# Expedited System Impact Study For Generation Interconnection Request GEN-2007-002

**SPP Tariff Studies**
**(#GEN-2007-002)**

**August 2007**

## Executive Summary

<OMITTED TEXT> (Customer) has requested an expedited System Impact Study for the purpose of interconnecting 160 MW of generation within the control area of Southwestern Public Service (SPS) located in Gray County, Texas. The method and proposed point of interconnection is to add a 115 kV line terminal at the Grapevine 230/115 kV Interchange, owned by SPS. The proposed in-service date is September 1, 2009.

Power flow analysis has indicated that for the powerflow cases studied, it is possible to interconnect the 160 MW of generation with transmission system reinforcements within the local transmission system.

The requirement to interconnect the 160 MW of generation consists of adding a new 115 kV terminal into the Grapevine 230/115 kV Interchange. Customer did not propose a specific route for the 115 kV line extending to serve its 115 kV switching facilities. It is assumed that obtaining all necessary right-of-way for this new transmission line to serve its facilities will not be a significant expense.

The total minimum cost for building the required facilities for this 160 MW of generation is $590,679. These costs are shown in Table 2. Other Network Constraints in the American Electric Power West (AEPW), SPS, and Western Farmers Electric Cooperative (WFEC) 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 115 kV line from the Customer's 115 kV substation into the Grapevine Interchange or the cost of the Customer's 115 kV substation.

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.

A transient stability analysis was conducted by ABB T&D Consulting, Inc. of Raleigh, N.C. for this generation interconnection request. The stability analysis indicated that the transmission system will remain stable for the studied contingencies for the addition of the proposed generation. The results of this analysis can be found in Attachment 1, at the end of this report.

There are several other proposed generation additions in the general area of the Customer's facility. It was assumed in this preliminary analysis that not all of these other projects within the AEPW and SPS control areas will be in service. Those previously queued projects that have advanced to nearly complete phases were included in this Impact Study. Due to the volume of generation interconnection requests in this area, some higher queued projects were not included in this study. In the event that another request for a generation interconnection with a higher priority withdraws, then this request may have to be re-evaluated to determine the local Network Constraints.

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.

## Introduction

<OMITTED TEXT> (Customer) has requested an expedited System Impact Study for the purpose of interconnecting 160 MW of generation within the control area of Southwestern Public Service (SPS) located in Gray County, Texas. The proposed method and point of interconnection is to add a 115 kV line terminal to the Grapevine 230/115 kV Interchange, which is owned by SPS. The proposed in-service date is September 1, 2009.

## 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 Impact 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 requirements for interconnection of the 160 MW consist of adding a new 115 kV line terminal into the Grapevine 230/115 kV Interchange owned by SPS. The Customer did not propose a specific route of its 115 kV line to serve its 115 kV substation facilities. It is assumed that obtaining all necessary right-of-way for construction of the Customer 115 kV transmission line and the 115 kV substation will not be a significant expense.

The total cost for adding a 115 kV terminal to the Grapevine Interchange is approximately $590,679. This cost is listed in Table 2. Other Network Constraints in the American Electric Power West (AEPW), SPS, and Western Farmers Electric Cooperative (WFEC) transmission systems that were identified are listed in Table 3. These estimates will be refined during the development of subsequent Interconnect Studies based on the final designs. This cost does not include building the 115 kV facilities from the Customer substation into the Grapevine Interchange. Also, this cost does not include the Customer's 115 kV substation. These costs, which were not available at the completion of this Impact Study, should be determined by the Customer. Unless otherwise stated, the Customer is responsible for all facilities up to the point of interconnection.

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

A preliminary one-line drawing of the interconnection and direct assigned facilities are shown in Figure 1. Figure 2 shows the local area of the point of interconnection.

## Interconnection Estimated Costs

**TABLE 1: Direct Assignment Facilities**

| FACILITY | ESTIMATED COST (2007 DOLLARS) |
|---|---|
| CUSTOMER – (1) 115 kV substation facilities. | * |
| CUSTOMER – (1) 115 kV transmission facilities between the Customer's 115 kV substation and the Grapevine Interchange. | * |
| CUSTOMER – Right-of-Way for Customer facilities. | * |
| SPS – Add (1) 115 kV terminal to the Grapevine Interchange. | **$590,679** |
| **TOTAL** | * |

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

**TABLE 2: Required Interconnection Network Upgrade Facilities**

| FACILITY | ESTIMATED COST (2007 DOLLARS) |
|---|---|
| None identified at this time. | |
| **TOTAL** | |

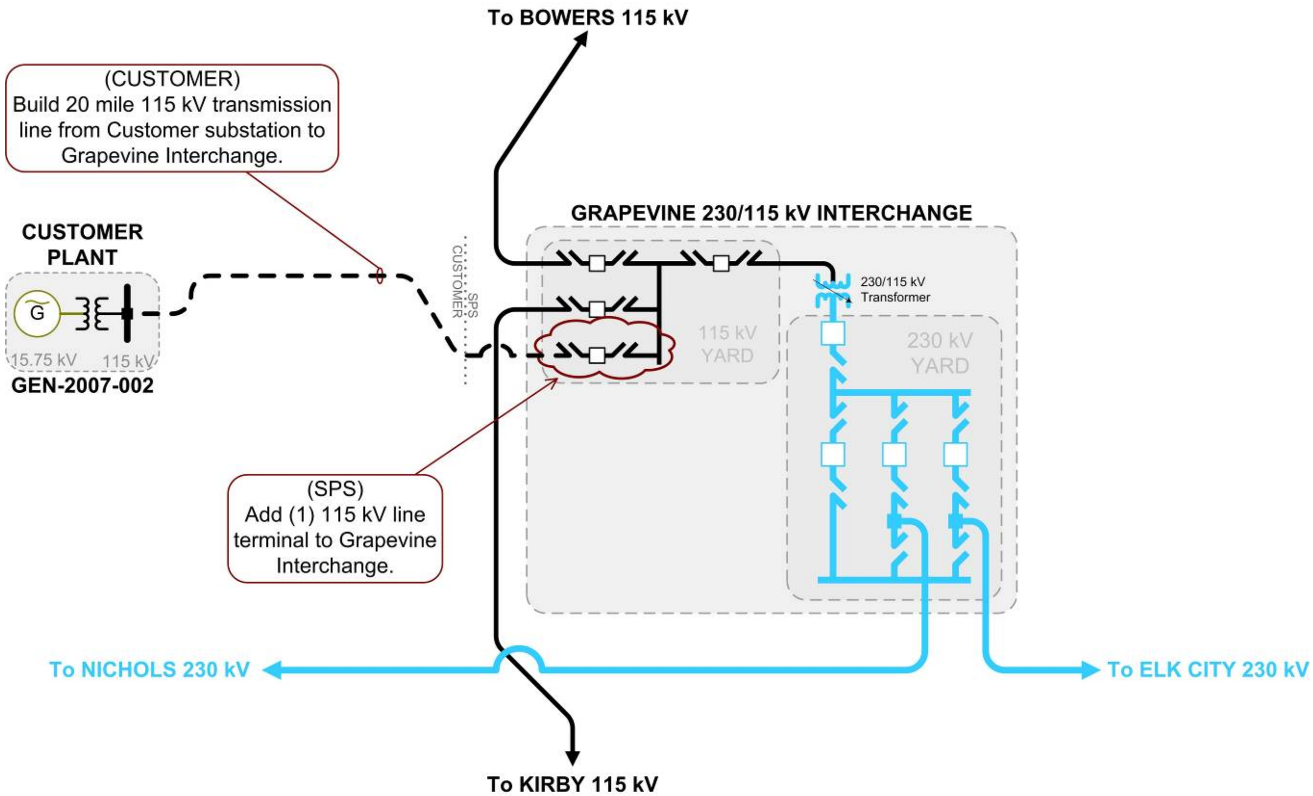


**FIGURE 1: Proposed Interconnection**
**(Final design to be determined)**

## Powerflow Analysis

A powerflow analysis was conducted for the facility using modified versions of the 2009 and 2012 summer and winter peak, and 2017 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 interconnect request is September 1, 2009. The available seasonal models used were through the 2017 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 160 MW and location, additional criteria violations will occur on the existing AEPW, SPS, and WFEC transmission systems under steady state and contingency conditions in the peak seasons. Table 3 lists these overloaded facilities.

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.

Numerous voltage violations for load serving buses within the SPP footprint were also observed for the some of the contingencies listed in Table 3. These voltage violations have not been listed in this report.

There are several other proposed generation additions in the general area of the Customer's facility. Some of the local projects that were previously queued were assumed to be in service in this System Impact Study. Those local projects that were previously queued and have advanced to nearly complete phases were included in this System Impact 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 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 portions or all of the modeled control areas of Sunflower Electric Power Corporation (SUNC), Missouri Public Service (MIPU), Westar (WESTAR), Kansas City Power & Light (KCPL), West Plains (WEPL), Midwest Energy (MIDW), Oklahoma Gas and Electric (OKGE), American Electric Power West (AEPW), Grand River Dam Authority (GRDA), Southwestern Public Service (SPS), Western Farmers Electric Cooperative (WFEC), Western Resources (WERE), and other control areas were applied and the resulting scenarios analyzed. This satisfies the 'more probable' contingency testing criteria mandated by NERC and the SPP criteria.

