GENERATION INTERCONECTION
REQUEST # GI-2010-11

FEASIBILITY STUDY REPORT
70 MW PV SOLAR, ALAMOSA COUNTY, COLORADO

PSCO TRANSMISSION ASSET MANAGEMENT
March, 2014

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Executive Summary

Public Service Company of Colorado (PSCo) and the Customer signed a Generation Interconnection Feasibility Study Agreement to evaluate the feasibility of interconnecting 70 MW of solar photovoltaic in San Luis Valley (SLV), Colorado. The primary point of interconnection is at San Luis Valley 230 kV substation. The Customer's solar facility consists of photovoltaic solar arrays, interconnecting to a 34.5 kV collector bus with one (1) dedicated 34.5/230 kV step-up transformer, see Figure 1. Figure 2 shows the conceptual one-line of the interconnection at the San Luis Valley 230 kV yard. The proposed commercial operation in-service date is October 31, 2015 with an assumed back feed date of April 30, 2015. According to the 18-month schedule from the Authorization to Proceed date, the Customer will not be able to make the back-feed date.

This request was studied both as Energy Resource (ER)[1], and Network Resource (NR)[2]. This investigation included steady-state power flow study and preliminary short circuit analysis. The request was studied as a stand-alone project, with no evaluations made of other potential new generation requests that may exist in the LGIP queue, other than the generation projects that are already approved and planned to be in service by the Fall of 2014. This feasibility study investigated three loading conditions in the San Luis Valley: 1) 2015 Heavy Summer = 140 MW, 2) 2015 Heavy Spring – 60% of 140 MW, and 3) 2015 Winter = 60 MW of loads.

Network Resource (NR) – up to 101 MW at SLV 230 kV (without PSCo upgrades)

Currently, there is an injection limit of approximately 101 MW at San Luis Valley substation, which will cause the Sargent – Poncha 115 kV line to load beyond acceptable levels for loss of the San Luis Valley – Poncha 230 kV line. This constraint can be mitigated by increasing the

[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

[2] **Network Resource Interconnection Service** shall mean an Interconnection Service that allows the Interconnection Customer to integrate its Large Generating Facility with the Transmission Provider's Transmission System (1) in a manner comparable to that in which the Transmission Provider integrates its generating facilities to serve native load customers; or (2) in an RTO or ISO with market based congestion management, in the same manner as all other Network Resources. Network Resource Interconnection Service in and of itself does not convey transmission service.

capacity of the Sargent – Poncha 115 kV line to 148 MVA. The GI-2010-11 generation injection is 70 MW, which is well under the injection limit. Therefore, this project is feasible to interconnect into San Luis Valley 230 kV substation if all the assumptions hold true and no other generation interconnection comes in before the expected in-service date.

The proposed generation has caused no new voltage violations. However it should be noted that dynamic reactive power capability is required of the GI-2010-11 generation as detailed throughout this report.

Energy Resource (ER) = up to 101 MW at SLV 230 kV (without PSCo upgrades)

As indicated above, the addition of the GI-2010-11 generation is feasible with no major network upgrades required.

Again it should be noted that dynamic reactive power capability is required of the GI-2010-11 generation as detailed throughout this report.

Cost Estimate

The cost for the transmission interconnection (in 2012 dollars)

The total estimated cost to interconnect the project is approximately **$3,075,000** and includes:

- $1,195,000 for PSCo-Owned, Customer-Funded interconnection facilities
- $1,880,000 for PSCo-Owned, PSCo-Funded interconnection facilities

See cost and schedule for an approximate in service date in Table 2 and Table 3. There are no major network upgrades needed to the current transmission system to transfer full power to PSCo native loads.

Any Interconnection Agreement (IA) requires that certain conditions be met, as follow:

1. The conditions of the Interconnection Guidelines[1] are met.
2. A single point of contact is given to Operations to manage the Transmission System reliably for all projects as found in the Interconnection Guidelines.

