Facility Study For Generation Interconnection Request GEN-2007-002

SPP Tariff Studies
(#GEN-2007-002)

January 2008

Summary

Pursuant to the tariff and at the request of the Southwest Power Pool (SPP), Xcel Energy performed the following Facility Study to satisfy the Facility Study Agreement executed by the requesting customer and SPP for SPP Generation Interconnection request Gen-2007-002. The request for interconnection was placed with SPP in accordance SPP's Open Access Transmission Tariff, which covers new generation interconnections on SPP's transmission system.

Impact ReStudy

Due to changes in prior queued projects, the Impact Study analysis has been re-evaluated as part of this Facility Study. This analysis can be found as Attachement 1 to this document. The Impact Study analysis has determined that changes in the prior queued projects did not have a material effect on GEN-2007-002. The analysis has determined that GEN-2007-002 will remain stable for all studied contingencies.

Facilities Study For Southwest Power Pool

160 MW of Generation
Gray County, Texas
SPP #GEN-2007-002

November 14, 2007

Xcel Energy Services, Inc.
Transmission Planning

Executive Summary

[Omitted Text] (the "Requester") has requested the interconnection of a new 160 MW Coal Plant to Southwestern Public Service Company (SPS) (an Xcel Energy Company) transmission system by connecting to the 115 kV bus at Grapevine Interchange. The Grapevine Interchange is an existing SPS facility, which has two 230 kV transmission lines and two 115 kV transmission lines with a 230/115 kV autotransformer.

The new unit has a nominal capacity of 160 MW net and is expected to be fully operational by December 1, 2009.

Grapevine Interchange is located about 50 miles east of Amarillo, Texas and 15 miles north of Interstate 40. Further described as located in Section 64 and 65, Block B-2 of the H & GN Survey of Gray County, Texas. See Figure A1 for a map of the area.

The Southwest Power Pool (SPP) evaluated the request to interconnect the 160 MW of generation to Grapevine Interchange and to the SPS transmission system in a Feasibility and System Impact Study completed in August 2007. This facility study also reports the results of the short circuit study omitted in SPP's System Impact Study for the Requester's Plant.

Xcel Energy requires the Interconnection Customer to construct the Interconnection Facilities in compliance with the latest revision of the Xcel Energy Interconnection Guidelines for Transmission Interconnection Producer-Owned Generation Greater than 20 MW. Version 3.0 dated 12/31/06, and is available at http://www.xcelenergy.com/XLWEB/CDA/0,3080,1-1-1_16699_24407-1428-0_0_0-0,00.html. This document describes the technical and protection requirements for connecting new generation to the Xcel Energy operating company transmission system and also includes commissioning, operation, and maintenance guidelines. Xcel Energy will also require that the Interconnection Customer be in compliance with all applicable criteria, guidelines, standards, requirements, regulations, and procedures issues by the North American Electric Reliability Council, (NERC), Southwest Power Pool (SPP), and Federal Energy Regulatory Commission (FERC) or their successor organizations.

Close work between the SPS Substation design and the requester's construction groups will be imperative to have this project in service on the scheduled date. SPS's facility modifications should be completed before the requester takes service from the new auxiliary transformer. The anticipated in-service date is September 2009, which is feasible.

The requester or their contractor will be performing the major portions of the construction to add the Requester's generator. There will be modifications to the SPS facilities associated with the interconnection. These modifications include the installation of one 115 kV breaker and the steel associated with the new structures at an estimated cost of $590,679. New revenue metering for the Requester's Plant will be on SPS's 115 kV and the estimated cost is $99,636. These costs are an estimate, but the requester will be responsible for the actual cost.

Discussion

General Description

The requester will be interconnecting the Coal Power Plant to the SPS transmission system by connecting their 115 kV transmission line to SPS's 115 kV bus at Grapevine, see figure A3. This will require minimal modifications to the existing Grapevine Interchange 115 kV. Primarily, these modifications include the addition of one 115 kV breaker (including bus and switches), and metering for the Coal Power Plant and its auxiliary transformer. The requester will be making all of the 115 kV connections to the steel tower on the 115 kV at Grapevine Interchange.

General Description of Modifications at Grapevine Interchange

1. **Modifications at Grapevine Interchange:** See Figure A2 in Appendix A for one-line diagram.

   1.1. **Location:** Grapevine Interchange is located approximately 50 miles east of Amarillo, Texas and 15 miles north of Interstate 40. Further described as located in Section 64 and 65, Block B-2 of the H & GN Survey of Gray County, Texas. See Figure A1 for a map of the area.

   1.2. **Bus Design:** The modifications planned for the Grapevine Interchange is the addition of 115 kV bus and a 115 kV breaker with switches. The addition of the Coal Power Plant will increase the potential current flow at Grapevine Interchange, but will not require any changes except for the possibility of replacing the 230/115 kV autotransformer.

   1.3. **Autotransformer:** The existing 230/115 kV autotransformer is rated at 100 MW, which is the limiting element and may need to be replaced with a 150 MW unit. This will be determined in the Transmission Service Study by the Southwest Power Pool.

   1.4. **Controls:** The existing control house will be utilized to house the new metering, protective relaying and control devices, terminal cabinets, and any fiber-optic cable terminations, etc for the new 115 kV breaker terminal.

   1.5. **Line Reactors:** None.

   1.6. **Security Fence:** There will be no changes to the Grapevine Interchange fencing.

   1.7. **Ground Grid:** There will be no changes to the ground grid within the Grapevine Interchange.

   1.8. **Site Grading:** No changes for Xcel Energy.

   1.9. **Station Power:** No changes for Grapevine Interchange.

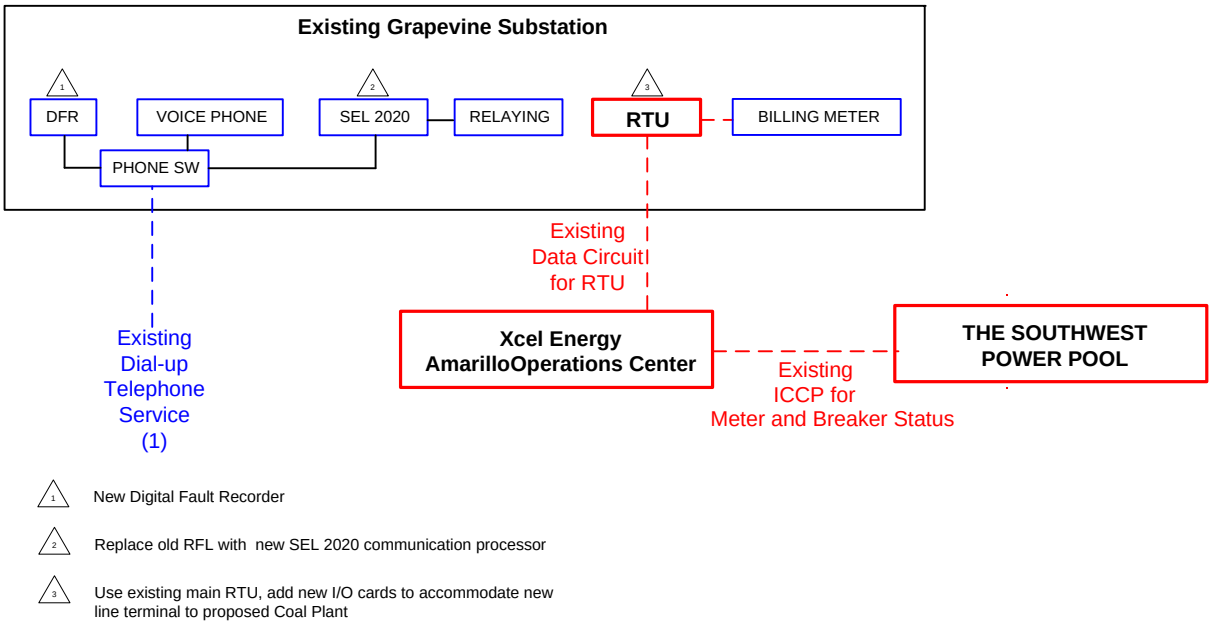
   1.10. **Relay and Protection Scheme**: The 115 kV at Grapevine Interchange that interconnects to the customer's owned line relaying will be step distance. A SEL 321-1 and a SEL 311-C will be used. Communications for the protective relaying will be achieved via a fiber optic ground wire (FOGW), installed by the requester in the neutral of the transmission line. An SEL 292H-2 will be installed; however no automatic re-closing will be installed. The SEL 292H-2 will be used for line/bus conditions and sync check with supervisory closing of the 115 kV breaker. A SEL-501-0 will also be installed for breaker failure.

   1.11. Revenue Metering: On the 115 kV line, revenue metering will be bi-directional and will be installed along with an ION 8600 meter unit, ANSI C12.1 accuracy class 0.2 (3 PTs IEEE C57.13 accuracy class 0.3 and 3 CTs IEEE C57.13 accuracy class 0.15) for full 3 phase 4-wire metering. The metering will utilize existing station PT's and new 115 kV self-contained CTs will be installed at the Breaker. There will be two meters one will be primary and the

other will be back-up, and each will have full 4 quadrant metering. Pulses out of the primary billing meter will be sent via SCADA to the Amarillo Control Center.

1.12. **Disturbance Monitoring Device:** Disturbance-monitoring equipment, capable of recording faults, swings, and long term trending, will be installed to monitor and record conditions in the substation and on the new terminal to the proposed coal plant. The disturbance equipment shall also be equipped with a GPS time synching clock. The disturbance equipment will utilize existing dial-up communications telephone circuit.

1.13. **Communications:** The existing RTU will be utilized. However, new input and output cards will be required to accommodate the additional points needed for the new line terminal. A new SEL 2020 communication processor will also be installed to communicate with the disturbance-monitoring device and the new protective relaying devices. The relaying communication is discussed in section 1.10.



2. **Transmission Line:** Requester is building 115 kV transmission line from the Coal Power Plant located near Celanese to the SPS system (Grapevine Interchange).
3. **Right-Of-Way (ROW):** There will be no physical expansion of the SPS facilities requiring new ROW.
4. **Construction Power and Distribution Service:** Both Construction and Station power, in addition to any distribution service required for the Requester's interconnection of the Coal Power Plant is the sole responsibility of the Requester.
5. **Engineering and Construction Schedule:** Close work between the SPS substation design and requester's construction groups will be imperative to have this project in service on the scheduled date. The anticipated in-service date is September 2009.
6. **Estimated Construction Costs:** The total estimated cost for the addition of 115 kV breaker and 115 kV switches is $590,679. The metering cost for the Coal Power Plant is $99,636. This is an estimated cost, but the requester will be responsible for the actual cost. These costs were

estimated using 2007 costs (2007 dollars) with no AFUDC[1] added with an estimated accuracy is ± 20%.

7. **Miscellaneous:**

The Southwest Power Pool (SPP) evaluated the request to interconnect the Requester's Coal Plant at Grapevine Interchange and to the SPS transmission system in a System Impact Study completed in August 2007. The SPP impact study did not contain a short circuit study; therefore, this facility study reports the results of the short circuit study.

8. Short Circuit Study Results:

The Short Circuit Analysis was performed internally by Xcel Energy Services to determine if the added generation would cause the available fault currents to exceed the interrupting capability of the SPS facilities. The results are shown in Table 2 below.

