

# Feasibility Study Report Request # GI-2007-2 Scenario A<sup>1</sup>

675 MW Integrated Gasification Combined Cycle (IGCC) Facility  
Near Las Animas, Colorado

PSCo Transmission Planning  
June 18, 2007

## Executive Summary

PSCo Transmission received a generation request to determine the feasibility of interconnecting a 675 MW IGCC Plant at a new 500 kV SE Tap 500kV Switching Station. The Customer proposed commercial operation date is May 2014 with an assumed back feed date of September 2012. This request was studied as a Network Resource (NR)<sup>2</sup> connecting to the Tri-State Generation and Transmission Association's (TSGT) Eastern Plains Transmission Project (EPTP). The EPTP is also owned by Western Area Power Administration (Western). **To meet the Customer proposed In-Service Dates, the Large Generator Interconnection Agreement (LGIA) or an Engineer and Procure (E&P) Agreement must be fully executed by January 2008.**

**This Feasibility Study did not determine the cost of utilizing the EPTP for delivery of the 675 MW of generation to native load. The cost of transmission service from Tri-State and Western to utilize the EPTP, or the cost to become a joint participant in the EPTP was not determined. The total estimated cost of the EPTP is approximately \$786.4 million<sup>3</sup>.**

## Results

### Network Resource:

PSCo evaluated the network to determine the upgrades required to deliver the full 675 MW of the IGCC to PSCo native load customers via the EPTP.

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<sup>1</sup> This study is Scenario A includes the Eastern Plains Transmission Projects (EPTP) where Scenarios B is the stand alone without the Eastern Plains Transmission Project that was published in May 31, 2007.

<sup>2</sup> 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.

<sup>3</sup> Cost obtained from Preliminary Report: Eastern Plains Transmission Project 500kV and 345kV Comparison dated March 31, 2006, page 6, located at the following web address:  
[http://www.oatioasis.com/TSGT/TSGTdocs/EPTP\\_VoltageOptions\\_033106.pdf](http://www.oatioasis.com/TSGT/TSGTdocs/EPTP_VoltageOptions_033106.pdf)

The total estimated cost of the recommended system upgrades to accommodate the project is approximately **\$104.92** million and includes:

- \$74.45 million for Transmission Provider Owned, Customer Funded Interconnection Facilities
- \$10.16 million for Transmission Provider Network Upgrades for Interconnection
- \$20.31 million for Transmission Provider Network Upgrades for Delivery

These basic upgrades including interconnection as shown in Figure 1 would consist of:

1. Constructing a new 500 kV Station at Las Animas just outside the proposed IGCC for both Interconnection and Delivery
2. Construct two new 31-mile 500 kV lines from the Las Animas IGCC Switching Station to the SE TAP Switching Station
3. Construct a new 500 kV SE TAP switching Station that interconnects to the 500 kV EPTP line between Lamar Energy Center and Boone for Interconnection and Delivery
4. Add a new 345/500 kV autotransformer at Midway to connect Western's 500 kV yard to PSCo's 345 kV yard.
5. Construct a new 345 kV yard at Green Valley including 345/230 kV autotransformation.

Estimates have been provided for items 1 through 5.

A partial one-line of the Las Animas Switching Station detailing the Interconnection and Delivery is shown in Figure 2.