Customer must show the ability to operate the solar generation within the required +/- 0.95 power factor range during all operating conditions (0 MW to 70 MW) as measured at the Point of Interconnection (POI). The MVAR output shall be proportional with the output of the plant.

Figure 1: San Luis Valley region

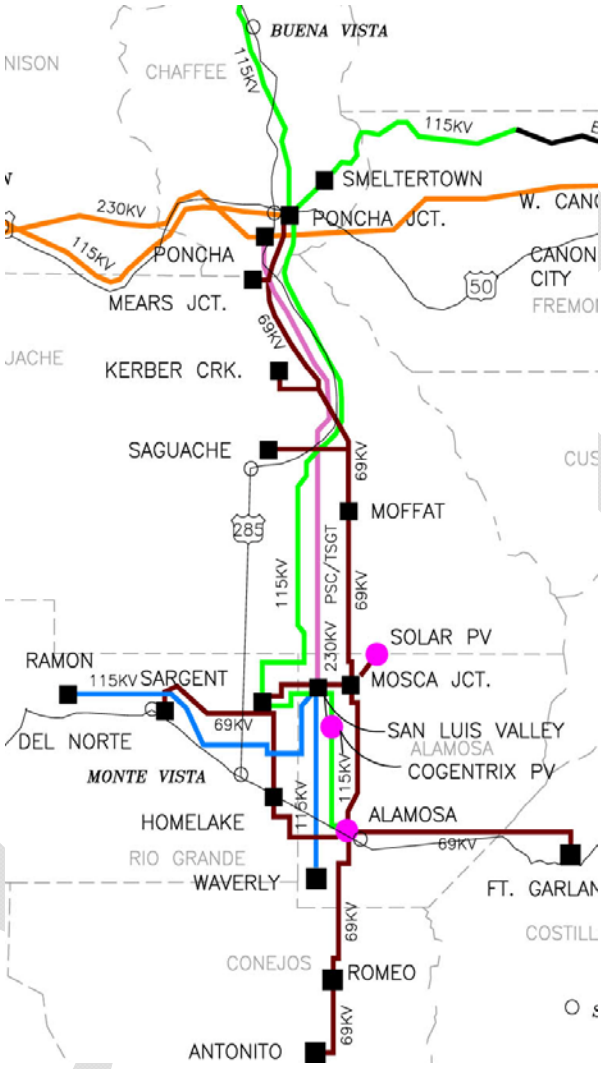
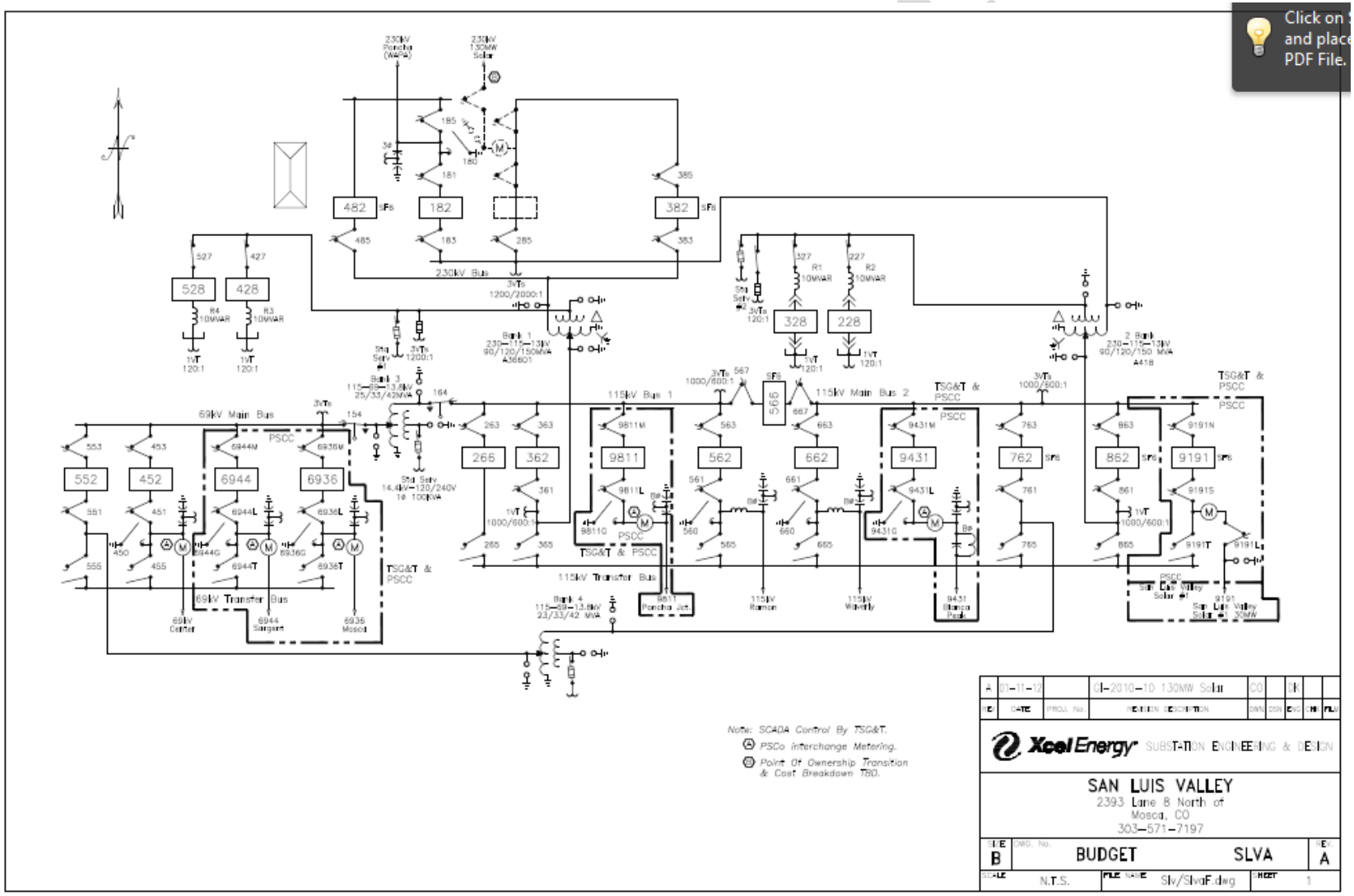


