



**Final**  
**Interconnection Facilities Study Report**

**Request # GI-2006-1e**

Facilities Study for the  
Squirrel Creek Energy Center

December 20, 2006

Xcel Energy Services, Inc.  
Public Service Company of Colorado

## I. Executive Summary

This Interconnection Facilities Study Report summarizes the analysis performed by Public Service Company of Colorado (PSCo) to specify and estimate the cost of the equipment, engineering, procurement, and construction needed to interconnect approximately 500 MW from the Squirrel Creek Energy Center (Squirrel Creek), near Fountain, Colorado. The facility will consist of combined cycle gas or fuel oil powered generation and interconnect to the PSCo transmission system at a new Squirrel Creek Switching Station. The Squirrel Creek Switching Station will tap into one of the Comanche – Daniels Park 345 kV transmission circuits. The requested commercial in-service date of the generation facility is May 1, 2009 with a requested back-feed date of February 1, 2009. The study results show that it should be feasible to implement the upgrades required for interconnection to facilitate the back feed date.

The total estimated cost for facilities required for interconnection is approximately **\$9.141 million**<sup>1</sup> including:

- \$0.556 million for PSCo Interconnection Facilities (Customer-funded facilities)
- \$8.585 million for PSCo Network Upgrades for Interconnection

The estimated time required to engineer, permit and construct the facilities described above is approximately 23 months after receiving authorization to proceed.

The System Impact Study (SIS) Report<sup>2</sup> listed the recommendations for Network Upgrades for Delivery for all of the generation included in that portfolio study. The upgrades related to the Squirrel Creek generation are readily identifiable and consist of the following:

- Establish a 345 kV transmission circuit between Midway and Waterton substations.
- Replace the two 100 MVA 230/115 kV autotransformers at Waterton substation with 280 MVA units.
- Increase the rating of the Waterton – Littleton 115 kV line from 135 MVA to 217 MVA.

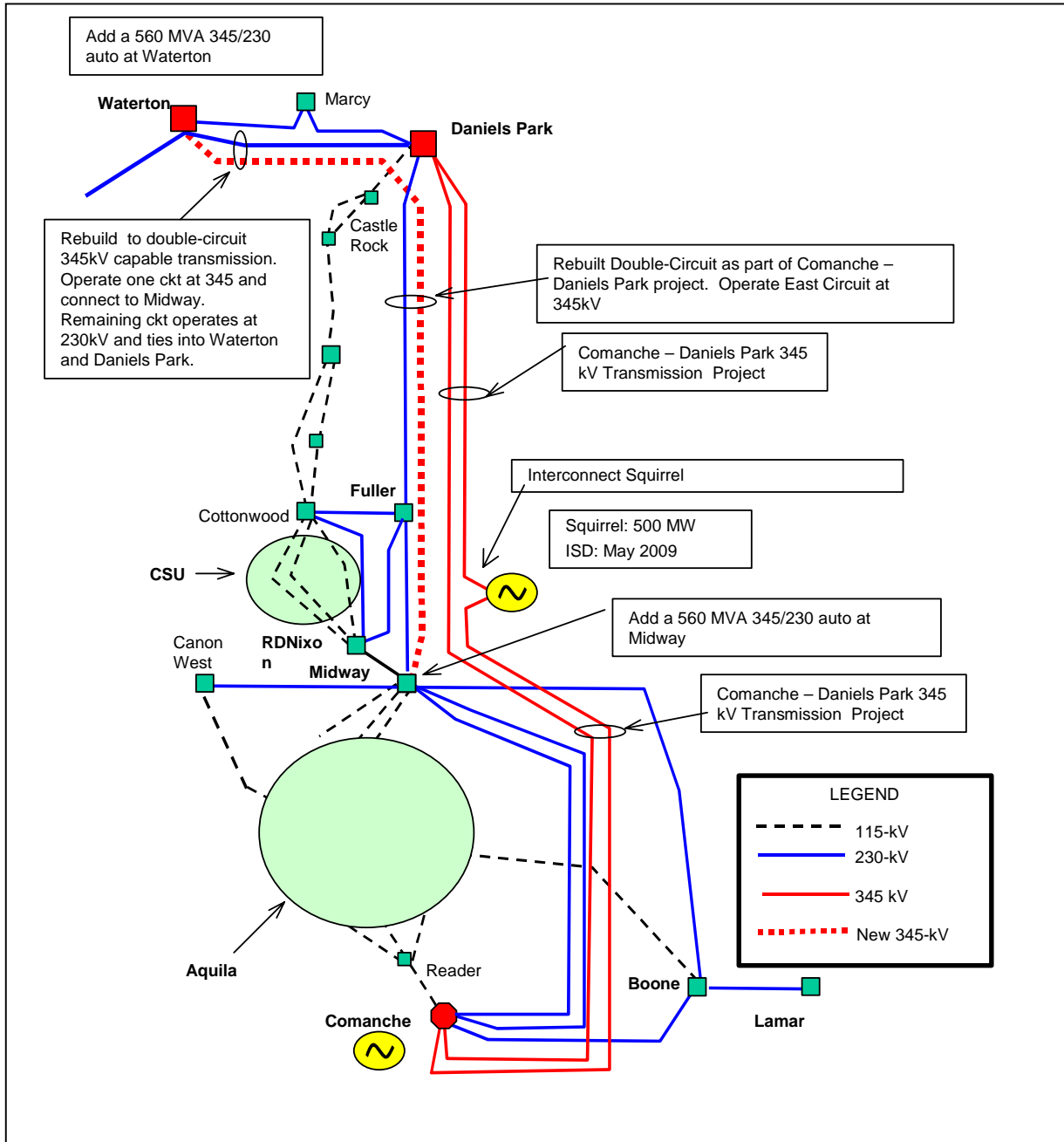
The estimated cost to implement the facilities as stated in the SIS is \$28.5 Million.