## Powerflow Study Results

### TABLE 3: Network Constraints

| AREA | OVERLOADED ELEMENT |
|---|---|
| AEPW | CLINTON JUNCTION - ELK CITY 138KV CKT 1 |
| AEPW | ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1 |
| AEPW | GEN-2006-002T 230.00 - ELK CITY 230KV 230KV CKT 1 |
| AEPW | SHAMROCK (SHAMRCK1) 115/69/14.4KV TRANSFORMER CKT 1 |
| AEPW/SPS | GRAPEVINE INTERCHANGE - GEN-2006-002T 230KV CKT 1 |
| AEPW/SPS | MCLEAN RURAL SUB - SHAMROCK 115KV CKT 1 |
| AEPW/WFEC | ALTUS JCT TAP - RUSSELL 138KV CKT 1 |
| AEPW/WFEC | LAKE PAULINE - RUSSELL 138KV CKT 1 |
| SPS | BOWERS INTERCHANGE - GRAPEVINE INTERCHANGE 115KV CKT 1 |
| SPS | CONWAY SUB - KIRBY SWITCHING STATION 115KV CKT 1 |
| SPS | CONWAY SUB - YARNELL SUB 115KV CKT 1 |
| SPS | DALHART INTERCHANGE - RITA BLANCA REC-HOGUE 115KV CKT 1 |
| SPS | DALHART INTERCHANGE 115/69KV TRANSFORMER CKT 1 |
| SPS | DUMAS SUB - EXELL TAP 115KV CKT 1 |
| SPS | ETTER RURAL SUB - MOORE COUNTY INTERCHANGE E. 115KV CKT 1 |
| SPS | EXELL TAP - FAIN SUB 115KV CKT 1 |
| SPS | FAIN SUB - NICHOLS STATION 115KV CKT 1 |
| SPS | GRAPEVINE INTERCHANGE - KIRBY SWITCHING STATION 115KV CKT 1 |
| SPS | GRAPEVINE INTERCHANGE 230/115KV TRANSFORMER CKT 1 |
| SPS | HERRING TAP - RITA BLANCA REC-SNEED 115KV CKT 1 |
| SPS | HERRING TAP - RIVERVIEW INTERCHANGE 115KV CKT 1 |
| SPS | KIRBY SWITCHING STATION - MCCLELLAN SUB 115KV CKT 1 |
| SPS | MCCLELLAN SUB - MCLEAN RURAL SUB 115KV CKT 1 |
| SPS | MOORE COUNTY INTERCHANGE E. - RITA BLANCA REC-HOGUE 115KV CKT 1 |
| SPS | MOORE COUNTY INTERCHANGE W. - DUMAS SUB 115KV CKT 1 |
| SPS | MOORE COUNTY INTERCHANGE W. - RITA BLANCA REC-SNEED 115KV CKT 1 |
| SPS | NICHOLS STATION - YARNELL SUB 115KV CKT 1 |
| SPS | RITA BLANCA REC-DALLAM COUNTY - DALLAM COUNTY INTERCHANGE 69KV CKT 1 |
| SPS | WEST BORGER SUB - HUTCHINSON COUNTY INTERCHANGE N. 115KV CKT 1 |
| | |
| AEPW | American Electric Power West |
| SPS | Southwestern Public Service |
| WFEC | Western Farmers Electric Cooperative |

## TABLE 4: Contingency Analysis

| SEASON | OVERLOADED ELEMENT | RATING (MVA) | LOADING (%) | ATC (MW) | CONTINGENCY |
|---|---|---|---|---|---|
| 09SP | ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1 | 287 | 161 | 0 | FINNEY SWITCHING STATION - HOLCOMB 345KV CKT 1 |
| 09SP | GEN-2006-002T 230.00 - ELK CITY 230KV 230KV CKT 1 | 351 | 135 | 0 | FINNEY SWITCHING STATION - HOLCOMB 345KV CKT 1 |
| 09SP | KIRBY SWITCHING STATION - MCCLELLAN SUB 115KV CKT 1 | 90 | 126 | 0 | GEN-2006-002T 230.00 - ELK CITY 230KV 230KV CKT 1 |
| 09SP | MCCLELLAN SUB - MCLEAN RURAL SUB 115KV CKT 1 | 90 | 124 | 0 | GEN-2006-002T 230.00 - ELK CITY 230KV 230KV CKT 1 |
| 09SP | GEN-2006-002T 230.00 - ELK CITY 230KV 230KV CKT 1 | 319 | 123 | 0 | BASE CASE |
| 09SP | CLINTON JUNCTION - ELK CITY 138KV CKT 1 | 143 | 116 | 0 | CLINTON AIR FORCE BASE TAP - ELK CITY 138KV CKT 1 |
| 09SP | MCLEAN RURAL SUB - SHAMROCK 115KV CKT 1 | 90 | 114 | 0 | GEN-2006-002T 230.00 - ELK CITY 230KV 230KV CKT 1 |
| 09SP | LAKE PAULINE - RUSSELL 138KV CKT 1 | 72 | 103 | 111 | GEN-2006-002T 230.00 - ELK CITY 230KV 230KV CKT 1 |
| | | | | | |
| 09WP | ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1 | 287 | 168 | 0 | (SPP-SWPS-04A): LAMAR - FINNEY SWITCHING STATION - POTTER COUNTY 345KV CKT 1 |
| 09WP | SHAMROCK (SHAMRCK1) 115/69/14.4KV TRANSFORMER CKT 1 | 69 | 167 | 0 | GEN-2006-002T 230.00 - ELK CITY 230KV 230KV CKT 1 |
| 09WP | SHAMROCK (SHAMRCK2) 138/69/14.4KV TRANSFORMER CKT 1 | 69 | 155 | 0 | GEN-2006-002T 230.00 - ELK CITY 230KV 230KV CKT 1 |
| 09WP | CLINTON JUNCTION - ELK CITY 138KV CKT 1 | 143 | 143 | 0 | CLINTON AIR FORCE BASE TAP - ELK CITY 138KV CKT 1 |
| 09WP | GEN-2006-002T 230.00 - ELK CITY 230KV 230KV CKT 1 | 351 | 142 | 0 | (SPP-SWPS-04A): LAMAR - FINNEY SWITCHING STATION - POTTER COUNTY 345KV CKT 1 |
| 09WP | GEN-2006-002T 230.00 - ELK CITY 230KV 230KV CKT 1 | 319 | 137 | 0 | BASE CASE |
| 09WP | LAKE PAULINE - RUSSELL 138KV CKT 1 | 72 | 129 | 0 | GEN-2006-002T 230.00 - ELK CITY 230KV 230KV CKT 1 |
| 09WP | KIRBY SWITCHING STATION - MCCLELLAN SUB 115KV CKT 1 | 107 | 115 | 0 | GEN-2006-002T 230.00 - ELK CITY 230KV 230KV CKT 1 |
| 09WP | MCCLELLAN SUB - MCLEAN RURAL SUB 115KV CKT 1 | 107 | 113 | 0 | GEN-2006-002T 230.00 - ELK CITY 230KV 230KV CKT 1 |
| 09WP | MCLEAN RURAL SUB - SHAMROCK 115KV CKT 1 | 107 | 108 | 0 | GEN-2006-002T 230.00 - ELK CITY 230KV 230KV CKT 1 |
| 09WP | GRAPEVINE INTERCHANGE - GEN-2006-002T 230KV CKT 1 | 351 | 106 | 0 | GEN-2006-002T 230.00 - ELK CITY 230KV 230KV CKT 1 |
| | | | | | |
| 12SP | MOORE COUNTY INTERCHANGE E. - RITA BLANCA REC-HOGUE 115KV CKT 1 | 99 | 171 | 0 | ETTER RURAL SUB - MOORE COUNTY INTERCHANGE E. 115KV CKT 1 |
| 12SP | ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1 | 287 | 160 | 0 | FINNEY SWITCHING STATION - HOLCOMB 345KV CKT 1 |
| 12SP | GEN-2006-002T 230.00 - ELK CITY 230KV 230KV CKT 1 | 351 | 134 | 0 | FINNEY SWITCHING STATION - HOLCOMB 345KV CKT 1 |
| 12SP | KIRBY SWITCHING STATION - MCCLELLAN SUB 115KV CKT 1 | 90 | 130 | 0 | GEN-2006-002T 230.00 - ELK CITY 230KV 230KV CKT 1 |
| 12SP | MCCLELLAN SUB - MCLEAN RURAL SUB 115KV CKT 1 | 90 | 128 | 0 | GEN-2006-002T 230.00 - ELK CITY 230KV 230KV CKT 1 |
| 12SP | GEN-2006-002T 230.00 - ELK CITY 230KV 230KV CKT 1 | 319 | 125 | 0 | BASE CASE |
| 12SP | CLINTON JUNCTION - ELK CITY 138KV CKT 1 | 143 | 120 | 0 | CLINTON AIR FORCE BASE TAP - ELK CITY 138KV CKT 1 |
| 12SP | MCLEAN RURAL SUB - SHAMROCK 115KV CKT 1 | 90 | 117 | 0 | GEN-2006-002T 230.00 - ELK CITY 230KV 230KV CKT 1 |
| 12SP | DALHART INTERCHANGE - RITA BLANCA REC-HOGUE 115KV CKT 1 | 99 | 153 | 11 | ETTER RURAL SUB - MOORE COUNTY INTERCHANGE E. 115KV CKT 1 |
| 12SP | LAKE PAULINE - RUSSELL 138KV CKT 1 | 72 | 103 | 109 | GEN-2006-002T 230.00 - ELK CITY 230KV 230KV CKT 1 |
| | | | | | |
| 12WP | ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1 | 287 | 160 | 0 | NICHOLS STATION - YARNELL SUB 115KV CKT 1 |
| 12WP | CLINTON JUNCTION - ELK CITY 138KV CKT 1 | 143 | 143 | 0 | CLINTON AIR FORCE BASE TAP - ELK CITY 138KV CKT 1 |
| 12WP | GEN-2006-002T 230.00 - ELK CITY 230KV 230KV CKT 1 | 319 | 138 | 0 | BASE CASE |
| 12WP | GEN-2006-002T 230.00 - ELK CITY 230KV 230KV CKT 1 | 351 | 131 | 0 | NICHOLS STATION - YARNELL SUB 115KV CKT 1 |
| 12WP | LAKE PAULINE - RUSSELL 138KV CKT 1 | 72 | 127 | 0 | GEN-2006-002T 230.00 - ELK CITY 230KV 230KV CKT 1 |
| 12WP | CONWAY SUB - YARNELL SUB 115KV CKT 1 | 218 | 127 | 0 | ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1 |
| 12WP | NICHOLS STATION - YARNELL SUB 115KV CKT 1 | 218 | 127 | 0 | ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1 |