Figure 2: Proposed San Luis Valley substation One-line with Project Interconnection



Introduction

Public Service Company of Colorado (PSCo) and the Customer signed a Generation Interconnection Feasibility Study Agreement to evaluate the feasibility of interconnecting 70 MW of solar photovoltaic in San Luis Valley (SLV), Colorado. The primary point of interconnection is at San Luis Valley 230 kV substation. The Customer's solar facility consists of photovoltaic solar arrays, interconnecting to a 34.5 kV collector bus with one (1) dedicated 34.5/230 kV step-up transformer, see figure 1. Figure 2 shows the conceptual one-line of the interconnection at the San Luis Valley 230 kV yard. The proposed commercial operation in-service date is October 31, 2015 with an assumed back feed date of April 30, 2015.

Study Scope and Analysis

The Feasibility study evaluated the transmission impacts associated with the proposed generation increase. It consisted of steady-state power flow and short circuit analyses. The steady-state power flow analysis identified any thermal or voltage limit violations resulting from the generation addition and determined the network upgrades required to mitigate the violations. The short circuit analysis evaluated the impact on the transmission system of the increase in available fault current due to the generation addition and determined the breaker upgrades required to accommodate the increase in available fault current.

This Generation Interconnection Feasibility study analyzed the impact of this addition, located in South Central Colorado, in accordance with PSCo's study criteria. PSCo adheres to NERC and WECC Reliability Criteria, as well as internal Company criteria for planning studies. The criterion used to identify thermal injection constraints met or exceeded the following criteria:

- There was a detrimental change in the facility loading due to the subject request.
- The resultant facility loading exceeded 100% of the continuous rating (Rate A in PSS/E) system intact or post contingent.

The criterion used to identify voltage injection constraints met or exceeded the following criteria.

- There was a detrimental change in bus voltage due to the subject request.

- The resultant bus voltage was outside of the acceptable range of 0.95 to 1.05 pu system intact or 0.90 to 1.05 pu post contingent.

This project was studied as a Network Resource. NRIS shall mean an Interconnection Service that allows the Interconnection Customer to integrate its Large Generating Facility with the Transmission Provider's Transmission System in a manner comparable to that in which the Transmission Provider integrates its generating facilities to serve native load Customers. NRIS in and of itself does not convey transmission service.

For this project, Tri-State Generation and Transmission Association (TSG&T) is an affected party. PSCo will provide TSG&T with a copy of this feasibility study report and will work with TSG&T during the system impact study phase.

Power Flow Study Models

WECC coordinates the preparation of regional power flow cases for transmission planning purposes. PSCo Transmission developed a starting point model, 2015HS_PSSE-V32_11-21-11.sav, with a 2015 summer peak load representation from the WECC 2015HS2 base case that was approved in May of 2010 for use in the steady state analyses.

Modeling of Request

The GI-2010-11 generation was included in the starting point model, 2015HS_PSSE-V32_11-21-11.sav. The new 70 MW photovoltaic solar power plant will transform the collected solar energy to DC electricity and utilize an inverter to convert to AC electricity. The photovoltaic solar power plant will be connected through a dedicated step-up transformer with a terminal voltage of 34.5 kV. For study purposes, the photovoltaic solar power plant was initially modeled as rated at 70 MVA with no capability of producing or consuming reactive power. However as the study progressed it was determined that dynamic reactive power capability would be required to achieve a convergent power flow solution for loss of the San Luis Valley to Poncha 230 kV line. Thus all further study was completed with GI-2010-11 generation modeled as capable of achieving +/- 0.95 power factor at the San Luis Valley 230 kV bus. This facility will be interconnected to the PSCo system at the SLV 230 kV bus.

The following is a summary of Project GI-2010-11 parameters as modeled by PSCo in the 2015HS_PSSE-V32_11-21-11.sav steady state model:

Total Plant Capacity	= 70 MW
Reactive Capability	= +/- 0 MVARs initially modeled, +28.8 MVARs, -14.8 MVARs ultimately modeled by PSCo due to divergence issues. This represents +/- 0.95% power factor at the San Luis Valley 230 kV bus.
Generator Step-up Transformer	= 34.5/115 kV step up transformer rated at 70 MVA, 10.5% positive sequence impedance on the transformer base, X/R Ratio of infinity, Winding ratio - 1.0
Voltage Regulation	= None initially modeled, 1.03 p.u at the San Luis Valley 230 kV bus ultimately modeled by PSCo due to divergence issues

Interconnecting to the PSCo bulk transmission system involves the Customer adhering to certain interconnection requirements. These requirements are contained in the Interconnection Guidelines for Transmission Interconnected Producer-Owned Generation Greater than 20 MW (Guidelines). In addition, PSCo System Operations conducts commissioning tests prior to the commercial in-service date for a Customer's facilities. Some of the requirements with which the Customer must comply include the following:

1. A generating plant shall maintain a power factor within the range of 0.95 leading to 0.95 lagging, measured at the POI, if the Transmission Provider's System Impact Study shows that such a requirement is necessary to ensure safety or reliability.
2. The results of the System Impact Study will not absolve the Customer from their responsibility to demonstrate to the satisfaction of PSCo System Operations prior to the commercial in-service date that it can safely operate within the required power factor and voltage ranges.

