/115 kV transformer

The customer is required to resolve this concern with TSG&T.

[1] Appropriation estimates considered to have an accuracy of +/- 20%.

Figure 1: Network Diagram with Proposed POI at Jackson Fuller Substation

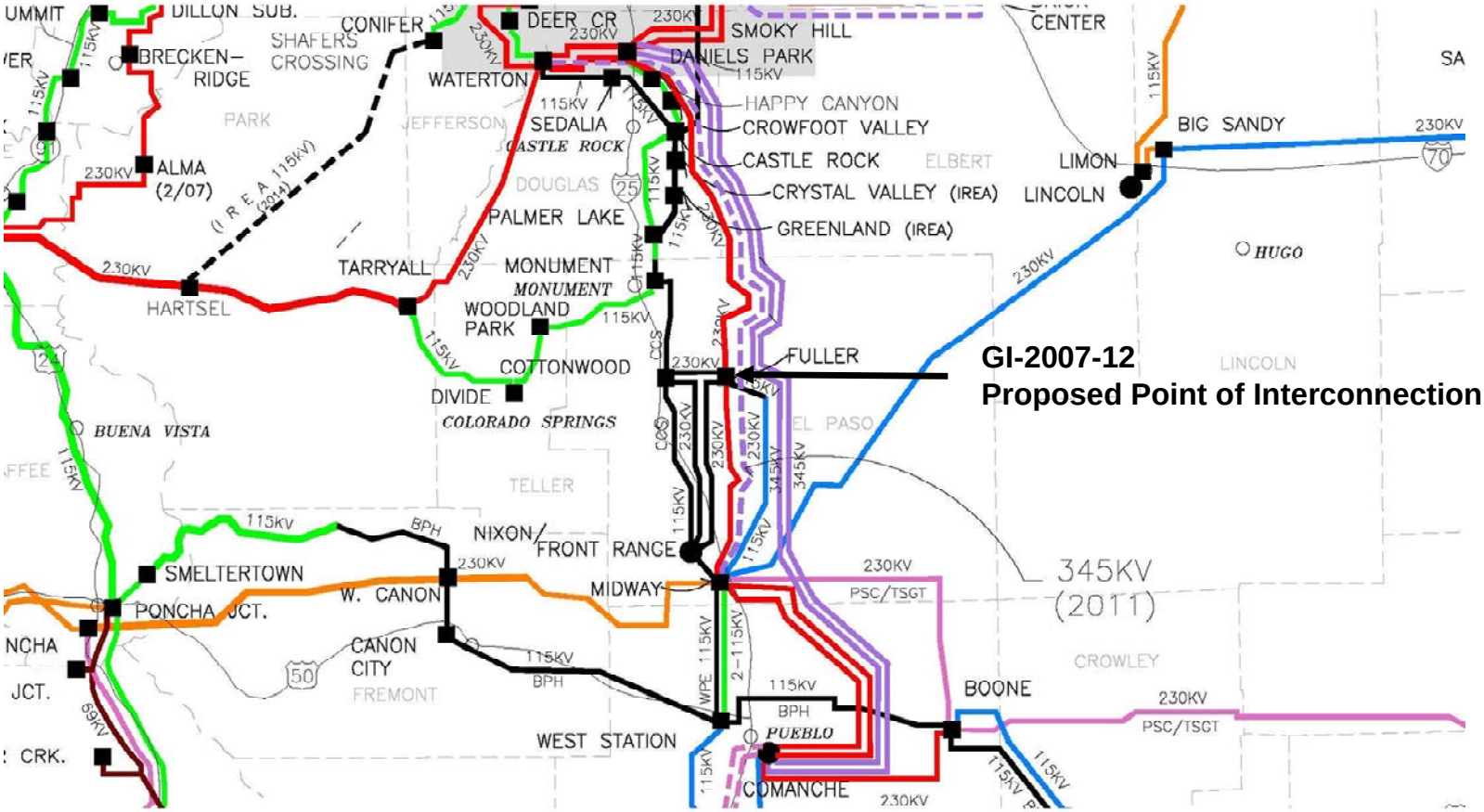
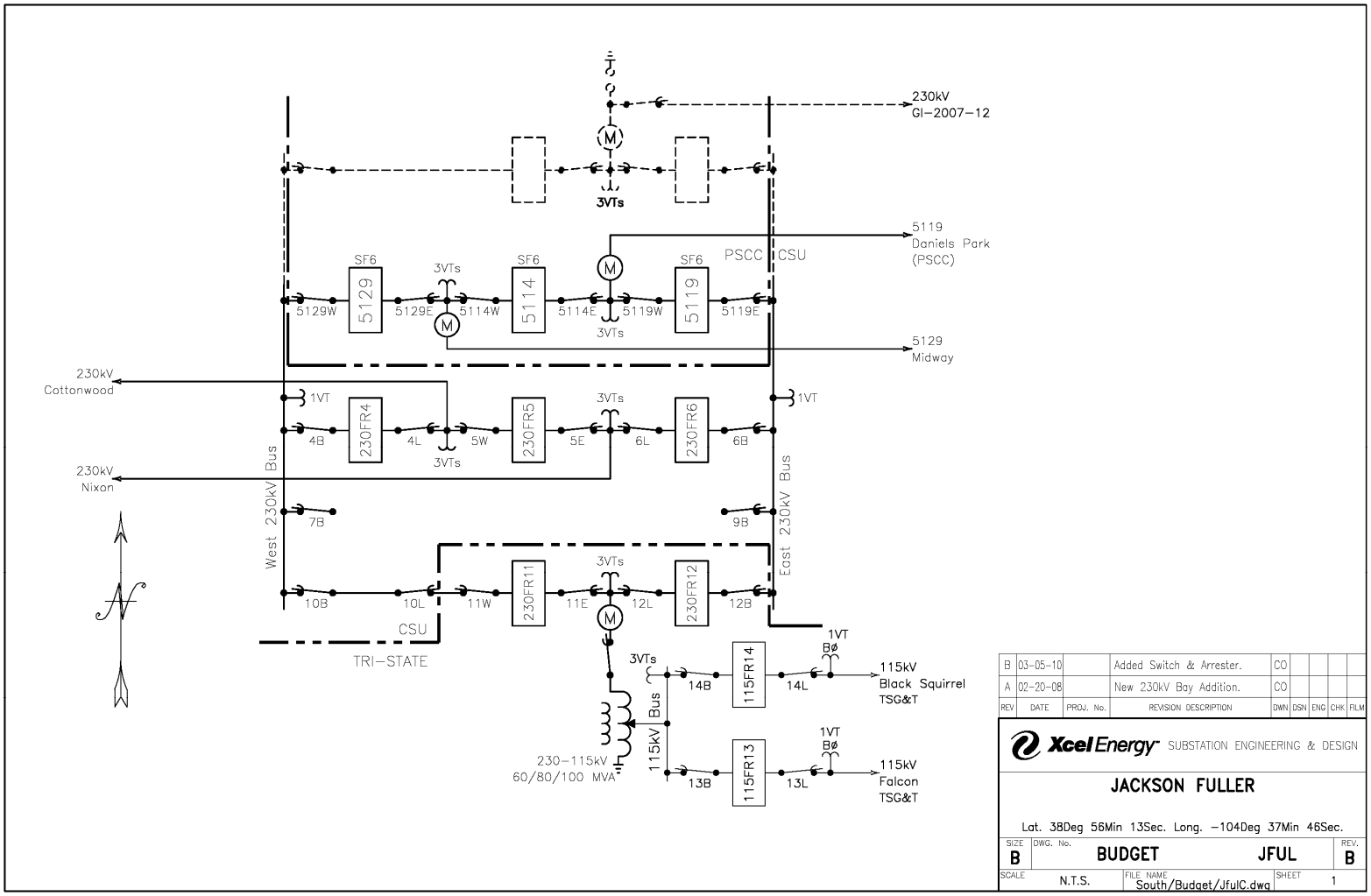


