



**SPP**

*Southwest  
Power Pool*

***Facility Study  
For  
Generation Interconnection  
Request  
GEN-2009-073T***

***SPP Generation  
Interconnection***

***(#GEN-2009-073T)***

**August 2012**

## **Summary**

Tri-County Electric Cooperative, Inc. (TCEC), performed a detailed Facility Study at the request of Southwest Power Pool (SPP) for Generation Interconnection request GEN-2009-073T consisting of three wind facilities totaling 46.4 MW. The request for interconnection was placed with Tri-County Electric Cooperative and has subsequently been transferred to SPP in accordance with SPP's Open Access Transmission Tariff, which covers new generation interconnections on SPP's transmission system.

## **Phases of the Interconnection Facility**

Interconnection Customer has proposed to install 10MW in a Phase I followed by the remainder of the generation in Phase II.

## **Interconnection Customer Interconnection Facilities**

The Interconnection Customer will be responsible for all of the transmission facilities connecting the customer owned substation to the Point of Interconnection (POI), a proposed 69kV one-breaker bus substation on the Keyes-Eva 69kV line for initial Phase I. When Phase II is installed, the proposed one-breaker configuration will be expanded to a three-breaker ring bus configuration. The Customer will also be responsible for any equipment located at the Customer substation necessary to maintain a power factor of 0.95 lagging to 0.95 leading at the POI.

## **Transmission Owner Interconnection Facilities and Non-Shared Network Upgrades**

The estimated in-service date for these Interconnection Facilities is unknown. At this time the Customer is responsible for Transmission Owner Interconnection Facilities and Non-Shared Network Upgrades as described in the attached study report. The estimated construction lead time for Phase I is 15 months after the execution of an Interconnection Agreement. When Phase II is installed, additional time will be required to expand the substation to a three breaker ring bus. Additional time will also be required to construct the necessary transmission line upgrades for Phase II.

## **Shared Network Upgrades**

At this time, the Interconnection Customer is allocated \$0 for Shared Network Upgrades

## **Contingent Network Upgrades**

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 Other Network Upgrades are currently not the cost responsibility of the Customer but will be required for full Interconnection Service. These Network Upgrades include:

- Beaver – Woodward 345kV double circuit, scheduled for 6/30/2014 in-service
- Clark – Thistle 345kV double circuit, scheduled for 12/31/2014 in-service
- Finney Switching Station – Holcomb 345kV circuit #2, assigned to GEN-2006-049
- Woodward – Border - TUCO 345kV, scheduled for 5/19/2014 in-service
- Hitchland – Beaver County - Woodward 345kV double circuit, scheduled for 6/30/2014 in-service
- Hitchland 345/230 transformer circuit 2, scheduled for 6/30/2014 in-service
- Spearville – Clark 345kV double circuit, scheduled for 12/31/2014 in-service
- Thistle - Woodward 345kV double circuit, scheduled for 12/31/2014 in-service
- Thistle – Wichita 345kV double circuit, scheduled for 12/31/2014 in-service
- Thistle 345/138kV Transformer circuit 1, scheduled for 12/31/2014 in-service
- Woodward 345/138kV Transformer circuit 2, scheduled for 05/14/2014 In-service

Depending upon the status of higher or equally queued customers, the Interconnection Customer's in-service date is at risk of being delayed or their Interconnection Service is at risk of being reduced until the in-service date of these Other Network Upgrades.

## **Conclusion**

Interconnection Service for GEN-2009-073T may be delayed until the Transmission Owner Interconnection Facilities and Network Upgrades are constructed. The Customer is responsible for \$1,200,600 of Transmission Owner Interconnection Facilities and Non-Shared Network Upgrades for Phase I. When Phase II is installed, the initial substation must be expanded to a three-breaker ring bus. The cost of the expansion for Phase II is an additional \$476,900. Additionally, Phase II transmission upgrades are estimated at \$16,000,000. At this time, the Interconnection Customer is also allocated \$0 for Shared Network Upgrades. After all Interconnection Facilities and Network Upgrades have been placed into service, Interconnection Service for 46.4MW, as requested by GEN-2009-073T, can be allowed. At this time the total allocation of costs of Interconnection Service for Phase I are estimated at \$1,736,900. An additional estimated cost of \$16,476,900 will be required for Phase II. The total allocation of costs for both phases, is estimated at \$17,677,500 if all higher queued projects remain in the queue.

