SPP Southwest Power Pool

Feasibility Study For Generation Interconnection Request GEN-2006-014

SPP Tariff Studies
(#GEN-2006-014)

October, 2006

Executive Summary

<OMITTED TEXT> (Customer) has requested a Feasibility Study for the purpose of interconnecting 300MW of generation within the control area of Missouri Public Service (d/b/a Aquila Networks – Missouri Public Service) (MIPU) in Atchison County, Missouri. The proposed point of interconnection is a new switching station in the existing Maryville – Midway 161kV transmission line, which is owned by MIPU. The proposed in-service date is May 31, 2008.

Power flow analysis has indicated that for the powerflow cases studied, it is possible to interconnect the 300MW of generation with transmission system reinforcements within the local transmission systems. In order to maintain acceptable reactive power compensation, the Customer will need to install 60Mvars of 34.5kV capacitor banks in the Customer's collector substation on the 34.5kV bus. Dynamic Stability studies performed as part of the impact study will provide additional guidance as to whether the required reactive compensation can be static or a portion must be dynamic (such as a SVC).

The requirements to interconnect the 300MW of generation at the new switching station on the Maryville – Midway 161kV line will consist of building a new 161kV three breaker ring bus substation with terminals to Midway, Maryville, and the Customer generating facility. The Customer proposed a specific 161kV line extending to serve its 161-34.5kV facilities that involved sharing right-of-way with MIPU facilities. There is a right-of-way purchasing issue that will have to be addressed in subsequent studies if necessary. It is assumed that obtaining all necessary right-of-way for the new switching station will not be a significant expense.

The total minimum cost for building the required facilities for this 300MW of generation is $3,500,000. These costs are shown in Table 2. Other Network Constraints in the MIPU, Westar, and AECI transmission systems that may be verified with a transmission service request and associated studies are listed in Table 3. These Network Constraints are in the local area of the new generation when this generation is sunk throughout the SPP footprint for the Energy Resource (ER) Interconnection request. With a defined source and sink in a Transmission Service Request (TSR), this list of Network Constraints will be refined and expanded to account for all Network Upgrade requirements. This cost does not include building the 161kV line from the Customer substation into the new 161kV ring bus. This cost does not include the Customer's 161-34.5kV substation or the 60Mvar of 34.5kV capacitor banks.

In Table 4, a value of Available Transfer Capability (ATC) associated with each overloaded facility is included. These values may be used by the Customer for future analyses including the determination of lower generation capacity levels that may be installed. When transmission service associated with this interconnection is evaluated, the loading of the facilities listed in this table may be greater due to higher priority reservations. If the loading of a facility is higher, the level of ATC will be lower.

Introduction

<OMITTED TEXT> (Customer) has requested a Feasibility study for the purpose of interconnecting 300MW of generation within the control area of Missouri Public Service (d/b/a Aquila Networks – Missouri) (MIPU) in Atchison County, Missouri. The proposed method of interconnection is to build a new 161kV ring bus switching station in the existing Maryville – Midway 161kV line owned by MIPU. The proposed in-service date is May 31, 2008.

Interconnection Facilities

The primary objective of this study is to identify the system problems associated with connecting the plant to the area transmission system. The Feasibility and other subsequent Interconnection Studies are designed to identify attachment facilities, Network Upgrades and other direct assignment facilities needed to accept power into the grid at the interconnection receipt point.

The Customer originally requested to interconnect into the MIPU Maryville 161kV substation. This request could not be honored to due land constraints in the area of the Maryville substation. The Customer later changed the requested interconnection point to a point on the Maryville – Midway 161kV line at a point as close to Maryville as possible.

The requirements for interconnection of the 300MW consist of building a new 161kV three breaker ring bus substation in the existing Midway – Maryville 161kV transmission line owned by MIPU. This 161kV substation shall be constructed and maintained by MIPU. The Customer has proposed a route of its 161kV line to serve its 161/34.5kV facilities. The proposed route included sharing right-of-way with existing MIPU facilities. MIPU is currently considering the Customer's proposal. There is a right-of-way purchasing issue that can be later addressed in subsequent studies if the Customer chooses to pursue the Interconnection Request into an Impact and Facility Study. It is assumed that obtaining all necessary right-of-way for the substation construction will not be a significant expense.

