



***Feasibility Study for Generation
Interconnection Request***

GEN-2003-020

***SPP Tariff Studies
(#GEN-2003-020)***

March 2004

Executive Summary

<OMITTED TEXT> (Customer) has requested a feasibility study for the purpose of interconnecting up to 240MW of wind generation in Carson County, Texas within the service territory of Southwestern Public Service Company (SWPS). The proposed point of interconnection is at the Carson County substation served from circuit V60. The proposed in-service date is December 2005. This request is for an additional 160MW to be added to an earlier request (GEN-2003-009) of 80MW at the same point of interconnection.

Power flow analysis has indicated that for the powerflow cases studied, it is possible to interconnect up to 160 MW only with a special protection scheme to trip a portion of the wind farm to reduce it's output such that the flow on the Carson Co. to Hutchinson line is 99MVA or less. The wind farm output has two paths to the rest of the system. For the loss of either of these paths, the entire farm output follows the remaining connected path. There are essentially two options: rebuild the two paths such that each path can accept the entire output of the wind farm or reduce the farm output to bring the flow on the remaining path to a point below its emergency summer rating. Reducing the full output of the farm to 160MW will alleviate any local overloads due to the loss of the Carson Co. to Hutchinson line.

With the wind farm output at 240MW, there were numerous overloads on several lines leaving the local area when contingencies were applied.

The proposed requirements for interconnection consist of re-constructing the existing Carson County substation tap as a main and transfer bus from circuit V60. However, the final substation design and layout will be determined later in the Facilities Study if the customer elects to proceed.

Currently, the Carson County substation is a simple tap on circuit V60. The new bus substation would route circuit V60 into and then out of the substation. A separate breaker terminal would be added to the new bus to accommodate the wind farm. One terminal of the new substation would lead to Hutchinson County Interchange to the north, another terminal would lead to the Pantex North substation, and the third terminal would lead to the customer facility. If the customer's substation facility will be built close to the new switch station (Carson County Substation) (less than one mile), a Certificate of Convenience and Necessity from the Public Utility Commission of Texas will not be required. The rerouting of the 115 kV line from Hutchinson County Interchange into Carson County Substation may require a Certificate of Convenience and Necessity from the Public Utility Commission of Texas.

The total cost for this 115kV interconnection facility is estimated at \$3.2 million dollars, which is based on estimates provided by the Southwestern Public Service Company engineering department. The cost includes building 115kV from the customer substation facility into the new switch station, which was estimated at 1/2 mile (this could vary once the customers substation is located) and the cost to construct the switch station including all breakers and metering equipment. This cost also does not take into account any special telemetering equipment required to facilitate the special protection scheme mentioned earlier.

This feasibility study takes into account static system reinforcements triggered by other generation projects that are positioned ahead in the queue. There have also been some higher queued requests removed from this study at the request of the customer. In the event that the assumption of particular generation projects and the system reinforcements triggered by these projects are different, this feasibility study may have to be revisited, potentially changing the requirements necessary for interconnecting this customer's 240 MW wind farm.

Introduction

The Customer has requested a Feasibility Study for interconnection of up to a 240MW wind generation facility in Carson County, Texas. The proposed point of interconnection is at the Carson County substation served from circuit V60. Carson County substation is approximately 5 miles west of the town of Panhandle, Texas. A map of the area, Figure 2, is provided at the end of this document. The proposed in-service date of the facility is December 2005.

Interconnection Facilities

The primary objective of this study is to identify the system problems associated with connecting the plant to the area transmission system and estimated costs of system modifications needed to alleviate the system problems.

The Feasibility and other subsequent Interconnection Studies are designed to identify attachment facilities and other direct assignment facilities needed to accept power into the grid at the interconnection receipt point.

The proposed requirements for interconnection consist of re-constructing the existing Carson County substation tap as a main and transfer bus from circuit V60. However, the final substation design and layout will be determined later in the Facilities Study if the customer elects to proceed.