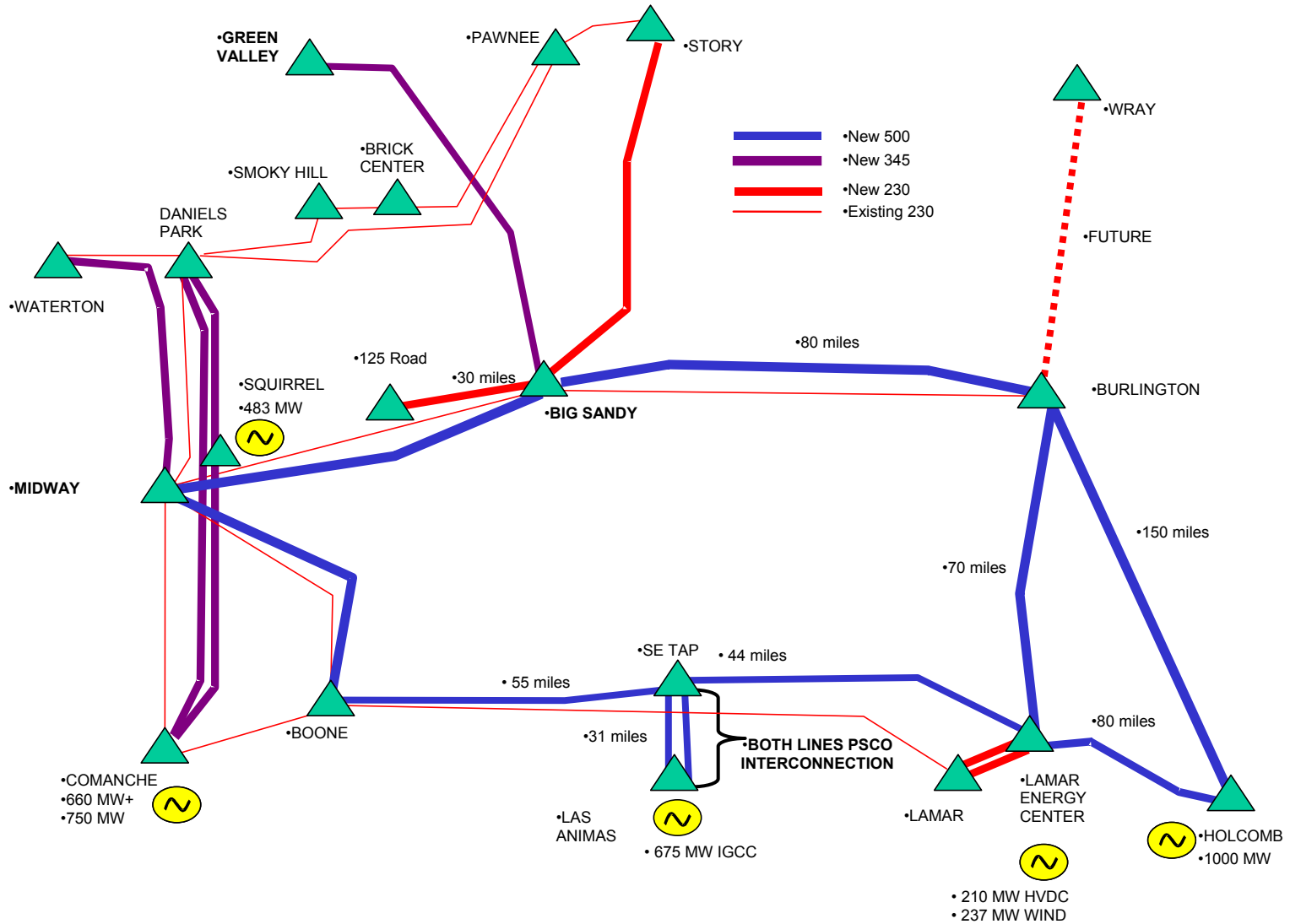
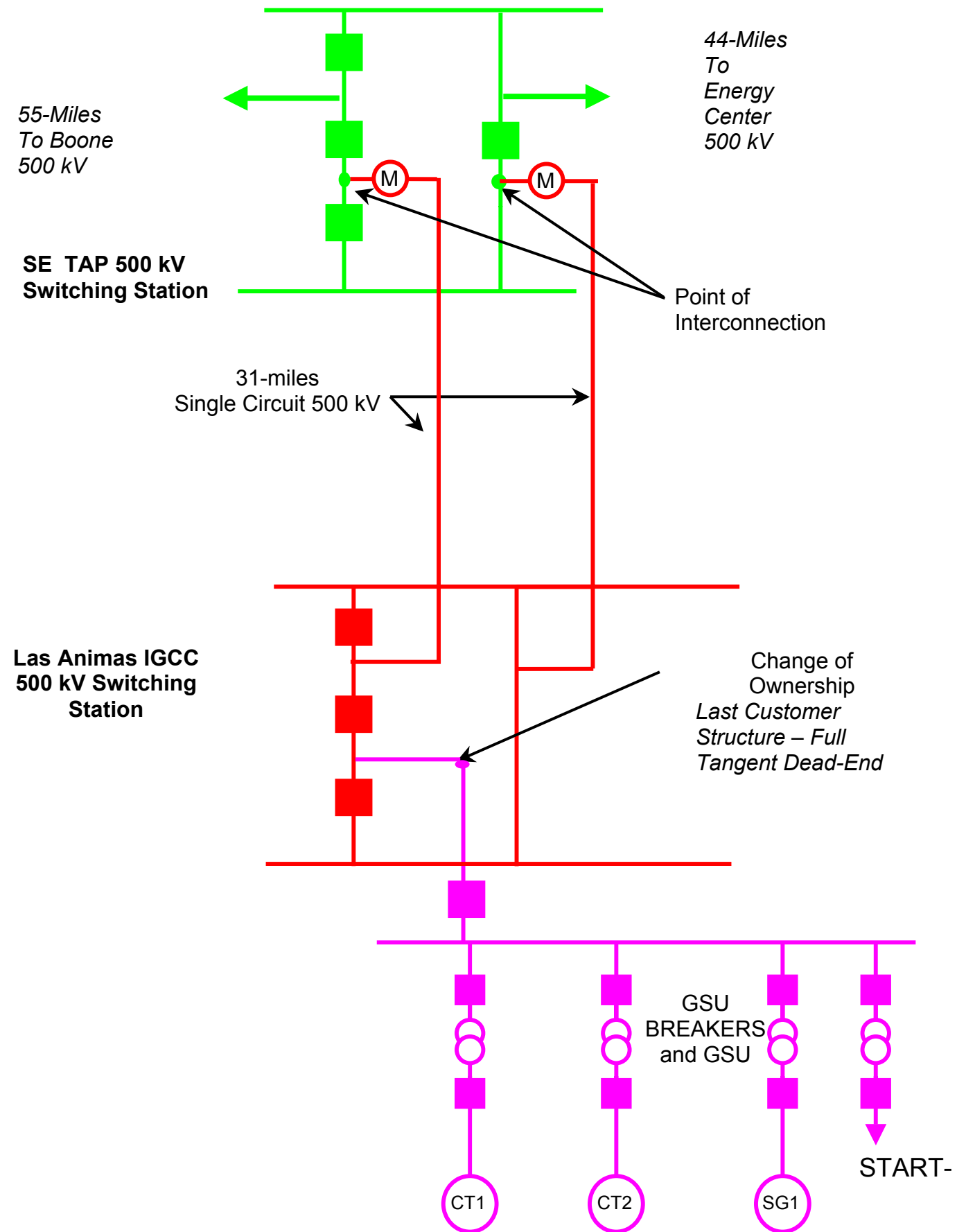
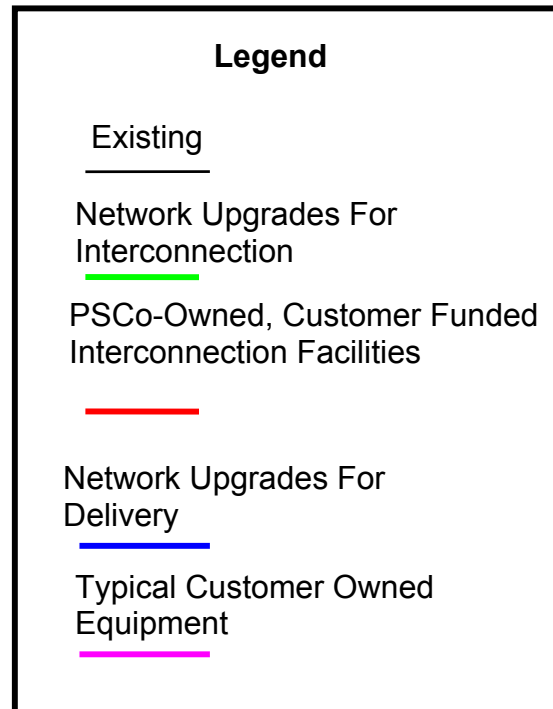


