Interconnection Feasibility Study Report
Request # GI-2008-23

34 MW Solar Generation Ranch at Hartsel, Colorado

Public Service Company of Colorado
Transmission Planning
August 7, 2009

Executive Summary

Public Service Company of Colorado received an interconnection request (GI-2008-23) to install a 34 MW solar photovoltaic generation facility at Hartsel, Colorado. The proposed interconnection point is the Hartsel 230 kV substation. This substation is connected to lines terminating at the Malta 230 kV and Tarryall 230 kV substations (see Figures 1 & 2 below). The solar generating facilities would be connected via a developer owned radial 230 kV line. The requested in service date is June 1, 2010.

This request was studied as an Energy Resource[1] at the full 34 MW requested generation level. These investigations included steady-state power flow and short circuit analyses. The request was studied as a stand-alone project only, with no evaluations made of other potential new generation requests that may exist in the Large Generator Interconnection Request (LGIR) queue, other than the generation projects that are already approved and planned to be in service by June 2010. The main purpose of this Feasibility Study was to evaluate the potential impact on the PSCo transmission infrastructure as well as that of neighboring utilities when injecting the proposed 34 MW of generation at the interconnection point at the Hartsel Substation, and delivering the additional generation to native PSCo loads. The costs to interconnect the project with the transmission system were also evaluated by PSCo Engineering.

Energy Resource

Based on the results of the study, the Energy Resource analysis indicates that the developer can deliver 34 MW on a firm basis with no overload concerns due to the proposed facility Non-firm transmission capability should also be available depending upon generation dispatch levels, demand levels, import path levels (TOT 3, etc.), and the operational status of transmission facilities.

[1] **Energy Resource Interconnection Service** shall mean an Interconnection Service that allows the Interconnection Customer to connect its Generating Facility to the Transmission Provider's Transmission System to be eligible to deliver the Generating Facility's electric output using the existing firm or non-firm capacity of the Transmission Provider's Transmission System on an as available basis. Energy Resource Interconnection Service in and of itself does not convey transmission service

Voltage Control at the Point of Interconnection

The Rocky Mountain Area Voltage Guidelines for the Northwest Colorado Region 1 specify the ideal voltage range at 230 kV should be 1.01 – 1.03 per unit for non-regulating buses. To ensure reliable operation, the interconnecting generation should adhere to these guidelines. Studies to evaluate the ability of the proposed project to conform to this requirement were not possible due to the lack of collector system line charging information.

Cost Estimates

The cost for the transmission interconnection (in 2009 dollars):

Transmission Proposal
The total estimated cost of the recommended system improvements to interconnect the project is approximately **$841,000** and includes:

- $ 0.453 million for PSCo-Owned, Developer-Funded Attachment Facilities
- $ 0.388 million for PSCo-Owned, PSCo-Funded Attachment Facilities
- $ 0.000 million for PSCo Network Upgrades for Delivery to PSCo Loads

The estimated time to complete this work following receipt of authorization to proceed is 18 months. Therefore, this work cannot be completed by the requested in service date.

The Interconnection Agreement (IA) requires that certain conditions be met, as follows:

1 The conditions of the Large Generator Interconnection Guidelines (LGIG) are met.

2 PSCO will require testing of the full range of 0 MW to 34 MW operational capability of the facility to verify that the facility can operate safely and reliably within required power factor and voltage ranges.

3 A single point of contact needs to be provided to PSCo Operations to facilitate reliable management of the transmission system.