Figure 2: Jackson Fuller Substation Budget One-Line Diagram
(Note – additions for new GI-2007-12 interconnection equipment shown dashed)



I. Introduction

On November 5, 2007 PSCo Transmission received a generation interconnection request to determine the feasibility of injecting power from a 250 MW wind turbine generation farm into the bulk transmission system at the Jackson Fuller Substation near Calhan, Colorado. The results of the Feasibility Study (GI-2007-12) were issued July 11, 2008. On October 10, 2008 PSCo Transmission received an interconnection request to perform a System Impact study for the 250 MW of generation at Jackson Fuller. The System Impact Study was issued on March 9, 2009. A System Impact Restudy 1 was issued on June 15, 2009. On October 12, 2009 PSCo Transmission received an interconnection request to perform a Facility Study for the 250 MW of generation at Jackson Fuller. The requested in-service date was originally December 31, 2010. Based on comments from the customer, this date is now December 20, 2011. This report documents the results of PSCo's Facility Study efforts.

II. General Interconnection Facilities Description

1. Project Purpose & Scope

The purpose of the project is to interconnect 250 MW of wind generation at the existing Jackson Fuller 230 kV Substation. The customer proposes to bring the 250 MW into Jackson Fuller via a customer owned 24 mile 230 kV line. The connection point is the north side of the substation. A new breaker bay and associated facilities is required to interconnect the proposed generation at Jackson Fuller. See Figure 2 for the interconnection details.

2. Background

Jackson Fuller 230 kV Substation is a 5 bay breaker and a half switching station near Colorado Springs, Colorado. It is jointly owned by Colorado Springs Utilities, Tri-State Generation & Transmission, and PSCo. The new interconnection facilities will connect to the PSCo portion of the substation.

3. Interconnection & Network Upgrades for Interconnection

Requirements for interconnection can be found in the Interconnection Guidelines for Transmission Interconnected Producer-Owned Generation Greater than 20 MW – Version 3.0[3], last revised in December 2006. Xcel Energy requires the interconnection customer to construct the Interconnection Facilities in compliance with this document. The guidelines describe the technical and protection requirements for connecting new generation to the Xcel Energy Operating Company transmission system and also requires that the Interconnection Customer be in compliance with all applicable criteria,

[3] Guidelines can be found at www.xcelenergy.com.

guidelines, standards, requirements, regulations, and procedures issued by the North American Electric Reliability Council, Public Utility Commission or their successor organizations.

a) Removals and Relocations

The north fence will need to be moved approximately 50 feet to the north.

b) Fault Current

Existing three-phase and SLG fault currents are 16,074A and 12,722A respectively at the Jackson-Fuller 230 kV bus. These fault current values do not include the contributions of the customer-proposed wind farm to the system. Refer to fault study included with feasibility study report.

c) Right of Way

For purposes of the facility study substation estimate, it is assumed that there is adequate land and all appropriate easements are in place. It is the customer's responsibility to obtain Right of Way for the interconnection transmission line into the Jackson Fuller substation.

d) High Voltage Electrical Installations

The Jackson Fuller 230kV switching station is arranged in a breaker-and-a-half (BHHB) configuration. The interconnection to the new wind farm will require the addition of a new bay to the BHHB. The utility (PSCo) will install all equipment that handles "network" flows, including the following:

- Two 230kV, 3000A circuit breakers
- Five 230kV, 3000A gang switches
- Three 230kV, 1200/2000:1 voltage transformers
- All associated grading, foundations, structures, grounding, conduit, bus work, control cable, and relaying to complete the BHHB bay addition (excluding the dead-end termination of the Customer's incoming line)

The Customer is responsible for the costs of all equipment and material that carry the current contributions of the incoming interconnect transmission line. The items include the following:

- Slack span of interconnection transmission line into substation
- Substation dead-end structure and foundation for new line
- Revenue metering transformers and metering cabinet
- All associated foundations, steel, grounding, conduit, control cable, and relaying to tie this equipment into the substation.