Figure 1 – EPTP Transmission Network Including Recommended Upgrades for the IGCC Delivery

**Figure 2: Las Animas IGCC Interconnection One-line**  
**GI-2007-2**  
**Las Animas IGCC**  
**Delivery With EPTP**



The estimated time required to engineer, permit, and construct all the required PSCo facilities for interconnection is estimated to be at 57 months. Therefore, the requested back feed date of September 2012 is achievable providing the project is started in January 2008. The estimated time required to engineer, permit, and construct the Network Upgrade facilities for delivery is 77 months once the project has started.

### **Study Scope and Analysis**

The Interconnection Feasibility Study evaluated the transmission requirements associated with the proposed interconnection to the PSCo Transmission System. It consisted of power flow and short circuit analyses. The power flow analysis provided a preliminary identification of any thermal or voltage limit violations resulting for the interconnection, and for a NR request, a preliminary identification of network upgrades required to deliver the proposed generation to PSCo loads. The short circuit analysis identified any circuit breaker short circuit capability limits exceeded as a result of the Interconnection and for a NR request, the delivery of the proposed generation to PSCo loads.

PSCo adheres to NERC / WECC Reliability Criteria, as well as internal Company criteria for planning studies. During system intact conditions, transmission system bus voltages are to be maintained between 0.95 and 1.05 per-unit of system nominal / normal conditions, and steady state power flows within 1.0 per-unit of all elements' thermal (continuous current or MVA) ratings. Operationally, PSCo tries to maintain a transmission system voltage profile ranging from 1.03 per-unit or higher at generation buses, to 1.0 per-unit or higher at transmission load buses. Following a single contingency element outage, transmission system steady state bus voltages must remain within 0.90 per-unit to 1.10 per-unit, and power flows within 1.0 per-unit of the elements continuous thermal ratings.

### **Study Models**

The power flow studies were based on a 2014 power flow case that was developed from the approved Western Electricity Coordinating Council (WECC) 2015 heavy summer base model. The loads were adjusted in the Rocky Mountain Region for the 2014 summer time frame. The Customer's 675 MW IGCC was modeled with Customer provided details and a +/-0.95 per unit (p.u.) power factor capability to simulate required VAR output. The project generation was dispatched to replace northern PSCo generation.

The Point of Interconnection (POI) between the Customer and PSCo is assumed to be the point at which the Customer connects to the proposed SE Tap Switching Station 500 kV bus. For this 500 kV interconnection, typical GSU transformer impedances were used for the Customer's equipment.

Efforts were made to include in the models all transmission projects expected to be in service for the 2014 heavy summer season. The studies assumed 2014 peak summer demand conditions in the PSCo system and in other utility systems.

## **Power Flow Study Results and Conclusions**

### **Network Resource (NR) Study Results**

The NR study determined the network upgrades that would be required to accept the full 675 MW from the proposed generating plant for the conditions studied. At 675 MW of generation from the Customer, there were a number of contingency overloads. Appendix A shows the most significant contingencies and the associated overloads along with results from the benchmark case and with the Network Upgrades.

