



Transmission Load Interconnection System Impact Study Request # T-2014-03

40 MW Industrial Load
Jefferson County, Colorado

Xcel Energy Services
Transmission Planning – West
September 16, 2015

A. Executive Summary

Public Service Company of Colorado (PSCo) received a Transmission Load Interconnection Request (T-2014-03) in December, 2014 to serve a 40 MW industrial load in Jefferson County, Colorado. The new 40 MW constant load with 95% (lag) power factor is proposed to be served from a new Lockheed 115 kV substation that will be provided transmission interconnection by tapping the existing PSCo 115 kV line L9337 at a location just south of PSCo's Deer Creek 115 kV substation. The interconnection from the L9337 line tap to Lockheed 115kV substation will be achieved via ~2.6 miles of new in-and-out 115kV transmission lines on double-circuit transmission structures.

Since PSCo will construct and own the new 115 kV double circuit transmission line tapped from L9337, the Point of Interconnection (POI) is expected to coincide with the Point of Change of Ownership (PCO) established within the Lockheed 115 kV substation. The requested in-service date is the 4th Quarter of 2018.

The Interconnection System Impact Study (ISIS) included steady-state power flow analyses to examine the impact of the proposed load interconnection on the thermal and voltage performance of the transmission grid. A 2020 heavy summer power flow base case was used for the analysis. The study also developed scoping level estimates for the interconnection facilities and any network upgrades required to accommodate the Customer Load Interconnection Request.

The results of the steady-state power flow analysis show that no adverse impacts are expected on the transmission system as a result of the proposed 40 MW load interconnection at Lockheed substation by tapping PSCo's 115 kV line L9337. The power flow analysis identified only one transmission reinforcement (i.e. network upgrade for interconnection) that involves upgrading the Facility Rating of Waterton–Martin Tap–Deer Creek line section of L9337 by replacing the limiting element in Waterton station. The remaining two network upgrades identified at Waterton and Soda Lakes stations involve upgrading the L9337 transmission line protection.

Cost estimates for the proposed Lockheed Load Interconnection project are as follows:



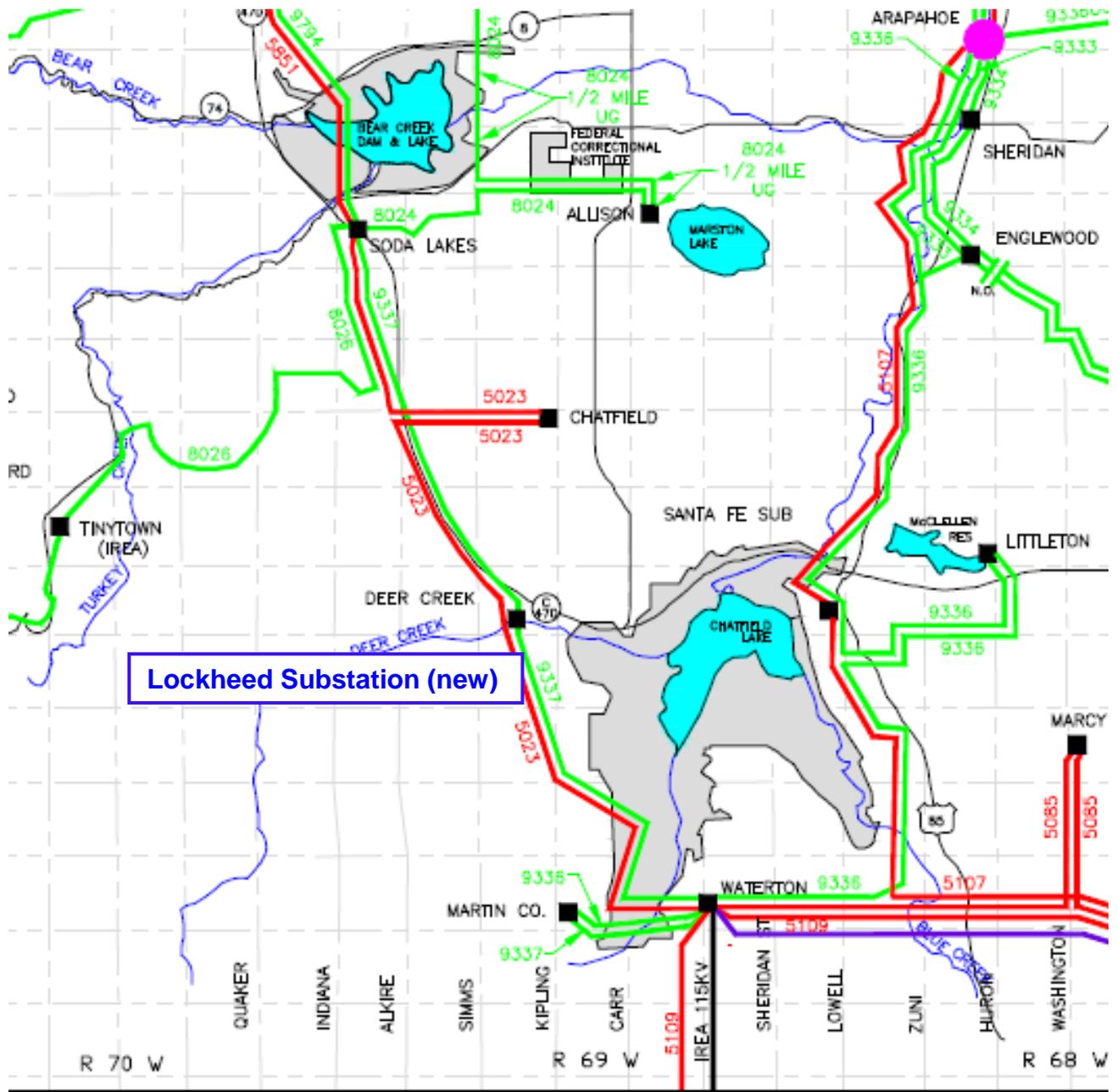
The total estimated cost of the recommended transmission improvements for the proposed load interconnection project is approximately **\$3.57 Million** (*excluding the new 115 kV transmission line cost*), as per the following:

- \$ 2.821 Million for PSCo-Owned, Customer-Funded Interconnection Facilities (Lockheed 115kV Substation only).
- TBD for PSCo-Owned, Customer-Funded Interconnection Facilities (115 kV Transmission Line from L9337 Tap to Lockheed Substation).
- \$751, 538 for PSCo-Owned, PSCo-Funded Network Upgrades for Interconnection.

PSCo Engineering estimates that it will require 18 months to complete the Customer Funded Interconnection Facilities in the new Lockheed 115 kV substation and for the completion of ~2.6 miles of new 115 kV double-circuit transmission line tapped from PSCo's 115kV Line L9337 as the PSCo Funded Network Upgrades for Interconnection.

DRAFT

Figure 1 Lockheed 115 kV Substation (new) and Surrounding Transmission System





B. Introduction

Public Service Company of Colorado (PSCo) received a Transmission Load Interconnection Request (T-2014-03) in December, 2014 to serve a 40 MW industrial load in Jefferson County, Colorado. The new 40 MW constant load with 95% (lag) power factor is proposed to be served from a new Lockheed 115 kV substation that will be provided transmission interconnection by tapping the existing PSCo 115 kV line L9337 at a location just south of PSCo's Deer Creek 115 kV substation. The interconnection from the L9337 line tap to Lockheed 115kV substation will be achieved via ~2.6 miles of new in-and-out 115kV transmission lines on double-circuit transmission structures.

C. Study Scope and Analysis

The Interconnection System Impact Study included steady-state power flow analyses to examine the impact of the proposed load interconnection on the thermal and voltage performance of the transmission grid. This study also developed scoping level estimates for the Interconnection Facilities and Network Upgrades for Interconnection required for the 40 MW Customer Load Interconnection Request.

PSCo adheres to NERC & WECC Reliability Criteria, as well as internal Company criteria for planning studies. During system intact conditions, criteria are to maintain transmission system bus voltages between 0.95 and 1.05 per unit (pu) of nominal and steady-state power flows below the continuous thermal ratings of all facilities. Based on the recommendations in the Colorado Coordinated Planning Group's (CCPG) Rocky Mountain Area Voltage Coordination Guidelines, in the area surrounding the Bergen Park POI, PSCo tries to maintain a transmission system voltage profile ranging from 1.02 per unit to 1.03 per unit at regulating (generation) buses and 1.0 per unit to 1.03 per unit at transmission load buses. Following a single NERC Category B contingency, transmission system steady state bus voltages should remain within 0.90 per unit to 1.05 per unit, power flows on transmission lines should remain within 100% of their continuous thermal ratings, and transformer flows should remain within their 8 hour emergency thermal ratings. Following a NERC Category C contingency, transmission system steady state bus voltages should remain within 0.90 per unit to 1.05 per unit, and power flows on transmission lines and transformers within 100% of their 30 minute emergency thermal ratings.

For this project, potential Affected Parties are not anticipated.

D. Steady State Power Flow Analysis

The power flow analysis was done using the 2020 peak summer power flow case that was developed in 2015 by the Colorado Coordinated Planning Group (CCPG) TPL Studies working group. This power flow case was developed by applying updates to the WECC approved 20HS base case. Updates were included for the PSCo, IREA, CSU, TSG&T, WAPA, PRPA, BHCT,



and BEPC systems. This benchmark case was modified to create a study case by adding a new 40 MW load at the existing Deer Creek substation as a proxy for the proposed 40 MW load interconnection at Lockheed substation.