Table 2: Short Circuit Information

Fault Location	Fault Current (A)		Interrupting Capability of the smallest breaker on the bus. (Amps)
	Line-to-Ground	3–Phase	
Grapevine Interchange 115 kV Bus	5,200	4,775	40,000

The available fault currents are within the interrupting capability of all identified breakers when the Coal Power Plant is added.

[1] AFUDC - Allowance for Funds Used During Construction.

Appendix A

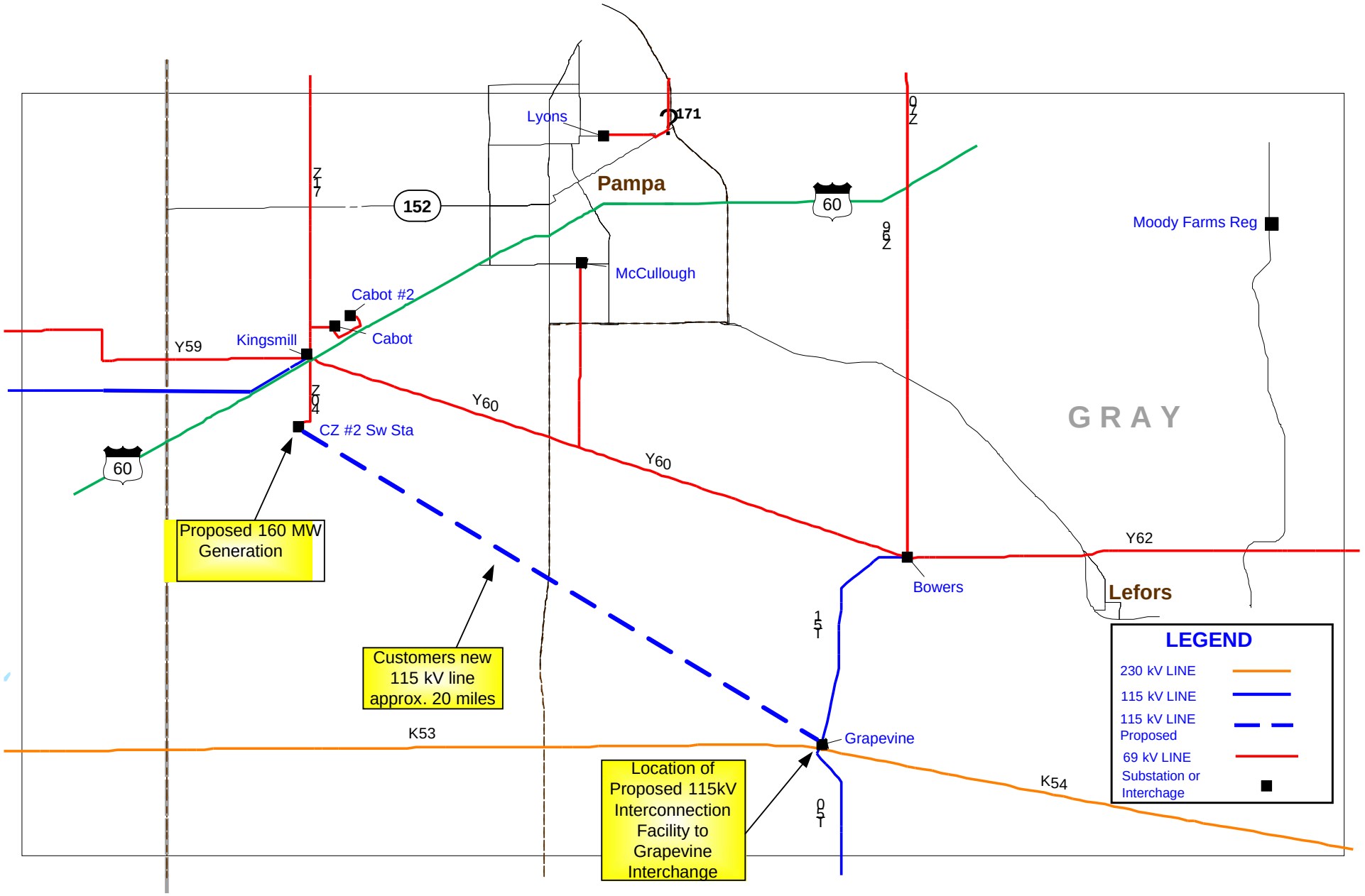


Figure A1 – Area Transmission and Location of Requester's Coal Power Plant.

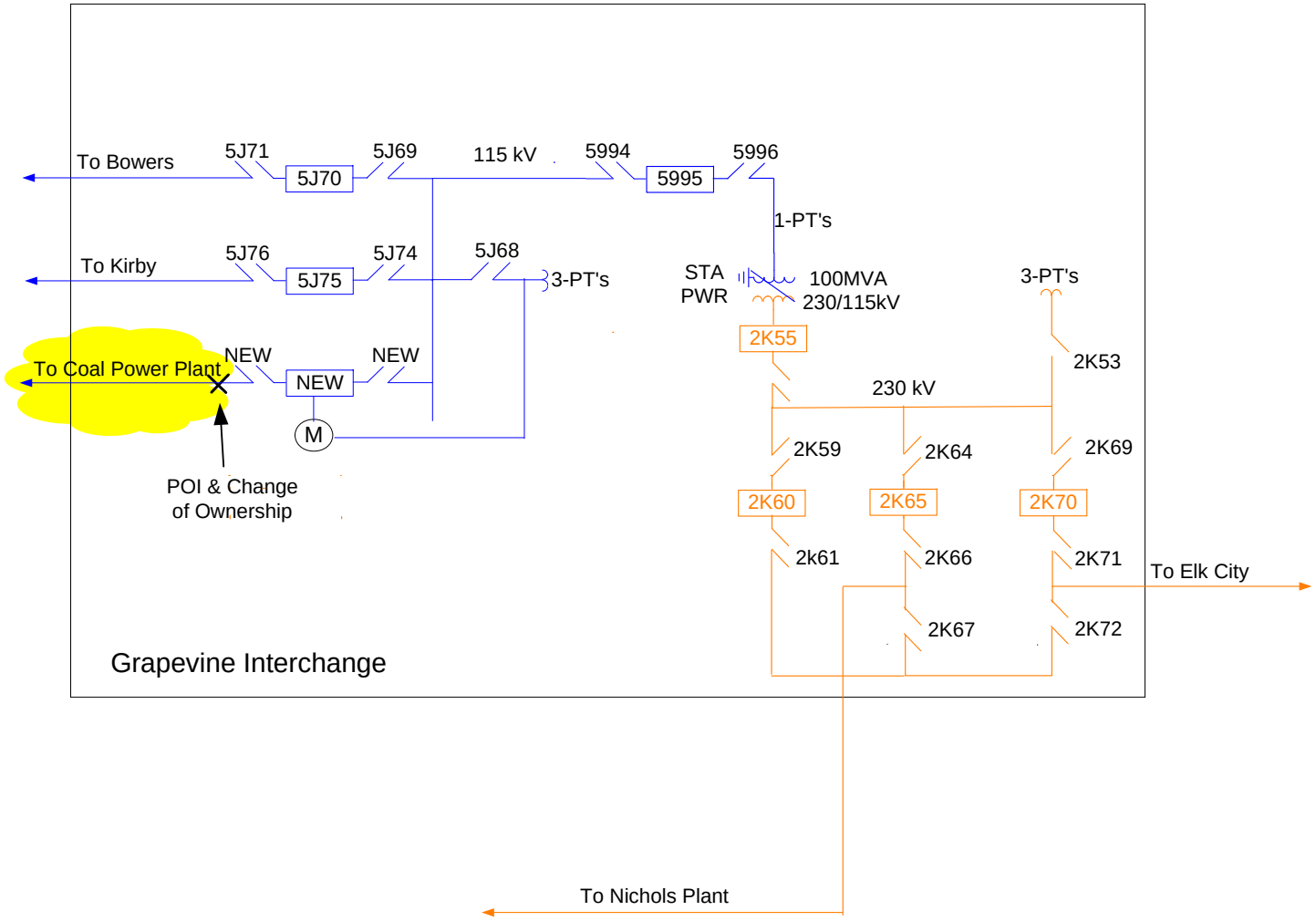


Figure A2 – Simplified One Line Diagram Illustrating Interconnection

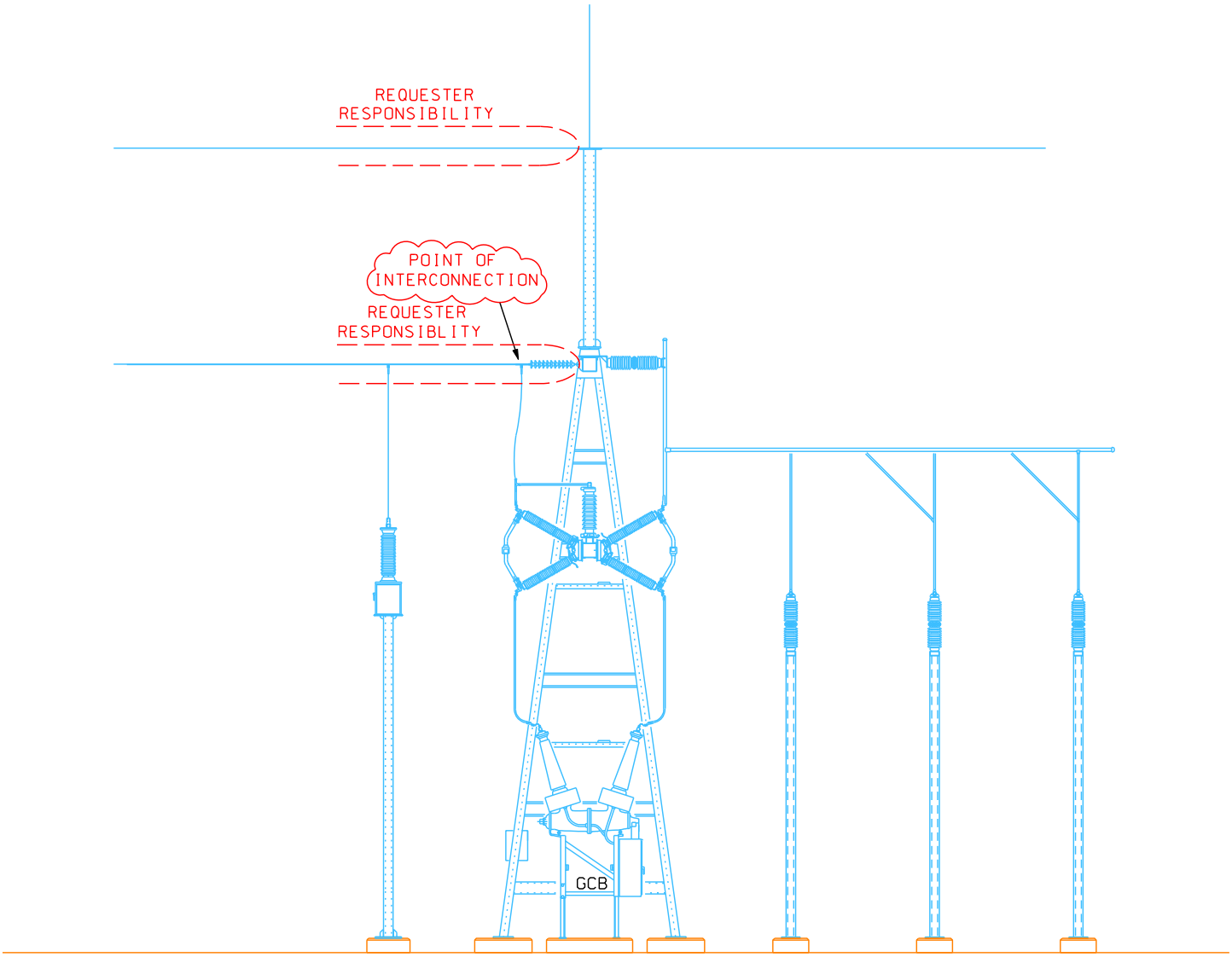


Figure A3. Elevation of the Point of Interconnection.