The total cost for building a new 161kV 3-breaker ring switching station, the required interconnection facility, is estimated at $3,500,000. Other Network Constraints in the MIPU, Westar, and AECI systems that were identified are listed in Table 3. These estimates will be refined during the development of the impact study based on the final designs. This cost does not include building the 161kV facilities from the Customer substation into the new MIPU 161kV switching station. The Customer is responsible for these 161kV facilities up to the point of interconnection. This cost also does not include the Customer's 161-34.5kV substation, which should be determined by the Customer.

The costs of interconnecting the facility to the MIPU transmission system are listed in Table 1 & 2. **These costs do not include any cost that might be associated with short circuit study results or dynamic stability study results**. These costs will be determined when and if a System Impact Study is conducted.

A preliminary one-line drawing of the interconnection and direct assigned facilities are shown in Figure 1.

Table 1: Direct Assignment Facilities

Facility	ESTIMATED COST (2006 DOLLARS)
Customer – 161-34.5 kV Substation facilities.	*
Customer – 161kV transmission line facilities between Customer facilities and MIPU 161kV switching station	*
Customer - Right-of-Way for Customer facilities.	*
Customer – 34.5kV, 60MVAR capacitor bank(s) in Customer substation	*
Total	*****

Note: *Estimates of cost to be determined by Customer.

Table 2: Required Interconnection Network Upgrade Facilities

Facility	ESTIMATED COST (2006 DOLLARS)
MIPU – Build 161kV, 3-breaker ring bus switching station. Station to include breakers, switches, control relaying, high speed communications, all structures and metering and other related equipment	$3,500,000
Total	**$3,500,000**