Figure 1 Network Diagram with Proposed POI at Hartsel

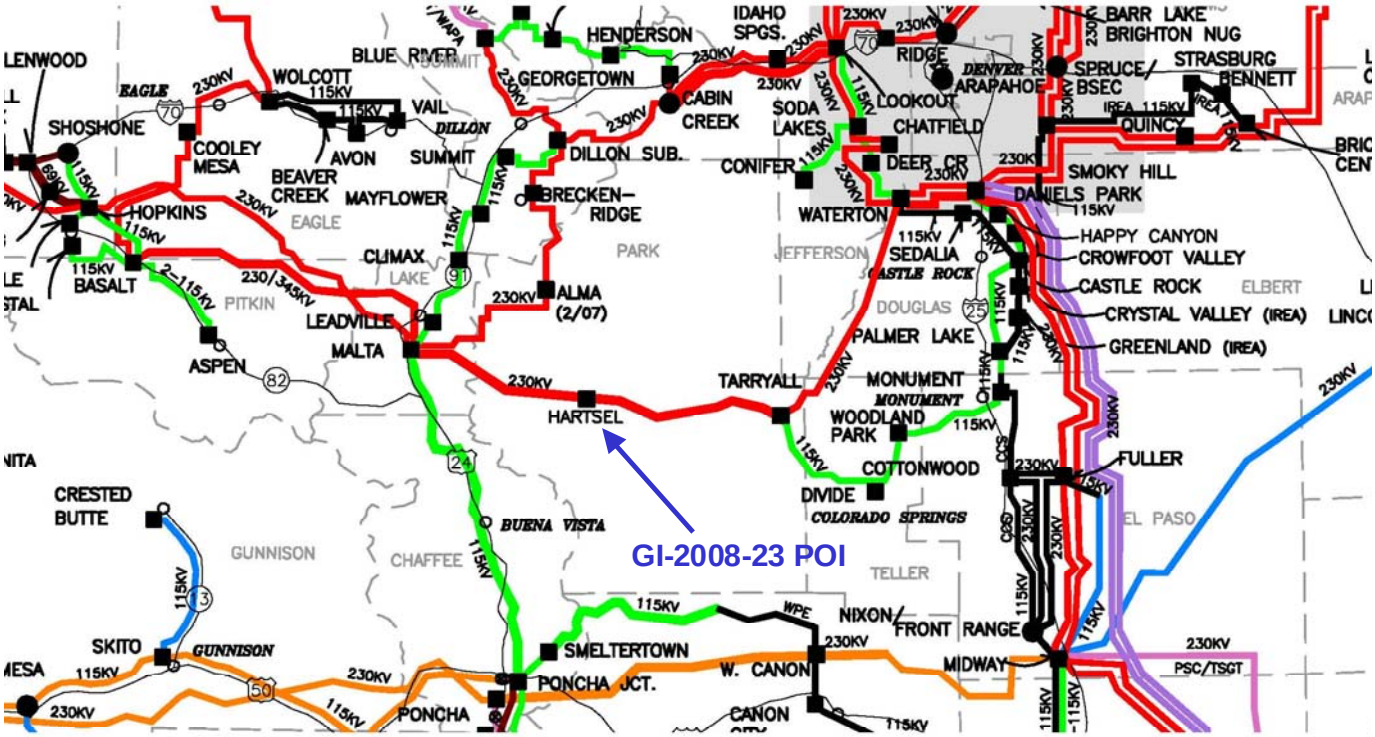
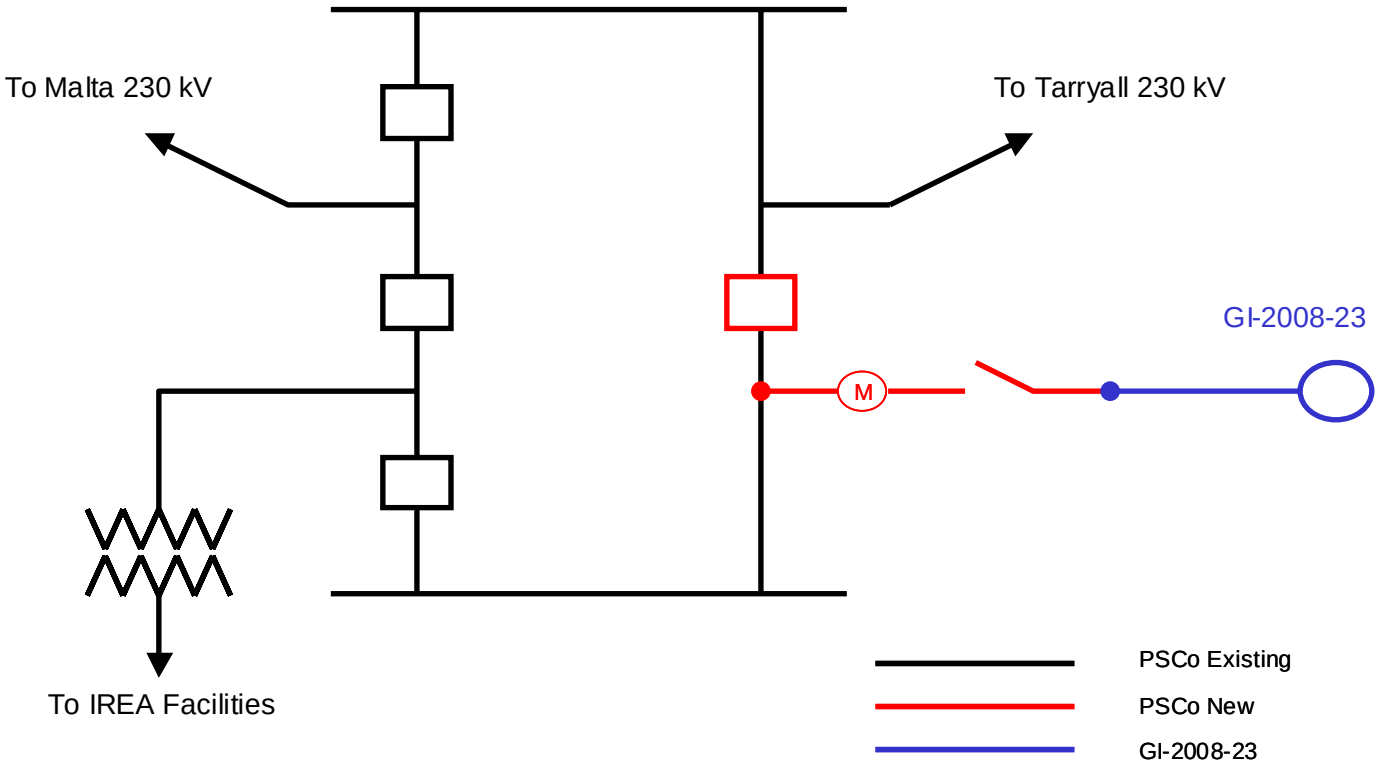