Studies indicated that if the proposed Network Upgrades for Delivery are implemented for this project, not every impact to the neighboring utilities could be addressed. It appears that impacts of the EPTP connections to Boone and Midway have not been fully mitigated. PSCo studies show that there exists the potential for impacts on the neighboring transmission system between Boone and Daniels Park. Additional transmission may be needed to address these impacts. These issues will be evaluated during the System Impact Study in coordination with the Affected Utilities to verify the system models are current and include any proposed projects for the 2014 time frame.

Appendix A shows the contingency comparison table.

### **Short Circuit Study Results**

The study results are not yet complete. Once the fault study is complete, this report will be revised to reflect the fault study results.

The fault study will examine faults at Las Animas, Boone, Brick Center, Midway, and Comanche.

## **Costs Estimates and Assumptions**

The estimated total cost for the required upgrades is **\$104,920,000**.

The estimated costs shown are “scoping” (+/-30%) estimates in 2007 dollars and are based upon typical construction costs for similar construction. These estimated costs include all applicable labor and overheads associated with the engineering, design, and construction of these new PSCo facilities. This estimate does not include any costs for any Customer-owned, supplied, and installed equipment and associated design and engineering. This estimate also does not include any costs that may be required for other entities’ systems and do not include costs to obtain Transmission Service from TSGT. 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.

The estimated costs for interconnection are detailed in Table 1 and Table 2. Table 3 shows the detailed costs for Network Upgrades required for Firm Delivery.

**Table 1 – Transmission Provider Owned Customer Funded Interconnection Facilities**

<b>Element</b>	<b>Description</b>	<b>Cost Est. Millions</b>
<b>SE TAP Switching Station</b>	PSCo's new 500 kV Las Animas Substation Metering and Communications and Witness Testing.	<b>\$0.92</b>
<b>Transmission</b>	Transmission tie line into Las Animas IGCC Substation.	<b>\$0.25</b>
	Two 31-mile Las Animas - SE TAP Single Circuit 500 kV Lines	<b>\$62.88</b>
<b>Siting and Land Rights</b>	Siting and Land Rights for required easements, reports, permits and licenses.	<b>\$2.30</b>
<b>Las Animas 500kV Switching Station</b>	500kV line terminal to SE Tap Station. The following equipment will be required:  Three 500kV, 2000 amp, 40kA circuit breakers Ten 500kV switches Misc. supporting steel and foundations Electric bus work Associated control, relaying and testing	<b>\$8.10</b>
<b>TOTAL</b>		<b>\$74.45</b>

**Table 2 – Transmission Provider Network Upgrades for Interconnection**

<b>Element</b>	<b>Description</b>	<b>Cost Est. Millions</b>
<b>SE TAP Switching Station</b>	500 kV line into new 500 kV Yard. The new equipment required includes:  Three new 500kV circuit breakers Ten 500kV switches Transmission line relaying and testing Required steel supporting structures and foundations	<b>\$8.37</b>

Element	Description	Cost Est. Millions
<b>SE TAP Switching Station</b>	New 500 kV Line terminals to Las Animas Switching Station requiring the following equipment:  One 500kV circuit breaker Two 500kV switches Required steel and foundations Electric bus work Control, relaying and testing	<b>\$1.73</b>
	Obtain necessary siting, permits, and ROW as required	<b>\$0.06</b>
<b>TOTAL</b>		<b>\$10.16</b>
<b>Time Frame</b>		<b>57 Months</b>



**Table 3 – PSCo Network Upgrades for Delivery**

Element	Description	Cost Est. Millions
<b>Midway Substation</b>	A new 500/345 kV autotransformer to interconnect the PSCo 345 kV yard with Western’s 500 kV yard. This includes the following equipment: Two 345 kV 2000 Amp 40 kA circuit breakers One 345/500 kV 560 MVA autotransformer One 345 kV 3000 Amp, gang switch Associated steel and foundations Associated control, relaying, and testing Electrical bus work	<b>\$7.06</b>
<b>Green Valley Substation</b>	Two new 345/230 kV autotransformers to interconnect the PSCo 345 kV yard with the 230 kV yard. This includes the following equipment: Three 345 kV 2000 Amp 40 kA circuit breakers Two 345/230 kV 560 MVA autotransformer Eight 345 kV 2000 Amp, gang switches Four 230 kV 3000 Amp circuit breakers Eight 230 kV 3000 Amp, gang switches Associated steel and foundations Associated control, relaying, and testing Electrical bus work	<b>\$13.25</b>
	Total Cost Estimate for PSCo Network Upgrades for Delivery	<b>\$20.31</b>
	Total Cost of Project	<b>\$104.92</b>
<b>Time Frame</b>		<b>77 Months</b>

### Assumptions

- The estimates and time frames given are for reference only are subject to change with a more detailed system study.
- The cost estimates provided are “scoping estimates” with an accuracy of +/- 30%.
- Estimates are based on **2007** dollars.

