Interconnection Feasibility Study Report
Request # GI-2007-9

Clipper Monarch Wind Energy 200 MW Project

PSCo Transmission Planning
December 13, 2007

Executive Summary

On June 28, 2007 Public Service Company of Colorado (PSCo) received a generation interconnection request to determine the potential impacts of interconnecting a proposed new 200 MW wind powered generation plant located approximately 40 miles east of Denver in Elbert County, Colorado. The Customer's Monarch Wind Energy project facility is to consist of eighty 2.5 MW Clipper Model C-99 wind turbine generators, with an associated collector system to step up the voltage to 34.5 kV – 230 kV at the Customer wind farm site. The wind farm would connect into the PSCo 230 kV transmission system via a Customer owned and constructed 8-mile, 230 kV transmission line, and require construction of a new PSCo 230 kV "Missile Site" switching station sectionalizing the PSCo Pawnee – Brick Center – Quincy 230 kV transmission line (see Fig.1, and Appendices A and B). The **commercial operation** in-service date requested buy the Customer is **December 31, 2010**. The back-feed in-service date is assumed to be a few months prior to the commercial operation date.

This request was studied as both a Network Resource (NR)[1], and as an Energy Resource (ER)[2]. This investigation included steady-state power flow studies, and short-circuit analysis, but did not include any transient dynamic stability studies. 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 LGIP queue, other than the generation projects that are already approved and planned to be in service by the summer of 2011. Additional sensitivity studies were performed to assess the impact

[1] **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.

[2] **Energy Resource Interconnection Service (ER 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

of the nearby existing Peetz – Logan 380 MW wind farm generation, and the planned new Fort St. Vrain G5-G6 generation (280 MW max, at 120 MW in this study), with the previously planned Squirrel Creek 500 MW generation off line, due to the recent cancellation of the Squirrel Creek generation project. The purpose of this feasibility study was to evaluate the potential impacts on the PSCo transmission infrastructure to inject the Customer's 200 MW into the new PSCo Missile Site 230 kV bus point of interconnection (POI), and deliver the additional generation to native PSCo loads. This project cost to install the transmission interconnection facilities (ER & NR), and transmission system infrastructure (NR) upgrades necessary to accommodate the added Customer generation has been evaluated by Engineering, with the details of these upgrades identified in the Power Flow Study Results and Conclusions, and the Appendix sections of this report.

Based upon the investigations completed, the required transmission upgrades should be achievable by the summer of 2010, consistent with providing back-feed service prior to the request December 31, 2010 commercial operation date. Although this project assumes that a CPCN would be unlikely, it will be up to the CPUC to determine if a CPCN would be required, through the CPUC Rule 3206 annual filing process. If a CPCN is required, then approximately 10 to 12 months would need to be added to the 18 months schedule assumed for this project. The work required consists of:

- Constructing a new PSCo 230 kV Missile Site Switching Station, 3-point ring-bus breaker station, sectionalizing the Pawnee – Brick Center / Quincy / Smoky Hill 230 kV transmission line (#5165), approximately 54 miles from the Pawnee station, and 25 miles from the new Brick Center substation. (PSCo funded costs)

- Transmission line work associated with interconnecting the new Missile Site breaker station into the Pawnee – Brick Center 230 kV transmission line. (PSCo funded costs)

- Revenue metering equipment (CT / VT metering instrument transformers, meters, recorder) and line termination equipment at the new Missile Site breaker station, associated with the Customer's 230 kV Monarch – Missile Site transmission line. (Customer funded costs)

- The only additional transmission infrastructure upgrades that are required for delivery of the new Customer generation to PSCo native loads (NR) involve potential upgrades to a neighboring utility's (IREA) 115 kV transmission system between Brick Center and Smoky Hill substations. An Operating Guide (switching procedure, without load shed) has been identified to mitigate these overloads has been identified. PSCo will be addressing with IREA potential projects that may be required as a long-term solution for these overloads.

Specific scopes of work and related costs for these upgrades have not yet been identified for this feasibility Study.

- **Estimated project cost $3.319 million total** ($0.547 million Customer-funded PSCo interconnection facilities, $2.772 million PSCo-funded interconnection and delivery PSCo facilities).

Stand Alone Study Results

The stand-alone results are based upon comparative studies with the new Customer Monarch Wind Energy generation interconnecting at a new Missile Site Switching Station 230 kV bus, with the Customer generation modeled in the power flow case either at a full output of approximately 200 MW, or off line at 0 MW output. The remaining PSCo control area 70 generation and loads in the power flow model reflect a heavy summer load, moderately heavy north-to-south (HSHN) stressed 2011 case. Regional transmission and generation dispatch stressed sensitivity cases were run to access the potential impacts of low and high generation levels for other existing nearby wind powered generation at Peetz Logan, in combination with planned additional generation at Fort St. Vrain, and previously planned new generation at Squirrel Creek off line (project cancelled). For further details, refer to the Power Flow Study Models section below.