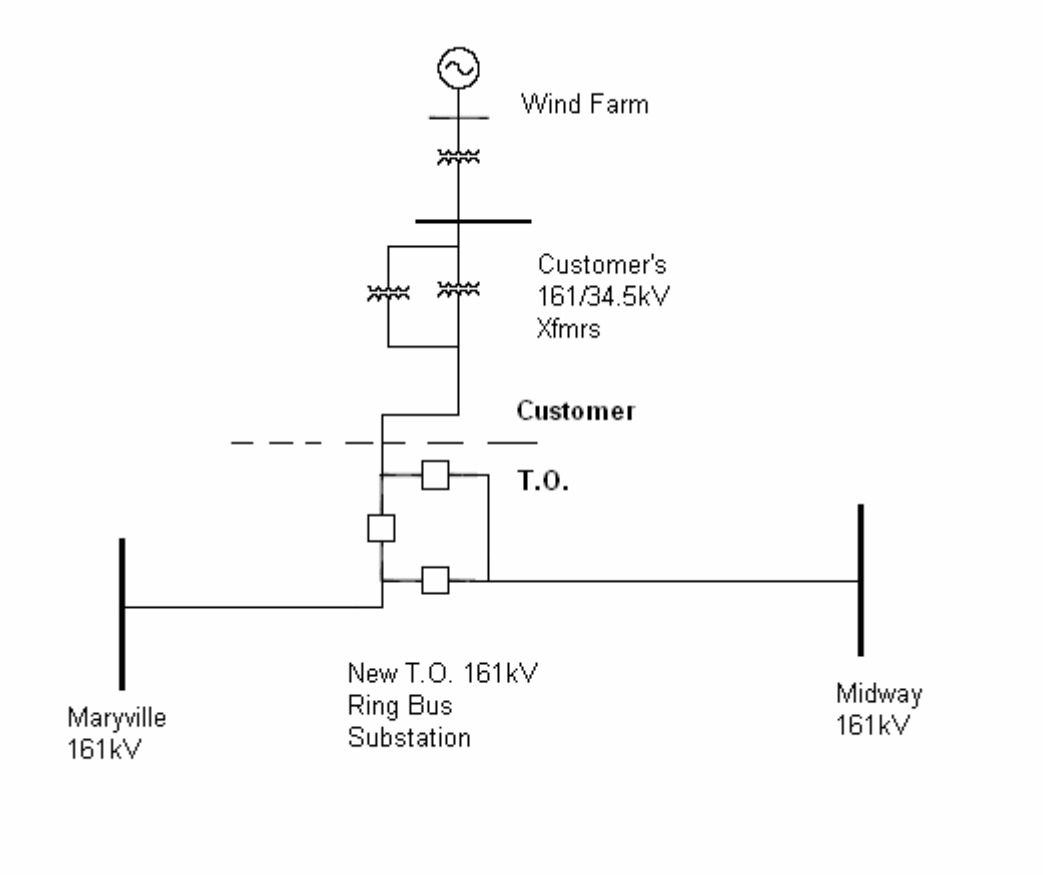

Figure 1: Proposed Interconnection
(Final substation design to be determined

Powerflow Analysis

A powerflow analysis was conducted for the facility using modified versions of the 2008 & 2011 summer and winter peak, and 2016 summer peak models. The output of the Customer's facility was offset in each model by a reduction in output of existing online SPP generation. This method allows the request to be studied as an Energy Resource (ER) Interconnection request. The proposed in-service date of the generation is May 31, 2008. The available seasonal models used were through the 2016 Summer Peak of which is the end of the current SPP planning horizon.

The analysis of the Customer's project indicates that, given the requested generation level of 300MW and location, additional criteria violations will occur on the existing MIPU, Associated Electric Cooperative Inc (AECI), and Westar (WERE) transmission systems under steady state and contingency conditions in the peak seasons.

Issues concerning the feasibility of this request pertain to the 161kV line that the Customer intends to interconnect to. The Maryville – Midway 161kV line has an emergency rating of 182 MVA, which would limit the export of 300MW from the interconnection point. Mitigation of this constraint as well as the other network constraints in Table 3. will be addressed when the Customer requests transmission service for this facility under the SPP OATT.

In Table 4, a value of Available Transfer Capability (ATC) associated with each overloaded facility is included. These values may be used by the Customer to determine lower generation capacity levels that may be installed. When transmission service associated with this interconnection is evaluated, the loading of the facilities listed in this table may be greater due to higher priority reservations. When a facility is overloaded for more than one contingency, only the highest loading on the facility for each season is included in the table.

In order to maintain a zero reactive power flow exchanged at the point of interconnection, additional reactive compensation is required at the point of interconnection. The Customer will be required to install 60Mvar of capacitor banks in their substation on the 34.5kV buses in the Customer substation. Dynamic Stability studies performed as part of the impact study will provide additional guidance as to whether the reactive compensation can be static or a portion must be dynamic (such as a SVC or STATCOM). It is possible that an SVC or STATCOM device will be required at the Customer facility because of FERC Order 661A Low Voltage Ride Through Provisions (LVRT) which went into effect January 1, 2006. FERC Order 661A orders that wind farms stay on line for 3 phase faults at the point of interconnection even if that requires the installation of a SVC or STATCOM device.

There are several other proposed generation additions in the general area of the Customer's facility. These local projects that were previously queued were assumed to be in service in this Feasibility Study. Those local projects that were previously queued and have advanced to nearly complete phases were included in this Feasibility Study.

Powerflow Analysis Methodology

The Southwest Power Pool (SPP) criteria states that: "The transmission system of the SPP region shall be planned and constructed so that the contingencies as set forth in the Criteria will meet the applicable *NERC Planning Standards* for System Adequacy and Security – Transmission System Table l hereafter referred to as NERC Table l) and its applicable standards and measurements".

Using the created models and the ACCC function of PSS\E, single contingencies in portions or all of the modeled control areas of MIPU, Westar (WERE), Kansas City Power & Light (KCPL), NPPD, OPPD, and AECI were applied and the resulting scenarios analyzed. This satisfies the 'more probable' contingency testing criteria mandated by NERC and the SPP criteria.

Table 3: Network Constraints

NETWORK CONSTRAINTS
MIPU – ‘ALABAMA5 161 - LAKE ROAD 161KV CKT 1'
MIPU – MEC – ‘CLRNDA 5 161 - MARYVILLE 161KV CKT 1'
WERE - 'JARBALO JUNCTION SWITCHING STATION - STRANGER CREEK 115KV CKT 1'
MIPU – ‘MARYVILLE - G06-14 161 161KV CKT 1'
MIPU – ‘MIDWAY - G06-14 161 161KV CKT 1'
MIPU - 'MIDWAY - ST JOE 161KV CKT 1'
AECI - 'MOBERLY TAP - THOMAS HILL 161KV CKT 1'