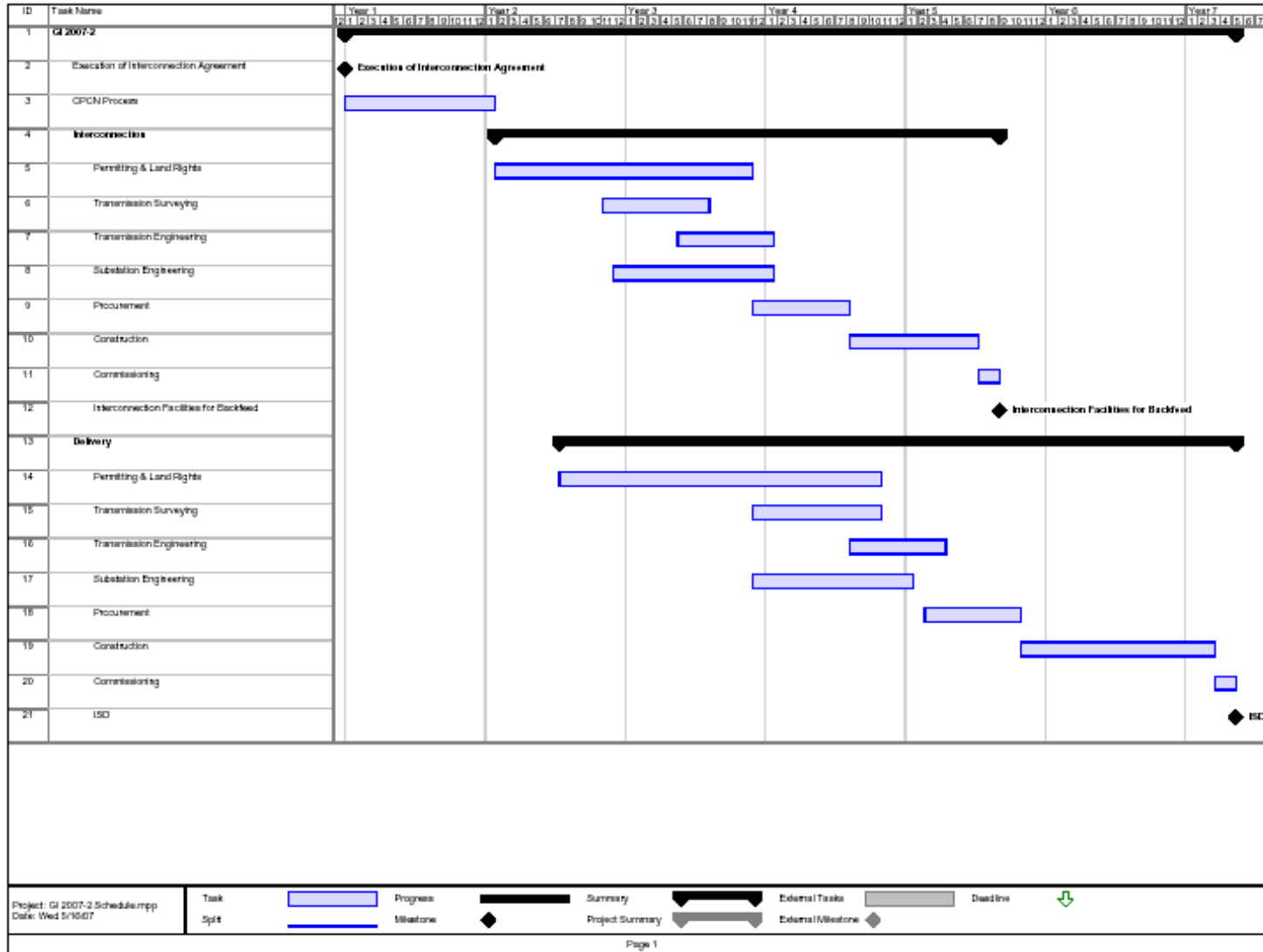
- PSCo crews will perform all substation construction and wiring associated with PSCo owned and maintained facilities. Contractor Crews may perform transmission line construction. It is assumed that all work will be done on straight time.
- The estimated time for design and construction of PSCo network upgrades for interconnection at the SE Tap Switching Station is 57 months.
- It is anticipated that in order to construct the PSCo network upgrades for Delivery and Interconnection, a Certificate of Public Convenience and Necessity (CPCN) will be required by the Colorado Public Utilities Commission (CPUC). The application for a CPCN will not be submitted until the Interconnection Agreement is fully executed. The estimated time frame for the CPCN process for the PSCo network upgrades is at least 14 months from the time the Interconnection Agreement is fully executed.
- A siting study will be required for network upgrades for interconnection and delivery. Extensive public involvement is anticipated. Permit applications and possible minor right-of-way acquisition will be required. Land use permits will be required from multiple local jurisdictions.
- This interconnection and delivery easement acquisition affects the following entities: Bent, Kiowa Counties.
- Five temporary staging areas for line construction at 5 acres per site will be needed and are included in this estimate.
- Any 500 kV single circuit line will require 200' width easements along the planned route. Two 500kV Single Circuits side by side on separate poles will require 400' easements.
- Implementation of the recommended infrastructure for Delivery and Interconnection will require that existing facilities be taken out of service for sustained periods. In most cases, these outages cannot be taken during peak load periods due to operational constraints. As a result, the estimated time frame for implementation could be increased.
- The last spans into SE Tap Switching Station from the Customer funded 500 kV line will be a slack span between the Transmission Provider's substation dead-end and the Customer's last structure, which is assumed to be a dead-end tangent structure.

