Facility Study
For
Generation Interconnection Request
GEN-2010-016

SPP Generation Interconnection

(#GEN-2010-016)

April 2011

Summary

ITC Great Plains (ITCGP) performed a detailed Facility Study at the request of Southwest Power Pool (SPP) for Generation Interconnection request GEN-2010-016. The request for interconnection was placed with SPP in accordance with SPP's Open Access Transmission Tariff, which covers new generation interconnections on SPP's transmission system.

Interconnection Customer Interconnection Facilities

The Interconnection Customer will be responsible for the 345 kV transmission line from its Generation Facility Substation to the Point of Interconnection (POI), a new 345 kV ring-bus on the Spearville – Post Rock 345kV transmission line. In addition, the customer will be responsible for reactive power compensation equipment to maintain 95% lagging (providing vars) and 95% leading (absorbing vars) power factor at the point of interconnection. Any capacitor banks installed by the Customer shall not cause voltage or other distortion on the transmission system in accordance with Article 9.7.6 of the Standard GIA, Power Quality.

Transmission Owner Interconnection Facilities and Non-Shared Network Upgrades

Per the following Facility Study, the Interconnection Customer is responsible for **$9,031,000** of Transmission Owner Interconnection Facilities and non-shared network upgrades.

Shared Network Upgrades

The interconnection customer was studied within the DISIS-2010-001-1 Impact Restudy. At this time, the Interconnection Customer's allocation of shared network upgrades is shown in the following table:

Post Rock 345/230/13.8kV Transformer CKT 2 DISIS-2010-001 Restudy	$3,048,291
Cimarron River Plant – Cimarron River Tap 115kV CKT 1 Rebuild approximately 4 miles of 115 kV line	$134,688
Shared Network Upgrade Costs - TOTAL	**$3,182,979**

If higher queued interconnection customers withdraw from the queue, suspend or terminate their GIA, restudies will have to be conducted to determine the Interconnection Customers' allocation of shared network upgrades. All studies have been conducted on the basis of higher queued interconnection requests and the upgrades associated with those higher queued interconnection requests being placed in service.

Other Network Upgrades

Certain Network Upgrades that are not the cost responsibility of the Customer are required for Interconnection. These Network Upgrades include:

1. Spearville - Axtel 345kV transmission line,
2. Axtel - Post Rock 345kV transmission line,
3. Comanche - Medicine Lodge double circuit 345kV transmission line,
4. Spearville - Comanche double circuit 345kV transmission line, and
5. Medicine Lodge - Wichita double circuit 345kV transmission line.

Some of these network upgrades are not scheduled to be in service until December 31, 2014. Depending upon the status of higher or equally queued customers, the Interconnection Customer's in service date may be delayed until the in service date of these Network Upgrades.

FACILITY STUDY
for
Generation Interconnection Request 2010-016

199.8 MW Wind Generating Facility
In Rush County, Kansas

April 7, 2011

Executive Summary

ITC Great Plains ("ITCGP") has performed a facility study at the request of Southwest Power Pool ("SPP") for Generation Interconnection request GEN-2010-016 under the SPP Open Access Transmission Tariff. The subject request entails interconnecting a 199.8 MW wind powered generation facility in southern Rush County, Kansas. The project will interconnect to the ITCGP Spearville to Post Rock 345 kV transmission line presently under construction.

ITCGP estimates the cost of the customer's interconnection facilities will be $9,031,000 including applicable company overheads and tax gross-ups, in present-day dollars. It is further estimated that the required legal/real estate acquisition and construction activities will require 603 days, or approximately 20 months. The attached report contains additional details regarding the details included within the estimate as well results of short circuit studies, review of reactive compensation, and information on voltage guidelines.

1.0 Introduction

ITC Great Plains ("ITCGP") performed the following study at the request of Southwest Power Pool ("SPP") for Generation Interconnection request GEN-2010-016 under the SPP Open Access Transmission Tariff ("OATT"). Subject request entails interconnecting a 199.8 MW wind powered generation facility in southern Rush County, Kansas. The project will interconnect to the ITCGP Spearville to Post Rock 345 kV transmission line presently under construction. The ITCGP scope of this Facility Study was to provide a cost estimate for the Customer's interconnection facilities.