3. Reactive Power Control at the POI is the responsibility of the Customer. Additional Customer studies should be conducted by the Customer to ensure that the facilities can meet the power factor control test and the voltage controller test when the facility is undergoing commissioning testing.
4. PSCo System Operations will require the Customer to perform operational tests prior to commercial operation that would verify that the equipment installed by the Customer meets operational requirements.
5. It is the responsibility of the Customer 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 that may be needed for acceptable performance during the commissioning testing.
6. PSCo requires the Customer 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 POI, SLV 230 kV bus, will need to be controlled according to the Interconnection Guidelines.

Post GI-2010-11 Model Development

Analyses were performed using a 2015 heavy summer, a 2015 heavy spring and a 2015 winter model, all derived from the 2015HS_PSSE-V32_11-21-11.sav model. The only modification made to the 2015HS_PSSE-V32_11-21-11.sav model to form the PostGI-2010-11 2015 Heavy Summer Model was the addition of 40 MVARs of inductors (4x10) at the SLV 230 kV bus with Vhigh set at 1.04 p.u and Vlow set at 1.02 p.u. The specific modifications made to the 2015HS_PSSE-V32_11-21-11.sav model to form the PostGI-2010-11 2015 Heavy Spring Model included:

- Scaling the Zone 710 (SLV) load to 60% of the summer peak level and adjusting the Cherokee Generation to compensate, a total adjustment of 57 MW.
- The addition of 40 MVARs of inductors (4x10) at the SLV 230 kV bus with Vhigh set at 1.04 p.u and Vlow set at 1.02 p.u.

The specific modifications made to the 2015HS_PSSE-V32_11-21-11.sav model to form the Post-GI-2010-11 2015 Winter Model included:

- Scaling the Zone 710 (SLV) load to 60 MW and adjusting the Cherokee Generation to compensate, a total adjustment of 80.3 MW.
- The addition of 40 MVARs of inductors (4x10) at the SLV 230 kV bus with Vhigh set at 1.04 p.u and Vlow set at 1.02 p.u.

The following Post GI-2010-11 steady state models were initially developed.

- PostGI2010-11.sav - 2015 Summer Heavy.
- PostGI2010-11.sav - 2015 Spring Heavy.
- PostGI2010-11.sav - 2015 Winter.

During the analysis of the above models, it was discovered that loss of the San Luis Valley to Poncha 230 kV line resulted in a divergent power flow condition due to the lack of GI-2010-11 dynamic reactive power capability. Thus the following additional Post- GI-2010-11 steady state models were also developed.

- PostGI-2010-11var.sav - 2015 Summer Heavy.
- PostGI-2010-11var.sav - 2015 Spring Heavy.
- PostGI2010-11var.sav - 2015 Winter.

These models included the GI-2010 generation modeled with +28.8 MVARs, -14.8 MVARs of dynamic reactive power capability, holding 1.03 p.u voltage at the San Luis Valley 230 kV bus. More detailed modeling information is given in the Modeling of Request Section of this report.

Pre GI-2010-11 Model Development

The PostGI-2010-11 Models, described above, were modified by turning off the new generation to create the PreGI-2010-11 Models. The Cherokee generation was incremented by 70 MW to compensate.

The following PreGI-2010-11 steady state models were developed.

- PreGI-2010-11.sav- 2015 Summer Heavy.
- PreGI-2010-11.sav- 2015 Spring Heavy.

- PreGI2010-11.sav- 2015 Winter.

Models were solved with transformer tap, switched shunt, phase shifter, DC tap adjustment and area interchange adjustment enabled.

Power Flow Study Process

Siemens Power Technologies, Inc. (PTI) PSS/E and evaluation software were used to determine system performance. PSS/E ACCC was used to determine system performance. Comparisons were made between the Pre and Post GI-2010-11 results.