ATTACHMENT 1.

IMPACT RE-STUDY

Executive Summary

<OMITTED TEXT>This document is a report on the restudy of the Expedited System Impact Study for Generation Interconnection Request GEN-2007-002 (Original Impact Study) dated August 2007. The restudy was conducted to determine the effects due to the change in status of certain prior queued projects.

Generation Interconnection Request GEN-2007-002 is a request for 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. In Table 2, 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.

The results of the stability analysis indicate that GEN-2007-002 and the transmission system remain stable for all the analyzed contingencies.

The costs for implementing this project are shown in the Facility Study for GEN-2007-002.

Nothing in this study should be construed as a guarantee of transmission service. If the customer wishes to sell power from the facility, a separate request for transmission service shall be requested on Southwest Power Pool's OASIS by the Customer.

1.0 Introduction

<OMITTED TEXT> (Customer) requested an Expedited System Impact Study for Generation Interconnection Request for 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.

2.0 Purpose

The purpose of this study is to re-evaluate the impact of the proposed interconnection on the reliability of the Transmission System due to the change in status of certain prior queued projects subsequent to the completion of the initial Impact Study.

3.0 Facilities

The details for the Generation Facility are in the Expedited System Impact Study for Generation Interconnection Request GEN-2007-002 (Original Impact Study). The Interconnect Facility is described in the Facility Study for GEN-2007-002

4.0 Powerflow Analysis

A powerflow analysis was conducted for the facility using modified versions of the 2009 & 2012 summer and winter peak models, and the 2017 summer peak model. 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 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 SPS, AEPW, and WFEC transmission systems under steady state and contingency conditions in the peak seasons. Table 1 lists these overloaded facilities.

In Table 2, 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.

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 Feasibility Study. Not all 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 Sunflower Electric Power Corporation (SUNC), Missouri Public Service (MIPU), Westar Energy (WERE), 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 Company (SPS), Western Farmers Electric Cooperative (WFEC) 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.

Table 1. Network Constraints

AREA	OVERLOADED ELEMENT
AEPW	2006-02T 230.00 - ELK CITY 230KV 230KV CKT 1
AEPW	CLINTON JUNCTION - ELK CITY 138KV CKT 1
AEPW	ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1
AEPW	JERICHO (JERIC2WT) 115/69/14.4KV TRANSFORMER CKT 1
AEPW	SHAMROCK (SHAMRCK1) 115/69/14.4KV TRANSFORMER CKT 1
AEPW	SHAMROCK (SHAMRCK2) 138/69/14.4KV TRANSFORMER CKT 1
AEPW/SPS	2006-02T 230.00 - GRAPEVINE INTERCHANGE 230KV CKT 1
AEPW/SPS	MCLEAN RURAL SUB - SHAMROCK 115KV CKT 1
AEPW/SPS	SHAMROCK - MCLEAN RURAL SUB 115KV CKT 1
AEPW/WFEC	ALTUS JCT TAP - RUSSELL 138KV CKT 1
AEPW/WFEC	ELDORADO - LAKE PAULINE 69KV CKT 1
AEPW/WFEC	LAKE PAULINE - RUSSELL 138KV CKT 1
SPS	BOWERS INTERCHANGE - GRAPEVINE INTERCHANGE 115KV CKT 1
SPS	BOWERS INTERCHANGE 115/69KV TRANSFORMER CKT 1
SPS	CANYON EAST SUB - OSAGE SWITCHING STATION 115KV CKT 1
SPS	CHERRY SUB - NICHOLS STATION 115KV CKT 1
SPS	CHERRY SUB - NORTHWEST INTERCHANGE 115KV CKT 1
SPS	CONWAY SUB - KIRBY SWITCHING STATION 115KV CKT 1
SPS	CONWAY SUB - YARNELL SUB 115KV CKT 1
SPS	DALHART INTERCHANGE 115/69KV TRANSFORMER CKT 1
SPS	DALLAM COUNTY INTERCHANGE 115/69KV TRANSFORMER CKT 1
SPS	EAST MANHATTAN (EMANHT3X) 230/115/18.0KV TRANSFORMER CKT 1
SPS	EAST PLANT INTERCHANGE - MANHATTAN SUB 115KV CKT 1
SPS	EAST PLANT INTERCHANGE - PIERCE STREET TAP 115KV CKT 1
SPS	GRAPEVINE INTERCHANGE 230/115KV TRANSFORMER CKT 1
SPS	HAPPY INTERCHANGE - PALO DURO SUB 115KV CKT 1
SPS	KIRBY SWITCHING STATION - MCCLELLAN SUB 115KV CKT 1
SPS	LUBBOCK POWER & LIGHT-HOLLY PLANT 230/69KV TRANSFORMER CKT 1
SPS	LUBBOCK POWER & LIGHT-SOUTHEAST 230/69KV TRANSFORMER CKT 1
SPS	MANHATTAN TAP - OSAGE SWITCHING STATION 115KV CKT 1
SPS	MCCLELLAN SUB - MCLEAN RURAL SUB 115KV CKT 1
SPS	NICHOLS STATION - WHITAKER SUB 115KV CKT 1
SPS	NICHOLS STATION - YARNELL SUB 115KV CKT 1
SPS	PALO DURO SUB - RANDALL COUNTY INTERCHANGE 115KV CKT 1
SPS	RITA BLANCA REC-HOGUE - DALHART INTERCHANGE 115KV CKT 1
SPS	RITA BLANCA REC-HOGUE - MOORE COUNTY INTERCHANGE E. 115KV CKT 1
WFEC	ELDORADO - ELDORADO JCT 69KV CKT 1
WFEC	ELDORADO JCT - GYPSUM 69KV CKT 1
WFEC	GYPSUM - RUSSELL 69KV CKT 1
AEPW	American Electric Power West
SPS	Southwestern Public Serice Company
WFEC	Western Farmers Electric Cooperatives

Table 2. Contingency Analysis

SEASON	OVERLOADED ELEMENT	RATING (MVA)	LOADING (%)	ATC (MW)	CONTINGENCY
09SP	GRAPEVINE INTERCHANGE 230/115KV TRANSFORMER CKT 1	129	182	0	NICHOLS STATION - YARNELL SUB 115KV CKT 1
09SP	ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1	287	161	0	FINNEY SWITCHING STATION - HOLCOMB 345KV CKT 1
09SP	BOWERS INTERCHANGE 115/69KV TRANSFORMER CKT 1	97	153	0	NICHOLS STATION - YARNELL SUB 115KV CKT 1
09SP	2006-02T 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	2006-02T 230.00 - ELK CITY 230KV 230KV CKT 1
09SP	MCCLELLAN SUB - MCLEAN RURAL SUB 115KV CKT 1	90	124	0	2006-02T 230.00 - ELK CITY 230KV 230KV CKT 1
09SP	SHAMROCK (SHAMRCK1) 115/69/14.4KV TRANSFORMER CKT 1	69	123	0	NICHOLS STATION - YARNELL SUB 115KV CKT 1
09SP	2006-02T 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	PALO DURO SUB - RANDALL COUNTY INTERCHANGE 115KV CKT 1	99	111	0	AMARILLO SOUTH INTERCHANGE - SWISHER COUNTY INTERCHANGE 230KV CKT 1
09SP	HAPPY INTERCHANGE - PALO DURO SUB 115KV CKT 1	99	110	0	AMARILLO SOUTH INTERCHANGE - SWISHER COUNTY INTERCHANGE 230KV CKT 1
09SP	SHAMROCK (SHAMRCK1) 115/69/14.4KV TRANSFORMER CKT 1	69	108	0	ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1
09SP	EAST PLANT INTERCHANGE - PIERCE STREET TAP 115KV CKT 1	161	108	0	EAST PLANT INTERCHANGE - MANHATTAN SUB 115KV CKT 1
09SP	EAST PLANT INTERCHANGE - MANHATTAN SUB 115KV CKT 1	161	107	0	EAST PLANT INTERCHANGE - PIERCE STREET TAP 115KV CKT 1
09SP	CANYON EAST SUB - OSAGE SWITCHING STATION 115KV CKT 1	99	106	9	BUSHLAND INTERCHANGE - DEAF SMITH COUNTY INTERCHANGE 230KV CKT 1
09SP	ELDORADO - LAKE PAULINE 69KV CKT 1	20	138	20	LAKE PAULINE - RUSSELL 138KV CKT 1
09SP	JERICHO (JERIC2WT) 115/69/14.4KV TRANSFORMER CKT 1	46	116	26	KIRBY SWITCHING STATION - MCCLELLAN SUB 115KV CKT 1
09SP	CONWAY SUB - YARNELL SUB 115KV CKT 1	164	114	31	BASE CASE
09SP	NICHOLS STATION - YARNELL SUB 115KV CKT 1	164	114	34	BASE CASE
09SP	MCLEAN RURAL SUB - SHAMROCK 115KV CKT 1	90	114	35	2006-02T 230.00 - ELK CITY 230KV 230KV CKT 1
09SP	MANHATTAN TAP - OSAGE SWITCHING STATION 115KV CKT 1	161	103	44	EAST PLANT INTERCHANGE - PIERCE STREET TAP 115KV CKT 1
09SP	BOWERS INTERCHANGE 115/69KV TRANSFORMER CKT 1	84	119	52	BASE CASE
09SP	NICHOLS STATION - WHITAKER SUB 115KV CKT 1	249	102	116	CHERRY SUB - NICHOLS STATION 115KV CKT 1
09SP	CHERRY SUB - NICHOLS STATION 115KV CKT 1	161	101	138	NICHOLS STATION - WHITAKER SUB 115KV CKT 1
09SP	LAKE PAULINE - RUSSELL 138KV CKT 1	72	103	143	2006-02T 230.00 - ELK CITY 230KV 230KV CKT 1
09SP	ELDORADO - ELDORADO JCT 69KV CKT 1	26	101	157	LAKE PAULINE - RUSSELL 138KV CKT 1
09WP	GRAPEVINE INTERCHANGE 230/115KV TRANSFORMER CKT 1	129	202	0	NICHOLS STATION - YARNELL SUB 115KV CKT 1
09WP	ELDORADO - LAKE PAULINE 69KV CKT 1	20	186	0	LAKE PAULINE - RUSSELL 138KV CKT 1
09WP	SHAMROCK (SHAMRCK1) 115/69/14.4KV TRANSFORMER CKT 1	69	167	0	ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1
09WP	ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1	287	159	0	NICHOLS STATION - YARNELL SUB 115KV CKT 1