Table 4: Contingency Analysis

ELEMENT	SEASON	RATE (MVA)	LOADING (%)	ATC (MW)	CONTINGENCY
2008 SUMMER PEAK					
'MOBERLY TAP - THOMAS HILL 161KV CKT 1'	08sp	372	110.1835	0	'AECI-MTL10'
'MIDWAY - ST JOE 161KV CKT 1'	08sp	182	157.9601	178	MARYVILLE - G06-14 161 161KV CKT 1'
MIDWAY - G06-14 161 161KV CKT 1'	08sp	182	167.5878	179	MARYVILLE - G06-14 161 161KV CKT 1'
MARYVILLE - G06-14 161 161KV CKT 1'	08sp	182	164.8492	182	MIDWAY - G06-14 161 161KV CKT 1'
2008 WINTER PEAK					
'MIDWAY - ST JOE 161KV CKT 1'	08wp	182	157.7089	163	MARYVILLE - G06-14 161 161KV CKT 1'
MIDWAY - G06-14 161 161KV CKT 1'	08wp	182	167.2283	179	MARYVILLE - G06-14 161 161KV CKT 1'
MARYVILLE - G06-14 161 161KV CKT 1'	08wp	182	164.8472	182	MIDWAY - G06-14 161 161KV CKT 1'
2011 SUMMER PEAK					
'JARBALO JUNCTION SWITCHING STATION - STRANGER CREEK 115KV CKT 1'	11sp	240	107.8474	0	'CRAIG - STRANGER CREEK 345KV CKT 1'
'MOBERLY TAP - THOMAS HILL 161KV CKT 1'	11sp	372	101.3041	159	'AECI-MTL10'
'MIDWAY - ST JOE 161KV CKT 1'	11sp	182	157.494	173	MARYVILLE - G06-14 161 161KV CKT 1'
MIDWAY - G06-14 161 161KV CKT 1'	11sp	182	166.9065	180	MARYVILLE - G06-14 161 161KV CKT 1'
MARYVILLE - G06-14 161 161KV CKT 1'	11sp	182	164.8541	182	MIDWAY - G06-14 161 161KV CKT 1'
'ALABAMA5 161 - LAKE ROAD 161KV CKT 1'	11sp	153	103.1553	247	'HAWTHORN - ST JOE 345KV CKT 1'
'CLRNDA 5 161 - MARYVILLE 161KV CKT 1'	11sp	192	100.6483	295	'CRESTON5 161 - MARYVILLE 161KV CKT 1'
2011 WINTER PEAK					
'MIDWAY - ST JOE 161KV CKT 1'	11wp	182	157.7475	165	MARYVILLE - G06-14 161 161KV CKT 1'
MIDWAY - G06-14 161 161KV CKT 1'	11wp	182	167.2838	179	MARYVILLE - G06-14 161 161KV CKT 1'
MARYVILLE - G6-14 161 161KV CKT 1'	11wp	182	164.8599	182	MIDWAY - G06-14 161 161KV CKT 1'
'CLRNDA 5 161 - MARYVILLE 161KV CKT 1'	11wp	192	106.5361	248	'CRESTON5 161 - MARYVILLE 161KV CKT 1'

Table 4: Contingency Analysis

ELEMENT	SEASON	RATE (MVA)	LOADING (%)	ATC (MW)	CONTINGENCY
2016 SUMMER PEAK					
'MIDWAY - ST JOE 161KV CKT 1'	16sp	182	157.6479	171	MARYVILLE - G06-14 161 161KV CKT 1'
MIDWAY - G06-14 161 161KV CKT 1'	16sp	182	167.1379	179	MARYVILLE - G06-14 161 161KV CKT 1'
MARYVILLE - G06-14 161 161KV CKT 1'	16sp	182	164.8592	182	MIDWAY - G06-14 161 161KV CKT 1'
'CLRNDA 5 161 - MARYVILLE 161KV CKT 1'	16sp	192	103.7973	270	'CRESTON5 161 - MARYVILLE 161KV CKT 1'

Note: When transmission service associated with this interconnection is evaluated, the loading of the facilities listed in this table may be greater due to higher priority reservations. If the loading of a facility is higher, the level of ATC will be lower.

Conclusion

The minimum cost of interconnecting the Customer's interconnection request is estimated at $3,500,000 for MIPU's interconnection Network Upgrade facilities listed in Table 2. These costs exclude upgrades of other transmission facilities by MIPU, Westar, and AECI listed in Table 3 of which are Network Constraints. At this time, the cost estimates for other Direct Assignment facilities including those in Table 1 have not been defined by the Customer. In addition to the Customer's proposed interconnection facilities, the Customer will be responsible for installing 60Mvar of 34.5kV capacitors in the Customer substation for reactive support. Dynamic Stability studies performed as part of the impact study will provide additional guidance as to whether the reactive compensation can be static or a portion must be dynamic (such as a SVC or STATCOM).As stated earlier, the local projects that were previously queued are assumed to be in service in this Feasibility Study.