2.0 Interconnection Facilities

The Customer's interconnection request indicated that the new wind generation project's substation facilities would be located such that the interconnection substation and the Customer's substation would be adjacent to each other and approximately 43 miles from the Spearville terminal of the ITCGP Post Rock to Spearville line.

Figure 1 – Interconnection Facility One-Line

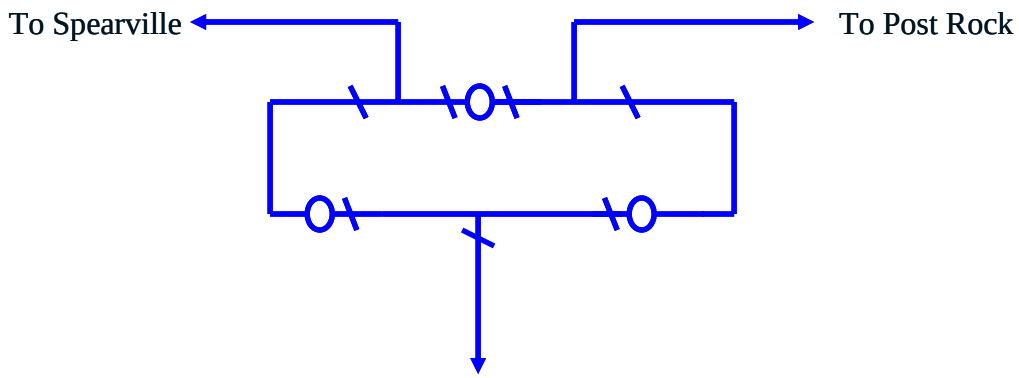
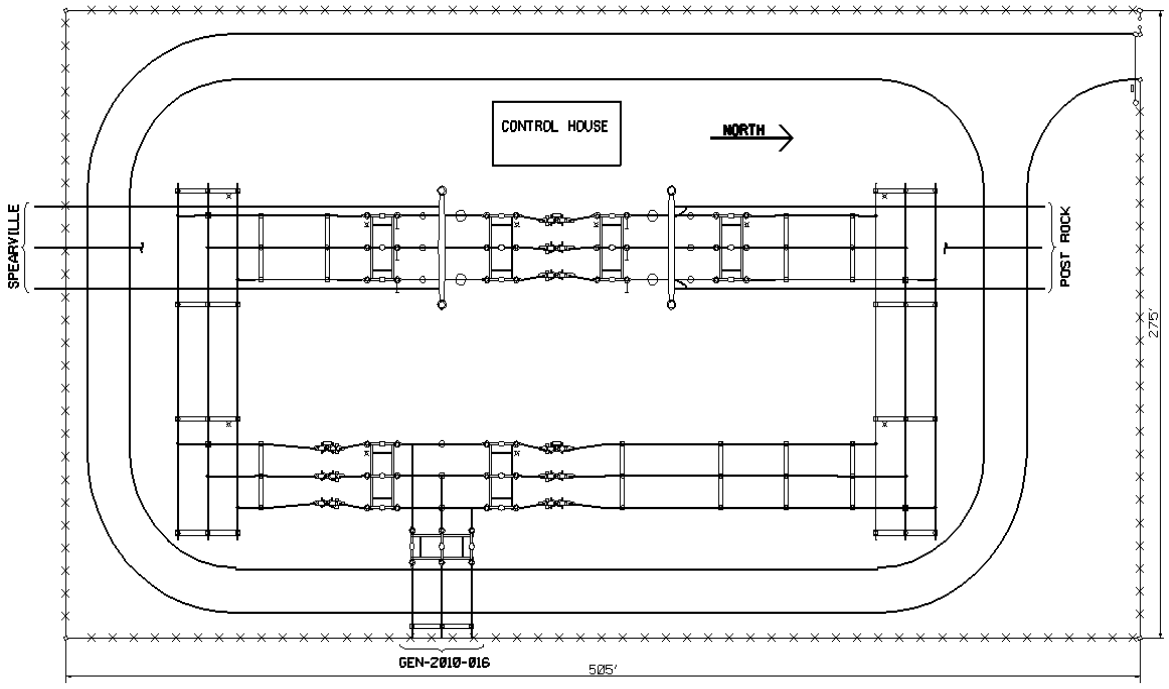


Figure 2 – Interconnection Facility Conceptual Plan View



Design Criteria:
The Transmission Owner's standards will be applicable. Where no applicable standards are available, the Transmission Owner will substitute industry standards and other good utility practices.