A simple diagram for Network Upgrades for Delivery and the regional transmission system for this request is depicted in Figure 1, and a simple one-line diagram of the proposed interconnection facilities shown in Figure 2. The figures are basic electrical illustrations and are not meant to imply precise physical or geographical layouts.

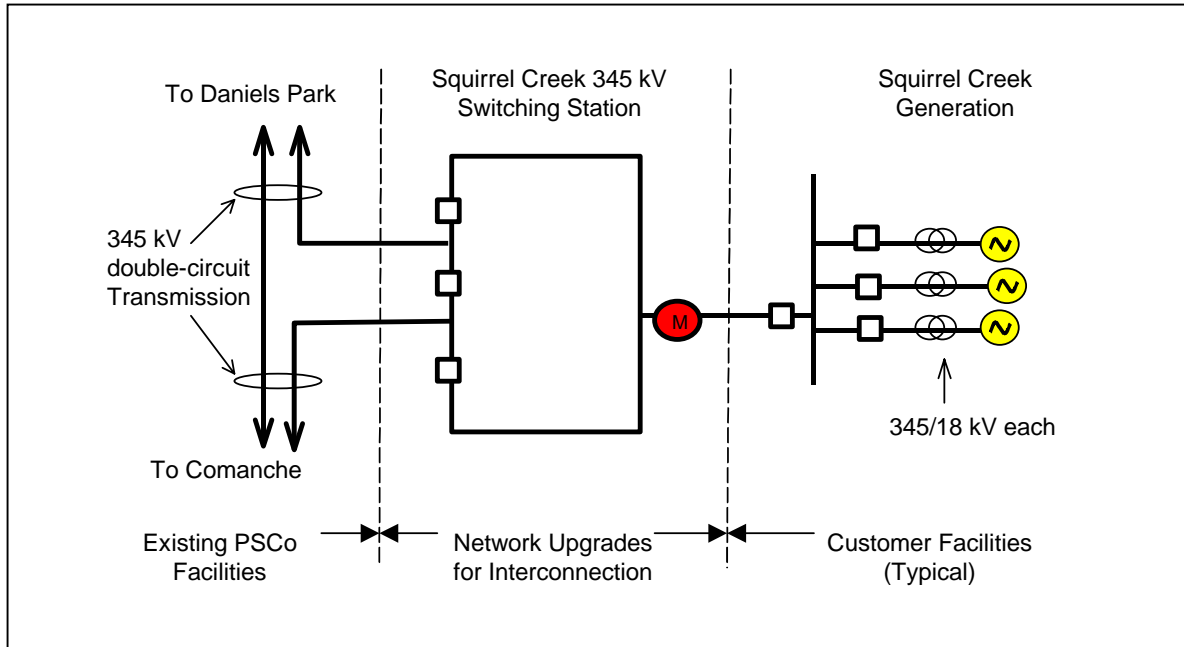
<sup>1</sup> Appropriation estimate considered to have an accuracy of +/- 20%.