Figure 2 Proposed Interconnection Station One-Line Diagram



Introduction

Public Service Company of Colorado received an interconnection request (GI-2008-23) to install a 34 MW solar photovoltaic generation facility at Hartsel, Colorado. The project will be comprised of a 34 MW interconnected subtransmission grid of 1 MW photovoltaic modules. The proposed interconnection point is the Hartsel 230 kV substation. This substation is connected to lines terminating at the Malta 230 kV and Tarryall 230 kV substations. (see Figures 1 & 2). The solar generating facilities would be connected via a developer owned radial 230 kV line. The requested in service date is June 1, 2010.

This study examined the system reinforcements and associated costs required to facilitate the addition of the new generating plant to the transmission system as an Energy Resource. The reinforcements include the direct connection of the generation facility to the system and any network upgrades required to maintain the reliability of the transmission system.

Study Scope and Analysis

The Feasibility Study evaluated the transmission impacts associated with the proposed generating station. It consisted of power flow and short circuit analyses. The power flow analysis identified any thermal or voltage limit violations resulting from the interconnection and an identification of any network upgrades required to deliver the proposed generation to PSCo loads. The short circuit analysis identified short circuit levels and any circuit breakers that might exceed their fault interruption capability due to addition of the new generation.

PSCo adheres to NERC and 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 of nominal, and steady-state power flows below the thermal ratings of all facilities. Per the Rocky Mountain Area Voltage Coordination Guidelines[2], PSCo tries to maintain a transmission system voltage profile ranging from 1.02 – 1.03 per unit at regulating buses and 1.01 – 1.03 per unit at non-regulating buses. Following a single contingency, transmission system steady state bus voltages must remain within 0.90 per unit to 1.10 per unit, and power flows within 100% of the facilities' continuous thermal ratings.

For this project, potential affected parties include the Intermountain Rural Electric Association (IREA), Tri-State Generation & Transmission (TSG&T), and Western Area Power Administration (WAPA).

[2] The Voltage Coordination Guidelines Subcommittee of the Colorado Coordinated Planning Group developed these guidelines. The subcommittee consisted of representatives from major Colorado utilities including Colorado Springs Utilities, Platte River Power Authority, Tri-State Generation and Transmission, Public Service Company of Colorado, and Western Area Power Administration-Rocky Mountain Region. Other major utilities outside of Colorado were involved in the development of these guidelines.

Power Flow Study Models

The power flow studies were based on the PSCo 2010 HS Budget base case, which was developed from the WECC approved 10HS2SAP base case. Load levels reflect 2010 heavy summer peak system conditions. The case was modified to update some facility ratings changes. The load at Hartsel was also updated based on the latest load forecast from IREA. In addition, the swing bus was moved from Cherokee Unit 3 to Comanche Unit 1. Also, the case was modified to reflect the delayed in service date of the Midway-Waterton 345 kV project and the Waterton 230/115 kV 280 MVA transformers. These facilities are presently scheduled to be in service in May 2011. The case was also modified to include the replacement of the Daniels Park 230/115 kV transformer with a 280 MVA unit.