## TABLE 4: Contingency Analysis (continued)

| SEASON | OVERLOADED ELEMENT | RATING (MVA) | LOADING (%) | ATC (MW) | CONTINGENCY |
|---|---|---|---|---|---|
| 12WP | KIRBY SWITCHING STATION - MCCLELLAN SUB 115KV CKT 1 | 107 | 119 | 0 | ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1 |
| 12WP | MCCLELLAN SUB - MCLEAN RURAL SUB 115KV CKT 1 | 107 | 117 | 0 | GEN-2006-002T 230.00 - ELK CITY 230KV 230KV CKT 1 |
| 12WP | 2006-02T 230.00 - GRAPEVINE INTERCHANGE 230KV CKT 1 | 351 | 110 | 0 | GEN-2006-002T 230.00 - ELK CITY 230KV 230KV CKT 1 |
| 12WP | SHAMROCK (SHAMRCK1) 115/69/14.4KV TRANSFORMER CKT 1 | 63 | 104 | 77 | BASE CASE |
| 12WP | ALTUS JCT TAP - RUSSELL 138KV CKT 1 | 72 | 105 | 124 | ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1 |
| | | | | | |
| 17SP | GRAPEVINE INTERCHANGE 230/115KV TRANSFORMER CKT 1 | 129 | 176 | 0 | NICHOLS STATION - YARNELL SUB 115KV CKT 1 |
| 17SP | BOWERS INTERCHANGE 15/69KV TRANSFORMER CKT 1 | 97 | 170 | 0 | NICHOLS STATION - YARNELL SUB 115KV CKT 1 |
| 17SP | ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1 | 287 | 160 | 0 | FINNEY SWITCHING STATION - HOLCOMB 345KV CKT 1 |
| 17SP | SHAMROCK (SHAMRCK1) 115/69/14.4KV TRANSFORMER CKT 1 | 69 | 149 | 0 | ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1 |
| 17SP | HERRING TAP - RIVERVIEW INTERCHANGE 115KV CKT 1 | 180 | 148 | 0 | MOORE COUNTY INTERCHANGE - POTTER COUNTY INTERCHANGE 230KV CKT 1 |
| 17SP | HERRING TAP - RITA BLANCA REC-SNEED 115KV CKT 1 | 180 | 141 | 0 | MOORE COUNTY INTERCHANGE - POTTER COUNTY INTERCHANGE 230KV CKT 1 |
| 17SP | CONWAY SUB - KIRBY SWITCHING STATION 115KV CKT 1 | 180 | 136 | 0 | NICHOLS STATION - YARNELL SUB 115KV CKT 1 |
| 17SP | GEN-2006-002T 230.00 - ELK CITY 230KV 230KV CKT 1 | 351 | 134 | 0 | FINNEY SWITCHING STATION - HOLCOMB 345KV CKT 1 |
| 17SP | GRAPEVINE INTERCHANGE - KIRBY SWITCHING STATION 115KV CKT 1 | 161 | 132 | 0 | NICHOLS STATION - YARNELL SUB 115KV CKT 1 |
| 17SP | SHAMROCK (SHAMRCK2) 138/69/14.4KV TRANSFORMER CKT 1 | 69 | 131 | 0 | ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1 |
| 17SP | FAIN SUB - NICHOLS STATION 115KV CKT 1 | 161 | 131 | 0 | MOORE COUNTY INTERCHANGE - POTTER COUNTY INTERCHANGE 230KV CKT 1 |
| 17SP | KIRBY SWITCHING STATION - MCCLELLAN SUB 115KV CKT 1 | 90 | 128 | 0 | ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1 |
| 17SP | MOORE COUNTY INTERCHANGE W. - RITA BLANCA REC-SNEED 115KV CKT 1 | 180 | 128 | 0 | MOORE COUNTY INTERCHANGE - POTTER COUNTY INTERCHANGE 230KV CKT 1 |
| 17SP | EXELL TAP - FAIN SUB 115KV CKT 1 | 161 | 127 | 0 | MOORE COUNTY INTERCHANGE - POTTER COUNTY INTERCHANGE 230KV CKT 1 |
| 17SP | MCCLELLAN SUB - MCLEAN RURAL SUB 115KV CKT 1 | 90 | 126 | 0 | ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1 |
| 17SP | MOORE COUNTY INTERCHANGE W. - DUMAS SUB 115KV CKT 1 | 99 | 126 | 0 | MOORE COUNTY INTERCHANGE - POTTER COUNTY INTERCHANGE 230KV CKT 1 |
| 17SP | GEN-2006-002T 230.00 - ELK CITY 230KV 230KV CKT 1 | 319 | 121 | 0 | BASE CASE |
| 17SP | CLINTON JUNCTION - ELK CITY 138KV CKT 1 | 143 | 117 | 0 | CLINTON AIR FORCE BASE TAP - ELK CITY 138KV CKT 1 |
| 17SP | MCLEAN RURAL SUB - SHAMROCK 115KV CKT 1 | 90 | 114 | 0 | ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1 |
| 17SP | DUMAS SUB - EXELL TAP 115KV CKT 1 | 161 | 113 | 63 | MOORE COUNTY INTERCHANGE - POTTER COUNTY INTERCHANGE 230KV CKT 1 |
| 17SP | RITA BLANCA REC-DALLAM COUNTY - DALLAM COUNTY INTERCHANGE 69KV CKT 1 | 46 | 117 | 87 | MOORE COUNTY INTERCHANGE - POTTER COUNTY INTERCHANGE 230KV CKT 1 |
| 17SP | BOWERS INTERCHANGE - GRAPEVINE INTERCHANGE 115KV CKT 1 | 161 | 102 | 97 | NICHOLS STATION - YARNELL SUB 115KV CKT 1 |
| 17SP | ETTER RURAL SUB - MOORE COUNTY INTERCHANGE E. 115KV CKT 1 | 99 | 113 | 106 | MOORE COUNTY INTERCHANGE - POTTER COUNTY INTERCHANGE 230KV CKT 1 |
| 17SP | WEST BORGER SUB - HUTCHINSON COUNTY INTERCHANGE N. 115KV CKT 1 | 161 | 102 | 136 | MOORE COUNTY INTERCHANGE - POTTER COUNTY INTERCHANGE 230KV CKT 1 |
| 17SP | DALHART INTERCHANGE 115/69KV TRANSFORMER CKT 1 | 46 | 104 | 144 | MOORE COUNTY INTERCHANGE - POTTER COUNTY INTERCHANGE 230KV 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.

## Transient Stability Analysis

ABB T&D Consulting conducted a transient stability analysis for this request. The analysis indicated the transmission system would remain stable for the studied system configuration for the studied contingencies for the addition of the proposed generation. The analysis indicated that a power system stabilizer (PSS) may be required for the Customer generation.

The stability analysis was not able to include all previous queued projects in the local area. The stability analysis will need to be revisited during the Facility Study to accommodate all previous queued projects.

The entire stability analysis can be found in Attachment 1, at the end of this study.

## Conclusion

The minimum cost of interconnecting the Customer's interconnection request #GEN-2007-002 is estimated at $590,679 for Direct Assignment facilities and Network Upgrades listed in Tables 1 and 2. These costs exclude upgrades of other transmission facilities that were 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 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.

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.