Currently, the Carson County substation is a simple tap on circuit V60. The new bus substation would route circuit V60 into and then out of the substation. A separate breaker terminal would be added to the new bus to accommodate the wind farm. One terminal of the new substation would lead to Hutchinson County Interchange to the north, another terminal would lead to the Pantex North substation, and the third terminal would lead to the customer facility. If the customer's substation facility will be built close to the new switch station (Carson County Substation) (less than one mile), a Certificate of Convenience and Necessity from the Public Utility Commission of Texas will not be required. The rerouting of the 115 kV line from Hutchinson County Interchange into Carson County Substation may require a Certificate of Convenience and Necessity from the Public Utility Commission of Texas.

The total cost for this 115 kV interconnection facility is estimated at \$3.2 million dollars, which is based on estimates provided by the SWPS engineering department. The cost includes construction of the new Carson County substation, associated breakers and metering, routing of circuit V60 into and out of the substation, 1/2 mile of 115 kV transmission line from the new substation to the wind farm collection substation, and right-of-way. This cost does not include any reactive support costs. Dynamic Stability studies will provide guidance as to whether any reactive compensation is necessary and whether it can be static or must be dynamic (such as a SVC).

The costs of interconnecting the facility to the SWPS transmission system are listed in Table 1. **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.

Table 1: Interconnection Facilities

Facility	ESTIMATED COST (2003 DOLLARS)
Re-build Carson County substation	\$2,402,903
Rebuild 1.2 miles of SPS 115 kV line V60 and route it into and out of the substation	\$686,384
½ mile of 115kV line to the customer's wind farm	\$100,000
Right-of-Way	\$30,000
Total	\$3,219,287

Powerflow Analysis

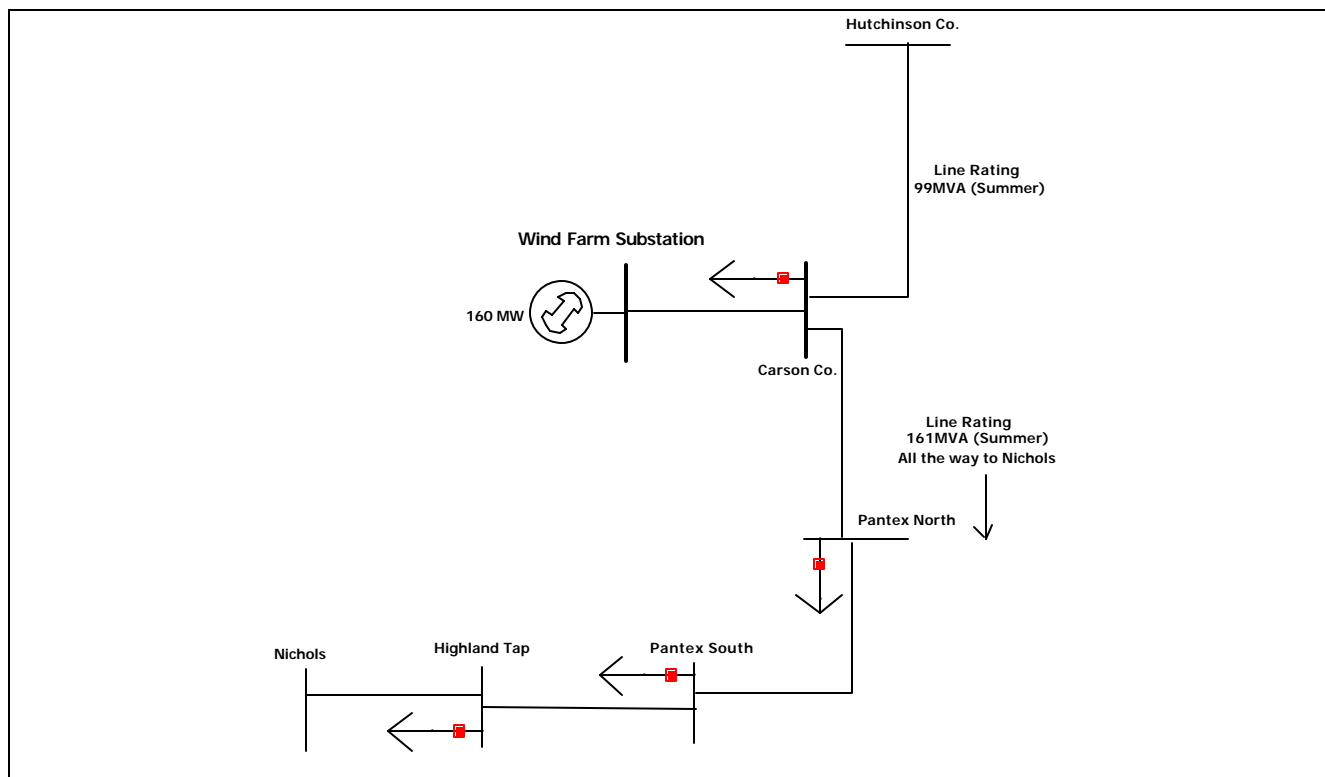
A powerflow analysis was conducted for the facility using modified versions of the 2004 series SPP Planning models. The in-service date of the facility is proposed to be December 2005. The models used in this study were: 2005 Winter Peak, 2007 Summer Peak, 2007 Winter Peak, 2010 Summer Peak, and a 2010 Winter Peak. This is the end of the current SPP planning horizon. The output of the Customer's facility was offset in each model by a reduction in output of existing online SWPS generation.