The Project's solar photovoltaic generation units were modeled as an equivalent 33.553 MW machine connected to a 34.5 kV bus at the low side of the main 230/34.5 kV 40 MVA transformer. The generation MW level was based on the results of the load flow model of the solar ranch that was provided by the Developer. Based on input from the Developer, the reactive capability was set to regulate a fixed voltage at the generator terminals with a reactive capability equivalent to 0.984 lead/lag. The fixed generator voltage was chosen to produce a unity power factor at the POI. The 230 kV side of the main step-up transformer was connected to the point of interconnection at Hartsel via a 230 kV line whose impedance was also taken from the load flow case.

Two main power flow generation dispatch scenarios were evaluated. One was created as a benchmark case and the other was created with the new generation. To evaluate the capabilities of the existing transmission system and the potential reinforcements that would be required, the power flow models were modified to simulate a higher flow bias through the TOT 5 transfer path. The TOT 5 flow was set to approximately 950 MW. This represents the 95th percentile level base on hourly flow data from 1/23/07 to 6/1/09. Multiple generating unit outputs in Utah were increased to produce this flow bias. Generation at Comanche and Pawnee was used to offset the generation increases in Utah. Generation at Cherokee Unit 3 was also adjusted to reflect a more typical dispatch after moving the swing bus to Comanche.

PSCo control area (Area 70) wind generation facilities, were dispatched to approximately 12% of facility ratings, consistent with other similar planning study models.

Power Flow Study Process

Automated contingency power flow studies were completed on the reference model and the model with the proposed generation using PTI's PSS™MUST program, switching out single branches one at a time for all of the transmission facilities (lines and transformers) in control areas 70 (PSCo) and 73 (WAPA RM). Results from the two

cases were compared and new overloads or overloads that increased by greater than 5% in the new generator case were noted.

Power Flow Results

The results of the load flow studies indicate that no facilities will be overloaded due to the proposed generation when it is operating at the full requested 34 MW level. Based on these results, there are no network upgrades required for delivery of the proposed generation to PSCo load centers.

Therefore, 34 MW of Energy Resource capability is available on a firm basis. Non-firm transmission capability should also be available depending upon generation dispatch levels, demand levels, import path levels (TOT 5, etc.), and the operational status of transmission facilities.

Voltage Control at the Point of Interconnection

Generator developers are required to conform to NERC and WECC Reliability Criteria, and Xcel Energy interconnection guidelines, including:

- The generating plant shall provide power factor control at the POI within the range of 0.95 leading to 0.95 lagging for the full MW operating range of the facility.
- During system intact conditions, criteria are to maintain transmission system bus voltages between 0.95 and 1.05 per unit of nominal. Following a single contingency, transmission system steady state bus voltages must remain within 0.90 per unit to 1.10 per unit.
- To ensure reliable operation, the interconnecting generation should adhere to the Rocky Mountain Area Voltage Coordination Guidelines for the Northwest Colorado Region 1; per the guidelines, PSCo tries to maintain an ideal transmission system voltage profile ranging from 1.02 – 1.03 per unit at regulating buses and 1.01 – 1.03 per unit at non-regulating buses.
- The impact of the generating facility on the reactive power schedules of nearby generating units may need to be mitigated by the developer if system studies demonstrate that the proposed wind generating facility causes nearby generating units to generate or absorb reactive power for voltage control[3]. It is understood that reactive power reserve must be maintained on generating units to allow them to dynamically regulate voltage for extreme system conditions.

[3] The Rocky Mountain Area Voltage Coordination Guidelines (July 2006), page 8 of 34, Item 6, states that "Static VAR sources (switched shunt capacitors, reactors) should be operated to control the voltage profile before relying on LTC or generator VAR output, and should be used in such a manner to keep LTC transformers near their nominal tap range and to keep reactive margin on generating equipment. The rationale for this goal is that the generator is a dynamic reactive source that can provide high-speed reactive support to the transmission system after a disturbance that results in low voltages, or conversely are in a position to reduce voltages after a contingency that results in high voltages. Keeping transformers near their mid-tap range also allows for maximum response to either boost or reduce voltages following a disturbance."