The studies identify that the Customer can provide the full 200 MW Monarch Wind Energy generation additions, once some modifications have been completed to the transmission system infrastructure, including planned and approved transmission projects, most notably planned upgrades to the Pawnee – Quincy - Smoky Hill, Pawnee – Daniels Park 230 kV lines in 2008, and yet to be determined upgrades to the IREA 115 kV transmission systems between Brick Center and Smoky Hill substations. The potentially overloaded transmission elements that have been identified by these studies as being influenced by the delivery of the added Monarch generation occur on both the PSCo and neighboring utilities (Intermountain Rural Electric Association, IREA) 230 kV and 115 kV systems in the immediate region electrically near the Missile Site POI. However, these same elements have also been identified in other previously performed Planning studies, and projects are being developed in conjunction with IREA as a normal course of business in the annual 5-year transmission capital budget analysis process. An operating guide has been identified to mitigate these overloads, which involves opening the IREA Strasburg – Bennett 115 kV line, without requiring load shed (see Table 1). Should this operating guide not be initially acceptable to IREA, prove insufficient under system conditions not studied herein, or be later cancelled by IREA, then a rapid re-dispatch of the Monarch Wind project generation may be required in order to mitigate transmission system overloads. Therefore, as it pertains to this feasibility Study, the ER and NR capabilities are as follows:

Energy Resource (ER):

ER Injection capability: 0 MW

The ER portion of this study determined that the Customer could provide 0 MW of firm injection at the POI without construction of network reinforcements (notably with respect to the aforementioned and yet to be defined IREA 115 kV system enhancements. Non-firm transmission capability may be available depending upon marketing activities, dispatch patterns, generation levels, demand levels, import path levels (TOT3, etc.) and the operational status of transmission facilities.

Network Resource (NR):

NR Injection capability: 200 MW

Following (Table 1) is a list of the lines and autotransformer that either incur new single contingency (N-1) overloading, or that become significantly overloaded as a result of adding 200 MW of new generation at the new Missile Site S.S. 230 kV bus POI. These results are for a power flow model for heavy summer 2011 system conditions, with the re-dispatched case for the maximum wind power generation at Peetz-Logan, new generation at FSV, and Squirrel Creek generation removed from the model (i.e., 5% or more differential loading between the case with the new Monarch generation at 200 MW vs. at 0 MW injection at Missile Site 230 kV). The line ratings and limiting elements identified in the following list (Table 1) are based upon the latest Rev.3 of FAC-009 (Transmission Equipment Facility Ratings), along with new project upgrades or additional that are already planned and budgeted for in the 2008 – 2011 time frame. The only additional transmission infrastructure upgrades that are required for firm delivery of the new Customer generation to PSCo native loads (NR), involve potential upgrades to a neighboring utility's (IREA) 115 kV transmission system between Brick Center and Smoky Hill substations. An Operating Guide has been identified to mitigate these overloads; a switching procedure to open the IREA Strasburg – Bennett 115 kV line, without load shed. PSCo will be addressing with IREA potential projects that may be required as a long-term solution for these overloads.