At Lookout the wind farm will have to be added to the EMS system, and appropriate LFAGC/SCADA systems will have to be implemented.

The step-up transformers at the customer facility shall be designed to meet the interconnection guidelines mentioned above. The configuration shall be grounded-wye on the 230 kV primary side, wye on the 34.5 kV secondary side, and delta on the tertiary. The Customer must specify their transformer(s) to meet PSCo's requirements for an effectively grounded system.

e) Removals & Relocations

There will be minor removals of the existing 230kV bus and wiring in order to extend the bus, but the costs of these removals will be negligible.

f) Control & Protection – Electrical Installations

Transmission line relaying will have to be installed on the Customer's new 230kV interconnect. It is assumed that the primary protection scheme will utilize a pilot system, and that the backup will be a step-distance phase and ground scheme. For purposes of the estimate, it was assumed that the Customer would be installing OPGW on the transmission line, and that a line current differential scheme will be used to protect the line.

Additional interconnection requirements will need to be satisfied as stated in PSCo's interconnection Guidelines For Transmission Interconnected Producer-Owned Generation Greater Than 20 MW.

Existing RTU at Lookout control center has space to add the additional SCADA points for the additional wind turbines.

g) Outages

Short outages will be required on both the east and west 230kV buses at the Jackson Fuller switching station.

h) Project and Operating Concerns

There are no known project or operating concerns at this time.

i) Point of Ownership Change

The Point of Ownership change/demarcation will be at the 4-hole pad (aerial lug) on the 230kV underground cable termination (pothead) inside the substation. The Developer will design, procure, construct, own, operate and maintain the 4-hole pad (aerial lug), underground cable termination (pothead), foundation, structure and arresters. Xcel will design, procure, construct, own, operate and maintain out from the 4-hole pad, the cabling and to the switch and beyond.

III. Cost Estimates and Assumptions for the Project:

Interconnection

The estimated non-binding good faith total cost for the PSCo Interconnection Facilities and Network Upgrades to provide an Interconnection for the Customer requested generation is:

$1.057 million for Customer Interconnection Facilities at Jackson Fuller Substation (Customer funded)

$1.620 million for PSCo Network Upgrades for Interconnection (PSCo funded)

Total Estimated cost of Interconnection = $2.677 million

The estimated costs shown above are "appropriation estimates" with an accuracy of +/-20%. These estimates do not include any costs for any Customer-owned, supplied, and installed equipment and associated design and engineering for the Customer's facilities. The estimates assume that the customer will interconnect to the north side of the substation where PSCo's facilities are located.

Delivery

There are no PSCo Network Upgrades for Delivery required for this Interconnection. However, the System Impact Study Restudy 1 identified transmission facilities in the Colorado Springs Utilities and Tri-State Generation & Transmission systems with overload concerns.

The customer will need to work with TSG&T to resolve the concern on their system.

Subsequent to the issuance of the System Impact Study Restudy 1, CSU performed a study to evaluate this interconnection request based on assumptions that CSU considers more reasonable regarding their system. The assumptions included a revised CSU load profile based on their updated load forecast completed in June 2009. The assumptions also included a revised CSU generation dispatch that more closely matched their demand requirements. The results of CSU's study are contained in the report entitled, "Colorado Springs Utilities Response to Xcel Energy Interconnection System Imapact Study Request # GI-2007-12, Restudy 1", dated August 6, 2009. These results indicate that if the Xcel Energy Midway-Waterton 345 kV circuit is placed in service as scheduled in May 2011 before the generation interconnection in service date, then the CSU system will not experience contingency overloads. However, if the Midway-Waterton 345 kV line in service date is delayed until after the in service date of the proposed generation, then contingency overloads are still possible and mitigating measures will still be required. As of the date of this report, that is not the case. Therefore, further measures concerning the CSU system should not be required at this time.

The cost responsibilities associated with the facilities described in the following estimates shall be handled per current FERC guidelines. The estimated engineering, procurement & construction schedule can be found in Figure 3 below.