## Point of Interconnection Area Map

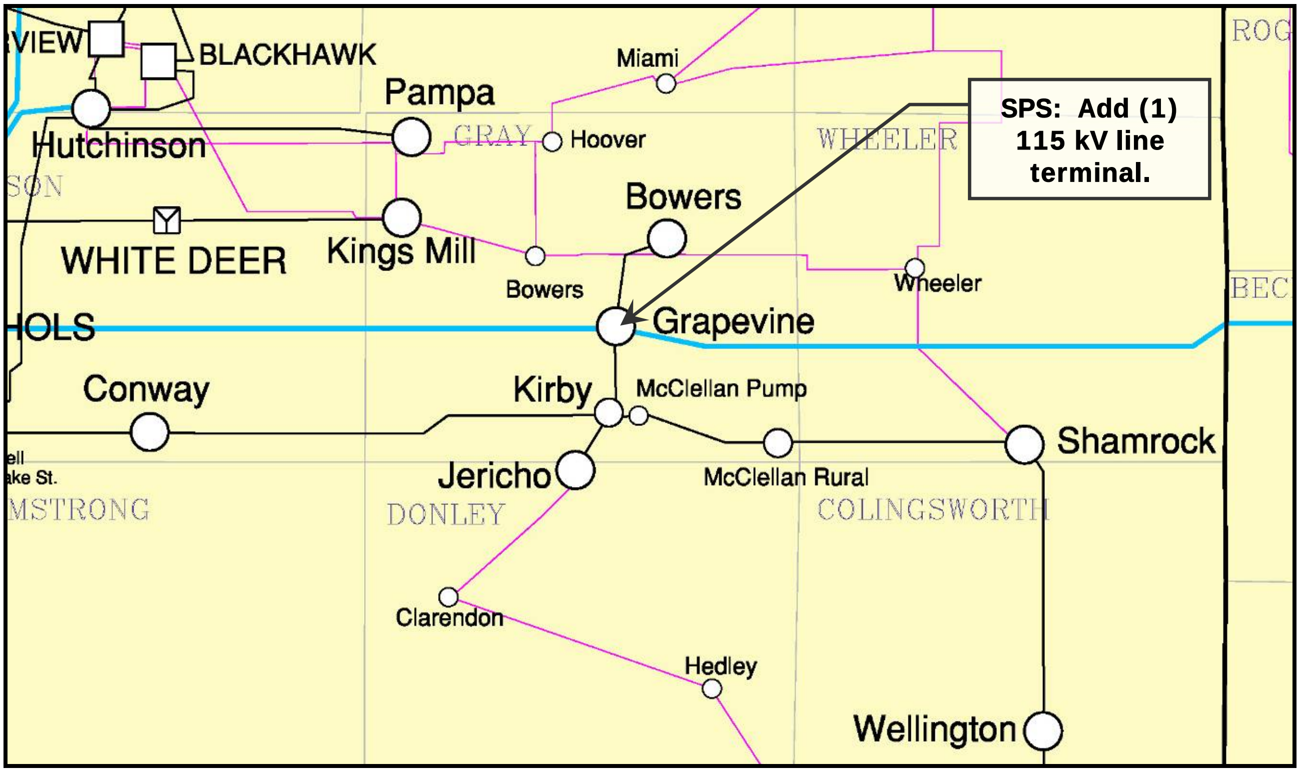


**FIGURE 2. Point of Interconnection**

ATTACHMENT 1:

# Stability Study
# For
# Generation Interconnection Request
# GEN-2007-002

POWER SYSTEMS DIVISION
GRID SYSTEMS CONSULTING

# IMPACT STUDY FOR GENERATION INTERCONNECTION REQUEST GEN-2007-002

# FINAL REPORT

REPORT NO.: 2007-11521-R0
Issued: August 14, 2007

**ABB Inc.**
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## ABB Inc – Grid Systems Consulting **Technical Report**

| **Southwest Power Pool** | **No.** 2007-11521-R0 | |
|---|---|---|
| Impact Study for Generation Interconnection request GEN-2007-002 | 8/14/2007 | # Pages<br>22 |


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|---|---|---|
| Sunil Verma | Bill Quaintance | Willie Wong |


**Executive Summary**


Southwest Power Pool (SPP) has requested a generator interconnection study through the Tariff for a 115 kV interconnection for 160 MW coal plant in Gray County, Texas. This coal plant would be interconnected into a bus position at the Grapevine 115 kV substation. The Grapevine substation is owned by Xcel Energy (d/b/a SWPS). The customer has asked for a study case of 100% MW output and with any instability runs reduced to the maximum MW with no upgrades.

This Coal plant was studied under two different system loading scenarios - 2007 winter peak and 2011 summer peak. Interconnection will be via a new breaker position in the existing Grapevine 115 kV bus.

The SPP system, prior-queued generators, and the proposed generator are stable following all simulated faults. Based on the results of the stability analysis, it is concluded that the proposed capacity addition of 160 MW does not adversely impact the stability of the SPP system. The coal plant stays online for all the faults simulated.

Based on some extended, but stable, oscillations following loss of the Grapevine 230/115 kV autotransformer, it is recommended that a properly tuned power system stabilizer be applied to the GEN-2007-002 excitation system.

The Grapevine 230/115 kV transformer currently controls the voltage on the 115 kV bus with an on-load tap changer. When GEN-2007-002 is connected to the 115 kV bus, voltage control between the generator and transformer will need to be coordinated.


*The results of this analysis are based on available data and assumptions made at the time of conducting this study. If any of the data and/or assumptions made in developing the study model change, the results provided in this report may not apply.*

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| 0 | Draft Report | 8/14/2007 | Sunil Verma | Bill Quaintance | Willie Wong |
| DISTRIBUTION:<br>Charles Hendrix – Southwest Power Pool | | | | | |

# TABLE OF CONTENTS

# 1 INTRODUCTION

SPP has requested an interconnection impact study for a 160 MW Coal plant in Gray County, Texas. This coal plant will be interconnected into a bus position at the Grapevine 115 kV substation (bus 50826). The Grapevine substation is owned by Xcel Energy (d/b/a SWPS). The feasibility (power flow) study was not performed as a part of this study.

The objective of the impact study is to evaluate the impact on system stability after connecting the additional 160 MW coal plant to the interconnection point and its effect on the nearby transmission system and generating stations including prior queued projects (such as GEN-2004-003, GEN-2005-021, GEN-2006-002, and GEN-2006-035). The study is performed on two system load scenarios (2007 winter peak and 2011 summer peak), as provided by SPP. **Error! Reference source not found.** shows the proposed 160 MW coal plant interconnecting station and Figure 1-2 shows the interconnection with the existing network.

