



***Facility Study
For
Generation Interconnection
Request
GEN-2006-022***

SPP Tariff Studies

(#GEN-2006-022)

November 2008

Executive Summary

<OMITTED TEXT> (Customer) has requested a Facility Study under the Southwest Power Pool Open Access Transmission Tariff (OATT) for interconnecting a 150 MW wind powered generation facility in Ninnescah County, Kansas to the transmission system of Mid Kansas Power Company, LLC (MKEC). The wind powered generation facility studied was proposed to comprise of sixty (60) Clipper 2.5 MW wind turbines. The original requested in-service date for the facility is May 31, 2008. The wind powered generation facility will interconnect into a proposed new substation adjacent to the MKEC Pratt substation currently proposed to be in service in 2009 summer.

The generation facility was studied to interconnect into the MKEC Medicine Lodge – St. John 115 kV transmission line. MKEC has proposed to build a new 115kV substation adjacent to the Pratt substation as part of MKEC's construction plan. MKEC will construct a new 115 kV line terminal including one 115kV circuit breaker and miscellaneous equipment for the interconnection of GEN-2006-022. The total cost of the interconnection facilities for this interconnection request is approximately \$525,000. If the proposed new substation by MKEC does not get constructed for any reason, this estimate will need to be revised.

The Customer will have certain facility requirements in their substation to interconnect the generation facility. The Customer will be required to install one (1) 34.5kV, 17 MVar capacitor banks and one (1) 34.5kV +75/-25 Mvar Static Var Compensator Device (SVC) in the Customer substation. This device shall be placed on the 34.5kV bus of the substation transformer. Once the Customer has obtained transmission service for this generation facility, a restudy should be requested to evaluate the reactive requirements of the wind farm.

1. Introduction

<OMITTED TEXT> (Customer) has requested a Facility Study under the Southwest Power Pool Open Access Transmission Tariff (OATT) for interconnecting a 150 MW wind powered generation facility in Ninnescah County, Kansas to the transmission system of Mid Kansas Power Company, LLC (MKEC) (formerly West Plains Electric). The wind powered generation facility studied was proposed to comprise of sixty (60) Clipper 2.5 MW wind turbines. The original requested in-service date for the facility is May 31, 2008. The wind powered generation facility will interconnect into a new substation adjacent to the MKEC Pratt substation that is currently proposed to be in service by 2009 summer.

2. Power Factor Analysis

A separate power factor analysis has been conducted for this Facility Study to further define the reactive power requirements of the Impact Study. In this analysis the wind farm was studied in the summer season and winter season with previous queued projects in service in the local area. A var generator was modeled in service at the point of interconnection to determine the reactive requirements. The results of the power factor analysis are listed below in Table 1.

From the analysis, it was determined that for the outage of the GEN-2006-021 wind farm to Harper 138kV line, the GEN-2006-022 wind farm will have to maintain a 95% leading (producing vars) power factor at the point of interconnection. The point of interconnection is the MKEC 115kV bus.

The Impact Study made the assumption that the Clipper wind turbines would be operating at unity power factor. The results of this assumption required the Customer to install a +75/-25Mvar SVC device to meet LVRT requirements and maintain voltage stability.

The Clipper wind turbines actually have the ability to run at a power factor within the range of 95% lagging to 95% leading at the generator terminal, although not dynamically. The modeling information used by SPP indicated that the Clipper turbines could at the maximum only produce vars at 98% lagging power factor before extremely high voltages were observed on the generator and collector system buses. This power factor resulted in a power factor of approximately unity at the point of interconnection. Please see Figure 1.