The analysis of the customer's project shows that the proposed location cannot handle the entire 240MW of output under steady state conditions without system upgrades in all seasons out to the end of SPP's planning horizon.

Power flow analysis has indicated that for the powerflow cases studied, it is possible to interconnect up to 160 MW only with a special protection scheme to trip a portion of the wind farm to reduce it's output such that the flow on the Carson Co. to Hutchinson line is 99MVA or less. The wind farm output has two paths to the rest of the system. For the loss of either of these paths, the entire farm output follows the remaining connected path. There are essentially two options: rebuild the two paths such that each path can accept the entire output of the wind farm or trip a portion of the farm to bring the wind farm output below the emergency rating of the remaining connected path. Reducing the full output of the farm to 160MW will alleviate any overloads due to the loss of the Carson Co. to Hutchinson line.

Special Tripping Scheme

Below is a simple one-line of the transmission system around Carson County substation.



The figure above shows the two paths for the wind farm's output to follow; the first path goes to Hutchinson Co. and the other path goes to Nichols. The path to Hutchinson Co. is rated at 99MVA in the summer and the path to Nichols is rated at 161 MVA in the summer. For loss of the line to Hutchinson Co., the entire wind farm output will flow south along the path to Nichols. As the wind farm output is limited to 160MW, the flow along the line to Nichols is within the line's emergency summer rating.

For a loss of any of the sections of the line to Nichols, the wind farm output will flow entirely along the line to Hutchinson Co. As this line is emergency rated at 99MVA in the summer, this line will be overloaded if the wind farm is generating above 99MW. A special tripping scheme should be implemented that will cause the wind farm's output to be limited such that the flow on the Carson Co. to Hutchinson line is 99MVA or less for the loss of any of the sections between Carson Co. and Nichols.

Note: There are loads located at Highland Tap, Pantex S, Pantex N, and Carson Co. The tripping logic used to reduce the wind farm's output could be set up to monitor the flow on the Carson Co. to Hutchinson line and increase the output of the farm to something greater than 99MVA such that any of the still online loads mentioned above are served in addition to the output of the farm. Ex. The section of line between Highland and Nichols is opened. There will still be four loads online for a total of approximately 30MW. The plant output could then be set at a total of $99+30=129\sim130$ MW. This would be achieved by having the wind farm tripping logic set to monitor the flow on the Carson Co. to Hutchinson line and adjusting the wind farm output to keep the flow on this line below its emergency rating.

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 I hereafter referred to as NERC Table I) and its applicable standards and measurements.

Using the created models and the ACCC function of PSS\E, single contingencies in the SWPS control area were applied and the resulting scenarios analyzed. This satisfies the ‘more probable’ contingency testing criteria mandated by NERC and the SPP criteria.

There are several other proposed wind generation additions in the general area of the Customer’s facility. It was assumed in the analysis that not all of these other projects were in service. Those previously queued projects that have advanced to nearly complete phases were included in this feasibility study.