<sup>2</sup> Cluster Request GI-2006-1, Portfolio K ([GI-2006-1 \(Portfolio K\) System Impact Study.pdf](#))

Figure 1: Regional Transmission System



**Figure 2: Interconnection Diagram<sup>3</sup>**



## II. Introduction

On February 10, 2006 Xcel Energy Transmission received a request to conduct a System Impact Study that would evaluate the integration of a “cluster” of potential generation resources. The Squirrel Creek Project was one of the resources considered in the study. The System Impact Study report was issued and posted on the Rocky Mountain Area OASIS (RMAO) web site on May 25, 2006. On June 21, 2006 the Squirrel Creek Project was identified on the RMAO website as a project that would proceed with the Facility Study process. An Interconnection Facilities Study Agreement was executed with the Customer on July 26, 2006.

## III. General Interconnection Facilities Description

### 1. Project Purpose & Scope

The purpose of this project is to interconnect a natural gas-fueled, combined cycle generation facility with an output of approximately 500 MW to the PSCo transmission system. The Squirrel Creek Switching Station will be a new facility connected to one of the planned Comanche – Daniels Park 345 kV transmission circuits. The recommended Network Upgrades for Interconnection include the new Squirrel Creek 345 kV switching station.

<sup>3</sup> Conceptual one-line depicts equipment necessary for interconnection only. Diagram depicts electrical layout and not meant to imply physical diagram.

PSCo will design, construct, own, operate, and maintain the new 345 kV switching station. The Customer is responsible for the design, procurement, construction, ownership and operation of the 345 kV radial transmission line connecting their generation facility and the PSCo Squirrel Creek Switching Station. Figure 4 shows a preliminary one-line diagram of the interconnection. Figure 5 shows a preliminary general arrangement of the Squirrel Creek Switching Station.

## 2. Interconnection & Network Upgrades for Interconnection

Requirements for interconnection can be found in the Interconnection Guidelines for Transmission Interconnected Producer-Owned Generation Greater Than 20 MW – Version 2.0, last revised in January 2004. Xcel Energy requires the Interconnection Customer to construct the Interconnection Facilities in compliance with this document. This document describes the technical and protection requirements for connecting new generation to the Xcel Energy operating company transmission system and also includes commissioning, operation, and maintenance guidelines. Xcel Energy also requires that the Interconnection Customer be in compliance with all applicable criteria, guidelines, standards, requirements, regulations, and procedures issued by the North American Electric Reliability Council, Western Electricity Coordinating Council, and Federal Energy Regulatory Commission or their successor organizations.

### a) Removals and Relocations

There will be a new interconnection switchyard and no removals or relocations are required.

### b) Fault Current

After completion in 2008, the 3-phase short circuit fault current is approximately 12 kA and the single line to ground fault current is approximately 13 kA at the Squirrel Creek Switching Station bus. These values were obtained from power system models that included the proposed generation addition and implementation of network upgrades necessary to deliver the generation at Squirrel Creek.

### c) Electrical Installations

The new Squirrel Creek Switching Station will be constructed to accommodate the new Customer 345 kV radial transmission line to connect the Customer facility. The switchyard will consist of a three-breaker ring bus constructed in a breaker and a half configuration. The switchyard will provide for the termination of two 345 kV lines and the line to the generator. Another 345 kV line will pass through the switchyard to avoid line crossings when connecting the switchyard to the transmission lines. The switchyard will be designed to allow for future connection of this line as well as three additional lines.

The interconnection guidelines mentioned above require the Customer to install 345 kV 3,000 Amp 40 kA circuit breaker protection on the Customer end of the 345 kV transmission line to isolate PSCo equipment from the generating facility. The step-up transformer at the customer facility shall be designed to meet the interconnection guidelines mentioned above. The configuration shall be

grounded-wye on the 345 kV primary side and delta on the generator side. The Customer must specify this transformer to meet PSCo requirements for an effectively grounded system.

d) AC Systems

A new AC system will be installed at PSCo's Squirrel Creek Switching Station. The new AC system will consist of a station service transformer and a propane standby generator. Back-up station service will be provided by the propane-powered generator.

e) Electrical Equipment Enclosure (EEE)

A new, large size EEE will be installed, complete with battery, charger, AC and DC panels, lighting, and HVAC system.

f) Grounding

All standard grounding practices in the new switchyard will be observed. All equipment and associated structures will be connected to the ground mat.

g) Lightning Protection

Arresters will be installed on the 345 kV transmission line interconnecting at Squirrel Creek to protect the metering equipment. Static masts and static wire along with the transmission line static wires will be installed to protect the substation equipment.