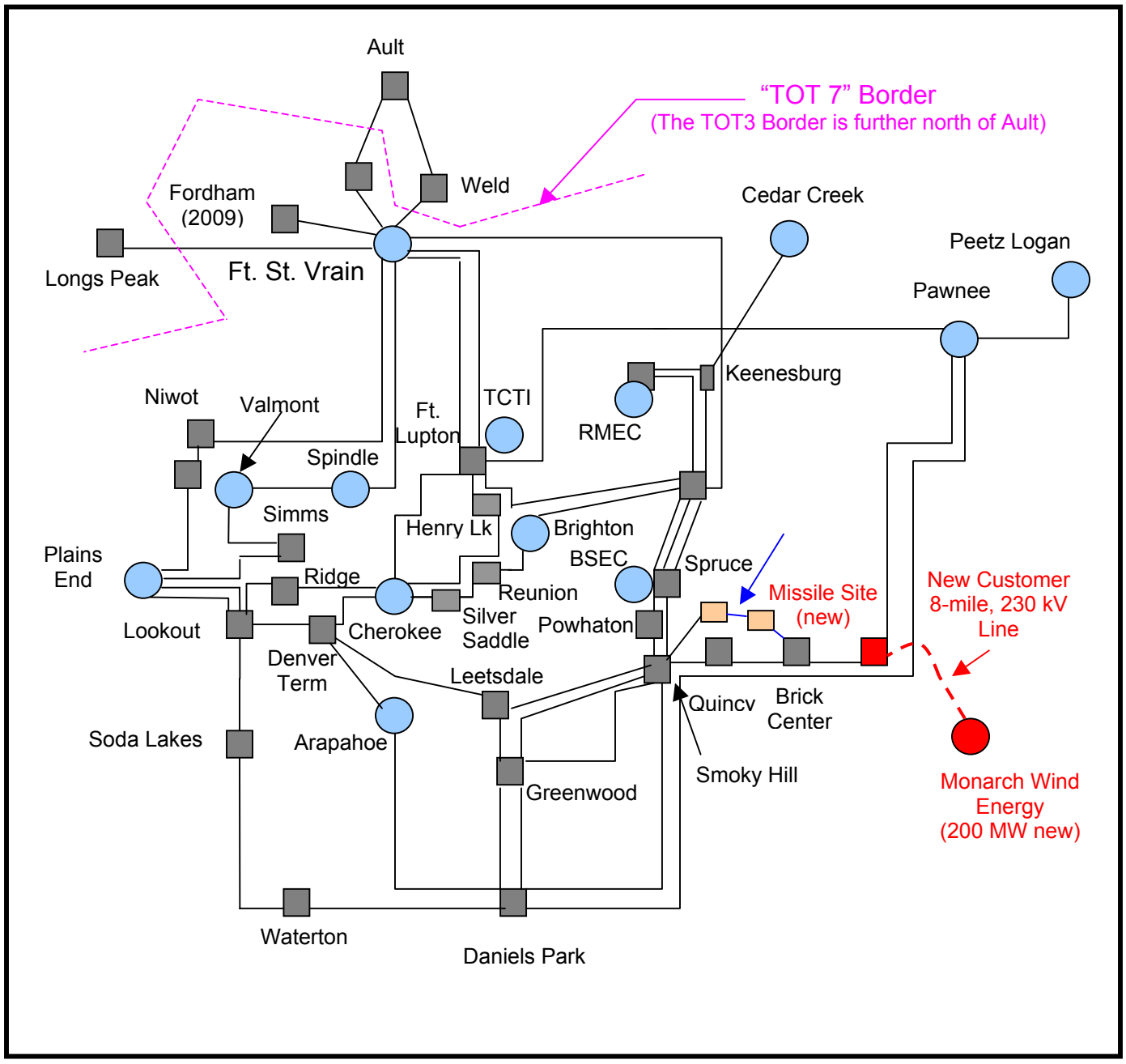
Table 1: Summary listing of differentially overloaded elements (newly overloaded elements, or delta overloads > 5% of rating, due to 200 MW Monarch generation injection at POI), 2011 HSMN "sensitivity case" (see NOTE).

Overloaded Element / (Element Rating MVA / Amps)	Max Loading % / MVA / Amps (Monarch Wind gen at 200 MW / 23.7MVAR)	Max Loading % / MVA / Amps (Monarch Wind gen at 0 MW / 0 MVAR)	Contingency Element Outage for Max OL	Operating Guide To Mitigate N-1 Overload
Brick Center 230-115 kV, 200 MVA Autoxfmr #1 (200 MVA Max Rate)	102% / 203.3 MVA	86% / 172.5 MVA	Quincy – Brick Center 230 kV Line	Open IREA Strasburg – Bennett 115 kV Line (No load shed), or alternatively monitor transformer heating as this 102% loading falls within PSCo's acceptable transformer temporary overload capability criteria standards.
Smoky Hill – Strasburg 115 kV IREA Line #9864 (144.6 MVA / 726 A Rate)	123% / 177.2 MVA / 889 A	99% / 143.9 MVA / 715 A	Quincy – Brick Center 230 kV Line	Open IREA Strasburg – Bennett 115 kV Line (No load shed)
Strasburg – Bennett 115 kV IREA Line (188 MVA / 944 A Rate)	109% / 204.4 MVA / 1,026 A	90% / 171.1 MVA / 848 A	Quincy – Brick Center 230 kV Line	Open IREA Strasburg – Bennett 115 kV Line (No load shed)
Monarch 230-34.5 kV Main Xfmrs #1 & #2 (105 MVA Rate)	101% / 106.4 MVA	0 % / 0 MVA	Brick Center – Missile Site 230 kV Line	NOTE – Suggest that these Customer transformers may need to be re-sized to allow for full 100 MW output plus some MVAR injection on the 34.5 kV bus, to meet p.f. requirements at POI.