Conclusion

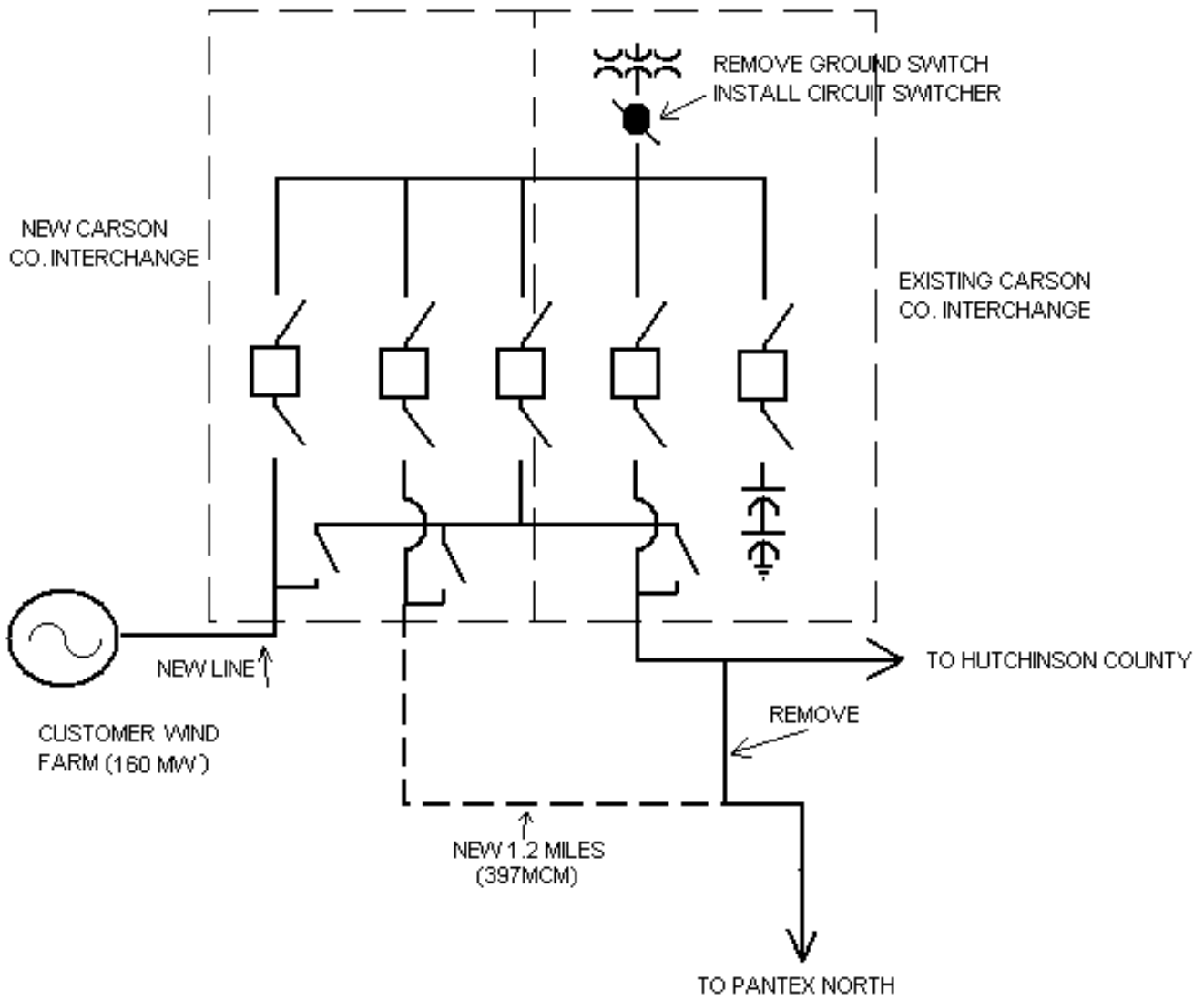
The analysis of the customer’s project shows that the proposed location cannot handle the entire 240MW of output under steady state conditions without system upgrades in all seasons out to the end of SPP’s planning horizon.

Power flow analysis has indicated that for the powerflow cases studied, it is possible to interconnect up to 160 MW only with a special protection scheme to trip a portion of the wind farm to reduce it’s output such that the flow on the Carson Co. to Hutchinson line is 99MVA or less. This special protection scheme would require close coordination with Southwest Public Service in order to adequately safeguard the reliability of the surrounding system.