One-Line Diagrams:
See Figure 1 for Transmission Owner One-Line.

Site Plan:
See Figure 2 for site plan of Transmission Owner substation. The Transmission Owner substation facility will have a fenced area of approximately 275' x 505'. Once the exact location of the substation is identified, the Transmission Owner will specify the dimension requirements for permanent construct and maintain

Route Information:
N/A

Right-of-Way Information:
It is assumed that the interconnection substation will be immediately adjacent to the Post Rock-Spearville 345 kV line. As such, the interconnection costs contained herein do not include any costs for extending the ITCGP transmission

line beyond minimal line rearrangements required to cut the line(s) in to the interconnection substation.

Permitting:
The Interconnection Customer will be responsible for satisfying all community or governmental site plan or zoning approval requirements which may include wetland or flood plain permits. The Transmission Owner will be responsible for the control center building permit and the KDHE storm water construction permits associated with the Transmission Owner portions of the construction.

Metering & Ownership Demarcation:

The Interconnection Customer or others will provide, own, operate and maintain revenue metering. The specifics of the revenue metering will be defined during the detailed engineering phase of the project. The customer must cooperate with the Transmission Provider and Local Transmission Owner requirements in the metering design. Revenue metering equipment will be required at the Point of Interchange in the Interconnection Customer's substation.

The ownership demarcation will be at the transition across the security fence between the Transmission Owner yard area and the Interconnection Customer yard area.

Protection & Control Overview:
One set of three 345kV CCVTs will be installed for each of the two 345kV line terminals and generator interconnection terminal. Two dual frequency wave traps and tuners will be installed for Post Rock line and Spearville line for power line carrier and transfer trip schemes. Two paths of fiber optic cable will be installed for the wind farm connection.

Three breaker control panels for all 345kV breakers with microprocessor based relays will be installed. Breaker failure protection, automatic reclosing supervised by synchronism check will be provided.

For Post Rock and Spearville 345kV lines, two line relaying panels containing two SEL-421-5 microprocessor based relays and three Pulsar UPLC units will be installed for each line. For the wind farm line, a line relaying panel containing two SEL-311L microprocessor based fiber optic line differential relays will be installed. The relaying will provide high speed tripping for line faults, direct transfer trip for breaker failure conditions and metering for the line.

Since the Interconnection Customer substation is located adjacent to the Transmission Owner substation, an alternate protection scheme should be considered. The Interconnection Customer does not need to install the 345kV breaker. Two transformer differential schemes can be utilized by using two

345kV ITC breaker CTs and the transformer low side CTs. The 345kV line relaying and fiber optic cable will not be required for this alternate scheme.

A synchronizing panel will be installed to provide the ability to close line breakers from the synchronizing control for all three 345kV lines.

Insulation Coordination:
345kV, 1050kV BIL

Short Circuit Study Results - Bus Fault Levels:
ITCGP calculated bus fault levels for the interconnection substation and adjacent substations to determine if the added generation will cause fault currents to exceed interrupting ratings for existing equipment and for use in sizing future equipment. Calculations are based on data for the interconnection transformer and installed wind turbines supplied by the Interconnection Customer. Variance from supplied data could materially change calculated short circuit values. Results are displayed in Table 1.

Table 1 – Short Circuit Results

Fault Location	Fault Current (Amps)	
	Three-Phase	Line-Ground*
Interconnection Substation	6832	5650
Post Rock 345 kV Bus	7080	7100
Spearville 345 kV Bus	6928	7100
* Zero-sequence impedance was not provided for the interconnection transformer. Line-Ground fault currents were increased by 15 percent at the interconnection substation and 10 percent at both Post Rock and Spearville to estimate impacts of contributions from the interconnection transformer.		

Fault currents shown in Table 1 are within the circuit breaker interrupting capabilities with the addition of 199.8 MW contributed by Gen-2010-016.