NOTE: The results shown in this table are applicable to a 2011 heavy summer peak load case model, re-dispatched for north-to-south stressed PSCo transmission system (approx. TOT3 at 1311 MW, TOT5 at 732 MW, TOT7 at 544 MW, CA73 to CA70 interchange at 906 MW), other northern region PSCo generation near max output, Squirrel Creek 500 MW gen off (0 MW), Peetz-Logan Wind (into Pawnee 230 kV) gen at 380 MW (near max 400 MW rating), new FSV G5 / G6 gen at 120 MW, other wind generation

Figure 1: PSCo 230 kV Transmission System in the proposed Monarch Wind Energy Project Region

(This is a simplified 230 kV system diagram and does not include all system details)



Study Scope and Analysis

This Interconnection Feasibility Study evaluated the transmission impacts associated with the proposed interconnection of 200 MW of new Customer generation into the PSCo Transmission System at a new PSCo Missile Site 230 kV switching station. The Customer's proposed new 200 MW Monarch Wind Energy project would be located approximately 40 miles east of Denver in Elbert County, Colorado. The study assumed that the Customer's new 230 kV transmission line would be constructed for approximately 8 miles, from the Monarch Wind Project site to the PSCo 230 kV Pawnee – Smoky Hill line, interconnecting at a new PSCo 230 kV Missile Site switching station. It was decided not to interconnect into the adjacent Pawnee – Daniels Park 230 kV line, primarily due to the possible future rebuild and potential upgrade to 345 kV for this circuit. Alternative interconnection points considered included constructing the new PSCo 230 kV switching station instead at the nearby Corner Point location, which was rejected due to the Customer's request to keep the interconnection point east of I-25 (refer to Appendix B, maps). Also considered was to interconnect instead art the planned new PSCo Brick Center substation. The Brick Center interconnection was rejected primarily as the Missile Site better conforms with possible future PSCo and IREA transmission needs in the Corner Point / Missile Site area. Lastly, the Brick Center substation site lies approximately 25 miles to the west of the preferred Missile Site location, and would greatly increase the estimated 8-mile length of the Customer's 230 kV transmission line from the Monarch Wind Project.

This study consisted of steady-state power flow analysis, and short-circuit analysis. 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. PSCo adheres to NERC / WECC Reliability Criteria, as well as internal Company criteria for planning studies. During system intact conditions, criteria are to maintain transmission system bus voltages between 0.95 and 1.05 per-unit 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 1.02 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.

For this project, potential affected parties include principally the Intermountain Rural Electric Association (IREA). These parties are in the process of being contacted for involvement in the potential transmission overloads mentioned in this study, and possible new projects that may be required as a result of this interconnection.

Power Flow Study Models

The power flow studies were based on a WECC approved 20011 heavy summer peak load case (11HS1BP), but modified to include recent re-ratings of the continuous thermal ratings for multiple elements (transmission lines) per recently developed FERC FAC-009 requirement. Additional topology modifications were made to include previously planned new PSCo projects that were not already included in the case model, or to remove projects that should no longer be included in the model. The generation in PSCo control area 70 was adjusted (dispatched) for a moderately heavy north-to-south stressing (TOT3 approx. 1310 MW, TOT 5 approx. 730 MW, TOT 7 approx. 540 MW, WAPA CA73 to PSCo CA70 interchange approx. 906 MW), with the area 70 swing bus moved to Comanche #1, and generation levels in the north generally increased to near maximum levels. Additional regional sensitivity studies were performed to assess the impact of the nearby existing Peetz – Logan 380 MW wind farm generation at 10% and 95% levels, adding the planned new Fort St. Vrain G5-G6 generation (at 120 MW), along with taking the previously planned Squirrel Creek 500 MW generation off line. The remainder of the existing / planned wind power generation in PSCo's control area was set at 10% of net facility ratings, consistent with other similar planning study models. For the studies with the Customer's Monarch generation at 200 MW, several generators in the PSCo control area were adjusted / lowered, consistent with the Customer's request to deliver the power to the PSCo native loads.

The Customer's Monarch facility was modeled as two 100 MW generators and associated 230–34.5 kV main transformer lumped equivalents. The actual wind farm is to consist of eighty 2.5 MW Clipper Model C-99 wind turbine generators, with an associated collector system to step up the voltage to 34.5 kV – 230 kV at the Customer wind farm site. The wind farm was further modeled as connecting into the PSCo 230 kV transmission system via a Customer-owned and constructed 8-mile, 230 kV transmission line, and requires construction of a new PSCo 230 kV "Missile Site" switching station sectionalizing the PSCo Pawnee – Brick Center – Quincy – Smoky Hill 230 kV transmission line (#5165, see Fig.1, and Appendices A and B). The two equivalent generators were each modeled with a maximum capability of 100 MW (Pmax) / 32.9 MVAR (Qmax), or effectively 0.95 p.f. at the Monarch 34.5 kV bus, however the actual MVAR output (Qgen) is dictated by the transmission system voltages, with the generation in the model adjusted to regulate to the 230 kV bus voltage at the POI (Missile Site). This was based upon information provided by the Customer that the actual generators could have some amount of dynamic power factor control provided by separate CVAR reactive power management system. As discussed later on, the studies show that additional variable MVAR support will be required at the Customer facilities to enable the required +/- 0.95 p.f. control capability at full rated injection (200 MW, +/- 65.7 MVAR) at the Missile Site 230 kV bus POI, and possible shunt reactive capability under a 0 MW generation condition.