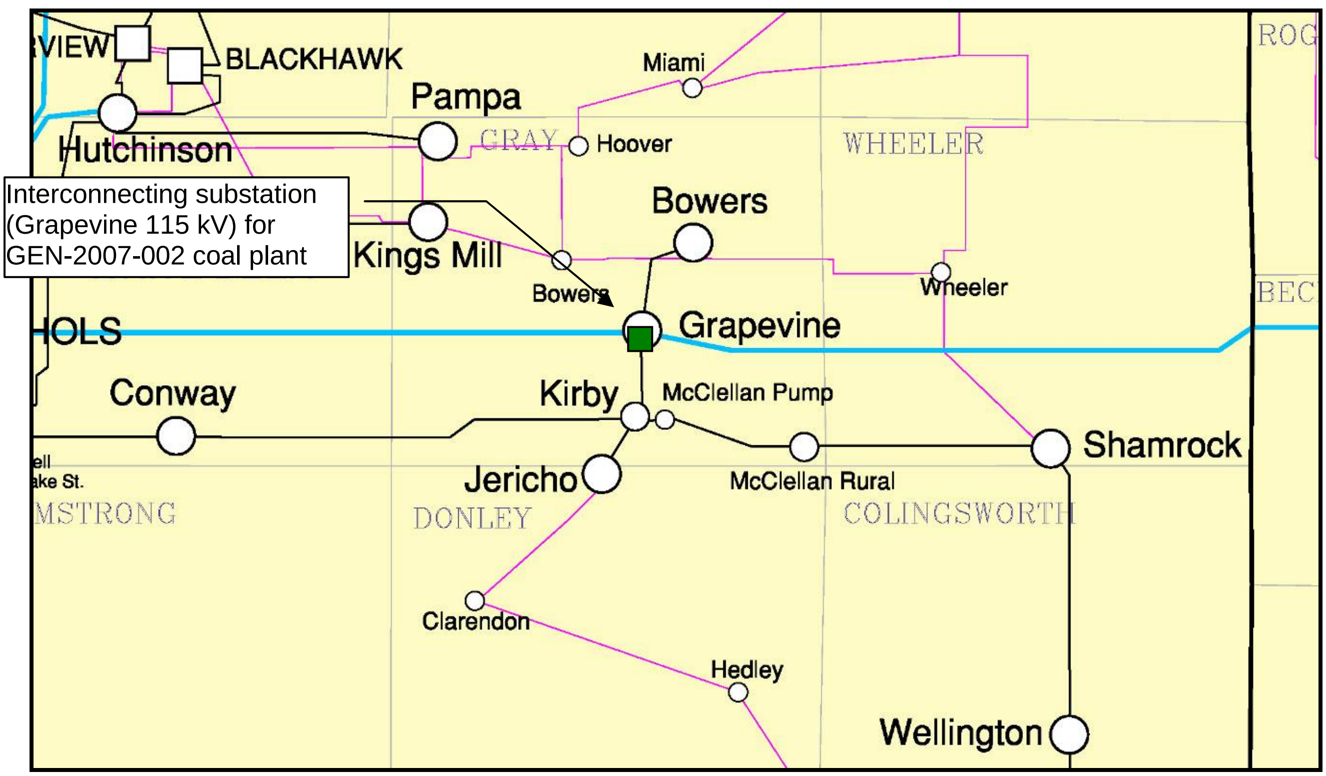


**Figure 1-1 GEN-2007-002 Coal Plant interconnecting substation**

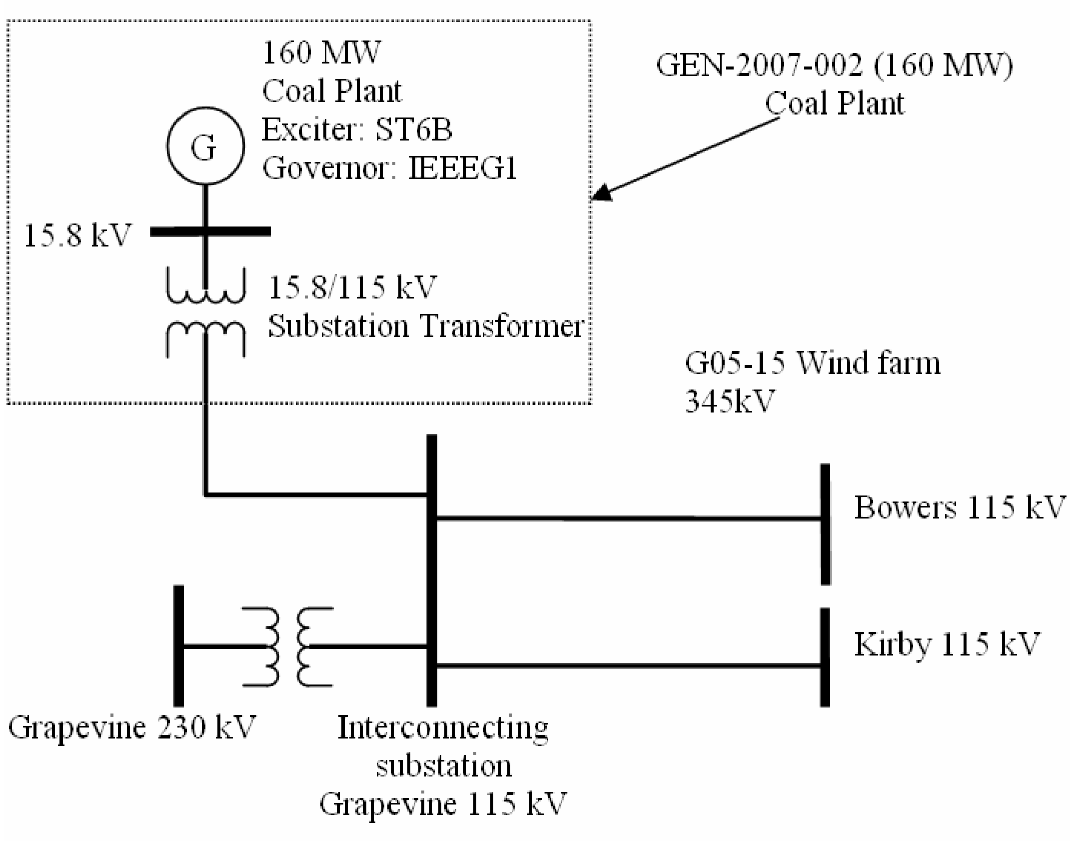


**Figure 1-2 Proposed 160 MW coal plant interconnection**

# 2 STABILITY ANALYSIS

In this stability study, ABB investigated the stability of the system for a series of faults specified by SPP, which are in the vicinity of the proposed plant. All of the simulations, except FLT_5_3PH, FLT_6_1PH, and FLT_23_3PH, represent three-phase or single-phase faults cleared by primary protection in 5 cycles, re-closing after 20 more cycles with the fault still on, and then permanently clearing of the fault 5 cycles later with primary protection. The faults FLT_5_3PH, FLT_6_1PH and FLT_23_3PH are on the autotransformer and are cleared after 5 cycles without reclosing operation. FLT_23_3PH was added to represent a fault on the strongest network branch at the POI (the 230/115 kV transformer) and on the side of the branch closest to the new generator (the 115 kV side).

## 2.1 STABILITY ANALYSIS METHODOLOGY

Using Planning Standards approved by NERC, the following stability definition was applied in the Transient Stability Analysis:

“Power system stability is defined as that condition in which the differences of the angular positions of synchronous machine rotors become constant following an aperiodic system disturbance.”

In addition, new coal plant generator is required to stay on-line following normally cleared faults at the Point of Interconnection (POI).

Stability analysis was performed using the PSS/E™ dynamics program V29. Three-phase and single-phase line faults were simulated for the specified durations, including re-closing, and the synchronous machine rotor angles were monitored to make sure they maintained synchronism following the fault removal. Stability of asynchronous machines was monitored as well.

Single-phase faults were simulated with the standard method of applying fault impedance to the positive sequence network to represent the effect of the negative and zero sequence networks on the positive sequence network. The fault impedance was estimated to give a positive sequence voltage at the fault location of approximately 60% of pre-fault voltage, which is a typical value.

The ability of the coal plant generator to stay connected to the grid during the disturbances and during the fault recovery was monitored.

## 2.2 STUDY MODEL DEVELOPMENT

The study model consists of power flow cases and dynamics databases, developed as follows.

***Base Power Flow Cases***

SPP supplied the following two (2) pre-project PSS/E power flow cases:

- *"gen07-02_07wp_base.sav"* representing the Winter Peak conditions of the SPP system for the year 2007,
- *"gen07-02_11sp_base.sav"* representing Summer Peak conditions of the SPP system for the year 2011, and

A transformer (25507-25430-1) in a distant area was corrected in the winter peak case to allow for good power flow and dynamic solutions. The modified winter peak pre-project case was then stored as "*gen07-02_07wp_base_mod.sav*".

Figure 2-1 shows a power flow one-line diagram for the 2007 winter peak base case. Figure 2-2 shows a power flow one-line diagram for the 2011 summer peak base case.