GEN-2009-073T

Facility Study Report

## **Executive Summary**

<OMITTED TEXT> (Customer) has requested a Facility Study under the Southwest Power Pool Open Access Transmission Tariff (OATT) for interconnecting three different wind powered generation facilities in Texas County, Oklahoma to the transmission system of Tri-County Electric Cooperative, Inc. (TCEC). The wind powered generation facilities studied are comprised of twenty-nine (29) G.E. 1.6 MW wind turbines. The wind powered generation facility will interconnect into the TCEC Keyes-Eva 69kV line.

TCEC will construct a 69kV one-breaker bus substation on the Keyes-Eva 69kV transmission line for initial 10MW (Phase I) the Customer generates into the SPP system. When the Customer is increased to full queued nameplate of 46.4MW (Phase II), the proposed one-breaker configuration will be expanded to a three-breaker ring bus configuration. The Interconnection Customer's non shared network upgrades and interconnection facilities are estimated at \$1,200,600 for Phase I. An additional estimated cost of \$476,900 is assigned to the Interconnection Customer's non shared network upgrades and interconnection facilities cost for Phase II for the expansion of the substation to a three breaker ring bus. Construction of the 69kV one-breaker ring bus substation facilities will take approximately 15 months after the execution of an Interconnection Agreement. When the Customer plans on increasing to their full queued nameplate of 46.4MW, an additional 15 months could be needed in estimated construction lead time to expand the POI from a one-breaker bus to a three-breaker ring bus.

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.

**1. Introduction**

<OMITTED TEXT> (Customer) has requested a Facility Study under the Southwest Power Pool Open Access Transmission Tariff (OATT) for interconnecting three different wind powered generation facilities in Texas County, Oklahoma to the transmission system of Tri-County Electric Cooperative, Inc. (TCEC). The wind powered generation facilities studied are comprised of twenty-nine (29) G.E. 1.6 MW wind turbines. The wind powered generation facility will interconnect into the TCEC Keyes-Eva 69kV line.

**2. Interconnection Facilities and Non Shared Network Upgrades for 10MW of Interconnection**

The cost for the Interconnection Facilities and Non Shared Network Upgrades is listed below in Table 1. The one-line diagram is shown in Figure 1. Construction of the 69kV one-breaker bus substation will take approximately 15 months after the execution of an Interconnection Agreement.

Project	Description	Estimated Cost
1	TCEC-Construct 69kV 1 breaker bus substation on the Keyes-Eva 69kV line	\$1,200,600
	<b>Total:</b>	<b>\$1,200,600</b>

**Table 1: Required Interconnection Facilities and Non Shared Network Upgrades for Phase I**

The cost for the Interconnection Facilities and Non Shared Network Upgrades is listed below in Table 2. When the Customer installs Phase II (nameplate of 46.4MW) the construction of expanding the 69kV one-breaker bus to a three-breaker ring bus substation will take approximately an additional 15 months.

Project	Description	Estimated Cost
1	TCEC-Expand 69kV 1-breaker bus substation to 3breaker ring bus substation on the Keyes-Eva 69kV line	\$476,300
	<b>Total:</b>	<b>\$476,300</b>

**Table 2: Required Interconnection Facilities and Non Shared Network Upgrades for Phase II (Full Nameplate 46.4MW)**

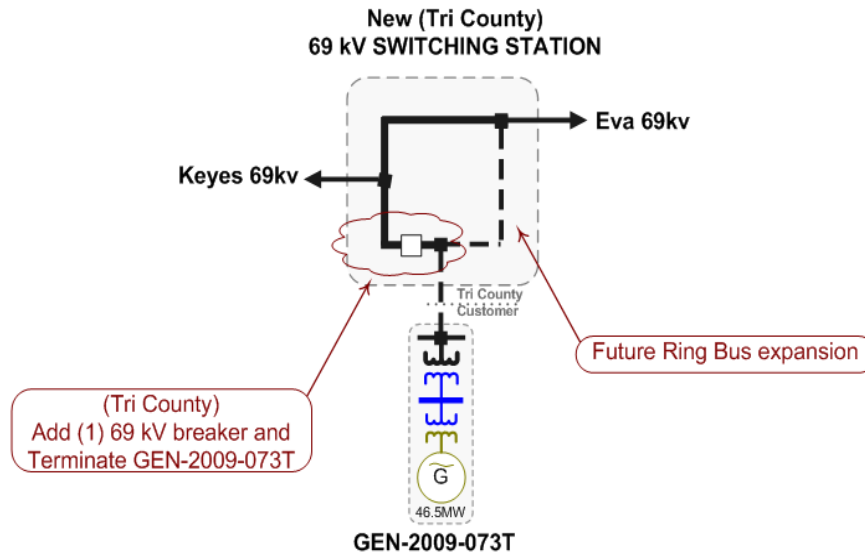


Figure 1. Interconnection Configuration for GEN-2009-073T

2.1. **Customer Facilities** – The Customer will be responsible for its Generating Facility and its 69/34.5 kV substation that will contain its 69/34.5 kV transformer(s) and wind turbine collector feeders. In addition, the Customer will be required to install the following equipment in its facilities.