Power Flow Study Results and Conclusions

Two main power flow case model generation dispatch scenarios were evaluated for both the preliminary studies (Peetz Logan wind farm at 10%, etc.), and for the regional sensitivity studies (Peetz Logan at 95% / 380 MW, etc.). A reference dispatch model was established without the additional 200 MW Monarch generation ("Monarch 0" case); and a second model with the new 200 MW of generation included ("Monarch 200" case). The Monarch 200 cases were re-dispatched to lower other PSCo control area 70 generation by 200 MW, mainly in the southern part of the PSCo system in order to maintain or maximize the north-to-south system stressing (and TOT 7 path flows) in the cases.

Automated contingency power flow studies were completed on all case models using PTI's MUST program routine, switching out single elements one at a time for all of the elements (lines and transformers) in control areas 70 (PSCo) and 73 (WAPA RM). Upon switching each element out, the program re-solves with all voltage taps and switched shunt devices locked, and control area interchange adjustments disabled. These automated contingency studies were performed for both the Monarch 200, and the Monarch 0 models, and the results listing the overloaded elements (load flows in excess of their continuous rating) were compared. As previously stated in the Stand Alone Study Results section of this report (see Table 1), these studies indicated that for the higher stressed regional sensitivity dispatched cases, the additional 200 MW of Customer injection into the Missile Site 230 kV bus POI could cause new and/or additional load flows in excess of present or planned element ratings on two IREA 115 kV transmission lines (line conductor, or associated substation termination equipment), plus one PSCo 230-115 kV autotransformer (Brick Center), plus the Customer's main 230 - 34.5 kV transformers, under single-contingency (N-1) conditions. However, these same elements have also been identified in other previously performed Planning studies, and projects are being developed in conjunction with IREA as a normal course of business in the annual 5-year transmission capital budget analysis process. An operating guide has been identified to mitigate these overloads, which involves 115 kV line switching (opening the IREA Strasburg - Bennett 115 kV line), without load shed. PSCo will be addressing with IREA potential projects that may be required as a long-term solution for these overloads. Specific scopes of work and related costs for these upgrades have not yet been identified for this feasibility Study.

The power flow models were also utilized to determine the Customer's MVAR generation capacities that may be necessary to meet the operational power factor and related MVAR requirements at the Missile Site 230 kV POI. Two basic operating scenarios were modeled. Note that a simplified model was used for the Customer wind generation farm, and detailed models of the Customer's 34.5 kV collector and feeder systems, and their associated reactive (capacitive) characteristics, have not been developed at this stage. The Customer will need to develop these models for further / future studies (e.g. dynamic System Impact Study,

detailed Facilities Study) in order to ascertain the specific dynamic MVAR capacitive and inductive / reactive equipment (DVAR, CVAR, SVC, Reactors, etc.) that would be required to meet both of the following operating scenarios.

1) One study determined the approximate MVAR generation levels that are required at full Monarch 200 MW rated output, for supplying the typical MVAR losses that could be expected in the two main Monarch 230-34.5 kV transformers, plus the Customer's 8-mile, 230 kV Monarch to Missile Site transmission line, and still meet the 0.95 p.f. (200 MW / +/- 66 MVAR) requirements. These transformer plus line losses were determined to be approximately 33 to 34 MVAR, with the Monarch generation at 200 MW. Therefore, any of the Customer-supplied dynamic power factor control equipment, such as may be provided by a separate CVAR reactive power management system, would need to be capable of supplying approximately 34 MVAR of losses, and still net 66 MVAR control capability at the Missile Site 230 kV POI. Primarily the transmission system operating voltages at the POI, and related voltage limits at the Monarch buses one time will determine the actual MVAR demands called on by the PSCo Operators. Specific MVAR controllability / capability testing / commissioning requirements still need to be developed by PSCo, and provided to the Customer prior to the facility designs being finalized by the Customer. Commissioning testing for similar installations have included requirements to demonstrate the Customer facility's ability to operate in a controlled fashion across a specified / controlled range of MVARs delivered and absorbed, at specified range of generation levels, while operating within the within the voltage limitations achievable for the transmission system conditions in place at the time of the testing.

2) The second study was performed with the Monarch generation at 0 MW, and the 230 kV Monarch – Missile Site line energized. This was used to determine the approximate MVAR flow from Monarch into the POI at Missile Site, due to the 230 kV line capacitance. PSCo requires that the Customer facilities will have a near neutral (0 +/- 5 MVAR) reactive impact on the PSCo POI transmission bus with the Customer generation off line. This requirement helps to assure that the PSCo transmission system would not be burdened with absorbing unwanted reactive flows and potential high voltages caused by these MVARs under typically light system loading conditions. The studies performed with this 8-mile 230 kV line model indicate that the reactive flow into the POI is approximately 2 to 3 MVAR, with the Monarch generation at 0 MW, and the bus voltage near 1.0 PU (230 kV) at the Missile Site 230 kV bus POI. Therefore it appears to be unlikely that any shunt reactors or generator CVAR leading pf operation would be needed to operate within the previously stated 0 +/- 5 MVAR range requirement at 0 MW. However, as previously stated, these models did not include any of the Customer's wind farm 34.5 kV collector / network feeders and cables, so the potential capacitive contribution of this 34.5 kV network has not been determined in this study.