The study area was defined as areas 70 PSCOLORADO and 73 WAPA R.M. in the study models. All study area elements were monitored. The study considered only the following contingency categories in the study area for the steady state analysis.

- Category A (System Intact).
- Category B (Single Contingencies including Poncha 230 kV Breaker Failure).

Thermal and voltage injection constraints were identified based on the following study criteria:

- The criterion used to flag thermal overloads was 100% of the monitored element's continuous rating (Rate A in PSS/E). Thermal overloads found on elements outside of Zone 710 which were both found as overloads in the Pre GI-2010-11 Analysis and only slightly impacted by the GI-2010-11 generation were not considered constraints by PSCo.
- The criterion used to flag voltage violations met or exceeded the following criteria.
  - There was a detrimental change in bus voltage due to the subject request.
  - The resultant bus voltage was outside of the acceptable range of 0.95 to 1.05 p.u system intact or 0.90 p.u to 1.05 p.u during a single contingency. Voltage violations found on elements outside of Zone 710 which were both found as voltage violations in the Pre GI-2010-11 Analysis and only slightly impacted by the GI-2010-11 generation were not considered constraints by PSCo. Also a few Zone 710 voltage violations found as outside of acceptable limits in the preGI-

2010-11 analysis, identified as known issues by PSCo and only slightly impacted by the GI-2010-11 generation were not considered constraints by PSCo.

The analysis was performed using PSS/E version 33.4. During the PSS/E ACCC contingency analysis, models were solved with transformer tap and switched shunt adjustments locked; phase shifter and DC tap adjustments enabled and area interchange adjustment disabled. The analysis results were obtained by comparing results from the Pre GI-2010-11 model to results from the Post GI-2010-11 model to determine the impact of the GI-2010-11 generation on the transmission system.

In addition to the traditional constraint analysis detailed above, a 5% voltage impact analysis was performed. The 5% voltage impact investigation consisted of identifying any contingency that would result in a voltage differential between the Pre GI-2010-11 results and the Post GI-2010-11 results of 5% or greater on any given bus regardless of whether or not the voltages were within acceptable limits. This analysis included all contingencies in the study area but due to the magnitude of the data involved was limited to monitoring only Zone 710 buses.

Power Flow Results

A contingency analysis was performed using models, criteria, and methodology described earlier in this report. The incremental impact of the 70 MW request was evaluated by comparing flows and voltages with and without the 70 MW request. This study has identified the system intact and single-event contingency (N-1) interconnection constraints. All system intact and N-1 interconnection constraints will require mitigation prior to granting the subject request.

It should be noted that the power flow solution diverged for loss of the San Luis Valley – Poncha 230 kV line, both prior to the addition of the GI-2010-11 generation and after the addition of the GI-2010-11 generation when it was modeled without reactive power generation capability. This is a known system deficiency that is currently ameliorated with the use of the TSG&T Under Voltage Load Shedding (UVLS) Scheme in place in the San Luis Valley. The TSG&T UVLS scheme results in the opening of breakers on the 115 kV lines from San Luis Valley to Stanley and San Luis Valley to Waverly and the 69 kV line from San Luis Valley to Hooper Tap, shedding approximately 50 MVA of TSG&T load in the San Luis Valley during summer peak