In Table 4, a value of Available Transfer Capability (ATC) associated with each overloaded facility is included. These values may be used by the Customer to determine lower generation capacity levels that may be installed. When transmission service associated with this interconnection is evaluated, the loading of the facilities listed in this table may be greater due to higher priority reservations. When a facility is overloaded for more than one contingency, only the highest loading on the facility for each season is included in the table.

These interconnection costs do not include any cost that may be associated with short circuit or transient stability analysis. These studies will be performed if the Customer signs a System Impact Study Agreement.

The required interconnection costs listed in Table 2 and other upgrades associated with Network Constraints listed in Table 3 do not include all costs associated with the deliverability of the energy to final customers. These costs are determined by separate studies if the Customer requests transmission service through Southwest Power Pool's OASIS.

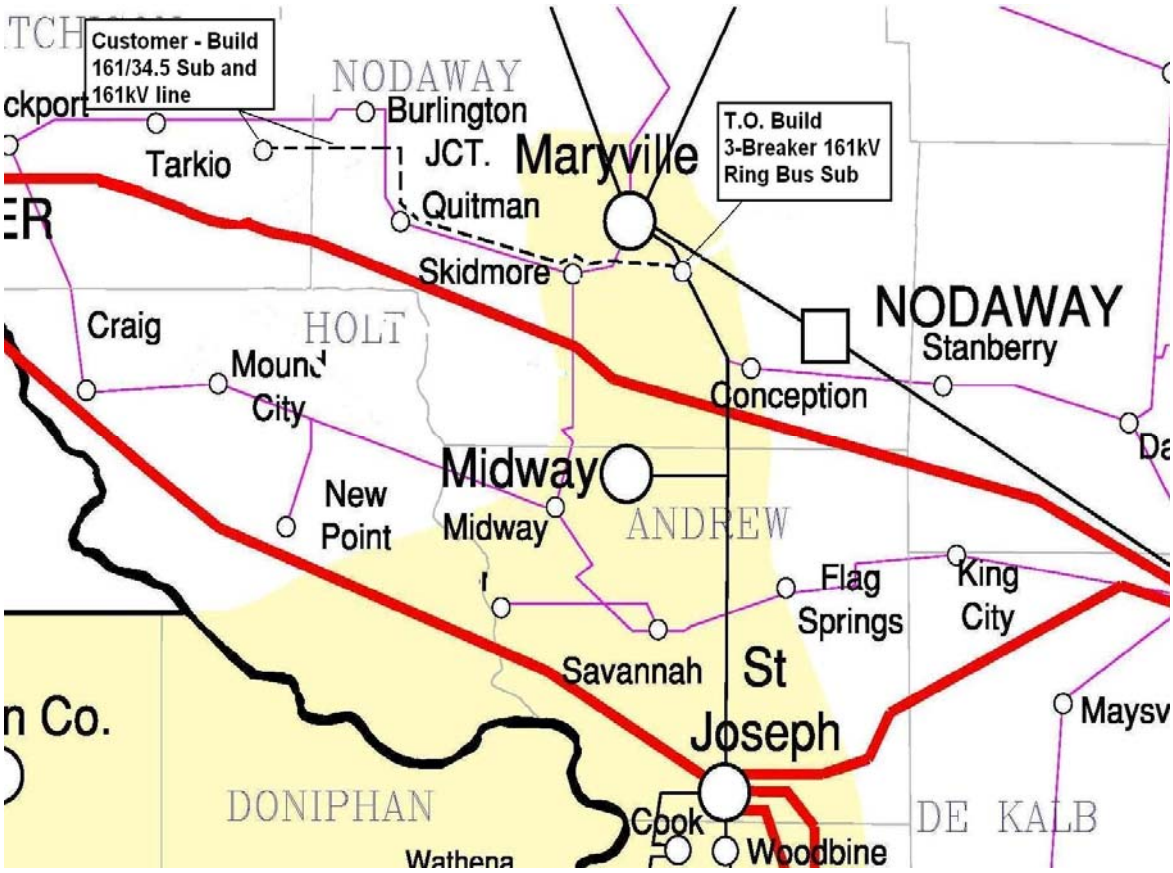

FIGURE 2. MAP OF THE LOCAL AREA