NOTE - It is the responsibility of the Customer to determine what type of equipment is required (CVAR, added switched capacitors, SVC, reactors, etc.) and at what final ratings (MVAR, voltage 34.5 kV, 230 kV) and location (Monarch or Missile Site POI) will be necessary to meet these reactive power controllability requirements. Furthermore, the actual voltage tap ratios used for the Customer's main 230 - 34.5 kV transformers will directly impact the operating voltages and related reactive capabilities for the Monarch facility. The Customer should review these issues in determining the final design requirements for this equipment (CVAR, transformer voltage tap ratios and MVA, etc.).

Short Circuit Study Results: Table 2

Short-circuit analysis faulted at the Missile Site 230 kV buses. Thevenin Equivalent impedance data is given in per-unit, on a 100 MVA base, and 230 kV bases, assuming Monarch generators on-line, for a 2011 system model.

3Φ Bus Fault 230 kV (A)	S-L-G Bus Fault 230 kV (A)	Pos Seq Thev Equiv (230 kV Bus, PU)	Zero Seq Thev Equiv (230 kV, Bus PU)	Monarch 230 kV Line Contribution (3-ph Amps)	Monarch 230 kV Line Contribution (3I0 Amps)
8,315	5,923	0.00322 + j0.03002	0.01354 + j0.06552	443	1,485

Costs Estimates, Schedule, and Assumptions

The Customer has requested a 200 MW Wind Project interconnecting into a new breaker station (Missile Site Substation) on the Pawnee-Daniels Park 230kV line. An 8-mile long, 230kV radial line will connect the Customer's collector site with the PSCo transmission system at the Point of Interconnection. The estimated **total cost** for the required upgrades for is **$3,319,000** ($0.547 million Customer-funded PSCo interconnection facilities, $2.772 million PSCo-funded interconnection and delivery PSCo facilities).

The estimated costs shown are (+/-30%) estimates in 2007 dollars and are based upon typical construction costs for previously performed similar construction. These estimated costs include all applicable labor and overheads associated with the engineering, design, procurement and construction of these new PSCo facilities. This estimate did not include the cost for any other Customer owned equipment and associated design and engineering.

The following tables 3, 4, and 5 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.

Table 3 – PSCo Owned; Customer Funded Interconnection Facilities

Element	Description	Cost Est. Millions
Missile Site 230kV Substation	Interconnect Customer to tap at PSCo's 230 kV substation. The new equipment includes: • One 230 kV, 1200 amp (or 2000 amp) gang switch • One bidirectional revenue meter & recorder • Three 230 kV combination CT/PT instrument transformers • Three 230 kV lightning arresters • Associated bus, wiring and equipment • Associated foundations and structures • Associated transmission line communications, relaying and testing	**$0.361**
	Transmission – labor to install slack span into Pawnee. Materials furnished by Customer	**$0.018**
	Customer Generator Communication equipment at Lookout Operations Center.	**$0.047**
	Customer generation telemetry equipment, and witnessing the Customer generator commissioning testing.	**$0.116**
	Siting and Land Rights for required easements, reports, permits and licenses.	**$0.005**
	Total Cost Estimate for Customer Interconnection Facilities	**$0.547**

Table 4: PSCo Owned; PSCo Funded Interconnection Facilities

Element	Description	Cost Est. Millions
Missile Site 230kV Substation	Interconnect Customer to tap at PSCo's 230 kV substation. The new equipment includes: • Three 230kV, 3000 amp, circuit breakers • Eight 230kV, 3000 amp gang switches • Six 230kV CCVT's • One electric equipment enclosure • Associated communications and SCADA equipment • Line relaying and testing • Electrical bus work • Associated foundations and structures • Associated yard surfacing, landscaping, fencing and grounding	**$2.612**
Missile Site 230kV Substation	Siting, permitting and acquisition of a 35-acre substation site and associated transmission line tap.	**$0.160**
	Total Estimated Cost for PSCo Interconnection Facilities	**$2.772**

Element	Description	Cost Est. Millions
Time Frame		18 Months

Table 5 – PSCo (and IREA) Network Upgrades for Delivery

Yet to be determined, discussions to follow with IREA.

Element	Description	Cost Est. Millions

Schedule:

The estimated time for XE / PSCo to complete the siting and permitting, design engineering, procurement, and construction of the scope of work identified in Tables 3 and 4 is **18 months**, after authorization to proceed has be obtained. This does not include any time for preparation and receipt of a CPCN, which would add an additional 10 to 12 months to this schedule (see Assumptions below).