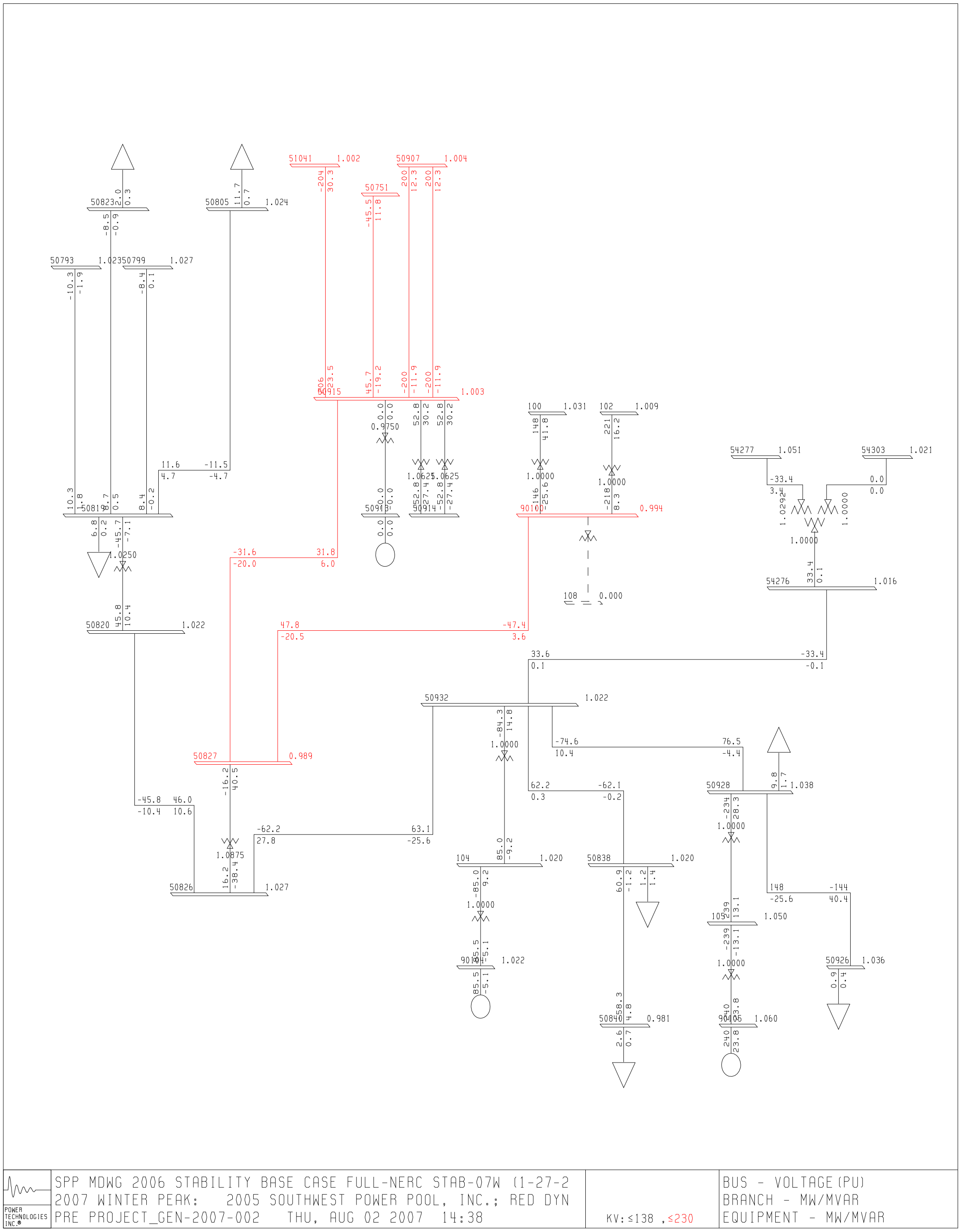


**Figure 2-1 2007 Winter Peak case without GEN-2007-002**

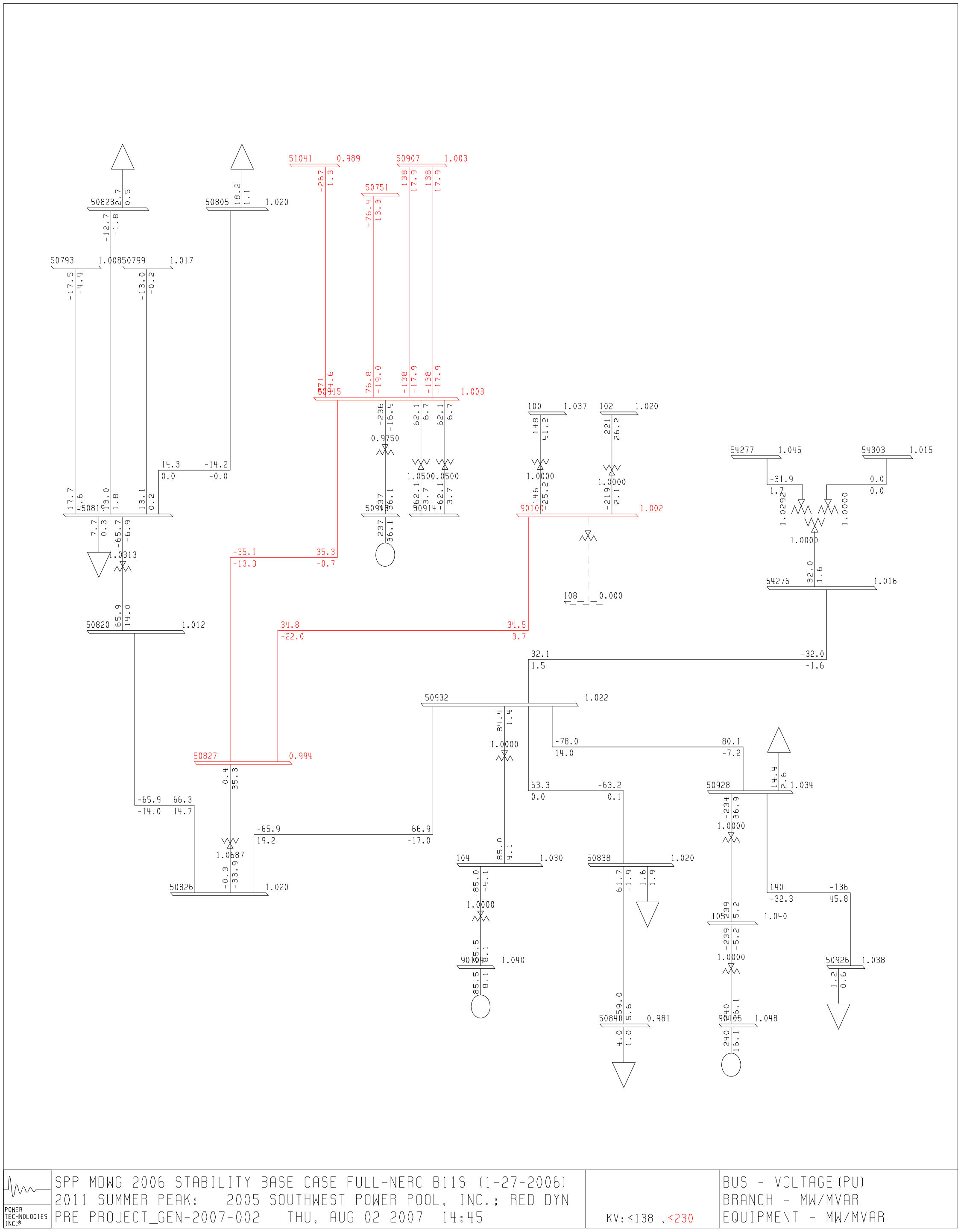


**Figure 2-2 2011 Summer Peak case without GEN-2007-002**

***Post-Project Power Flow Cases***

The proposed GEN-2007-002 project is comprised of a round rotor generator with governor model “IEEEG1” and exciter model “ST6B”. The plant will be connected to the Grapevine 115 kV substation (bus 50826) with a 15.75/115 kV transformer. The proposed project was added to the pre-project cases and the generation was dispatched by scaling down generation in areas 502, 524, 525, 536, 540, 541, and 544. The detailed process of coal plant model development is described in Appendix A.

Two post-project power flow cases with GEN-2007-002 were thus established:

- *WP07-GEN-2007-002.SAV – 2007 winter peak case*
- *SP11-GEN-2007-002.SAV – 2011 summer peak case*

Figure 2-3 shows a power flow one-line diagram with the coal plant for 2007 winter peak. Figure 2-4 shows a power flow one-line diagram with the coal plant for 2011 summer peak.

Note that the Grapevine 230/115 kV autotransformer currently controls the Grapevine 115 kV bus voltage with an on-load tap changer. When the GEN-2007-002 generator connects to the Grapevine 115 kV bus, the voltage controls of the 230/115 kV autotransformer and the new generator will need to be coordinated to avoid conflicts.