conditions. This resolves the issue of low voltages and divergence observed for the loss of the San Luis Valley – Poncha 230 kV line, without causing any other thermal overloads or voltage violations. When the UVLS scheme was modeled, a convergent power flow solution was found for the San Luis Valley – Poncha 230 kV line contingency prior to the addition of the GI-2010-11 generation. After the addition of the GI-2010-11 generation, the power flow solution diverged regardless of the modeling of the UVLS scheme. Further analysis determined that a convergent power flow solution could be obtained post-GI-2010-11 if the GI-2010-11 generation were enhanced with dynamic reactive power capability. When dynamic reactive power capability of +28.80 MVARs and -14.8 MVARs (+/- 0.95% power factor at the San Luis Valley 230 kV bus) was incorporated into the GI-2010-11 modeling, convergent power flow solutions were obtained for all contingencies involving the San Luis Valley – Poncha 230 kV line including the Poncha Breaker Failure 1, 2, and 3 contingencies. Thus all Pre-GI-2010-11 results for contingencies involving the San Luis Valley – Poncha 230 kV line given throughout this report include the modeling of the existing UVLS scheme and all Post-GI-2010-11 results for contingencies involving the San Luis Valley – Poncha 230 kV line given throughout this report include the modeling of dynamic reactive power capability of +28.8 MVARs and -14.8 MVARs for the GI-2010-11 generation. Thus the inclusion of such reactive power generation capability is an interconnection requirement for the GI-2010-11 generation.

With the modeling of the existing UVLS scheme for all Pre-GI-2010-11 contingencies involving the San Luis Valley – Poncha 230 kV line and the modeling of GI-2010-11 dynamic reactive power capability for all Post-GI-2010-11 contingencies involving the San Luis Valley – Poncha 230 kV line, a convergent power flow solution was obtained for all contingencies deemed relevant to this study by PSCo.

2015 Heavy Summer Analysis Results (140 MW of Loads in SLV)

Thermal

No 2015 Heavy Summer system intact or single contingency thermal constraints due to the subject request were found.

Voltage

No 2015 Heavy Summer system intact or single contingency voltage constraints due to the subject request were found.

2015 Heavy Spring Analysis Results (60% of Summer Peak Loads in SLV = 84 MW)

Thermal

No 2015 Heavy Spring system intact or single contingency thermal constraints due to the subject request were found.

Voltage

No 2015 Heavy Spring system intact or single contingency voltage constraints due to the subject request were found.

2015 Winter Analysis Results (60 MW of Loads in SLV)

Thermal

No 2015 Winter system intact thermal constraints due to the subject request were found.

It should be noted that the PCABKR1 contingency, which includes loss of the San Luis Valley – Poncha 230 kV line, also included the modeling of the existing UVLS scheme in the Pre-GI-2010-11 analysis and also included the modeling of GI-2010-11 dynamic reactive power capability in the Post-GI-2010-11 analysis. It should be further noted that due to the voltage support provided by the GI-2010-11 generation, the UVLS scheme will not operate during the San Luis Valley – Poncha 230 kV line contingency when the GI-2010-11 generation is on-line at rated output of 70 MW with dynamic reactive power capability.

Voltage

No 2015 Winter system intact or single contingency voltage constraints due to the subject request were found.

5% Voltage Impact Analysis

As discussed earlier, in addition to the traditional constraint analysis, a 5% Voltage Impact Analysis was performed. The results of this analysis identified that the only contingencies that would result in a voltage differential between the Pre GI-2010-11 results and the Post GI-2010-

11 results of 5% or greater on any Zone 710 bus were contingencies involving loss of the San Luis Valley – Poncha 230 kV line. This condition will be further investigated in the GI-2010-11 System Impact Study.

Network Resource (NR) = up to 101 MW at SLV 230 kV (without PSCo upgrades)

Currently, there is an injection limit of approximately 101 MW at San Luis Valley substation, which will cause the Sargent – Poncha 115 kV line to load beyond acceptable levels for loss of the San Luis Valley – Poncha 230 kV line. This constraint can be mitigated by increasing the capacity of the Sargent – Poncha 115 kV line to 148 MVA. The GI-2010-11 generation injection is 70 MW, which is well under the injection limit. Therefore, this project is feasible to interconnect into San Luis Valley 230 kV substation if all the assumptions hold true and no other generation interconnection comes in before the expected in-service date.

The proposed generation has caused no new voltage violations. However it should be noted that dynamic reactive power capability is required of the GI-2010-11 generation as detailed throughout this report.

Energy Resource (ER) = up to 101 MW at SLV 230 kV (without PSCo upgrades)

As indicated above, the addition of the GI-2010-11 generation is feasible with no major network upgrades required.