Table 2. Contingency Analysis

SEASON	OVERLOADED ELEMENT	RATING (MVA)	LOADING (%)	ATC (MW)	CONTINGENCY
09WP	SHAMROCK (SHAMRCK2) 138/69/14.4KV TRANSFORMER CKT 1	69	155	0	ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1
09WP	CLINTON JUNCTION - ELK CITY 138KV CKT 1	143	143	0	CLINTON AIR FORCE BASE TAP - ELK CITY 138KV CKT 1
09WP	2006-02T 230.00 - ELK CITY 230KV 230KV CKT 1	319	137	0	BASE CASE
09WP	ELDORADO - ELDORADO JCT 69KV CKT 1	26	136	0	LAKE PAULINE - RUSSELL 138KV CKT 1
09WP	JERICHO (JERIC2WT) 115/69/14.4KV TRANSFORMER CKT 1	46	131	0	2006-02T 230.00 - ELK CITY 230KV 230KV CKT 1
09WP	2006-02T 230.00 - ELK CITY 230KV 230KV CKT 1	351	130	0	NICHOLS STATION - YARNELL SUB 115KV CKT 1
09WP	LAKE PAULINE - RUSSELL 138KV CKT 1	72	129	0	ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1
09WP	CONWAY SUB - KIRBY SWITCHING STATION 115KV CKT 1	218	116	0	NICHOLS STATION - YARNELL SUB 115KV CKT 1
09WP	CONWAY SUB - YARNELL SUB 115KV CKT 1	218	114	0	GRAPEVINE INTERCHANGE 230/115KV TRANSFORMER CKT 1
09WP	NICHOLS STATION - YARNELL SUB 115KV CKT 1	218	114	0	GRAPEVINE INTERCHANGE 230/115KV TRANSFORMER CKT 1
09WP	KIRBY SWITCHING STATION - MCCLELLAN SUB 115KV CKT 1	90	115	12	ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1
09WP	MCCLELLAN SUB - MCLEAN RURAL SUB 115KV CKT 1	90	113	29	ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1
09WP	ELDORADO JCT - GYPSUM 69KV CKT 1	26	127	37	LAKE PAULINE - RUSSELL 138KV CKT 1
09WP	GYPSUM - RUSSELL 69KV CKT 1	26	119	75	LAKE PAULINE - RUSSELL 138KV CKT 1
09WP	BOWERS INTERCHANGE 115/69KV TRANSFORMER CKT 1	105	117	83	NICHOLS STATION - YARNELL SUB 115KV CKT 1
09WP	MCLEAN RURAL SUB - SHAMROCK 115KV CKT 1	90	108	84	ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER 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	BOWERS INTERCHANGE 115/69KV TRANSFORMER CKT 1	97	155	0	NICHOLS STATION - YARNELL SUB 115KV CKT 1
12SP	ELDORADO - LAKE PAULINE 69KV CKT 1	20	145	0	LAKE PAULINE - RUSSELL 138KV CKT 1
12SP	2006-02T 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	2006-02T 230.00 - ELK CITY 230KV 230KV CKT 1
12SP	SHAMROCK (SHAMRCK1) 115/69/14.4KV TRANSFORMER CKT 1	69	126	0	NICHOLS STATION - YARNELL SUB 115KV CKT 1
12SP	2006-02T 230.00 - ELK CITY 230KV 230KV CKT 1	319	125	0	BASE CASE
12SP	JERICHO (JERIC2WT) 115/69/14.4KV TRANSFORMER CKT 1	46	121	0	KIRBY SWITCHING STATION - MCCLELLAN SUB 115KV CKT 1
12SP	CLINTON JUNCTION - ELK CITY 138KV CKT 1	143	120	0	CLINTON AIR FORCE BASE TAP - ELK CITY 138KV CKT 1
12SP	EAST PLANT INTERCHANGE - PIERCE STREET TAP 115KV CKT 1	161	108	0	EAST PLANT INTERCHANGE - MANHATTAN SUB 115KV CKT 1
12SP	EAST PLANT INTERCHANGE - MANHATTAN SUB 115KV CKT 1	161	107	0	EAST PLANT INTERCHANGE - PIERCE STREET TAP 115KV CKT 1
12SP	NICHOLS STATION - WHITAKER SUB 115KV CKT 1	249	106	0	CHERRY SUB - NICHOLS STATION 115KV CKT 1
12SP	CHERRY SUB - NICHOLS STATION 115KV CKT 1	161	105	0	NICHOLS STATION - WHITAKER SUB 115KV CKT 1
12SP	MCLEAN RURAL SUB - SHAMROCK 115KV CKT 1	90	117	2	2006-02T 230.00 - ELK CITY 230KV 230KV CKT 1
12SP	GRAPEVINE INTERCHANGE 230/115KV TRANSFORMER CKT 1	129	177	4	NICHOLS STATION - YARNELL SUB 115KV CKT 1
12SP	BOWERS INTERCHANGE 115/69KV TRANSFORMER CKT 1	84	124	27	BASE CASE
12SP	MCCLELLAN SUB - MCLEAN RURAL SUB 115KV CKT 1	90	132	39	NICHOLS STATION - YARNELL SUB 115KV CKT 1
12SP	MANHATTAN TAP - OSAGE SWITCHING STATION 115KV CKT 1	161	102	57	EAST PLANT INTERCHANGE - PIERCE STREET TAP 115KV CKT 1
12SP	CONWAY SUB - YARNELL SUB 115KV CKT 1	164	110	64	BASE CASE

Table 2. Contingency Analysis

SEASON	OVERLOADED ELEMENT	RATING (MVA)	LOADING (%)	ATC (MW)	CONTINGENCY
12SP	NICHOLS STATION - YARNELL SUB 115KV CKT 1	164	110	66	BASE CASE
12SP	SHAMROCK (SHAMRCK2) 138/69/14.4KV TRANSFORMER CKT 1	69	107	114	NICHOLS STATION - YARNELL SUB 115KV CKT 1
12SP	ELDORADO - ELDORADO JCT 69KV CKT 1	26	106	133	LAKE PAULINE - RUSSELL 138KV CKT 1
12SP	LAKE PAULINE - RUSSELL 138KV CKT 1	72	103	142	2006-02T 230.00 - ELK CITY 230KV 230KV CKT 1
12WP	GRAPEVINE INTERCHANGE 230/115KV TRANSFORMER CKT 1	129	196	0	NICHOLS STATION - YARNELL SUB 115KV CKT 1
12WP	ELDORADO - LAKE PAULINE 69KV CKT 1	20	185	0	LAKE PAULINE - RUSSELL 138KV 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	2006-02T 230.00 - ELK CITY 230KV 230KV CKT 1	319	138	0	BASE CASE
12WP	ELDORADO - ELDORADO JCT 69KV CKT 1	26	135	0	LAKE PAULINE - RUSSELL 138KV CKT 1
12WP	SHAMROCK (SHAMRCK1) 115/69/14.4KV TRANSFORMER CKT 1	69	133	0	NICHOLS STATION - YARNELL SUB 115KV CKT 1
12WP	2006-02T 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	2006-02T 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
12WP	JERICHO (JERIC2WT) 115/69/14.4KV TRANSFORMER CKT 1	46	121	0	KIRBY SWITCHING STATION - MCCLELLAN SUB 115KV CKT 1
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	CONWAY SUB - KIRBY SWITCHING STATION 115KV CKT 1	218	115	0	NICHOLS STATION - YARNELL SUB 115KV CKT 1
12WP	2006-02T 230.00 - GRAPEVINE INTERCHANGE 230KV CKT 1	351	110	0	2006-02T 230.00 - ELK CITY 230KV 230KV CKT 1
12WP	MCCLELLAN SUB - MCLEAN RURAL SUB 115KV CKT 1	107	117	12	2006-02T 230.00 - ELK CITY 230KV 230KV CKT 1
12WP	SHAMROCK (SHAMRCK2) 138/69/14.4KV TRANSFORMER CKT 1	69	118	32	NICHOLS STATION - YARNELL SUB 115KV CKT 1
12WP	ELDORADO JCT - GYPSUM 69KV CKT 1	26	125	42	LAKE PAULINE - RUSSELL 138KV CKT 1
12WP	BOWERS INTERCHANGE 115/69KV TRANSFORMER CKT 1	105	119	74	NICHOLS STATION - YARNELL SUB 115KV CKT 1
12WP	GYPSUM - RUSSELL 69KV CKT 1	26	116	85	LAKE PAULINE - RUSSELL 138KV CKT 1
12WP	SHAMROCK (SHAMRCK1) 115/69/14.4KV TRANSFORMER CKT 1	63	104	128	BASE CASE
12WP	ALTUS JCT TAP - RUSSELL 138KV CKT 1	72	105	141	ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1
17SP	RITA BLANCA REC-HOGUE - MOORE COUNTY INTERCHANGE E. 115KV CKT 1	99	196	0	ETTER RURAL SUB - MOORE COUNTY INTERCHANGE E. 115KV CKT 1
17SP	RITA BLANCA REC-HOGUE - DALHART INTERCHANGE 115KV CKT 1	99	174	0	ETTER RURAL SUB - MOORE COUNTY INTERCHANGE E. 115KV CKT 1
17SP	BOWERS INTERCHANGE 115/69KV TRANSFORMER CKT 1	97	171	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	148	0	2006-02T 230.00 - ELK CITY 230KV 230KV CKT 1