**3. Civil Features**

a) Grading and Fencing

The site has not been determined. It is assumed that minimal grading is required. The civil engineering and design details have not been determined at this time.

b) Foundation and Structural

All foundations and structures will be new.

c) Removals and Relocations:

No foundations are required to be removed or relocated

**4. Protection and Control Features**

a) Protection Equipment

New relay panels will be installed in the EEE. Line protection will consist of a SEL-321 (PKG-P), SEL-311C (PKG-S), and SEL -351 (BF and Reclosing) using mirrored bits over the fiber optic ground wire for pilot relay communication or via power line carrier. Transducers will also be installed on the new relay panels for SCADA telemetry. A new RTU/LCU will be installed and be utilized for SCADA.

b) Load Control Equipment

A RTU for Load Frequency/Automatic Generation Control (LF/AGC) will be required at the Customer's substation, which will provide information to a new RTU to be installed

at the PSCo Control Center. Customer will supply all necessary AC and DC station service and space for the required equipment.

## 5. Communications

PSCo Squirrel Creek Switching Station to the Lookout Control Center: Two communication circuits will be required from Squirrel Creek to the Lookout Control Center, one for the RTU communications and one for Load Frequency Control from the Jemstar meter.

PSCo Squirrel Creek Switching Station to Customer Generating Facility: The Customer will need to supply protective relaying circuits going from the Customer substation to the PSCo Squirrel Creek Switching Station. PSCo requires this circuit to be a fiber optic circuit. The fiber optic cable could be installed in the transmission line overhead ground wire between these two facilities. If the customer requires data from the Squirrel Creek Switching Station, they will need to supply an additional communication line, specifics on the data needed, and be capable of receiving this data at the generating station via a protocol supplied by PSCo.

Customer Generating Facility to PSCo Control Center: Communication circuit supplying SCADA points using a protocol acceptable to PSCo. Also a dedicated ring-down phone circuit is required.

## 6. Revenue Metering

The 345 kV revenue metering instruments will be installed at the PSCo Squirrel Creek Switching Station to measure real and reactive power from the Customer generation facility. PSCo meters will be 4-quadrant, bi-directional meters with recorders. The meters/recorders will be equipped such that they can be accessed remotely through a phone circuit. PSCo will own and operate the metering equipment.

## 7. Outages

It is assumed that scheduled outages will not be required since the 345 kV lines will not be energized during construction of the switchyard. It is assumed that the switchyard will be completed prior to energization of the 345 kV lines.

## 8. Other Considerations

- Customer will engineer, procure, and construct all equipment up to their 345 kV transmission line dead-end structure, just outside the Squirrel Creek 345 kV Switching Station (Point of Change of Ownership). PSCo will engineer, procure, and construct all equipment between the Point of Change of Ownership and the Point of Interconnection at Squirrel Creek Switching Station, which are depicted in Figure 4.

- The Customer will fund the engineering, procurement and construction of all equipment between the Point of Change of Ownership and Point of Interconnection.
- The Squirrel Creek Energy Center is not situated within PSCo’s retail service territory, and therefore, the Customer will need to make arrangements for its station service needs from the local service provider.
- PSCo needs approximately 4-6 weeks to conduct testing. Much of the testing can be performed in parallel with the construction schedule.