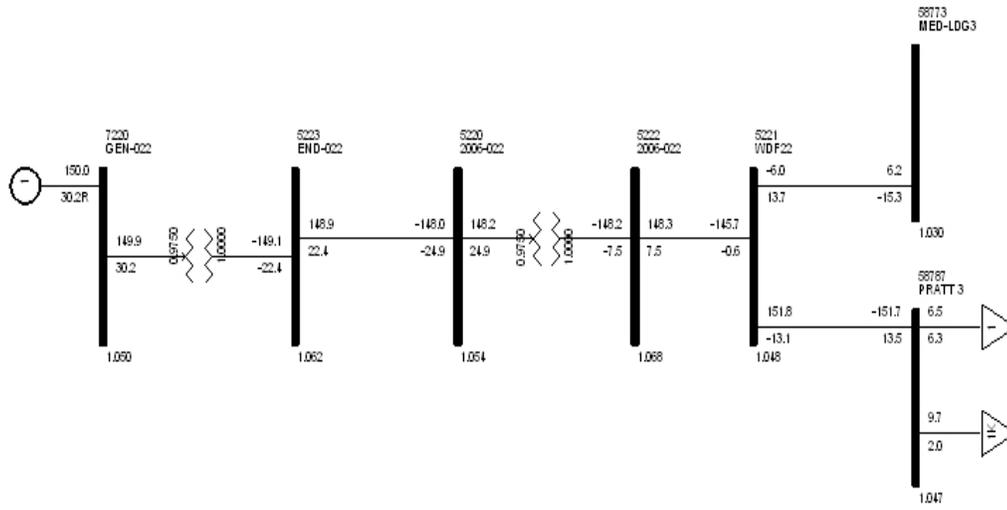


Figure 1. One Line of GEN-2006-022

To meet the +/-95% power factor requirement, the Customer will still be required to provide additional reactive power equipment in addition to the Clipper wind turbines, but it may be possible to lower the size of the SVC from the original +75Mvar/-25Mvar size.

Table 1. Power Factor Analysis

| Season | Outage | Wind Farm MW at POI | Wind Farm Mvar at POI | Power Factor |
|--------|----------------------------------|---------------------|-----------------------|-------------------------------|
| Summer | Wind Farm – St. John 138kV | 145 MW | -6 Mvar | 99.8 leading |
| Summer | Wind Farm – Medicine Lodge 138kV | 145 MW | -12 Mvar | 99.6 leading |
| Summer | GEN06-21 – Harper 138kV | 145 MW | 45 Mvar | 95.5 lagging (producing vars) |
| Winter | Wind Farm – St. John 138kV | 145 MW | -9 Mvar | 99.7 leading |
| Winter | Wind Farm – Medicine Lodge 138kV | 145 MW | -2.5 Mvar | Unity |
| Winter | GEN06-21 – Harper 138kV | 145 MW | 47 Mvar | 95.0 lagging (producing vars) |

3. Interconnection Facilities

All required interconnection facilities are tabulated in Table 2 and are shown in Figure 1.

3.1. MKEC 115 kV Substation - The Customer will be interconnecting into a new 115kV substation adjacent to the existing Pratt substation that is proposed to be in service by 2009 summer. The substation is proposed to be constructed, owned, and maintained by MKEC as part of its construction plan. The substation will be constructed using applicable MKEC engineering and construction standards.

To interconnect GEN-2006-022, a new 115kV line terminal to the wind farm will be added to the proposed substation. The Customer will be responsible for the cost of this line terminal addition. These facilities will be sole-use, radial facilities and will not be classified as Network Upgrades. If for any reason, the new substation is not constructed by MKEC, this estimate will have to be revised.

The costs for the substation work is estimated below

- Add a 115kV line terminal to the proposed substation. This work will include the addition of a 115kV circuit breaker, 115kV disconnect switches, metering, and all miscellaneous and associated equipment.

| | |
|-----------------------------------------|------------------|
| Subtotal | \$ 525,000 |
| Total Interconnection Facilities | \$525,000 |

Table 2: Required Interconnection Facilities

| Project | Description | Estimated Cost |
|---------|------------------------------------------------|------------------|
| 1 | Add 115kV line terminal to new MKEC Substation | \$525,000 |
| | Total: | \$525,000 |

3.2. Customer Facilities – The Customer will be responsible for its Generating Facility and its 115/34.5kV substation that will contain its 115/34.5kV transformer(s) and wind turbine collector feeders. In addition, the Customer will be required to install the following equipment in its facilities.