Table 2. Contingency Analysis

SEASON	OVERLOADED ELEMENT	RATING (MVA)	LOADING (%)	ATC (MW)	CONTINGENCY
17SP	BOWERS INTERCHANGE 115/69KV TRANSFORMER CKT 1	84	138	0	BASE CASE
17SP	CONWAY SUB - KIRBY SWITCHING STATION 115KV CKT 1	180	136	0	NICHOLS STATION - YARNELL SUB 115KV CKT 1
17SP	2006-02T 230.00 - ELK CITY 230KV 230KV CKT 1	351	134	0	FINNEY SWITCHING STATION - HOLCOMB 345KV CKT 1
17SP	SHAMROCK (SHAMRCK2) 138/69/14.4KV TRANSFORMER CKT 1	69	131	0	2006-02T 230.00 - ELK CITY 230KV 230KV CKT 1
17SP	KIRBY SWITCHING STATION - MCCLELLAN SUB 115KV CKT 1	90	128	0	2006-02T 230.00 - ELK CITY 230KV 230KV CKT 1
17SP	MCCLELLAN SUB - MCLEAN RURAL SUB 115KV CKT 1	90	126	0	2006-02T 230.00 - ELK CITY 230KV 230KV CKT 1
17SP	JERICHO (JERIC2WT) 115/69/14.4KV TRANSFORMER CKT 1	46	123	0	2006-02T 230.00 - ELK CITY 230KV 230KV CKT 1
17SP	2006-02T 230.00 - ELK CITY 230KV 230KV CKT 1	319	121	0	BASE CASE
17SP	CONWAY SUB - YARNELL SUB 115KV CKT 1	180	120	0	ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1
17SP	NICHOLS STATION - YARNELL SUB 115KV CKT 1	180	120	0	ELK CITY 230KV (ELKCTY-6) 230/138/13.8KV TRANSFORMER CKT 1
17SP	CLINTON JUNCTION - ELK CITY 138KV CKT 1	143	117	0	CLINTON AIR FORCE BASE TAP - ELK CITY 138KV CKT 1
17SP	CHERRY SUB - NICHOLS STATION 115KV CKT 1	161	110	0	NICHOLS STATION - WHITAKER SUB 115KV CKT 1
17SP	EAST PLANT INTERCHANGE - PIERCE STREET TAP 115KV CKT 1	161	108	0	EAST PLANT INTERCHANGE - MANHATTAN SUB 115KV CKT 1
17SP	LUBBOCK POWER & LIGHT-SOUTHEAST 230/69KV TRANSFORMER CKT 1	100	108	0	GEN522866 1
17SP	NICHOLS STATION - WHITAKER SUB 115KV CKT 1	249	108	0	CHERRY SUB - NICHOLS STATION 115KV CKT 1
17SP	EAST PLANT INTERCHANGE - MANHATTAN SUB 115KV CKT 1	161	107	0	EAST PLANT INTERCHANGE - PIERCE STREET TAP 115KV CKT 1
17SP	EAST MANHATTAN (EMANHT3X) 230/115/18.0KV TRANSFORMER CKT 1	308	105	0	MCDOWELL CREEK (MCDWL 1X) 230/115/13.8KV TRANSFORMER CKT 1
17SP	MANHATTAN TAP - OSAGE SWITCHING STATION 115KV CKT 1	161	105	0	EAST PLANT INTERCHANGE - PIERCE STREET TAP 115KV CKT 1
17SP	GRAPEVINE INTERCHANGE 230/115KV TRANSFORMER CKT 1	129	177	4	NICHOLS STATION - YARNELL SUB 115KV CKT 1
17SP	LUBBOCK POWER & LIGHT-HOLLY PLANT 230/69KV TRANSFORMER CKT 1	100	105	31	GEN522866 1
17SP	SHAMROCK - MCLEAN RURAL SUB 115KV CKT 1	90	114	34	2006-02T 230.00 - ELK CITY 230KV 230KV CKT 1
17SP	DALLAM COUNTY INTERCHANGE 115/69KV TRANSFORMER CKT 1	46	121	44	ETTER RURAL SUB - MOORE COUNTY INTERCHANGE E. 115KV CKT 1
17SP	ELDORADO - LAKE PAULINE 69KV CKT 1	20	130	50	LAKE PAULINE - RUSSELL 138KV CKT 1
17SP	CONWAY SUB - YARNELL SUB 115KV CKT 1	164	110	65	BASE CASE
17SP	NICHOLS STATION - YARNELL SUB 115KV CKT 1	164	110	67	BASE CASE
17SP	DALHART INTERCHANGE 115/69KV TRANSFORMER CKT 1	46	106	129	ETTER RURAL SUB - MOORE COUNTY INTERCHANGE E. 115KV CKT 1
17SP	BOWERS INTERCHANGE - GRAPEVINE INTERCHANGE 115KV CKT 1	161	102	144	NICHOLS STATION - YARNELL SUB 115KV CKT 1
17SP	CHERRY SUB - NORTHWEST INTERCHANGE 115KV CKT 1	161	100	154	NICHOLS STATION - WHITAKER SUB 115KV CKT 1

5.0 Stability Analysis

The following stability definition was applied in this study:

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

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

The stability analysis was performed by using PSS/E Power System Simulator Version 30.2.1. Both three-phase and single-phase line faults were simulated. The synchronous machine rotor angles were monitored as well as the stability of the asynchronous machines.

5.1 Modeling of the Coal Plant Generator in the Power Flow

The Customer generation facility consists of one round rotor generator capable of producing up to 160 MW. The generator will be connected to the Grapevine 115 kV Interchange through a 15.75/115 kV transformer. Further details are found in the Original Impact Study.

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.

5.2 Modeling of the Coal Plant Generator in Dynamics

The Customer generator was modeled as a round rotor generator "GENROU" with governor model "IEEEG1" and exciter model "ST6B". Further details are found in the Original Impact Study.

5.3 Contingencies Simulated

Twenty-three (23) contingencies were considered for the transient stability simulations. These contingencies are shown in Table 3.

The single phase faults were simulated by applying the 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 determined by using PSS/E to give a positive sequence voltage at the fault location of approximately 60% of the pre-fault value.

5.4 Results

The results of the stability analysis are summarized in Table 4. The results indicate that for all contingencies simulated, GEN-2007-002 and the transmission system remained stable for both seasons. None of the prior queued wind farms tripped off-line during the simulations. Selected stability plots are shown in the appendices. All plots are available on request.

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.

Table 3: Contingencies Evaluated

Cont. No.	Cont. Name	Description
1	FLT_1_3PH	Three phase fault on the Grapevine (523770) to Kirby (524088), 115 kV line, near Grapevine. a. Apply fault at the Grapevine (523770) b. Clear Fault after 5 cycles by removing the line from Grapevine (523770) to Kirby (524088). c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
2	FLT_2_1PH	Single phase fault and sequence like Cont. No. 1
3	FLT_3_3PH	Three phase fault on the Grapevine (523770) to Bowers (523748), 115 kV line, near Grapevine. a. Apply Fault at the Grapevine (523770). b. Clear fault after 5 cycles by removing the line from Grapevine (523770) to Bowers (523748) c. Wait 20 cycles, and then re-close the line in (b) into the fault. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
4	FLT_4_1PH	Single phase fault and sequence like Cont. No. 3
5	FLT_5_3PH	Three phase fault on the Grapevine 230/115 kV autotransformer a. Apply fault at the Grapevine 230 kV bus (523771) Clear fault after 5 cycles by removing the autotransformer from service.
6	FLT_6_1PH	Single phase fault and sequence like Cont. No. 5
7	FLT_7_3PH	Three phase fault on the Elk City (511490) to Wind Farm Tap (560012) 230 kV line, near Elk City. a. Apply fault at Elk City (511490). b. Clear fault after 5 cycles by removing the line from Elk City (511490) to the Wind Farm tap (560012). c. Wait 20 cycles, and then re-close the line in (b) into the fault. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
8	FLT_8_1PH	Single phase fault and sequence like Cont. No.7
9	FLT_9_3PH	Three phase fault on the Nichols (524044) to Grapevine (523771), 230 kV line near Grapevine. a. Apply Fault at the Grapevine bus (523771) b. Clear Fault after 5 cycles by removing the line from Nichols (524044) to Grapevine (523771). c. Wait 20 cycles, and then re-close the line in (b) back into the fault. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
10	FLT_10_1PH	Single phase fault and sequence like Cont. No.9
11	FLT_11_3PH	Three phase fault on the Grapevine (523771) to Wind Farm Tap (560012) 230 kV line, near Grapevine. a. Apply fault at the Grapevine (523771). b. Clear fault after 5 cycles by removing the line from Grapevine (523771) to the Wind Farm tap (560012). c. Wait 20 cycles, and then re-close the line in (b) into the fault. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
12	FLT_12_1PH	Single phase fault and sequence like Cont. No.11
13	FLT_13_3PH	Three phase fault on the Kirby (524088) to McLelln3 (523804), 115 kV line, near McLelln3 a. Apply fault at the Mclelln3 bus (523804) b. Clear fault after 5 cycles by removing the line from Kirby (524088) to McLelln3 (523804). c. Wait 20 cycles, and then re-close the line in (b) into the fault. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
14	FLT_14_1PH	Single phase fault and sequence like Cont. No.13

Cont. No.	Cont. Name	Description
15	FLT_15_3PH	Three phase fault on the McLelln3 (523804) to McLean Rural (523811), 115 kV line, near McLean Rural a. Apply fault at the Mclean Rural bus (523811) b. Clear fault after 5 cycles by removing the line from McLelln3 (523804) to McLean Rural (523811). c. Wait 20 cycles, and then re-close the line in (b) into the fault. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
16	FLT_16_1PH	Single phase fault and sequence like Cont. No.15
17	FLT_17_3PH	Three phase fault on the Nichols (524044) to Hutchison County Interchange (523551), 230 kV line, near Hutchison County Interchange. a. Apply Fault at the Hutchison County Interchange bus (523551). b. Clear fault after 5 cycles by removing the line from Nichols (524044) to Hutchison County Interchange (523551). c. Wait 20 cycles, and then re-close the line in (b) into the fault. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
18	FLT_18_1PH	Single phase fault and sequence like Cont. No.17
19	FLT_19_3PH	Three phase fault on the Nichols (524044) to Whitaker (524058), 115 kV line, near Whitaker a. Apply Fault at the Whitaker bus (524058). b. Clear fault after 5 cycles by removing the line from Nichols (524044) to Whitaker (524058). c. Wait 20 cycles, and then re-close the line in (b) into the fault. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
20	FLT_20_1PH	Single phase fault and sequence like Cont. No.19
21	FLT_21_3PH	Three phase fault on the Whitaker (524058) to East Plant Interchange (524162), 115 kV line, near East Plant Interchange a. Apply Fault at the East Plant Interchange bus (524162). b. Clear fault after 5 cycles by removing the line from Whitaker (524058) to East Plant Interchange (524162). c. Wait 20 cycles, and then re-close the line in (b) into the fault. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
22	FLT_22_1PH	Single phase fault and sequence like Cont. No.21
23	FLT_23_3PH	Three phase fault on the Grapevine 230/115 kV autotransformer a. Apply fault at the Grapevine 115 kV bus (523770) b. Clear fault after 5 cycles by removing the autotransformer from service.

Table 3: Contingencies Evaluated (continued)

Contingency. Name	2008 Winter Peak	2012 Summer Peak
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

Table 4: Results of Simulation

6.0 Conclusion

The results of a restudy of the Expedited System Impact Study for Generation Interconnection Request GEN-2007-002 are presented in this report. The restudy was conducted to determine the effects due to the change in status of certain prior queued projects.