Again it should be noted that dynamic reactive power capability is required of the GI-2010-11 generation as detailed throughout this report.

Short Circuit

A short circuit study was conducted to determine the fault currents (single-line-to-ground or three-phase) at the San Luis Valley 230 kV bus. Table 1 summarizes the approximate fault currents at the San Luis Valley 230 kV bus with the addition of the 70 MW solar facility.

Table 1 – Short-circuit study results at San Luis Valley 230 kV bus.

System Condition	3Φ (A)	S-L-G (A)
System Intact	I1=2400	I1=I2=2900

Cost Estimate

The cost for the transmission interconnection (in 2012 dollars)

The total estimated cost to interconnect the project is approximately **$3,075,000** and includes:

- $1,195,000 for PSCo-Owned, Customer-Funded interconnection facilities
- $1,880,000 for PSCo-Owned, PSCo-Funded interconnection facilities

See cost and schedule for an approximate in service date in Table 2 and Table 3. There are no major network upgrades needed to the current transmission system to transfer full power to PSCo native loads.

Table 2 – PSCo Owned; Customer Funded Transmission Provider Interconnection Facilities

Element	Description	Cost Est. (Millions)
PSCo's San Luis Valley 230kV Transmission Substation	Interconnect Customer to tap at PSCo's San Luis Valley 230kV Transmission Substation (at the 230kV bus). The new equipment includes: • One 230kV gang switch • Three 230kv arresters • One set 230kV CT/PT metering units • Associated bus, wiring and equipment • Associated site development, grounding, foundations and structures • Associated transmission line communications, relaying and testing	**$0.870**
	Transmission line-tap into substation. Structure, conductor, hardware and installation labor.	**$0.075**
Customer's 230kV Substation	Load Frequency/Automated Generation Control (LF/AGC) RTU and associated equipment.	**$0.250**
	Total Cost Estimate for PSCo-Owned, Customer-Funded Interconnection Facilities	**$1.195**
Time Frame	**Site, design, procure and construct**	**18 Months**

Table 3 – PSCo Owned; PSCo Funded Interconnection Network Facilities

Element	Description	Cost Estimate (Millions)
PSCo's San Luis Valley 230kV Transmission Substation	Interconnect Customer to tap at PSCo's San Luis Valley 230kV Transmission Substation (at the 230kV bus). The new equipment includes: • One 230kV circuit breaker • Two 230kV gang switches • One Electric Equipment Enclosure (control bldg.) • Associated communications, supervisory and SCADA equipment • Associated line relaying and testing • Associated bus, miscellaneous electrical equipment, cabling and wiring • Associated foundations and structures • Associated road and site development, fencing and grounding	**$1.870**
	Siting and Land Rights support for substation land acquisition and construction.	**$0.010**
	Total Cost Estimate for PSCo-Owned, PSCo-Funded Interconnection Facilities	**$1.880**
Time Frame	**Site, design, procure and construct**	**18 Months**

Cost Estimate Assumptions

- Scoping level cost estimates for Interconnection Facilities and Network/Infrastructure Upgrades for Delivery (+/- 30% accuracy) were developed by PSCo Engineering.
- Estimates are based on 2012 dollars (appropriate contingency and escalation applied).
- AFUDC has been excluded.
- Labor is estimated for straight time only – no overtime included.
- Lead times for materials were considered for the schedule.
- The Solar Generation Facility 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, wiring, testing and commissioning for PSCo owned and maintained facilities.
- The estimated time to site, design, procure and construct the interconnection facilities is approximately 18 months after authorization to proceed has been obtained.
- A CPCN will not be required for the interconnection facilities construction.
- Customer will string OPGW fiber into substation as part of the transmission line construction scope.
- No new substation land will need to be acquired.
- Breaker duty study determined that no breaker replacements are needed in neighboring substations