- The generating plant is required to demonstrate to the satisfaction of PSCo System Operations prior to the commercial in-service date that it can safely and reliably operate within required power factor and voltage ranges.
- It is the responsibility of the project developer to determine what type of equipment (DVAR, added switched capacitors, SVC, reactors, etc.), the ratings (MVAR, voltage--34.5 kV or 230 kV), and the locations of those facilities to meet the power factor and voltage range standards.
- PSCo requires the Developer to provide a single point of contact to coordinate compliance with the power factor and voltage regulation at the POI. The reactive flow at the end of the line near the POI will need to be controlled according to the Interconnection Guidelines.

This study was not able to examine the ability of the proposed solar ranch to adhere to the power factor and reactive power requirements of the interconnection guidelines due to the lack of line charging data for the 34.5 kV collector system.

Short Circuit Study Results

The Developer indicates that the short circuit current from the proposed solar ranch will be less than 125% of full load current. Therefore, since the three phase fault current is presently less than 15% of the breaker fault duty, no new circuit breakers are expected to exceed their capabilities following installation of the new generation. The calculated short circuit parameters for the point of interconnection at Hartsel are shown in Table 1 below.

Table 1 Short Circuit Parameters at the POI

System Condition	Three-Phase Fault Level (Amps)	Single-Line-to-Ground Fault Level (Amps)	Thevenin System Equivalent Impedance (R +j X) (ohms)
All Facilities in Service	5637.50	5024.56	Z1(pos)= 2.67643 +j 23.4023 Z2(neg)= 2.68717 +j 23.3991 Z0(zero)= 5.06375 +j 31.7948

Costs Estimates and Assumptions

GI-2008-23 (Feasibility Study Report)

The estimated total cost for the required upgrades is **$841,000.**

Table 2 PSCo Owned; Customer Funded Interconnection Facilities

Element	Description	Cost Est. (Millions)
Hartsel 230 kV Substation	Interconnect customer to the 230 kV bus at Hartsel Substation • 230 kV bidirectional metering • Three 230 kV combination CT/PT instrument transformers • Associated foundations and structures • Associated line relaying and testing • One 230 kV, 3000 A, Gang Operated Switch • Deadend structure to terminate customer's line	**$0.385**
	Customer Load Frequency and Generator Witness Testing. (Customer generation telemetry equipment, and witnessing the Customer generator commissioning testing).	**$0.058**
	Customer Generator Communication to Lookout.	**$0.010**
	Total Cost Estimate for PSCo-Owned, Customer-Funded Interconnection Facilities	**$0.453**

Table 3 PSCo Owned; PSCo Funded Interconnection Facilities

Element	Description	Cost Estimate (Millions)
Hartsel 230 kV Substation	Interconnect Customer's to line at PSCo's Hartsel 230 kV Substation. The new equipment includes: • One 230 kV, 40 kA, Circuit Breaker • Two 230 kV, 3000 A, Gang Operated Switches • Transmission Line Relaying • Associated Structures and Foundations	**$0.388**
	Total Cost Estimate for PSCo-Owned, PSCo-Funded Interconnection Facilities	**$0.388**

Assumptions

- The cost estimates provided are "scoping estimates" with an accuracy of +/- 30%.
- Estimates are based on 2009 dollars (no escalation applied).
- There is no contingency or AFUDC included in the estimates.
- Labor is estimated for straight time only – no overtime included.

- Lead times for materials were considered for the schedule.
- PSCo (or it's Contractor) crews will perform all construction and wiring associated with PSCo owned and maintained facilities.
- The estimated time for PSCo to site, engineer, procure and construction the scope of work identified in Table 3 is **18 months** after authorization to proceed has be obtained. This is completely independent of other queued projects and their respective in-service dates.