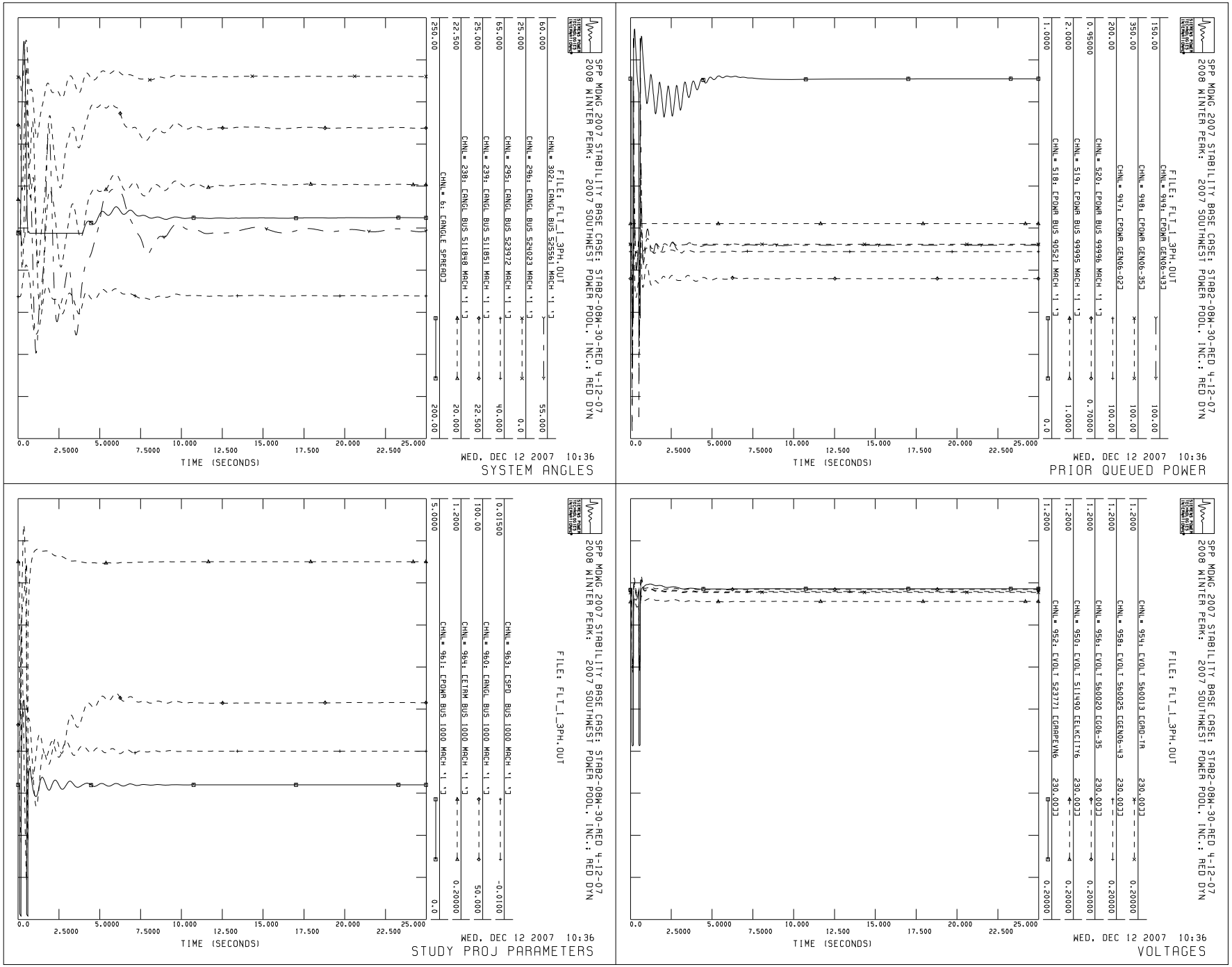
The results of the powerflow analysis are indicated in Table 1 and Table 2. The results of the stability analysis indicate that for the analyzed contingencies GEN-2007-002 and the transmission system remains stable.

Any costs shown in this document do not include any costs associated with the deliverability of the energy to final customers. These costs are determined by separate studies when the Customer requests transmission service through Southwest Power Pool's OASIS. It should be noted that the models used for simulation do not contain all SPP transmission service.

APPENDIX A.