2.1.1. **Reactive Power Equipment** – 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 Interconnection Customer shall not cause voltage distortion in accordance with Article 9.7.6 of the standard SPP Generation Interconnection Agreement.

3. **Additional Network Upgrades for 46.4MW of Interconnection with Higher Queueds in Service**

The Interconnection Customer has been studied for 46.4MW of interconnection assuming the GEN-2008-124T interconnection request (42MW) has been placed in service. For the full 46.4MW of interconnection the following network upgrades are needed. **A full scale Facility Study estimate or construction lead time has not been finalized at this time.** Costs are shown in Table 3.

Upgrade Description	Total Cost
Rebuild 31 miles of 69kV transmission line from Eva to Thompson and applicable substation work at both ends.	\$16,000,000
<b>Total</b>	<b>\$16,000,000</b>

Table 3. Additional Network Upgrades for 46.4MW Interconnection

**4. Shared Network Upgrades**

At this time, the Interconnection Customer is allocated \$0 for Shared Network Upgrades.

**5. Contingent Network Upgrades**

If GEN-2008-124T interconnection customer withdraws from the queue, suspends or terminates its 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. Certain Contingent Network Upgrades, total estimated cost of \$671,000, that are assigned to higher queued projects that are currently not the responsibility of the Customer but will be required for full Interconnection Service. These Contingent Network Upgrades include the costs shown in Table 4.

<b>Upgrade Description</b>	<b>Total Cost</b>
Install 4.3Mvar switched (3-step) Capacitor bank at 69kV in the Eva Substation	\$372,000
Removal of the Regulating Transformer at Eva	\$49,000
Relay change outs at Keys	\$125,000
Relay change outs at Elkhart	\$125,000
<b>Total</b>	<b>\$671,000</b>

**Table 4. Contingent Upgrades**

**6. Network Upgrade Costs Options and Possibilities**

Table 5 estimates the Interconnection Customer costs for different scenarios.

<b>Scenario</b>	<b>Total Cost</b>
Interconnection Customer interconnects at 46.4MW and GEN-2008-0124T does not interconnect	\$2,347,900
Interconnection Customer interconnects at 46.4MW and GEN-2008-0124T does interconnect	\$17,646,900
Interconnection Customer interconnects at 10MW and GEN-2008-0124T does not interconnect	\$1,871,600
Interconnection Customer interconnects at 10MW and GEN-2008-0124T does interconnect	\$1,646,900

**Table 5. Interconnection Total Cost by Scenario**



## **7. Short Circuit Analysis**

Short Circuit analysis performed by S&C Electric Consulting for the Impact Study indicated a three phase L-L fault current at the Point of Interconnection of 996.6 A and L-G fault current of 825A.

## **8. Conclusion**

The Customer is responsible for \$1,200,600 of Transmission Owner Interconnection Facilities and Non-Shared Network Upgrades for the initial generation of 10MW (Phase I). An Additional estimated cost of \$476,900 is assigned to the Interconnection Customer's non shared network upgrades and interconnection facilities cost when expanding from a one-breaker bus to a three-break ring bus configuration. The expansion of a three-breaker ring bus is needed when Customer increases from the initial generation amount of 10MW to the full queued nameplate of 46.4MW (Phase II). At this time, the Interconnection Customer is also allocated \$0 for Shared Network Upgrades. Construction of the 69kV one-breaker bus substation will take approximately 15 months after the execution of an Interconnection Agreement. When the Customer generations increases from 10MW to full queued nameplate of 46.4MW the construction of expanding the 69kV one-breaker bus to a three-breaker ring bus substation will take approximately an additional 15 months.

After all Interconnection Facilities and Network Upgrades have been placed into service, Interconnection Service for 46.4MW, as requested by Interconnection Customer can be allowed. The total allocation of costs for both phases, initial 10MW generation and then increasing to 46.4MW, is estimated at \$1,677,500.