**IV. Costs Estimates and Assumptions**

**1. Interconnection**

Table 1 describes the costs assumed for work to be performed by PSCo, and funded by the Customer, for the dedicated “sole-use” interconnection facilities installed between the 345 kV Point of Interconnection located at Squirrel Creek Switching Station, and the customer generation facility. The estimated total cost for the PSCo Interconnection Facilities and Network Upgrades to provide an interconnection for the Customer generation is:

- **\$0.556 million for PSCo Interconnecting Facilities at Squirrel Creek Switching Station (Customer funded).**
- **\$8.585 million for PSCo Network Upgrades for Interconnection at Squirrel Creek Switching Station (PSCo funded).**
- **Total Estimated cost of Interconnection = \$9.141 million**

The estimated costs shown above are assumed to have an accuracy of  $\pm 20\%$ . The estimates are in 2006 dollars, do not include escalation, and are based upon typical construction costs for previously performed similar construction. These estimates do not include any costs for any customer-owned, supplied, and installed equipment and associated design and engineering for the Customer’s facilities.

Table 2 describes the estimated costs of PSCo Transmission Network Upgrades associated with the Squirrel Creek Project Interconnection.



**Table 1: PSCo Interconnecting Facilities (Customer funded):**

Element	Description	Cost (\$Million)
<b>Customer Interconnect to new PSCo Squirrel Creek Switching Station</b>	Interconnect Customer 345kV transmission line from Customer's generating facility to a new 345kV PSCo switching station. The new equipment required includes: <ul style="list-style-type: none"> <li>• 345kV bi-directional revenue metering</li> <li>• Required steel supporting structures</li> <li>• Associated metering, control and relaying equipment</li> </ul>	\$0.556
<b>Time Frame</b>	<b>Months</b>	<b>6 months</b>
<b>Total</b>	<b>Customer Funded Facilities</b>	<b>\$0.556</b>

**Table 2: PSCo Transmission Network Upgrades Required for Interconnection:**

Element	Description	Cost (\$Million)
<b>PSCo Squirrel Creek Switching Station</b>	Construct a new 345kV PSCo switching station to interconnect Customer's generating facility. The new equipment required includes: <ul style="list-style-type: none"> <li>• Three 345kV circuit breakers</li> <li>• Site development, including moderate grading and landscaping</li> <li>• One Electrical Equipment Enclosure (EEE) with batteries, RTU &amp; LCU</li> <li>• Two 345kV transmission line relaying panels</li> </ul>	<b>\$7.463</b>
	Transmission line tap structures & tap	\$0.556
	Siting & Land Rights	\$0.566
<b>Total Cost</b>	<b>Estimated Costs for Network Upgrades for Interconnection</b>	<b>\$8.585</b>
<b>Time Frame</b>	<b>Months - Substation</b>	<b>23 months</b>

## 2. Major Assumptions related to Table 1, Table 2 and the attached schedule

- The estimated costs provided are assumed to have an accuracy of  $\pm 20\%$ .
- All applicable overheads are included. AFUDC has been included with the PSCo Network Upgrades and removed from the Customer Interconnection Facilities.
- There is no contingency added to the estimates.
- Estimates have not been escalated. All estimates are in 2006 dollars.
- The switching station location has not been determined. It is assumed that the site will be available within close proximity to the transmission line to be sectionalized. It is also assumed that the site will require minimal grading, minimal landscaping and no significant visual screening. The civil engineering and design details cannot be determined until the actual site is identified, and the estimated costs could increase once the site is determined.
- Generation is not in PSCo's retail service territory; therefore no costs for retail load metering are included in these estimates.
- PSCo (or its contractor) crews will perform all construction and wiring associated with PSCo-owned and maintained equipment.
- A Certificate of Public Convenience and Necessity (CPCN) will not be required from Colorado Public Utility Commission (CPUC) for the PSCo network upgrades for interconnection.
- The estimated time for design, procurement and construction for the PSCo network upgrades required for the interconnection is at least 23 months after the Interconnection Agreement has been signed.
- All required transmission outages necessary to support construction will be obtained as needed.

## V. Engineering, Procurement & Construction Schedule

The following schedule identifies milestones needed to complete the interconnection of the proposed Squirrel Creek generation facility.

The following schedule, depicted in Figure 3, 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 for the interconnection is 23 months after receiving authorization to proceed.