Contingency analysis using PTI's PSSE Ver. 33.4.0 program was conducted for critical NERC Category B and C contingencies that could have potential adverse impact on the system performance for transmission facilities between the Waterton and Soda Lakes substations. Results from each of the cases were compared and new overloads or overloads that increased significantly in the study case were noted. Voltage criteria violations were also recorded.

The results of the steady-state power flow analysis show that no adverse impacts are expected on the transmission system as a result of the proposed 40 MW load interconnection at Lockheed substation by tapping PSCo's 115 kV line L9337. The power flow analysis identified only one transmission reinforcement (i.e. network upgrade for interconnection) that involves upgrading the Facility Rating of Waterton–Martin Tap–Deer Creek line section of L9337 by replacing the limiting element in Waterton station.

E. Short Circuit Analysis

Engineering judgment dictates that a load interconnection will not result in any increase in short-circuit current (fault level) at the existing PSCo stations or the new Lockheed substation. Since the short circuit duty does not increase, no related network upgrades may be attributed to the proposed load interconnection.

F. Costs Estimates and Assumptions

T-2014-3 (System Impact Study Report)

The Customer has requested 40 MW transmission service at a new Lockheed 115-12.5 kV substation that will be supplied from PSCo's 115 kV transmission line L9337. The Customer proposes to tap the Deer Creek–Waterton line-section of L9337 and construct new 115 kV double-circuit in-and-out transmission line from the L9337 tap to the new Lockheed substation. The Customer's load will be connected via two customer owned 115/12.5 kV 30/40/50 MVA distribution transformers in Lockheed substation.

The estimated costs shown are scoping level estimates (+/-30%) in 2015 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 these new PSCo facilities. The estimates do not include the cost for any other Customer owned equipment and associated design and engineering. The engineering design and cost estimates are subject to revision during the Facilities Study stage of the project.



Tables 1 and 2 list the required transmission improvements – interconnection facilities and network upgrades respectively – for the proposed 40 MW load interconnection. The cost responsibilities associated with these facilities shall be handled per current FERC guidelines and existing contractual agreements between PSCo and the Interconnection Customer. One-line drawing for the Lockheed 115 kV Substation depicting the proposed load interconnection project is provided in the Appendix.

Table 1 – PSCo Owned; Customer Funded Interconnection Facilities

Element	Description	Cost Estimate
Lockheed 115kV Substation	Includes the following equipment in 115 kV switchyard for two line termination positions (per one-line drawing in Appendix): <ul style="list-style-type: none"> • Two 115 kV circuit breakers • Eight 115 kV gang switches and conductor • Six 115 kV surge arresters - 76 kV MCOV • Line & Bus protective relaying & controls • Instrument transformers (CCVTs and CTs) for protection & metering • Primary metering units • Control house equipment (batteries, battery chargers, relay & metering panels, etc.) • Communications equipment • Associated foundations and structures, yard improvements (incl. fence, grading, grounding) • Associated construction, installation and testing 	\$2,821,000
Double-circuit T-line from L9337 Tap to Lockheed 115kV Substation	Tap the 115kV line L9337 south of Deer Creek 115kV substation. <ul style="list-style-type: none"> • In-and-out T-line from L9337 Tap to Lockheed 115kV substation on double circuit structures. • Siting and Land Rights support for required T-line right-of-way acquisition, substation land acquisition, reports, permits and licenses. 	TBD
	Total Cost Estimate for Interconnection Facilities	TBD
Time Frame	To site, design, procure and construct	18 Months