### **Project Schedule**

The following schedule, depicted in Figure 3, identifies the main milestones needed to complete the interconnection and the delivery portion of the proposed 675 MW IGCC generation facility.

The following schedule identifies project milestones for three separate phases of work needed to complete the proposed interconnection: Siting, Permitting & Land Acquisition, Substation Design & Construction and Transmission Line Design & Construction. The total estimated duration to complete all of the required activities and tasks is 77 months.

Figure 3 – Preliminary Schedule



# Appendix A

## Contingency Table

**Table 4 – Contingency Results**

							Case	BASE	BASE w/IGCC	IGCC w/ BOONE-MIDWAY-BIGSANDY @ 500 KV & GREEN VAL-BIG SANDY @ 345 KV & 500/345 KV AUTO @ MIDWAY								
Branches with MVA flow more than 100.0 % of nominal rating																		
**	From bus	**	**	To bus	**	CKT	Type	Rating	Loading%	Loading%	Loading%	Contingency						
70236	HYDEPARK	115	70339	PUEBLO	115	1	LN	99.0		109.9	102.1	70002	BURNT MI	115	70004	FREEMARY	115	1
70236	HYDEPARK	115	70339	PUEBLO	115	1	LN	99.0		105.8		70002	BURNT MI	115	70456	W.STATON	115	1
70236	HYDEPARK	115	70339	PUEBLO	115	1	LN	99.0	106.0	116.2	108.3	70004	FREEMARY	115	70352	READER	115	1
70236	HYDEPARK	115	70456	W.STATON	115	1	LN	99.0		103.5		70004	FREEMARY	115	70352	READER	115	1
70049	BELMONT	69.0	70051	BLENDE	69.0	1	LN	35.0		101.5	100.5	70042	ASPEN TP	69.0	70051	BLENDE	69.0	1
70049	BELMONT	69.0	70305	OVERTON	69.0	1	LN	48.0	109.5	111.7	110.6	70042	ASPEN TP	69.0	70051	BLENDE	69.0	1
70054	BMONT TP	69.0	70305	OVERTON	69.0	1	LN	48.0	133.5	136.1	134.8	70042	ASPEN TP	69.0	70051	BLENDE	69.0	1
70054	BMONT TP	69.0	70455	W.STATON	69.0	1	LN	59.0	109.1	111.4	110.2	70042	ASPEN TP	69.0	70051	BLENDE	69.0	1
70455	W.STATON	69.0	70456	W.STATON	115	1	TR	42.0	124.6	125.1	124.9	70042	ASPEN TP	69.0	70051	BLENDE	69.0	1
70455	W.STATON	69.0	70456	W.STATON	115	2	TR	42.0	122.0	122.5	122.2	70042	ASPEN TP	69.0	70051	BLENDE	69.0	1
70049	BELMONT	69.0	70305	OVERTON	69.0	1	LN	48.0	109.5	111.6	110.6	70042	ASPEN TP	69.0	70353	READER	69.0	1
70054	BMONT TP	69.0	70305	OVERTON	69.0	1	LN	48.0	133.4	136.1	134.8	70042	ASPEN TP	69.0	70353	READER	69.0	1
70054	BMONT TP	69.0	70455	W.STATON	69.0	1	LN	59.0	109.1	111.3	100.9	70042	ASPEN TP	69.0	70353	READER	69.0	1
70455	W.STATON	69.0	70456	W.STATON	115	1	TR	42.0	124.6	125.1	124.9	70042	ASPEN TP	69.0	70353	READER	69.0	1
70455	W.STATON	69.0	70456	W.STATON	115	2	TR	42.0	122.0	122.5	122.2	70042	ASPEN TP	69.0	70353	READER	69.0	1
70121	COMANCHE	115	70122	COMANCHE	230	A1	TR	176.0	104.7	103.6	101.9	70060	BOONE	115	70061	BOONE	230	1
70253	LAMAR CO	115	70254	LAMAR CO	230	1	TR	100.0		114.7	105.5	70060	BOONE	115	70061	BOONE	230	1