Figure 3: Engineering, Procurement & Construction Schedule

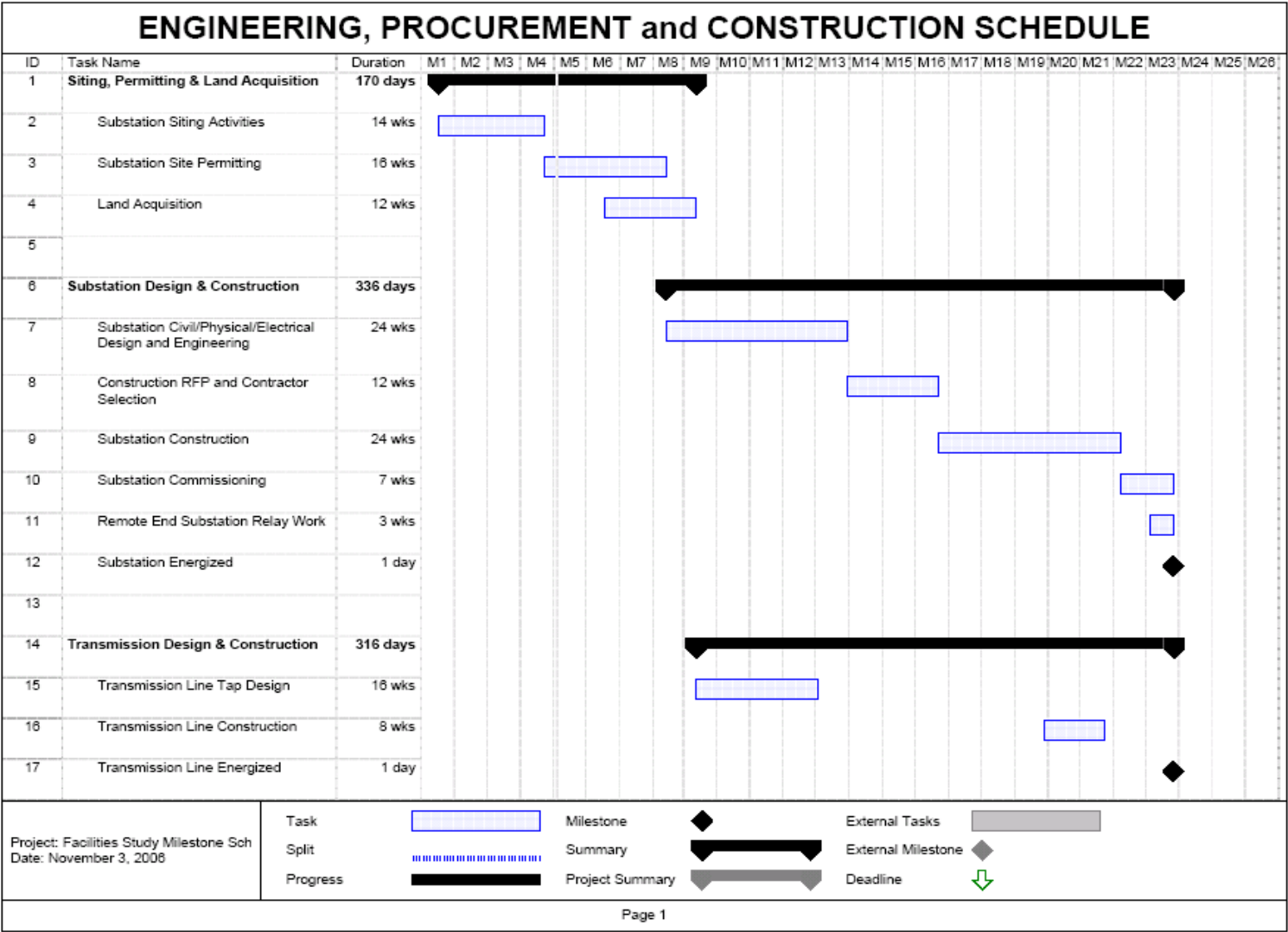