Appendix

A. Generation Dispatch

Table 4 – Area Generation Dispatch in the GI-2008-23 Study New Generator Case

GI-2008-23 Feasibility Study				
Generation Dispatch in New Generator Case				
Bus	Name	ID	Status	Pgen
70010	QF_MNFRT 13.800	G1	0	0.0
70034	ARAP3 13.800	G3	1	44.0
70035	ARAP4 13.800	G4	1	115.0
70069	CABCRKA 13.800	HA	1	100.0
70070	CABCRKB 13.800	HB	1	62.0
70080	CAMEO1 13.800	G1	1	20.0
70081	CAMEO2 13.800	G2	1	44.0
70083	CANON_55 13.800	C1	1	16.0
70084	CANON_59 13.800	C2	1	21.5
70103	CHEROK1 15.500	C1	1	100.0
70104	CHEROK2 15.500	C2	1	100.0
70105	CHEROK3 20.000	C3	1	160.0
70106	CHEROK4 22.000	C4	1	320.0
70119	COMAN_1 24.000	C1	1	200.0
70120	COMAN_2 24.000	C2	1	310.6479
70160	E_CANON 69.000	G1	0	0.0
70180	FRUITA 13.800	G1	1	15.0
70188	FTLUP1-2 13.800	G1	0	0.0
70188	FTLUP1-2 13.800	G2	0	0.0
70310	PAWNEE 22.000	C1	1	270.6
70314	MANCHEF1 16.000	G1	1	109.0
70315	MANCHEF2 16.000	G2	1	109.0
70350	RAWHIDE 24.000	C1	1	290.0
70351	RAWHIDEA 13.800	GA	1	57.0
70406	ST.VR_2 18.000	G2	1	100.0
70407	ST.VR_3 18.000	G3	1	100.0
70408	ST.VR_4 18.000	G4	1	100.0
70409	ST.VRAIN 22.000	G1	1	300.0
70446	VALMONT 20.000	C5	1	100.0

GI-2008-23 Feasibility Study				
Generation Dispatch in New Generator Case				
Bus	Name	ID	Status	Pgen
70448	VALMONT6 13.800	G6	1	50.0
70478	ZUNI1 13.800	G1	0	0.0
70479	ZUNI2 13.800	G2	0	0.0
70487	QF_TC-T4 13.800	G4	1	30.0
70487	QF_TC-T4 13.800	G5	1	30.0
70490	QF_TC-T3 13.800	G3	1	30.0
70490	QF_TC-T3 13.800	ST	1	50.0
70493	QF_TI-T2 13.800	ST	1	50.0
70495	QF_TI-T1 13.800	G1	1	30.0
70495	QF_TI-T1 13.800	G2	1	30.0
70498	QF_BCP2T 13.800	G3	1	20.0
70498	QF_BCP2T 13.800	ST	1	20.0
70499	QF_B4-4T 13.800	G4	1	20.0
70499	QF_B4-4T 13.800	G5	1	20.0
70500	QF_CPP1T 13.800	G1	1	20.0
70500	QF_CPP1T 13.800	G2	1	20.0
70501	QF_CPP3T 13.800	ST	1	25.0
70502	QF_UNC 13.800	G1	1	25.0
70502	QF_UNC 13.800	G2	1	25.0
70502	QF_UNC 13.800	G3	1	20.0
70553	ARAP5&6 13.800	G5	1	37.0
70553	ARAP5&6 13.800	G6	1	37.0
70554	ARAP7 13.800	G7	1	40.0
70556	QF_B4D4T 12.500	S3	1	50.0
70557	VALMNT7 13.800	G7	1	30.0
70558	VALMNT8 13.800	G8	1	30.0
70560	LAMAR_DC 230.00	DC	1	101.0
70561	RAWHIDEF 18.000	GF	0	0.0
70562	SPRUCE1 18.000	G1	1	100.0
70563	SPRUCE2 18.000	G2	1	100.0
70565	BRTNNUG1 13.800	G1	1	64.0
70566	BRTNNUG2 13.800	G2	1	64.0
70567	RAWHIDED 13.800	GD	0	58.0
70568	RAWHIDEB 13.800	GB	0	57.0
70569	RAWHIDEC 13.800	GC	0	57.0
70577	FTNVL1&2 13.800	G1	0	38.0
70577	FTNVL1&2 13.800	G2	0	38.0