Reactive Compensation:
ITCGP evaluated the impact of the proposed interconnection on the line reactors presently planned for the Spearville and Post Rock terminals. ITCGP studies determined that the planned reactors were not affected due to the fact that the proposed interconnection is near the midpoint of the line. Should this change materially, these results will need to be reevaluated.

Voltage Guidelines:
Reactive power, voltage regulation and operating requirements will be per Transmission Operator (TOP) and Transmission Provider directives. Interconnection Customer will operate the Generating Facility to a voltage

schedule of 354 kV (1.026 pu) with a bandwidth of +/- 6 kV (0.017 pu) at the Point of Interconnection utilizing the Generating Facility's required power factor design capability as indicated in SPP DISIS-2010-001. Relevant language from the SPP DISIS is included below for reference:

> "Per FERC and SPP Tariff requirements, if the power factor needed to maintain scheduled voltage was less than 0.95 lagging, then the requirement was set to 0.95 lagging. This limit was reached for GEN-2010-015 and GEN-2010-016. Much greater reactive power supply would be needed to meet the voltage schedules under some contingencies, but only 0.95 lagging will be required. The limit for leading power factor requirement is also 0.95, and this limit was not reached for any study project. If the project never operated leading under any contingency, then the leading requirement is set to 1.0. Similar for lagging.
>
> **GEN-2010-016 will need to add 96 Mvar of capacitors at its 34.5kV substation bus (576702).** The reactive power resources need not be dynamically controlled. However, any change in wind turbine model or controls could change the stability results, possibly resulting in a need for a dynamically controlled reactive power supply."

For further clarification, the Customer may meet the +/-95% power factor requirement by means other than capacitor banks such as reactive capability from the wind generators. Also, any capacitor banks installed by the Customer shall not causes voltage distortion in accordance with Article 9.7.6 Power Quality of the Generation Interconnection Agreement.

The Interconnection Customer will regulate the Generating Facility's voltage to the specified set-point within the defined bandwidth stated above using an automatic voltage controller utilizing the inherent reactive power capability in the wind turbines and static capacitor banks. The Interconnection Customer is required to have a generator operator available for 24/7 communication with the TOP. The TOP may, at any time request a variance from the schedule in response to system operating/security requirements.

Other Equipments & Materials:

- Gas Circuit Breakers (GCB):
  Three (3) 345 kV, 3000A rated, 1300 kV BIL, 50 kAIC GCBs.

- Disconnect Switch:
  Seven (7) 345 kV, 3000A rated, 63kA, 1050 kV BIL disconnect switches.

- CCVTs:
  Nine (9) 345 kV, 3-winding, 1300kV BIL CCVTs.

- Insulators:
  Fifty-eight (58) 345 kV, 1050 kV BIL station post, porcelain insulators.

- Surge Arresters:
  Six (6) 345 kV, vertical mount, 209 kV MCOV, polymer surge arresters

- Station Service AC Supply System:
  Two independent single-phase station service feeds will be required. If only a single distribution fed service is available, a standby generator will be installed as the backup source. One automatic transfer switch (ATS) will switch between sources to ensure AC service is maintained. The ATS will feed one AC distribution panel.

- Station Service DC Supply System:
  The station service DC supply system will be comprised of two 60 cell station battery systems, two battery chargers, two surge rectifier cabinet and two DC distribution cabinets.

- Control Cable:
  Control cables per Transmission Owner standards will be installed in direct buried PVC conduits, above grade IMG conduits and in pre-cast cable trench. All control cables from the yard will be terminated at the relaying control panels. The control building will have overhead cable trays for necessary cable runs and inter-panel connections.

- Station Fence and Gate:
  A 7' tall chain link fence will be installed around the perimeter of the substation. The fence fabric will be 6' tall, with a one foot high V-configuration six wire barbed wire installation on top. The fence will be connected to the ground grid. One 24' drive-through gate, one pedestrian gate adjacent to the sliding gate and one pedestrian gate between the Transmission Owner yard area and the Interconnection Customer yard area will be installed to provide access to the substation.