							Case	BASE	BASE w/IGCC	IGCC w/ BOONE-MIDWAY-BIGSANDY @ 500 KV & GREEN VAL-BIG SANDY @ 345 KV & 500/345 KV AUTO @ MIDWAY								
Branches with MVA flow more than 100.0 % of nominal rating																		
**	From bus	**	**	To bus	**	CKT	Type	Rating	Loading%	Loading%	Loading%	Contingency						
70294	NCANON W	69.0	70451	VICTOR	69.0	1	LN	24.0	109.5	114.2	106.9	70085	CANONCTY	69.0	70086	CANONCTY	115	1
70121	COMANCHE	115	70122	COMANCHE	230	A2	TR	184.0	139.4	134.9	134.1	70121	COMANCHE	115	70122	COMANCHE	230	A1
70121	COMANCHE	115	70122	COMANCHE	230	A1	TR	176.0	145.3	140.7	139.8	70121	COMANCHE	115	70122	COMANCHE	230	A2
70121	COMANCHE	115	70122	COMANCHE	230	A1	TR	176.0	129.9	129.3	128.4	70122	COMANCHE	230	70459	WALSENBG	230	1
70121	COMANCHE	115	70122	COMANCHE	230	A2	TR	184.0	125.0	124.5	123.6	70122	COMANCHE	230	70459	WALSENBG	230	1
70308	PALMER	115	73414	MONUMENT	115	1	LN	134.8		106.2	100.2	70138	DANIELPK	115	70139	DANIELPK	230	T1
70101	CHEN TAP	69.0	70225	HOLL TAP	69.0	1	LN	39.6	114.1	116.3	116.2	70253	LAMAR CO	115	70452	VILAS	115	1
70203	GRAN TAP	69.0	70225	HOLL TAP	69.0	1	LN	39.6	129.8	132.2	132.3	70253	LAMAR CO	115	70452	VILAS	115	1
70203	GRAN TAP	69.0	70473	WILOW CK	69.0	1	LN	39.6	145.4	147.7	148.0	70253	LAMAR CO	115	70452	VILAS	115	1
70249	LAJUNTAW	115	70250	LAJUNTAW	69.0	1	TR	25.0	105.3	118.9	121.2	70253	LAMAR CO	115	70472	WILOW CK	115	1
70352	READER	115	70353	READER	69.0	2	TR	47.0	124.8	127.2	126.0	70352	READER	115	70353	READER	69.0	1
70352	READER	115	70353	READER	69.0	1	TR	47.0	124.8	127.2	126.0	70352	READER	115	70353	READER	69.0	2
70517	PARKERPS	115	70581	GRNDVIEW	115	1	LN	186.6	107.0	108.3	107.6	70395	SMOKYHIL	115	70521	PEAKVIEW	115	1
70101	CHEN TAP	69.0	70225	HOLL TAP	69.0	1	LN	39.6	113.2	115.6	115.2	70452	VILAS	115	70453	VILAS	69.0	1
70203	GRAN TAP	69.0	70225	HOLL TAP	69.0	1	LN	39.6	128.8	131.4	131.1	70452	VILAS	115	70453	VILAS	69.0	1
70203	GRAN TAP	69.0	70473	WILOW CK	69.0	1	LN	39.6	144.3	146.9	146.2	70452	VILAS	115	70453	VILAS	69.0	1
70042	ASPEN TP	69.0	70051	BLLENDE	69.0	1	LN	57.0	99.9	102.7	100.9	70455	W.STATON	69.0	70456	W.STATON	115	1
70042	ASPEN TP	69.0	70353	READER	69.0	1	LN	57.0	99.9	102.7	100.9	70455	W.STATON	69.0	70456	W.STATON	115	1
70042	ASPEN TP	69.0	70051	BLLENDE	69.0	1	LN	57.0	99.9	102.2	100.5	70455	W.STATON	69.0	70456	W.STATON	115	2
70042	ASPEN TP	69.0	70353	READER	69.0	1	LN	57.0	99.9	102.2	100.5	70455	W.STATON	69.0	70456	W.STATON	115	2
70308	PALMER	115	73414	MONUMENT	115	1	LN	134.8		110.9	106.6	70464	WATERTON	230	70466	WATERTON	345	T1