GI-2008-23 Feasibility Study				
Generation Dispatch in New Generator Case				
Bus	Name	ID	Status	Pgen
70578	FTNVL3&4 13.800	G3	0	38.0
70578	FTNVL3&4 13.800	G4	0	38.0
70579	FTNVL5&6 13.800	G5	0	38.0
70579	FTNVL5&6 13.800	G6	0	38.0
70588	RMEC1 15.000	G1	1	120.0
70589	RMEC2 15.000	G2	1	120.0
70591	RMEC3 23.000	ST	1	250.0
70593	SPNDLE1 18.000	G1	1	100.0
70594	SPNDLE2 18.000	G2	1	100.0
70710	PTZLOGN1 34.500	W1	1	25.0
70712	PTZLOGN2 34.500	W2	1	12.5
70713	PTZLOGN3 34.500	W3	1	12.5
70777	COMAN_3 24.000	C3	1	684.0
70822	CEDARCK1 34.500	W1	1	18.8
70823	CEDARCK2 34.500	W2	1	18.8
70932	PTZLOGN4 34.500	W4	1	21.78
70950	ST.VR_5 18.000	G5	1	120.0
70951	ST.VR_6 18.000	G6	1	120.0
79015	CRAIG 1 22.000	1	1	440.0
79016	CRAIG 2 22.000	1	1	440.0
79017	CRAIG 3 22.000	1	1	430.0
79019	MORRO1-2 12.500	1	1	76.0
79019	MORRO1-2 12.500	2	1	76.0
79040	HAYDEN1 18.000	1	1	198.0
79041	HAYDEN2 22.000	1	1	282.0
79154	FLGORG1 12.500	1	1	40.0
79155	FLGORG2 12.500	1	1	40.0
79156	FLGORG3 12.500	1	1	40.0
79157	BMESA1-2 12.500	1	1	42.0
79157	BMESA1-2 12.500	2	1	42.0
79158	NUCLA 1 13.800	1	1	14.0
79159	NUCLA 2 13.800	1	1	14.0
79160	NUCLA 3 13.800	1	1	14.0
79161	NUCLA 4 13.800	1	1	66.0
79162	CRYSTAL 12.500	1	1	26.0
79164	TOWAOC 6.9000	1	1	10.0
79251	QFATLAS1 13.800	1	1	30.0

GI-2008-23 Feasibility Study				
Generation Dispatch in New Generator Case				
Bus	Name	ID	Status	Pgen
79251	QFATLAS1 13.800	2	1	16.0
79252	QFATLAS2 13.800	3	1	16.0
79252	QFATLAS2 13.800	4	1	16.0
90503	8-23_GEN 34.500	1	1	33.553
			(1=on)	

Table 5 – Area Generation Dispatch in the GI-2008-23 Study Benchmark Case

GI-2008-23 System Impact Study				
Generation Dispatch in Benchmark Case				
Bus	Name	ID	Status	Pgen
70010	QF_MNFRT 13.800	G1	0	0.0
70034	ARAP3 13.800	G3	1	44.0
70035	ARAP4 13.800	G4	1	115.0
70069	CABCRKA 13.800	HA	1	100.0
70070	CABCRKB 13.800	HB	1	62.0
70080	CAMEO1 13.800	G1	1	20.0
70081	CAMEO2 13.800	G2	1	44.0
70083	CANON_55 13.800	C1	1	16.0
70084	CANON_59 13.800	C2	1	21.5
70103	CHEROK1 15.500	C1	1	100.0
70104	CHEROK2 15.500	C2	1	100.0
70105	CHEROK3 20.000	C3	1	160.0
70106	CHEROK4 22.000	C4	1	320.0
70119	COMAN_1 24.000	C1	1	200.0
70120	COMAN_2 24.000	C2	1	311.9672
70160	E_CANON 69.000	G1	0	0.0
70180	FRUITA 13.800	G1	1	15.0
70188	FTLUP1-2 13.800	G1	0	0.0
70188	FTLUP1-2 13.800	G2	0	0.0
70310	PAWNEE 22.000	C1	1	270.6
70314	MANCHEF1 16.000	G1	1	120.0
70315	MANCHEF2 16.000	G2	1	120.0
70350	RAWHIDE 24.000	C1	1	290.0
70351	RAWHIDEA 13.800	GA	1	57.0
70406	ST.VR_2 18.000	G2	1	100.0
70407	ST.VR_3 18.000	G3	1	100.0
70408	ST.VR_4 18.000	G4	1	100.0
70409	ST.VRAIN 22.000	G1	1	300.0
70446	VALMONT 20.000	C5	1	100.0
70448	VALMONT6 13.800	G6	1	50.0
70478	ZUNI1 13.800	G1	0	0.0
70479	ZUNI2 13.800	G2	0	0.0
70487	QF_TC-T4 13.800	G4	1	30.0
70487	QF_TC-T4 13.800	G5	1	30.0
70490	QF_TC-T3 13.800	G3	1	30.0