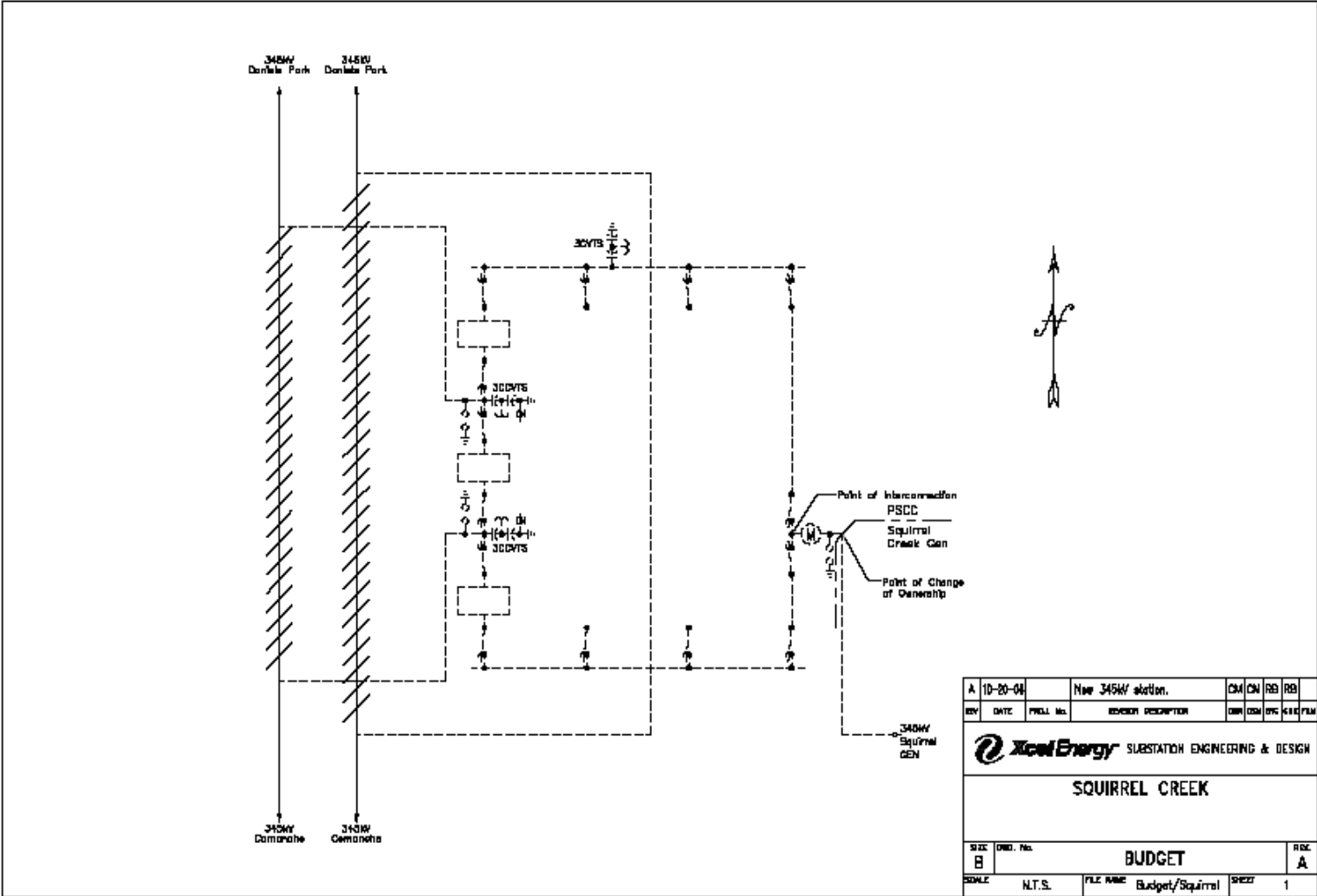
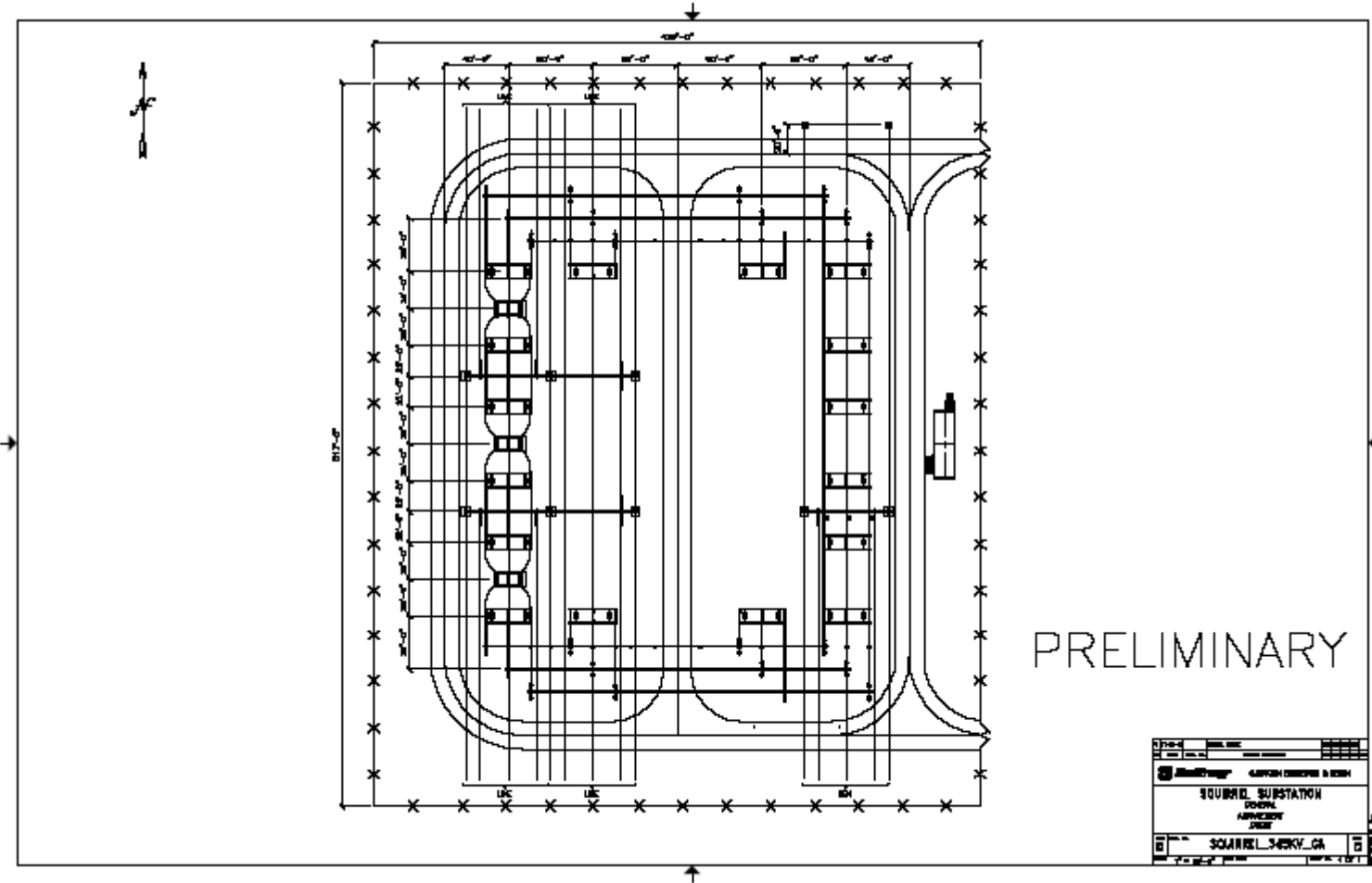