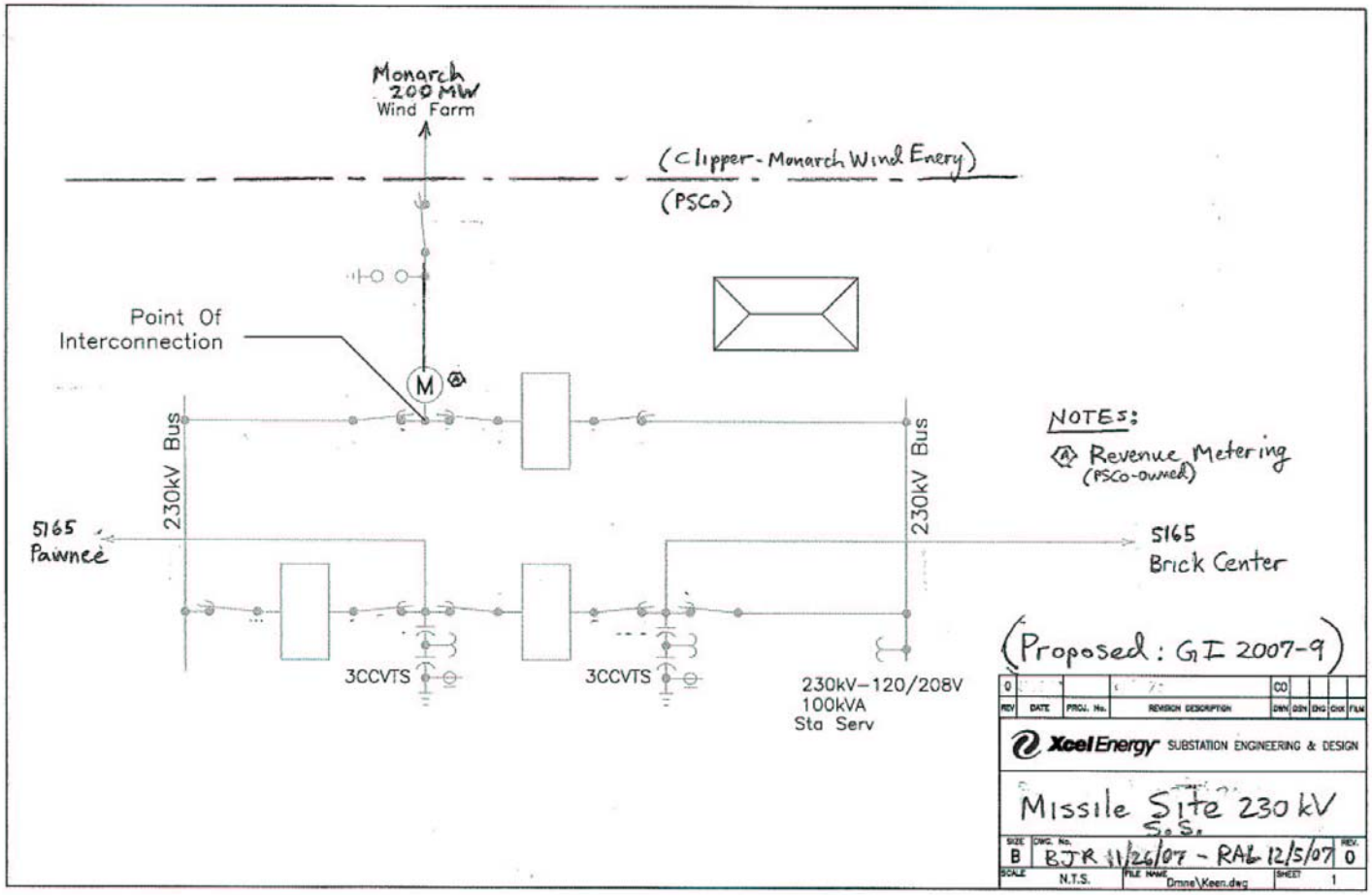
Assumptions

- The cost estimates provided are "scoping estimates" with an accuracy of +/- 30%.
- Estimates are based on 2007 dollars.
- There is no contingency added to the estimates. AFUDC is not included.
- Labor is estimated for straight time only – no overtime included.
- The Generator 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 and wiring associated with PSCo owned and maintained facilities.
- The estimated time to site, design, procure and construct the interconnection facilities is at least 18 months, and is completely independent of other queued projects and their respective ISD's.
- A CPCN may not be required for interconnection facility construction. However, this would be determined by the CPUC as part of the annual Rule 3206 filing by XE/PSCo with the CPUC. Should a CPCN be required, this would add approximately 10 to 12 months time to the at the beginning of the project, increasing the 18 month time frame listed to 28 to 30 months total schedule time, after authorization to proceed has be obtained.