Table 2 – PSCo Owned, PSCo Funded Network Upgrades for Interconnection

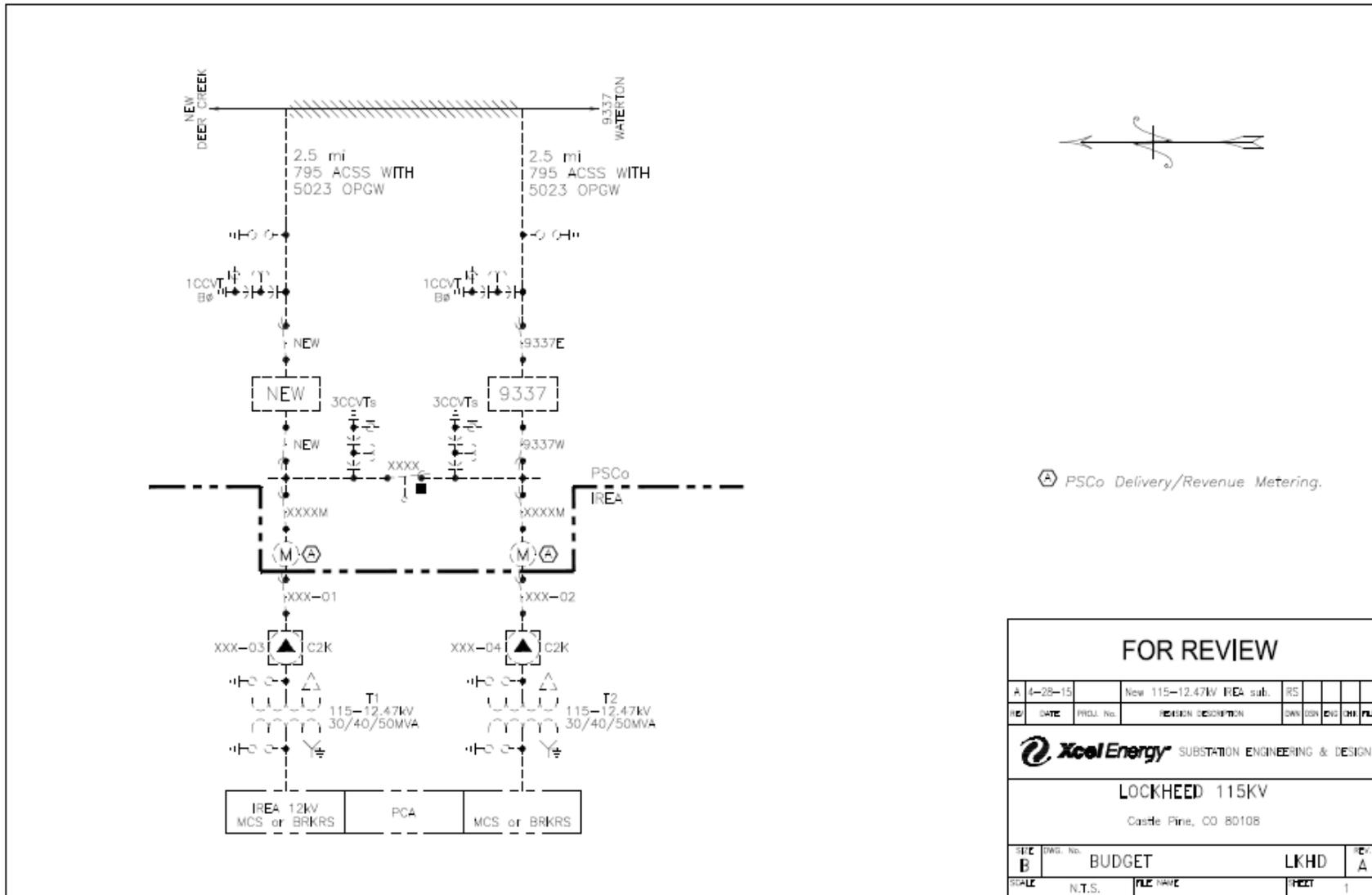
Element	Description	Cost Estimate
Soda Lakes 115kV Substation	Protective Relaying Upgrade of L9337 T-Line – Replace existing T-line protection	\$241,000
Waterton 115kV Substation	Protective Relaying Upgrade of L9337 T-Line – Replace existing T-line protection	\$243,000
Waterton 115kV Substation	Facility Rating Upgrade of L9337 Waterton–Martin Tap–Deer Creek line-section – Replace Limiting Elements	\$67,538
	Total Cost Estimate for Network Upgrades for Interconnection	751,538
Time Frame	To site, design, procure and construct	18 Months

Assumptions

- Cost estimates provided are “scoping estimates” with an accuracy of +/- 30%.
- Cost estimates are based on 2015 dollars.
- Contingency and escalation are included in the cost estimates. AFUDC is not included.
- Labor is estimated for straight time only – no overtime included.
- Acquisition of new land is required for Lockheed substation and acquisition of new right-of-way is required for L9337 Tap to Lockheed 115 kV T-line.
- CPCN will not be required for Lockheed interconnection facility and L9337 Tap to Lockheed 115 kV T-line construction.
- 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 projects and their respective ISD’s.
- PSCo (or it’s Contractor) crews will perform all construction and wiring associated with PSCo owned and maintained facilities.
- PSCo (or it’s Contractor) crews to perform checkout, relay panel construction and final commissioning.

Appendix

A. Lockheed Substation One-Line



⊗ PSCo Delivery/Revenue Metering.

FOR REVIEW								
A	4-28-15	New 115-12.47kV IREA sub.	RS					
REV	DATE	PROJ. No.	REVISION DESCRIPTION	OWN	DES	ENG	CHK	
Xcel Energy SUBSTATION ENGINEERING & DESIGN								
LOCKHEED 115KV Castle Pine, CO 80108								
REV	DWG. No.	BUDGET				LKHD		REV
B								A
SCALE	N.T.S.	FILE NAME	FIGS					1