The minimum cost of interconnecting the Customer project is estimated at \$3.2 million dollars. However, as stated earlier, previously queued projects were assumed to not be in service in this feasibility study. If any of those projects are constructed or the assumptions used in creating the study scenarios are significantly different, then this feasibility study may have to be revisited to determine the impacts of this customer’s project on other SWPS transmission facilities.

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 costs do not include any 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 1: Proposed Interconnection
(Final substation design to be determined)**

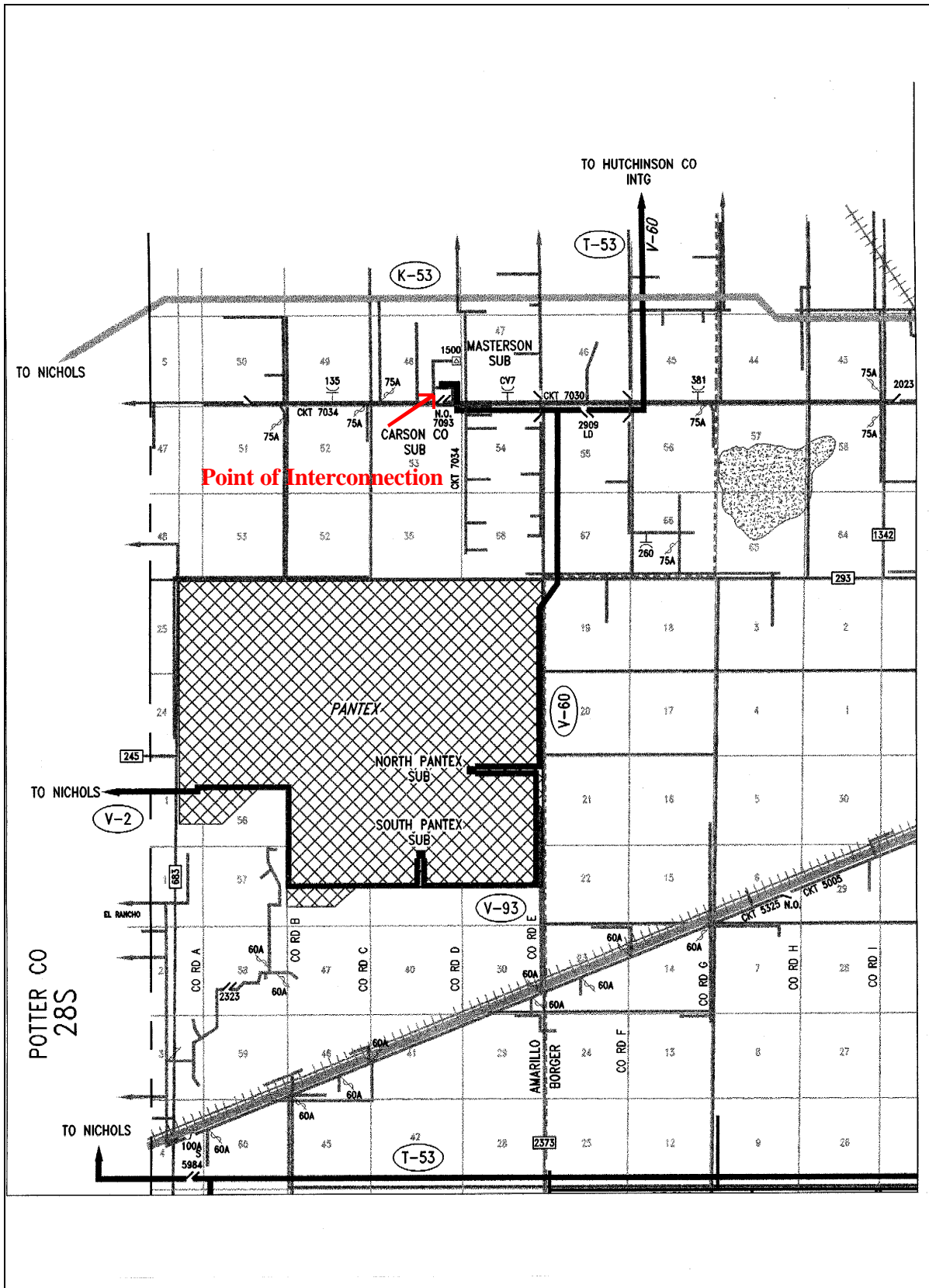


Figure 2: Map of the surrounding area