3.2.1. 34.5kV Capacitor Banks – In its responsibility in maintaining the required power factor at the wind farm, the Customer will be required to install one (1) 34.5kV, 17 Mvar capacitor banks on the Customer's 115/34.5kV

transformer 34.5kV bus. The size of this bank may be changed depending on the results of the manufacturer's SVC sizing study.

3.2.2. SVC Device – To maintain acceptable voltage regulation and to maintain system reliability and stability, the Customer will be required install one (1) 34.5kV +75/-25Mvar Static Var Compensator Device on its transformer 34.5kV bus at the Wind Farm substation. These devices were sized according to generic modeling devices within PTI's PSS/E software. Final sizing should be performed by the manufacturer of the device. SPP will provide the transmission system modeling information to the manufacturer for this purpose.

3.2.3. Special Considerations for Reactive Power Equipment – The Customer's requirements for additional reactive power equipment is due to the lack of available transmission in the area. After delivery transmission service has been acquired for the facility, a restudy should be requested to evaluate the reactive power requirements.

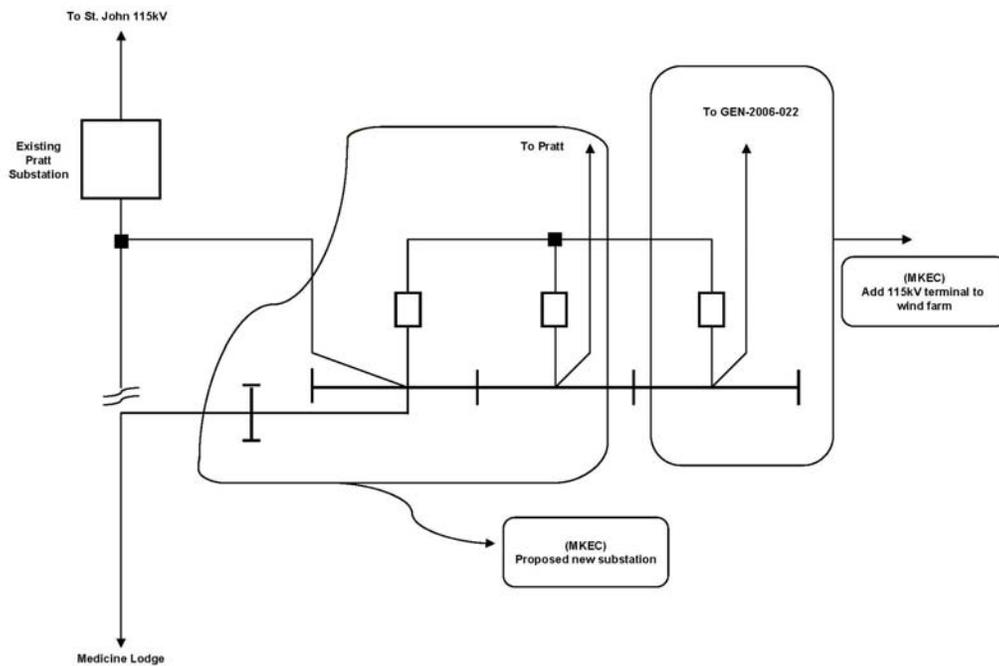


Figure 2. Interconnection Facilities for GEN-2006-022

4. Short Circuit Study

MKEC has indicated that no MKEC facilities will be affected due to short circuit contribution by the interconnection of GEN-2006-022.

5. Conclusion

The cost to interconnect the GEN-2006-022 generation interconnection request for 150MW is estimated by this Facility Study to cost approximately \$525,000. The Customer has certain facilities they are required in their substation as a requirement to the Interconnection Agreement.