Relaying, Control, & SCADA:

- Relay Panels:
  - Two (2) SEL 421-5 Line Relaying panels
  - Three (3) RD3024 Breaker Control & Breaker Failure panels
- One (1) RTU/Annunciator panel
- One (1) Digital Fault Recorder panel
- One (1) Synchronizing panel

Grounding System:

The grounding system will be designed and installed per Transmission Owner's standards. These standards follow the IEEE 80 standards.

Lightning Shielding Design:
Lightning shielding will be provided per Transmission Owner's standards. Multiple H-frame structures and four lightning masts, along with shield wire, will be used for lightning protection.

Yard Lighting:
Yard lighting will be installed to be sufficient for visual indication of the disconnect switch positions or egress of personnel, and will not serve as task lighting.

Structures:
The required new outdoor steel structures listed below will be hot-dipped galvanized wide flange structures:

- Nine (9) high height three phase bus support stands
- Five (5) intermediate height three phase bus support stands
- Four (4) 345 kV low height disconnect switch stands [used as bus supports]
- Four (4) 345 kV low height single phase bus support stands
- Six (6) 345 kV intermediate height disconnect switch stands
- One (1) 345 kV high height disconnect switch stand
- Two (2) H-frame line entrance structures
- Nine (9) 345 kV CCVT stands
- Nine (9) 345 kV surge arrester stands
- Four (4) 345 kV line trap support stands
- Three (3) intermediate height bus supports for connecting through the future breaker position
- Four (4) 70' lightning masts

One (1) approximately 40' x 28' control building will be installed to house the relay and control panels as well as the station battery.

Foundations:
Foundations and slabs will be designed and installed in accordance with the owner's standards and specifications. The minimum design depth to firm bearing is contingent upon soil borings at the site.

Conductors, Shield Wires, & OPGW:
N/A

Scheduling Requirements:

Legal/Real Estate Procurement	29 days
Substation/OHL Design	149 days
Material Procurement	180 days
Substation Construction	185 days
Closeout Activities	60 days

Site Requirements:

1. Site dimensions will be determined through joint evaluation of the Transmission Owner and Interconnection Customer requirements.
2. The site shall be cleared, rough graded, and have positive drainage to eliminate the hazard of standing water at or near energized equipment.
3. All fill material shall be capable of sustaining design loadings of concrete mats and piers. Certification of material used and density obtained shall be provided by an independent testing laboratory prior to start of construction.
4. Storm sewer or drainage systems shall be provided close to site wherever possible to carry run off from the substation facility.
5. The Interconnection Customer shall certify that the site satisfies all state and federal rules pertaining to toxic and hazardous substances and waste. The certification is to be done by a mutually agreed upon, independent environmental testing firm.
6. Access to the site shall be via 20-foot wide, all weather roads designed for 35,000-lb axle loads. Road grades shall not exceed 6 percent, a minimum turning radius shall be no less than 50 feet. A minimum overhead clearance of 20 feet shall exist.
7. Substation Security shall not be jeopardized by buildings, other structures, or trees located adjacent to the fence line. Trees overhanging the fence shall be pruned. Building windows and low roof lines adjacent to the fence shall be secured in a manner to prevent access to the substation.
8. Suitable rights of way on the Interconnection Customer's property for overhead line feeds to and from the substation and the entrance driveway shall be provided by the Interconnection Customer.
9. To accomplish the engineering, design, and construction in time to meet the requested in-service date, the following information shall be supplied by the customer if available. If not available, access to the site shall be granted to the Transmission Owner.

a) A topographic survey showing existing grade elevations at 25-foot intervals within and to a distance of 200-feet beyond the site is required by Transmission Owner's Engineering prior to design start. The survey shall include identification of all below grade structures within the site. All utilities shall be noted on the survey.
b) Soil borings shall be taken at all points of heavy loading as identified by Transmission Owner's Engineering. Borings shall be taken before any fill is placed on the site.
c) In the event fill is required, the Interconnection customer shall identify the proposed rough grade elevations prior to the engineering and design of Transmission Owner's concrete structures.

Total Cost Estimate Accuracy: **+/- 20%**

Total Project Cost: **$9,031,000**

Note that the cost estimate provided is in expressed in 2011 terms and includes applicable company overheads and potential tax gross-ups.