SELECTED STABILITY PLOTS – 2008 Winter Peak

All plots available on request.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CHNL = 494: CPOWR GEN06-493
CHNL = 948: CPOWR GEN06-357
CHNL = 947: CPOWR GEN06-023
CHNL = 520: CPOWR BUS 99996 MACH 1, 'C'
CHNL = 519: CPOWR BUS 99995 MACH 1, 'C'
CHNL = 518: CPOWR BUS 90521 MACH 1, 'C'
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200.00
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100.00
100.00
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1.0000
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0.0
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SPP MDWG 2007 STABILITY BASE CASE: STAB2-08W-30-RED 4-12-07
2008 WINTER PEAK: 2007 SOUTHWEST POWER POOL, INC.: RED DYN
FILE: FLT_1_3PH.OUT
CHNL = 954: EVOLT 560013 CGRD-TR 230.00JJ
CHNL = 958: EVOLT 560025 CGEN06-143 230.00JJ
CHNL = 956: EVOLT 560020 CG06-35 230.00JJ
CHNL = 950: EVOLT 511490 CELKC1176 230.00JJ
CHNL = 952: EVOLT 523771 CGRAFE1N6 230.00JJ
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1.2000
1.2000
1.2000
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0.20000
0.20000
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0.0
2.5000
5.0000
7.5000
10.000
12.500
15.000
17.500
20.000
22.500
25.000
TIME (SECONDS)
WED, DEC 12 2007 10:36
VOLTAGES
SPP MDWG 2007 STABILITY BASE CASE: STAB2-08W-30-RED 4-12-07
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CHNL = 6: EANGLE SPREG01
CHNL = 238: EANGL BUS 511898 MACH 1, 'C'
CHNL = 239: EANGL BUS 511851 MACH 1, 'C'
CHNL = 295: EANGL BUS 523972 MACH 1, 'C'
CHNL = 296: EANGL BUS 524023 MACH 1, 'C'
CHNL = 302: EANGL BUS 525261 MACH 1, 'C'
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22.500
25.000
65.000
25.000
60.000
200.00
20.000
22.500
40.000
0.0
55.000
0.0
2.5000
5.0000
7.5000
10.000
12.500
15.000
17.500
20.000
22.500
25.000
TIME (SECONDS)
WED, DEC 12 2007 10:36
SYSTEM ANGLES
SPP MDWG 2007 STABILITY BASE CASE: STAB2-08W-30-RED 4-12-07
2008 WINTER PEAK: 2007 SOUTHWEST POWER POOL, INC.: RED DYN
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CHNL = 964: IETRM BUS 1000 MACH 1, 'C'
CHNL = 960: CANGL BUS 1000 MACH 1, 'C'
CHNL = 963: CSPD BUS 1000 MACH 1, 'C'
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100.00
0.01500
0.0
0.20000
50.000
-0.0100
2.5000
5.0000
7.5000
10.000
12.500
15.000
17.500
20.000
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25.000
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WED, DEC 12 2007 10:36
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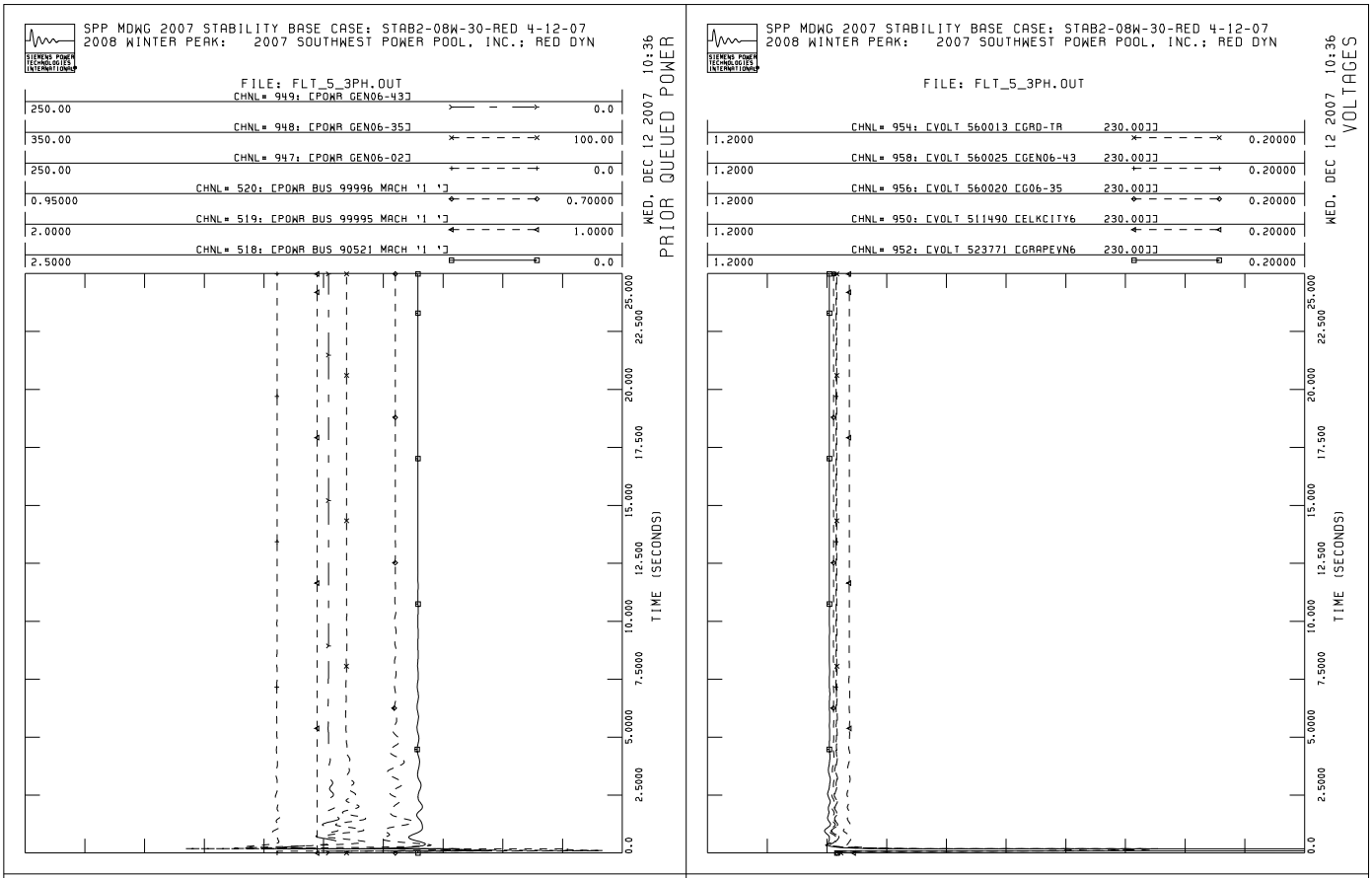
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FILE: FLT_5_3PH.OUT
CHNL= 949: CPOWR GEN06-43]
CHNL= 948: CPOWR GEN06-35]
CHNL= 947: CPOWR GEN06-02]
CHNL= 520: CPOWR BUS 99996 MACH '1 ']
CHNL= 519: CPOWR BUS 99995 MACH '1 ']
CHNL= 518: CPOWR BUS 90521 MACH '1 ']
TIME (SECONDS)
WED, DEC 12 2007 10:36
PRIOR QUEUED POWER
SPP MDWG 2007 STABILITY BASE CASE: STAB2-08W-30-RED 4-12-07
2008 WINTER PEAK: 2007 SOUTHWEST POWER POOL, INC.; RED DYN
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CHNL= 956: CVOLT 560020 CG06-35 230.00]]
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CHNL= 952: CVOLT 523771 CGRAPEVN6 230.00]]
TIME (SECONDS)
WED, DEC 12 2007 10:36
VOLTAGES
SPP MDWG 2007 STABILITY BASE CASE: STAB2-08W-30-RED 4-12-07
2008 WINTER PEAK: 2007 SOUTHWEST POWER POOL, INC.; RED DYN
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CHNL= 295: CANGL BUS 523972 MACH '1 ']
CHNL= 239: CANGL BUS 511851 MACH '1 ']
CHNL= 238: CANGL BUS 511848 MACH '1 ']
CHNL= 6: CANGLE SPREAD]
TIME (SECONDS)
WED, DEC 12 2007 10:36
SYSTEM ANGLES
SPP MDWG 2007 STABILITY BASE CASE: STAB2-08W-30-RED 4-12-07
2008 WINTER PEAK: 2007 SOUTHWEST POWER POOL, INC.; RED DYN
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CHNL= 960: CANGL BUS 1000 MACH '1 ']
CHNL= 964: CETRM BUS 1000 MACH '1 ']
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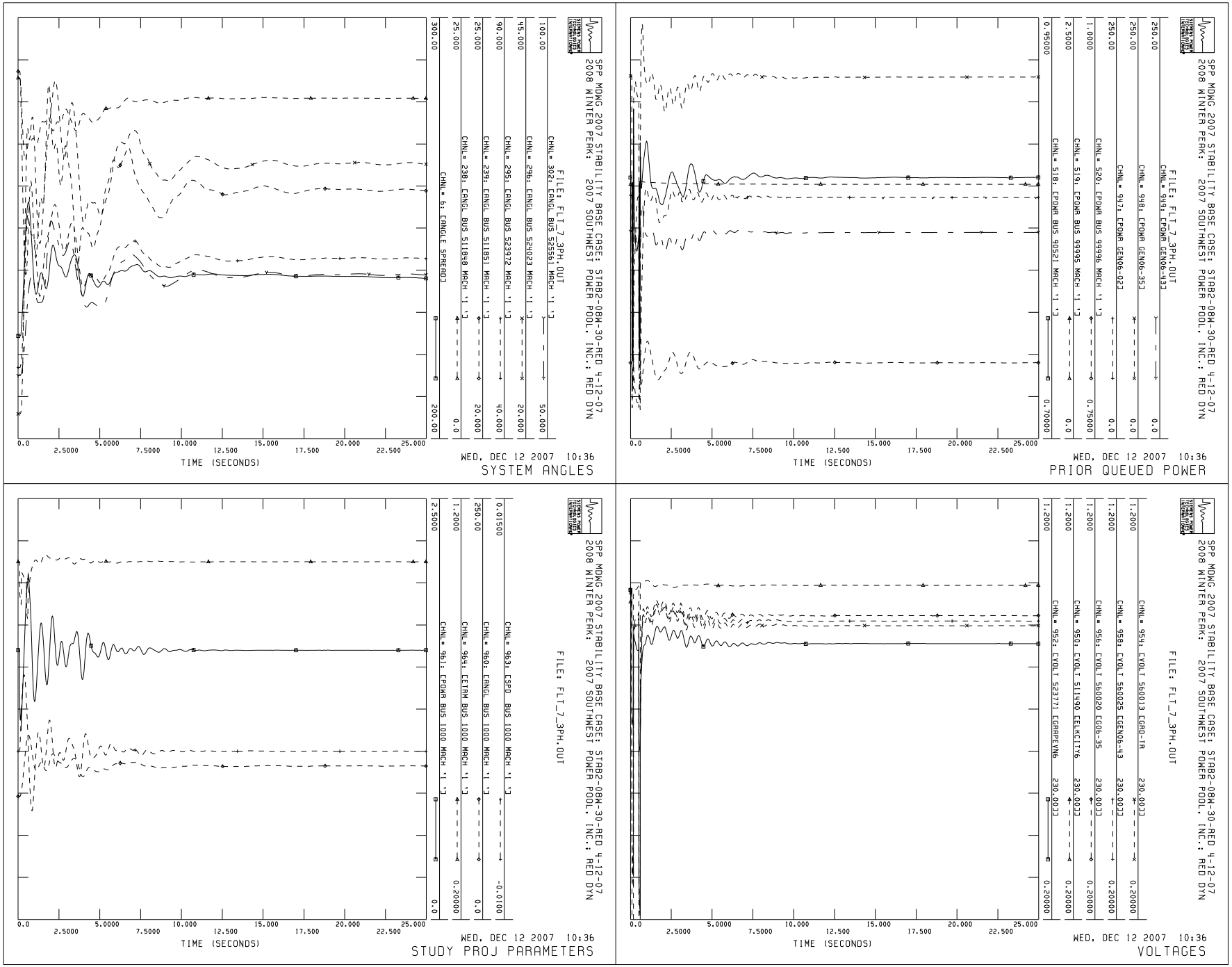
STUDY PROJ PARAMETERS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PRIOR QUEUED POWER
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CHNL = 950: EVOLT 511490 CELKG1176
CHNL = 952: EVOLT 523771 CGRAPE346
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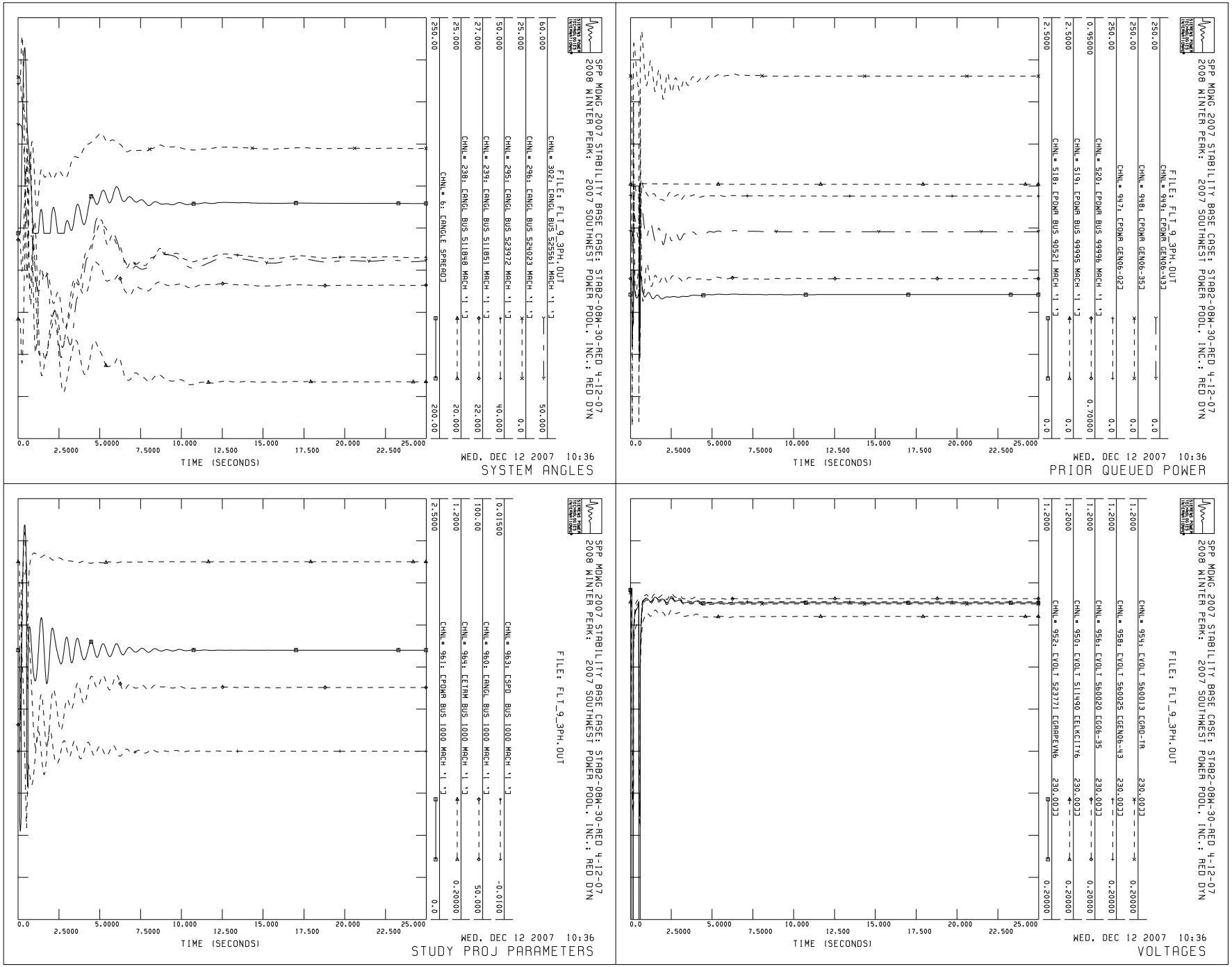
CHNL = 964: CETRM BUS 1000 MACH 1, 'C'
CHNL = 961: CPOWR BUS 1000 MACH 1, 'C'
STUDY PROJ PARAMETERS
CHNL = 302: CANGL BUS 555361 MACH 1, 'C'
CHNL = 296: CANGL BUS 524623 MACH 1, 'C'
CHNL = 295: CANGL BUS 523972 MACH 1, 'C'
CHNL = 239: CANGL BUS 511851 MACH 1, 'C'
CHNL = 238: CANGL BUS 511848 MACH 1, 'C'
CHNL = 6: CANGLE SPREG01
SYSTEM ANGLES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CHNL = 947: CPOWR GEN06-023
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CHNL = 519: CPOWR BUS 99995 MACH 1, 'C'
CHNL = 518: CPOWR BUS 90521 MACH 1, 'C'
CHNL = 302: CANGL BUS 525261 MACH 1, 'C'
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CHNL = 295: CANGL BUS 523972 MACH 1, 'C'
CHNL = 239: CANGL BUS 511851 MACH 1, 'C'
CHNL = 238: CANGL BUS 511848 MACH 1, 'C'
CHNL = 6: EANGLE SPREG01
TIME (SECONDS)
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CHNL = 956: EVOLT 560020 CG06-357
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CHNL = 952: EVOLT 523771 CGRAPE396
VOLTAGES
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CHNL = 960: CANGL BUS 1000 MACH 1, 'C'
CHNL = 964: ZETAM BUS 1000 MACH 1, 'C'
CHNL = 961: CPOWR BUS 1000 MACH 1, 'C'
STUDY PROJ PARAMETERS

SPP MDWG 2007 STABILITY BASE CASE: STAB2-08W-30-RED 4-12-07
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CHNL = 947: [POWR GEN06-023]
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PRIOR QUEUED POWER
SPP MDWG 2007 STABILITY BASE CASE: STAB2-08W-30-RED 4-12-07
2008 WINTER PEAK: 2007 SOUTHWEST POWER POOL, INC.: RED DYN
FILE: FLT_15_3PH.OUT
CHNL = 6: [ANGLE SPREAD]
CHNL = 239: [ANGL BUS 518191 MACH 1, 1]
CHNL = 238: [ANGL BUS 518198 MACH 1, 1]
CHNL = 295: [ANGL BUS 523972 MACH 1, 1]
CHNL = 296: [ANGL BUS 524023 MACH 1, 1]
CHNL = 302: [ANGL BUS 525561 MACH 1, 1]
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SYSTEM ANGLES
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STUDY PROJ PARAMETERS
SPP MDWG 2007 STABILITY BASE CASE: STAB2-08W-30-RED 4-12-07
2008 WINTER PEAK: 2007 SOUTHWEST POWER POOL, INC.: RED DYN
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CHNL = 950: [VOLT 511490 [ELKCITY6 230.00]]
CHNL = 956: [VOLT 560020 [CO06-35 230.00]]
CHNL = 958: [VOLT 560025 [GEN06-43 230.00]]
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VOLTAGES

SPP MDWG 2007 STABILITY BASE CASE: STAB2-08W-30-RED 4-12-07
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CHNL = 947: CPOWR GEN06-023
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CHNL = 519: CPOWR BUS 99995 MACH 1, 'C'
CHNL = 518: CPOWR BUS 90521 MACH 1, 'C'
150.00
350.00
200.00
0.95000
2.0000
1.0000
100.00
100.00
100.00
0.70000
1.0000
0.0
0.0 2.5000 5.0000 7.5000 10.000 12.500 15.000 17.500 20.000 22.500 25.000
TIME (SECONDS)
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PRIOR QUEUED POWER