B. Costs Estimates and Assumptions

GI-2007-12 (Facilities Study Report)
March 10, 2010
Revised June 29, 2011

The Customer has requested a 250 MW Wind Generation Project interconnecting on the 230kV bus at Jackson Fuller Substation. A 230kV radial transmission line will connect the Customer's collector site with the PSCo transmission system at the Point of Interconnection. The estimated total cost for the required upgrades for is **$2,677,000.**

The estimated costs shown are appropriation or scoping level estimates in 2010 dollars and are based upon typical construction costs for previously performed similar construction. These estimated costs include all applicable labor and overheads associated with the engineering, design, procurement and construction of the new PSCo facilities. This estimate does not include the cost for any other Customer owned equipment and associated design and engineering.

The following tables list the improvements required to accommodate the interconnection and the delivery of the Project. The cost responsibilities associated with these facilities shall be handled as per current FERC guidelines. System improvements are subject to change upon more detailed analysis.

Table 1 – PSCo Owned; Customer Funded Interconnection Facilities

Element	V. Description	Cost Est. Millions
Jackson Fuller 230kV Substation	Interconnect Customer to tap the bus at the Jackson Fuller 230kV substation. The new equipment includes: • 230kV bidirectional metering • Three 230kV combination CT/PT instrument transformers • Associated structures and foundations • Associated transmission line communications, relaying and testing	**$0.739**
	Transmission – design and construction support for the customer underground line tap into Jackson Fuller. Design, procure and construct by Customer.	**$0.050**
	Customer Generator Communications to Lookout.	**$0.010**
	Customer Load Frequency/Automated Generator Control, Generator RTU and Testing.	**$0.248**
	Siting and Land Rights support for required easements, reports, permits and licenses.	**$0.010**
	Total Cost Estimate for Customer Interconnection Facilities	**$1.057**
	2. To design, procure and construct	**18 Months**

Table 2: PSCo Owned; PSCo Funded Interconnection Facilities

	Description	Cost
Jackson Fuller 230kV Substation	Interconnect Customer to tap the bus at the Jackson Fuller 230kV substation. The new equipment includes: • Two 230kV, 3000 amp, gas circuit breakers • Five 230kV, 3000 amp gang switches • Three 230kV voltage transformers • Associated communications and SCADA equipment • Line relaying and testing • Electrical bus work • Associated foundations and structures • Associated yard surfacing, landscaping, fencing and grounding	**$1.610**
Jackson Fuller 230kV Substation	**3. Siting and Land Rights support for required easements, reports, permits and licenses.**	**$0.010**
	4. Total Estimated Cost for PSCo Interconnection Facilities	**$1.620**
	5. To design, procure and construct	**18 Months**

Table 3 – PSCo Network Upgrades for Delivery Not Applicable

Element	Description	Cost Est. Millions

Assumptions

- The cost estimates provided for interconnection facilities are “appropriation estimates” with an accuracy of +/- 20%.
- The cost estimates provided for network upgrades for delivery (if applicable) are “scoping estimates” with an accuracy of +/- 30%.
- Estimates are based on 2010 dollars.
- There is contingency and escalation added to the estimates. AFUDC is not included.
- Labor is estimated for straight time only – no overtime included.
- The Generator is not in PSCo’s retail service territory. Therefore no costs for retail load metering are included in these estimates.
- PSCo (or it’s Contractor) crews will perform all construction and wiring associated with PSCo owned and maintained facilities.
- The estimated time to site, design, procure (long lead time materials) and construct the interconnection facilities is at least 18 months, and is completely independent of other queued projects and their respective ISD’s.
- A CPCN will not be required for interconnection facility construction.
- Customer will string OPGW fiber into substation as part of the transmission line construction scope.
- PSCo crews to perform checkout, relay panel construction and final commissioning.
- No new substation land required. Substation work to be completed within existing property boundaries – expanding the substation facilities 50’ to the north.

IV. Engineering, Procurement & Construction Schedule

Figure 3: GI-2007-12 Preliminary / Draft Schedule