Figure 4: PSCo's Squirrel Creek Switching Station: Proposed One-Line Diagram



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Figure 5: Squirrel Creek Switching Station: Proposed General Arrangement Drawing



## VI. Customer Comments to the Draft Facilities Study Report

1. The IFSR identifies Squirrel Creek Interconnection of approximately 500MW. Our maximum Winter (5oF) to Summer (95oF) Range is 550MW to 500MW, respectively (That is with 100% Power Augmentation). Please confirm your designs will encompass this approximate range.

*PSCo Response: The design and cost estimates for Interconnection associated with this Facilities Study will accommodate the 550 MW winter rating.*

2. We would want to remove our Extra Breaker on our Radial Line. The high side breakers between the generator transformers and our switchyard would be used for intent purpose of protection between PSCo and Squirrel Creek. An air switch would be used instead of the breaker on the radial line to PSCo Switching Station for visual/safety isolation. Please see attached single line that identifies our proposed Squirrel Creek SWYD and Breaker locations.

*PSCo Response: Xcel Energy Interconnection Guidelines require the configuration shown in Figure 2, which includes a high-voltage (345 kV) breaker on the transmission line entering the Customer station.*

3. Based on information from the engineering & construction companies, the Back Feed Date of February 1, 2009 would be too late for commissioning and completing a Combined Cycle Plant by May 1, 2009. We would request a Back Feed Date of November 1, 2008 and the possibility of improving the 23month Schedule.

*PSCo Response: The estimated time of completion shown in the Report is PSCo's best estimate, based on the information and assumptions available at the time of this Facilities Study.*