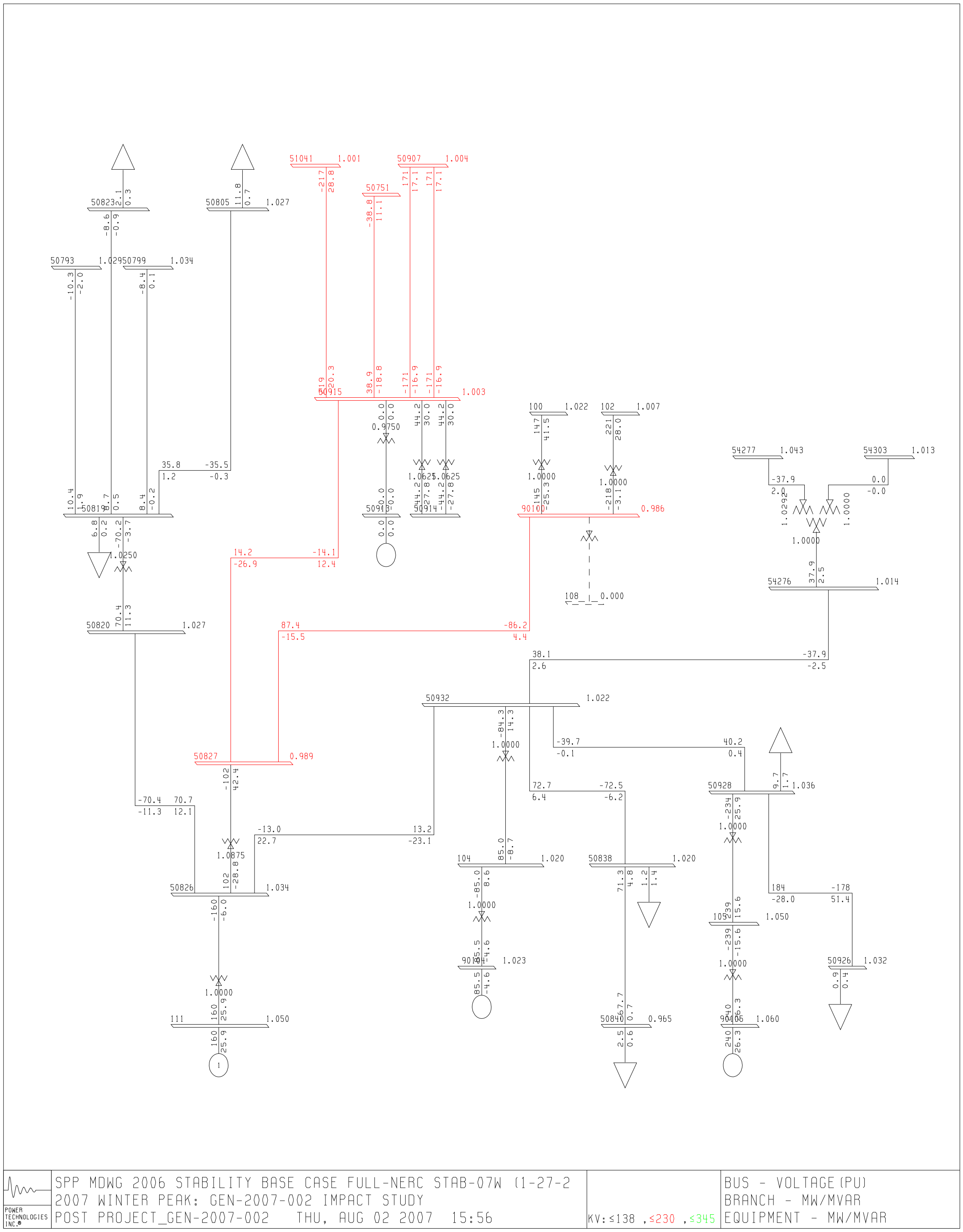


**Figure 2-3 2007 Winter Peak case with GEN-2007-002**

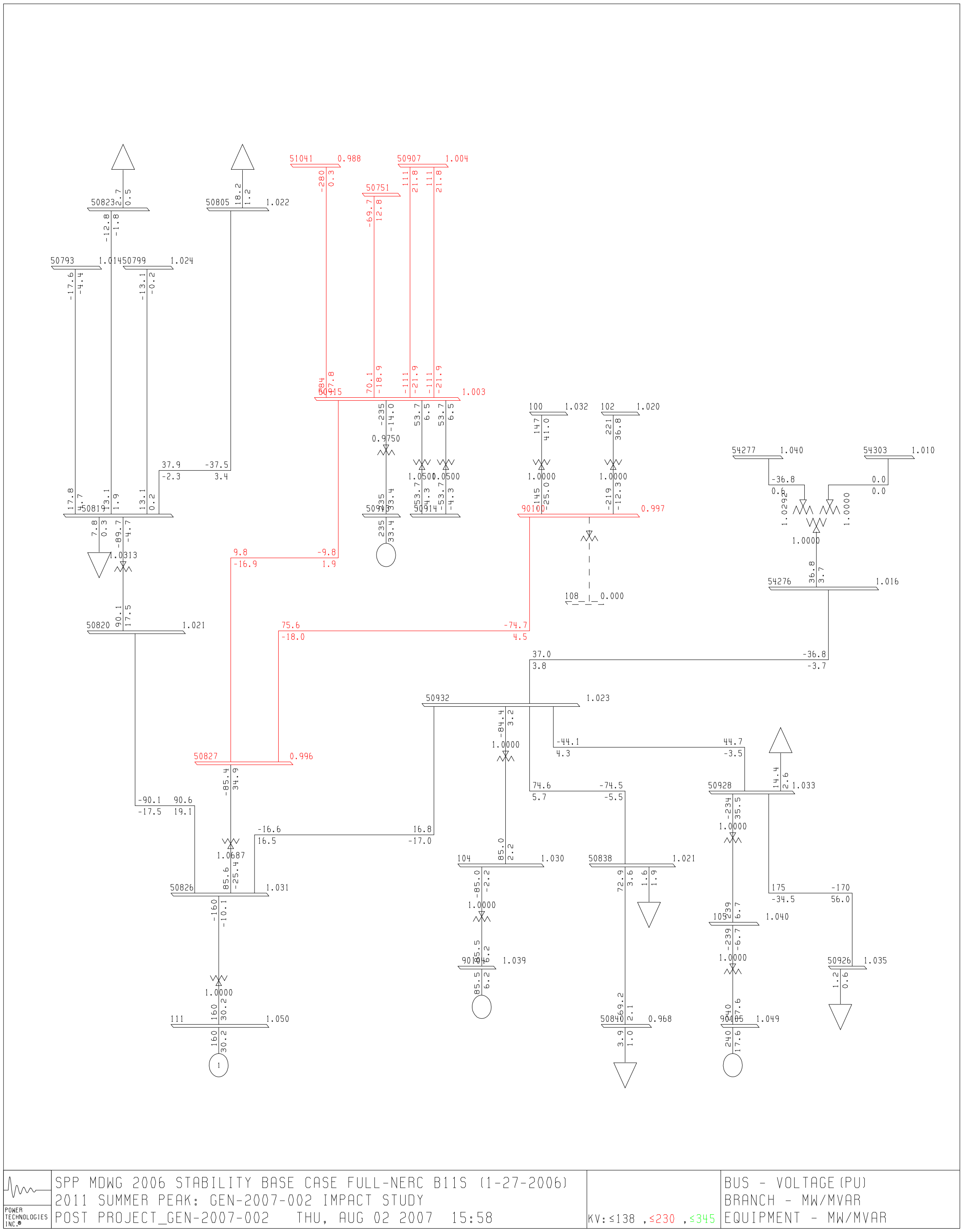


**Figure 2-4 2011 Summer Peak case with GEN-2007-002**

## ***Stability Model***

SPP provided the stability database in the form of PSS/E dynamic data files, "*gen07-02_07wp_base.dyr*" to model the 2007 Winter Peak, and "*gen07-02_11sp_base.dyr*" to model the 2011 Summer Peak configuration. Command files were also provided to compile and link user-written models. These files are compatible with PSS/E version 29.

The stability model was prepared for the GEN-2007-002 with machine model "GENROU", governor model "IEEEG1" and exciter model "ST6B". The stability data for GEN-2007-002 was appended to the pre-project data.

The power flow and stability model representations for GEN-2007-002 are included in Appendix B.

## ***Simulated Faults***

Table 2-1 lists the disturbances simulated for stability analysis.

**Table 2-1 List of Faults for Stability Analysis**

| ***Fault Name*** | ***Description*** |
|---|---|
| FLT_1_3PH | Three phase fault on the Grapevine (#50826) to Kirby (#50932), 115 kV line, near Grapevine.<br>a) Apply fault at the Grapevine (#50826)<br>b) Clear Fault after 5 cycles by removing the line from Grapevine (#50826) to Kirby (#50932).<br>c) Wait 20 cycles, and then re-close the line in (b) back into the fault.<br>d) Leave fault on for 5 cycles, then trip the line in (b) and remove fault. |
| FLT_2_1PH | Single phase fault on the Grapevine (#50826) to Kirby (#50932), 115 kV line, near Grapevine.<br>a) Apply fault at the Grapevine (#50826)<br>b) Clear Fault after 5 cycles by removing the line from Grapevine (#50826) to Kirby (#50932).<br>c) Wait 20 cycles, and then re-close the line in (b) back into the fault.<br>d) Leave fault on for 5 cycles, then trip the line in (b) and remove fault. |
| FLT_3_3PH | Three phase fault on the Grapevine (#50826) to Bowers (#50820), 115 kV line, near Grapevine.<br>a) Apply Fault at the Grapevine (#50826).<br>b) Clear fault after 5 cycles by removing the line from Grapevine (#50826) to Bowers (#50820)<br>c) Wait 20 cycles, and then re-close the line in (b) into the fault.<br>d) Leave fault on for 5 cycles, then trip the line in (b) and remove fault. |
| FLT_4_1PH | Single phase fault on the Grapevine (#50826) to Bowers (#50820), 115 kV line, near Grapevine.<br>a) Apply Fault at the Grapevine (#50826).<br>b) Clear fault after 5 cycles by removing the line from Grapevine (#50826) to Bowers (#50820)<br>c) Wait 20 cycles, and then re-close the line in (b) into the fault.<br>d) Leave fault on for 5 cycles, then trip the line in (b) and remove fault. |
| FLT_5_3PH | Three phase fault on the Grapevine 230/115 kV autotransformer<br>a) Apply fault at the Grapevine 230 kV bus (#50827)<br>b) Clear fault after 5 cycles by removing the autotransformer from service. |

| ***Fault Name*** | ***Description*** |
|---|---|
| FLT_6_1PH | Single phase fault on the Grapevine 230/115 kV autotransformer<br>a) Apply fault at the Grapevine 230 kV bus (#50827)<br>b) Clear fault after 5 cycles by removing the autotransformer from service. |
| FLT_7_3PH | Three phase fault on the Elk City (#54153) to Wind Farm Tap (#90100) 230 kV line, near Elk City.<br>a) Apply fault at Elk City (#54153).<br>b) Clear fault after 5 cycles by removing the line from Elk City (#54153) to the Wind Farm tap (#90100).<br>c) Wait 20 cycles, and then re-close the line in (b) into the fault.<br>d) Leave fault on for 5 cycles, then trip the line in (b) and remove fault. |
| FLT_8_1PH | Single phase fault on the Elk City (#54153) to Wind Farm Tap (#90100) 230 kV line, near Elk City.<br>a) Apply fault at Elk City (#54153).<br>b) Clear fault after 5 cycles by removing the line from Elk City (#54153) to the Wind Farm tap (#90100).<br>c) Wait 20 cycles, and then re-close the line in (b) into the fault.<br>d) Leave fault on for 5 cycles, then trip the line in (b) and remove fault. |
| FLT_9_3PH | Three phase fault on the Nichols (#50915) to Grapevine (#50827), 230 kV line near Grapevine.<br>a) Apply Fault at the Grapevine bus (#50827)<br>b) Clear Fault after 5 cycles by removing the line from Nichols (#50915) to Grapevine (#50827).<br>c) Wait 20 cycles, and then re-close the line in (b) back into the fault.<br>d) Leave fault on for 5 cycles, then trip the line in (b) and remove fault. |
| FLT_10_1PH | Single phase fault on the Nichols (#50915) to Grapevine (#50827), 230 kV line near Grapevine.<br>a) Apply Fault at the Grapevine bus (#50827)<br>b) Clear Fault after 5 cycles by removing the line from Nichols (#50915) to Grapevine (#50827).<br>c) Wait 20 cycles, and then re-close the line in (b) back into the fault.<br>d) Leave fault on for 5 cycles, then trip the line in (b) and remove fault. |