							Case	BASE	BASE w/IGCC	IGCC w/ BOONE-MIDWAY-BIGSANDY @ 500 KV & GREEN VAL-BIG SANDY @ 345 KV & 500/345 KV AUTO @ MIDWAY								
Branches with MVA flow more than 100.0 % of nominal rating											Contingency							
**	From bus	**	**	To bus	**	CKT	Type	Rating	Loading%	Loading%	Loading%							
70308	PALMER	115	73414	MONUMENT	115	1	LN	134.8		110.8	106.6	70465	MIDWAYPS	345	70466	WATERTON	345	1
70472	WILOW CK	115	70473	WILOW CK	69.0	2	TR	42.0	96.1	104.4	101.1	70472	WILOW CK	115	70473	WILOW CK	69.0	1
70472	WILOW CK	115	70473	WILOW CK	69.0	1	TR	42.0	96.1	104.4	101.1	70472	WILOW CK	115	70473	WILOW CK	69.0	2
70138	DANIELPK	115	70139	DANIELPK	230	T1	TR	150.0	103.4	102.0	102.3	70517	PARKERPS	115	70518	BAYOU	115	1
70517	PARKERPS	115	70523	SULPHUR	115	2	LN	180.0	112.0	110.3	110.2	70517	PARKERPS	115	70523	SULPHUR	115	1
70517	PARKERPS	115	70523	SULPHUR	115	1	LN	180.0	112.0	110.3	110.2	70517	PARKERPS	115	70523	SULPHUR	115	2
70395	SMOKYHIL	115	70521	PEAKVIEW	115	1	LN	186.6	107.4	108.1	107.6	70517	PARKERPS	115	70581	GRNDVIEW	115	1
70330	PORTLAND	115	70456	W.STATON	115	1	LN	80.0	99.9	117.4	103.6	70550	W CANON	115	73551	W CANON	230	1
70121	COMANCHE	115	70122	COMANCHE	230	A1	TR	176.0	105.9	108.5	107.6	70601	DANIELPK	345	70630	SQUIRLCR	345	1
70121	COMANCHE	115	70122	COMANCHE	230	A2	TR	184.0	101.9	104.4	103.6	70601	DANIELPK	345	70630	SQUIRLCR	345	1
70236	HYDEPARK	115	70339	PUEBLO	115	1	LN	99.0		107.3	100.3	70601	DANIELPK	345	70630	SQUIRLCR	345	1
70308	PALMER	115	73414	MONUMENT	115	1	LN	134.8		112.4	103.6	70601	DANIELPK	345	70630	SQUIRLCR	345	1
70121	COMANCHE	115	70122	COMANCHE	230	A1	TR	176.0		102.2	101.3	70601	DANIELPK	345	70654	COMANCHE	345	2
70308	PALMER	115	73414	MONUMENT	115	1	LN	134.8		104.2		70601	DANIELPK	345	70654	COMANCHE	345	2
73004	ALCOVA	115	73137	MIRACLEM	115	2	LN	80.0	109.0	115.6	115.0	73004	ALCOVA	115	73137	MIRACLEM	115	1
73004	ALCOVA	115	73137	MIRACLEM	115	1	LN	80.0	109.0	115.7	115.2	73004	ALCOVA	115	73137	MIRACLEM	115	2
73008	ARCHER	115	73043	CHEYENNE	115	1	LN	80.0	102.5	110.8	109.7	73008	ARCHER	115	73480	CROWCRK	115	1
70470	WELD PS	115	70471	WELD PS	230	T1	TR	150.0	112.0	116.3	117.4	73211	WELD LM	115	73212	WELD LM	230	1
73384	BIRDSALE	115	73422	TEMPLTON	115	1	LN	79.0	100.5	108.2	108.0	73397	DRAKE N	115	73430	FAIRVWCS	115	1
73408	KELKER E	115	73496	ATMELSUB	115	1	LN	129.0	108.0	117.0	116.5	73398	DRAKE S	115	73409	KELKER W	115	1
70308	PALMER	115	73414	MONUMENT	115	1	LN	134.8		102.8		73400	EMIL AND	115	73414	MONUMENT	115	1



Branches with MVA flow more than 100.0 % of nominal rating							Case	BASE	BASE w/IGCC	IGCC w/ BOONE-MIDWAY-BIGSANDY @ 500 KV & GREEN VAL-BIG SANDY @ 345 KV & 500/345 KV AUTO @ MIDWAY	Contingency							
**	From bus	**	**	To bus	**	CKT	Type	Rating	Loading%	Loading%	Loading%							
73408	KELKER E	115	73496	ATMELSUB	115	1	LN	129.0	102.9	109.3	108.7	73408	KELKER E	115	73409	KELKER W	115	1
73409	KELKER W	115	73420	ROCKISLD	115	1	LN	159.0	98.4	106.3	105.8	73408	KELKER E	115	73422	TEMPLTON	115	1
73412	MIDWAYBR	115	73413	MIDWAYBR	230	1	TR	100.0		100.2	106.9	73413	MIDWAYBR	230	73419	RD NIXON	230	1
70330	PORTLAND	115	70456	W.STATON	115	1	LN	80.0	113.7	148.2	145.2	73413	MIDWAYBR	230	73551	W CANON	230	1
73412	MIDWAYBR	115	73413	MIDWAYBR	230	1	TR	100.0	100.7	104.2	109.4	73417	RD NIXON	115	73419	RD NIXON	230	1
70231	HOPKINS	115	79003	BASALT	115	1	LN	66.9	124.0	117.4	116.4	73419	RD NIXON	230	73559	FRTRANGE	230	1
73413	MIDWAYBR	230	73419	RD NIXON	230	1	LN	482.0		101.5	103.4	73419	RD NIXON	230	73559	FRTRANGE	230	1
70231	HOPKINS	115	79003	BASALT	115	1	LN	66.9	117.8	117.8	117.8	79003	BASALT	115	79004	BASALT	230	T2
70231	HOPKINS	115	79003	BASALT	115	1	LN	66.9	118.1	111.0	102.5	79033	GOREPASS	230	79039	HAYDEN	230	1
70253	LAMAR CO	115	70254	LAMAR CO	230	1	TR	100.0		107.6	100.7	Unit: 70133 CTY LAM 14.4 Id:1						
73408	KELKER E	115	73496	ATMELSUB	115	1	LN	129.0		101.7	100.6	Unit: 73428 DRAKE 6 13.8 Id:1						
73408	KELKER E	115	73496	ATMELSUB	115	1	LN	129.0	107.7	113.9	113.1	Unit: 73429 DRAKE 7 13.8 Id:1						