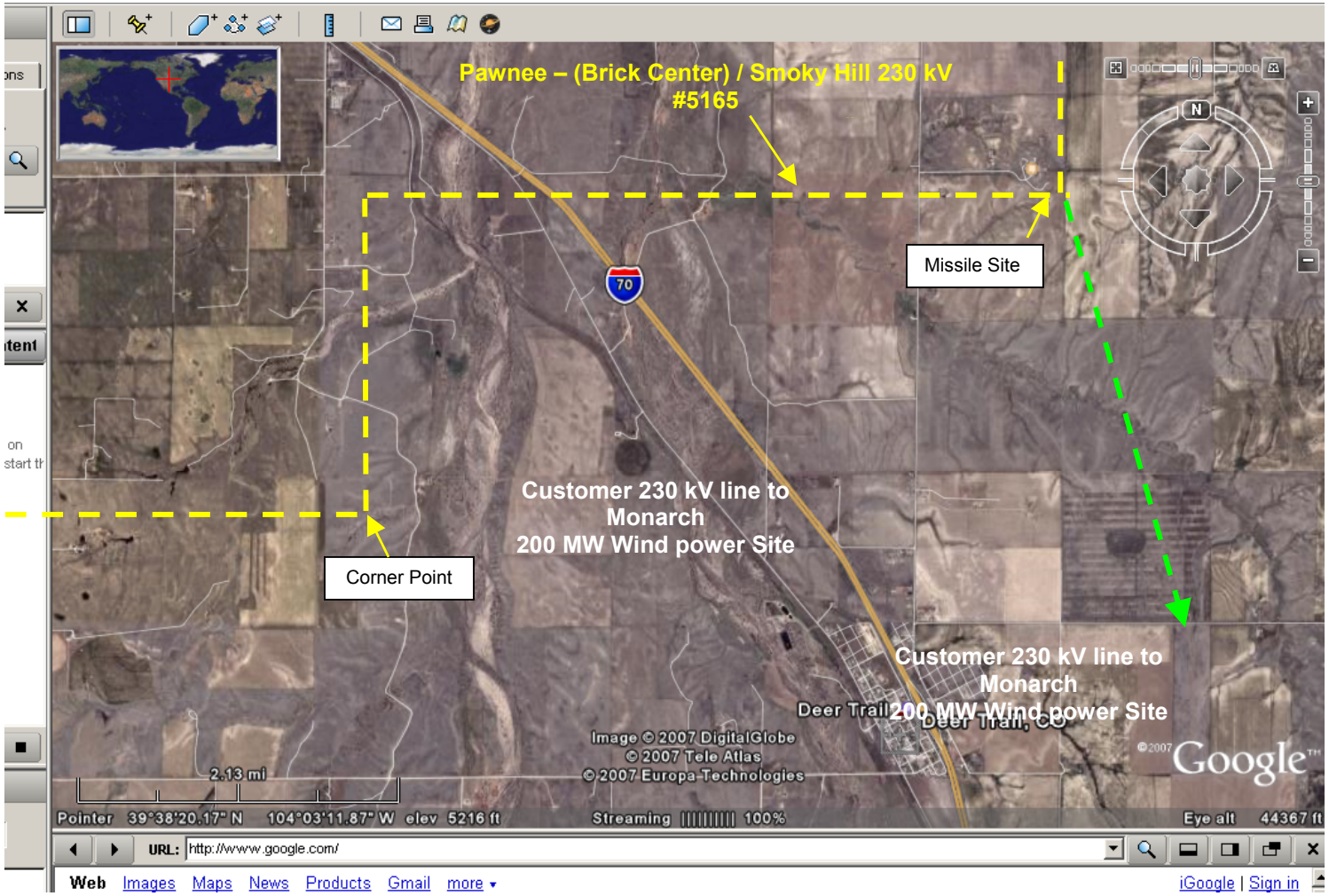
- Customer will string OPGW fiber into substation as part of the transmission line construction scope.
- Contractor to construct the new substation, PSCo crews to perform checkout, relay panel construction and final commissioning.
- Relaying requirements are adequate at Brick Center and Pawnee Substations.
- Acquisition of a new site this size eliminates the subdivision process.
- New site is adjacent to the existing transmission line corridor, most likely assumed to be on the north and / or west side of the existing 230 kV double-circuit transmission lines at this location (see Appendix B maps). However, the specific details regarding the new Missile Site switching station layout, location, potential transmission line exits and line crossings, and detailed requirements necessary to meet both the initial station design / construction requirements, and still meet the ultimate expansion capabilities will need to be further reviewed in the later Facilities Study phase.

Appendix A

Station One-Line Diagram
(New PSCo Missile Site Switching Station)



Appendix B



"Corner Point" & "Missile Site" NE of Deer Trail, CO

(230 kV Dbl Ckt 230kV Lines: Pawnee – Daniels Park 5457 East / South Ckt; Pawnee – Smoky Hill 5165 West / North Ckt)