| ***Fault Name*** | ***Description*** |
|---|---|
| FLT_11_3PH | Three phase fault on the Grapevine (#50827) to Wind Farm Tap (#90100) 230 kV line, near Grapevine.<br>a) Apply fault at the Grapevine (#50827).<br>b) Clear fault after 5 cycles by removing the line from Grapevine (#50827) to the Wind Farm tap (#90100).<br>c) Wait 20 cycles, and then re-close the line in (b) into the fault.<br>d) Leave fault on for 5 cycles, then trip the line in (b) and remove fault. |
| FLT_12_1PH | Single phase fault on the Grapevine (#50827) to Wind Farm Tap (#90100) 230 kV line, near Grapevine.<br>a) Apply fault at the Grapevine (#50827).<br>b) Clear fault after 5 cycles by removing the line from Grapevine (#50827) to the Wind Farm tap (#90100).<br>c) Wait 20 cycles, and then re-close the line in (b) into the fault.<br>d) Leave fault on for 5 cycles, then trip the line in (b) and remove fault. |
| FLT_13_3PH | Three phase fault on the Kirby (#50932) to McLelln3 (#50383), 115 kV line, near McLelln3<br>a) Apply fault at the Mclelln3 bus (#50383)<br>b) Clear fault after 5 cycles by removing the line from Kirby (#50932) to McLelln3 (#50383).<br>c) Wait 20 cycles, and then re-close the line in (b) into the fault.<br>d) Leave fault on for 5 cycles, then trip the line in (b) and remove fault. |
| FLT_14_1PH | Single phase fault on the Kirby (#50932) to McLelln3 (#50383), 115 kV line, near McLelln3<br>a) Apply fault at the Mclelln3 bus (#50383)<br>b) Clear fault after 5 cycles by removing the line from Kirby (#50932) to McLelln3 (#50383).<br>c) Wait 20 cycles, and then re-close the line in (b) into the fault.<br>d) Leave fault on for 5 cycles, then trip the line in (b) and remove fault. |
| FLT_15_3PH | Three phase fault on the McLelln3 (#50383) to McLean Rural (#50840), 115 kV line, near McLean Rural<br>a) Apply fault at the Mclean Rural bus (#50840)<br>b) Clear fault after 5 cycles by removing the line from McLelln3 (#50383) to McLean Rural (#50840).<br>c) Wait 20 cycles, and then re-close the line in (b) into the fault.<br>d) Leave fault on for 5 cycles, then trip the line in (b) and remove fault. |

| ***Fault Name*** | ***Description*** |
|---|---|
| FLT_16_1PH | Single phase fault on the McLelln3 (#50383) to McLean Rural (#50840), 115 kV line, near McLean Rural<br>a) Apply fault at the Mclean Rural bus (#50840)<br>b) Clear fault after 5 cycles by removing the line from McLelln3 (#50383) to McLean Rural (#50840).<br>c) Wait 20 cycles, and then re-close the line in (b) into the fault.<br>d) Leave fault on for 5 cycles, then trip the line in (b) and remove fault. |
| FLT_17_3PH | Three phase fault on the Nichols (#50915) to Hutchison County Interchange (#50751), 230 kV line, near Hutchison County Interchange.<br>a) Apply Fault at the Hutchison County Interchange bus (#50751).<br>b) Clear fault after 5 cycles by removing the line from Nichols (#50915) to Hutchison County Interchange (#50751).<br>c) Wait 20 cycles, and then re-close the line in (b) into the fault.<br>d) Leave fault on for 5 cycles, then trip the line in (b) and remove fault. |
| FLT_18_1PH | Single phase fault on the Nichols (#50915) to Hutchison County Interchange (#50751), 230 kV line, near Hutchison County Interchange.<br>a) Apply Fault at the Hutchison County Interchange bus (#50751).<br>b) Clear fault after 5 cycles by removing the line from Nichols (#50915) to Hutchison County Interchange (#50751).<br>c) Wait 20 cycles, and then re-close the line in (b) into the fault.<br>d) Leave fault on for 5 cycles, then trip the line in (b) and remove fault. |
| FLT_19_3PH | Three phase fault on the Nichols (#50915) to Whitaker (#50922), 115 kV line, near Whitaker<br>a) Apply Fault at the Whitaker bus (#50922).<br>b) Clear fault after 5 cycles by removing the line from Nichols (#50915) to Whitaker (#50922).<br>c) Wait 20 cycles, and then re-close the line in (b) into the fault.<br>d) Leave fault on for 5 cycles, then trip the line in (b) and remove fault. |
| FLT_20_1PH | Single phase fault on the Nichols (#50915) to Whitaker (#50922), 115 kV line, near Whitaker<br>a) Apply Fault at the Whitaker bus (#50922).<br>b) Clear fault after 5 cycles by removing the line from Nichols (#50915) to Whitaker (#50922).<br>c) Wait 20 cycles, and then re-close the line in (b) into the fault.<br>d) Leave fault on for 5 cycles, then trip the line in (b) and remove fault. |

| ***Fault Name*** | ***Description*** |
|---|---|
| FLT_21_3PH | Three phase fault on the Whitaker (#50922) to East Plant Interchange (#50956), 115 kV line, near East Plant Interchange<br>a) Apply Fault at the East Plant Interchange bus (#50956).<br>b) Clear fault after 5 cycles by removing the line from Whitaker (#50922) to East Plant Interchange (#50956).<br>c) Wait 20 cycles, and then re-close the line in (b) into the fault.<br>d) Leave fault on for 5 cycles, then trip the line in (b) and remove fault. |
| FLT_22_1PH | Single phase fault on the Whitaker (#50922) to East Plant Interchange (#50956), 115 kV line, near East Plant Interchange<br>a) Apply Fault at the East Plant Interchange bus (#50956).<br>b) Clear fault after 5 cycles by removing the line from Whitaker (#50922) to East Plant Interchange (#50956).<br>c) Wait 20 cycles, and then re-close the line in (b) into the fault.<br>d) Leave fault on for 5 cycles, then trip the line in (b) and remove fault. |
| FLT_23_3PH | Three phase fault on the Grapevine 230/115 kV autotransformer<br>a) Apply fault at the Grapevine 115 kV bus (#50826)<br>b) Clear fault after 5 cycles by removing the autotransformer from service. |

## 2.3 STUDY RESULTS

All the three phase and single phase faults listed above were simulated. Responses of the coal plant, nearby prior-queued projects (GEN-2004-003, GEN-2005-021, GEN-2006-002 and GEN-2006-035), and other nearby generators were monitored. The results for the simulated disturbances are summarized in Table 2-2. Plots showing the simulation results are included in Appendix C.

The results of the simulations indicate that GEN-2007-002 is stable and causes no system problems for the 23 simulated faults and two system conditions.

Note that the GEN-2007-002 power and speed oscillations do not damp out until around 10 seconds for faults on the Grapevine 230/115 kV transformer (faults 5, 6, and 23). While these responses are ultimately stable, it is recommended that a properly tuned power system stabilizer (PSS) be applied to the GEN-2007-002 excitation system to ensure a well damped response.

The Wildorado generator (bus #50997) oscillates in numerous simulations as well. This generator uses a GENCLS model on a 34.5 kV bus, which is not the most accurate model for a wind farm. The oscillations of Wildorado were thus ignored.

Table 2-2: Results of Stability Simulations

| FAULT | Winter Peak 2007 | Summer Peak 2011 |
|---|---|---|
| FLT_1_3PH | STABLE | STABLE |
| FLT_2_1PH | STABLE | STABLE |
| FLT_3_3PH | STABLE | STABLE |
| FLT_4_1PH | STABLE | STABLE |
| FLT_5_3PH | STABLE | STABLE |
| FLT_6_1PH | STABLE | STABLE |
| FLT_7_3PH | STABLE | STABLE |
| FLT_8_1PH | STABLE | STABLE |
| FLT_9_3PH | STABLE | STABLE |
| FLT_10_1PH | STABLE | STABLE |
| FLT_11_3PH | STABLE | STABLE |
| FLT_12_1PH | STABLE | STABLE |
| FLT_13_3PH | STABLE | STABLE |
| FLT_14_1PH | STABLE | STABLE |
| FLT_15_3PH | STABLE | STABLE |
| FLT_16_1PH | STABLE | STABLE |
| FLT_17_3PH | STABLE | STABLE |
| FLT_18_1PH | STABLE | STABLE |
| FLT_19_3PH | STABLE | STABLE |
| FLT_20_1PH | STABLE | STABLE |
| FLT_21_3PH | STABLE | STABLE |
| FLT_22_1PH | STABLE | STABLE |
| FLT_23_3PH | STABLE | STABLE |

# 3 CONCLUSIONS

The objective of this study is to evaluate the power system stability after addition of the GEN-2007-002 coal plant. The study is performed for two system scenarios: 2007 Winter Peak and 2011 Summer Peak.

GEN-2007-002 will remain on-line and stable for all the faults specified, and the SPP system will be stable following these faults in both Summer Peak and Winter Peak system conditions. Prior queued projects are stable as well.

A power system stabilizer (PSS) is recommended for the GEN-2007-002 generator, based on some extended but stable oscillations following loss of the Grapevine 230/115 kV autotransformer.

*The results of this analysis are based on available data and assumptions made at the time of conducting this study. If any of the data and/or assumptions made in developing the study model change, the results provided in this report may not apply.*

# APPENDIX A - Coal Plant Model Development

# APPENDIX B - Load Flow and Stability Data

# APPENDIX C - Plots for Stability Simulations with Gen-2007-002