GI-2008-23 System Impact Study				
Generation Dispatch in Benchmark Case				
Bus	Name	ID	Status	Pgen
70490	QF_TC-T3 13.800	ST	1	50.0
70493	QF_TI-T2 13.800	ST	1	50.0
70495	QF_TI-T1 13.800	G1	1	30.0
70495	QF_TI-T1 13.800	G2	1	30.0
70498	QF_BCP2T 13.800	G3	1	20.0
70498	QF_BCP2T 13.800	ST	1	20.0
70499	QF_B4-4T 13.800	G4	1	20.0
70499	QF_B4-4T 13.800	G5	1	20.0
70500	QF_CPP1T 13.800	G1	1	20.0
70500	QF_CPP1T 13.800	G2	1	20.0
70501	QF_CPP3T 13.800	ST	1	25.0
70502	QF_UNC 13.800	G1	1	25.0
70502	QF_UNC 13.800	G2	1	25.0
70502	QF_UNC 13.800	G3	1	20.0
70553	ARAP5&6 13.800	G5	1	37.0
70553	ARAP5&6 13.800	G6	1	37.0
70554	ARAP7 13.800	G7	1	40.0
70556	QF_B4D4T 12.500	S3	1	50.0
70557	VALMNT7 13.800	G7	1	30.0
70558	VALMNT8 13.800	G8	1	30.0
70560	LAMAR_DC 230.00	DC	1	101.0
70561	RAWHIDEF 18.000	GF	0	0.0
70562	SPRUCE1 18.000	G1	1	100.0
70563	SPRUCE2 18.000	G2	1	100.0
70565	BRTNNUG1 13.800	G1	1	64.0
70566	BRTNNUG2 13.800	G2	1	64.0
70567	RAWHIDED 13.800	GD	0	58.0
70568	RAWHIDEB 13.800	GB	0	57.0
70569	RAWHIDEC 13.800	GC	0	57.0
70577	FTNVL1&2 13.800	G1	0	38.0
70577	FTNVL1&2 13.800	G2	0	38.0
70578	FTNVL3&4 13.800	G3	0	38.0
70578	FTNVL3&4 13.800	G4	0	38.0
70579	FTNVL5&6 13.800	G5	0	38.0
70579	FTNVL5&6 13.800	G6	0	38.0
70588	RMEC1 15.000	G1	1	120.0
70589	RMEC2 15.000	G2	1	120.0

GI-2008-23 System Impact Study				
Generation Dispatch in Benchmark Case				
Bus	Name	ID	Status	Pgen
70591	RMEC3 23.000	ST	1	250.0
70593	SPNDLE1 18.000	G1	1	100.0
70594	SPNDLE2 18.000	G2	1	100.0
70710	PTZLOGN1 34.500	W1	1	25.0
70712	PTZLOGN2 34.500	W2	1	12.5
70713	PTZLOGN3 34.500	W3	1	12.5
70777	COMAN_3 24.000	C3	1	695.0
70822	CEDARCK1 34.500	W1	1	18.8
70823	CEDARCK2 34.500	W2	1	18.8
70932	PTZLOGN4 34.500	W4	1	21.78
70950	ST.VR_5 18.000	G5	1	120.0
70951	ST.VR_6 18.000	G6	1	120.0
79015	CRAIG 1 22.000	1	1	440.0
79016	CRAIG 2 22.000	1	1	440.0
79017	CRAIG 3 22.000	1	1	430.0
79019	MORRO1-2 12.500	1	1	76.0
79019	MORRO1-2 12.500	2	1	76.0
79040	HAYDEN1 18.000	1	1	198.0
79041	HAYDEN2 22.000	1	1	282.0
79015	CRAIG 1 22.000	1	1	440.0
79016	CRAIG 2 22.000	1	1	440.0
79017	CRAIG 3 22.000	1	1	430.0
79019	MORRO1-2 12.500	1	1	76.0
79019	MORRO1-2 12.500	2	1	76.0
79040	HAYDEN1 18.000	1	1	198.0
79041	HAYDEN2 22.000	1	1	282.0
79015	CRAIG 1 22.000	1	1	440.0
79016	CRAIG 2 22.000	1	1	440.0
79017	CRAIG 3 22.000	1	1	430.0
79019	MORRO1-2 12.500	1	1	76.0
79251	QFATLAS1 13.800	1	1	30.0
79251	QFATLAS1 13.800	2	1	16.0
79252	QFATLAS2 13.800	3	1	16.0
79252	QFATLAS2 13.800	4	1	16.0
			(1=on)	

B. Proposed Interconnection Station One-line