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CHNL = 956: CVOLT 560022 CG06-35 230.00 [1]
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1.2000
1.2000
1.2000
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0.20000
0.20000
0.20000
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TIME (SECONDS)
WED, DEC 12 2007 10:36
VOLTAGES

SPP MDWG 2007 STABILITY BASE CASE: STAB2-08W-30-RED 4-12-07
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CHNL = 295: CANGL BUS 523972 MACH 1, 'C'
CHNL = 2339: CANGL BUS 511851 MACH 1, 'C'
CHNL = 2338: CANGL BUS 511848 MACH 1, 'C'
CHNL = 6: CANGLE SPREG01
60.000
25.000
65.000
25.000
22.500
300.00
55.000
0.0
40.000
22.500
20.000
200.00
0.0 2.5000 5.0000 7.5000 10.000 12.500 15.000 17.500 20.000 22.500 25.000
TIME (SECONDS)
WED, DEC 12 2007 10:36
SYSTEM ANGLES

SPP MDWG 2007 STABILITY BASE CASE: STAB2-08W-30-RED 4-12-07
2008 WINTER PEAK: 2007 SOUTHWEST POWER POOL, INC.: RED DYN
FILE: FLT_23_3PH.OUT
CHNL = 963: CSPD BUS 1000 MACH 1, 'C'
CHNL = 960: CANGL BUS 1000 MACH 1, 'C'
CHNL = 964: IEITAM BUS 1000 MACH 1, 'C'
CHNL = 961: CPOWR BUS 1000 MACH 1, 'C'
0.01500
250.00
1.2000
5.0000
-0.0100
0.0
0.20000
0.0
0.0 2.5000 5.0000 7.5000 10.000 12.500 15.000 17.500 20.000 22.500 25.000
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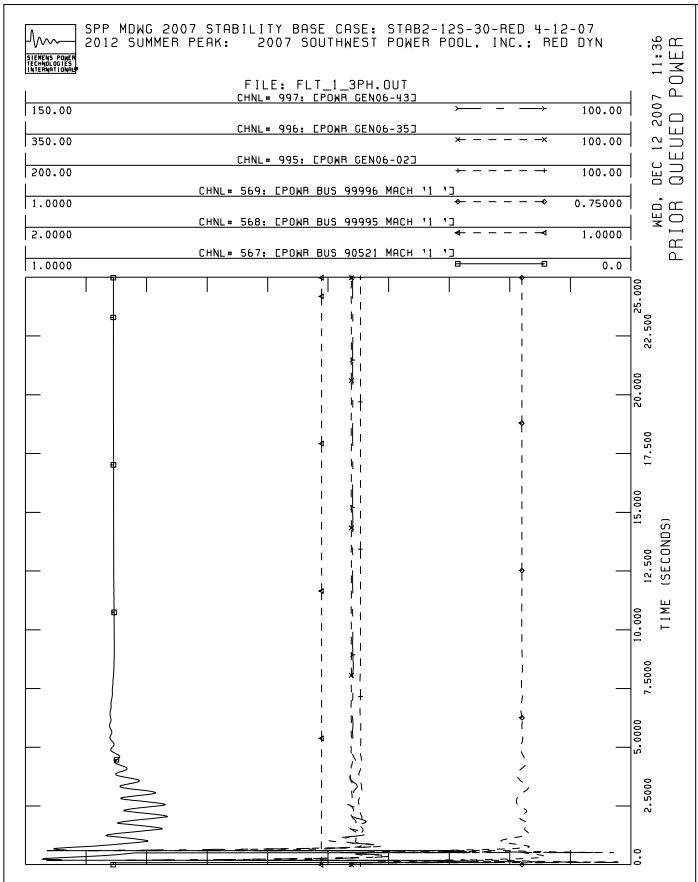
STUDY PROJ PARAMETERS

APPENDIX B.

SELECTED STABILITY PLOTS – 2012 Summer Peak

All plots available on request.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2012 SUMMER PEAK: 2007 SOUTHWEST POWER POOL, INC.; RED DYN
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CHNL= 569: CPOWR BUS 99996 MACH '1 '
CHNL= 568: CPOWR BUS 99995 MACH '1 '
CHNL= 567: CPOWR BUS 90521 MACH '1 '
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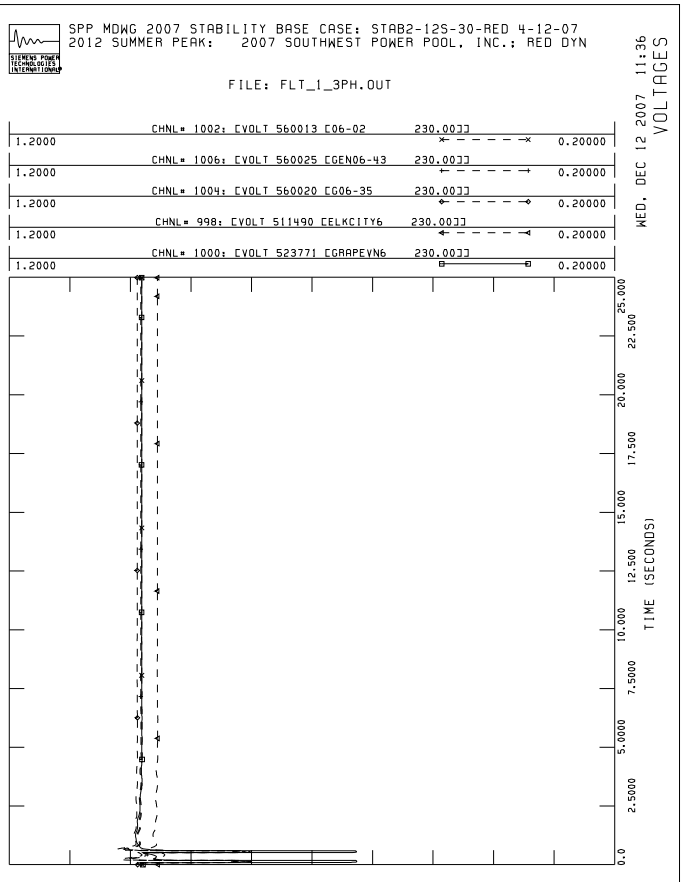
PRIOR QUEUED POWER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2012 SUMMER PEAK: 2007 SOUTHWEST POWER POOL, INC.; RED DYN
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CHNL= 998: CVOLT 511490 CELKCITY6
CHNL= 1000: CVOLT 523771 CGRAPEVN6
TIME (SECONDS)
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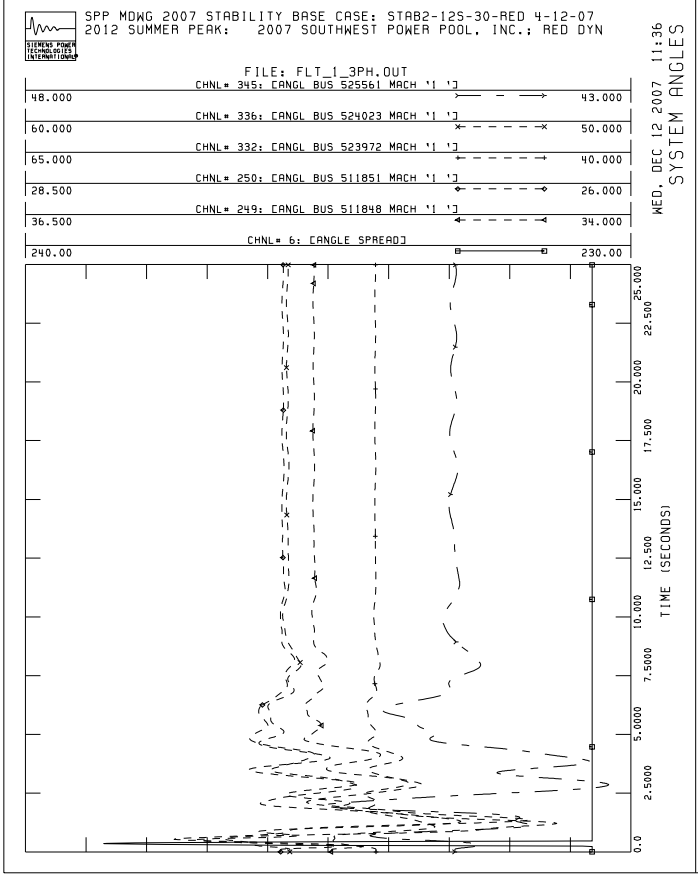
VOLTAGES


SPP MDWG 2007 STABILITY BASE CASE: STAB2-12S-30-RED 4-12-07
2012 SUMMER PEAK: 2007 SOUTHWEST POWER POOL, INC.; RED DYN
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CHNL= 336: CANGL BUS 524023 MACH '1 '
CHNL= 332: CANGL BUS 523972 MACH '1 '
CHNL= 250: CANGL BUS 511851 MACH '1 '
CHNL= 249: CANGL BUS 511848 MACH '1 '
CHNL= 6: CANGLE SPREAD
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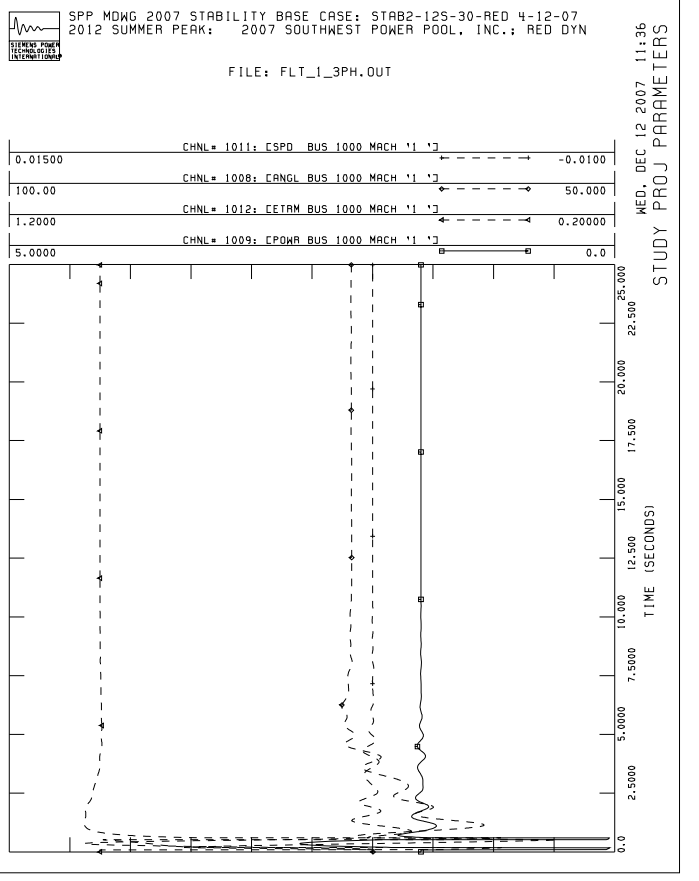
SYSTEM ANGLES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2012 SUMMER PEAK: 2007 SOUTHWEST POWER POOL, INC.; RED DYN
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CHNL= 1012: CETAM BUS 1000 MACH '1 '
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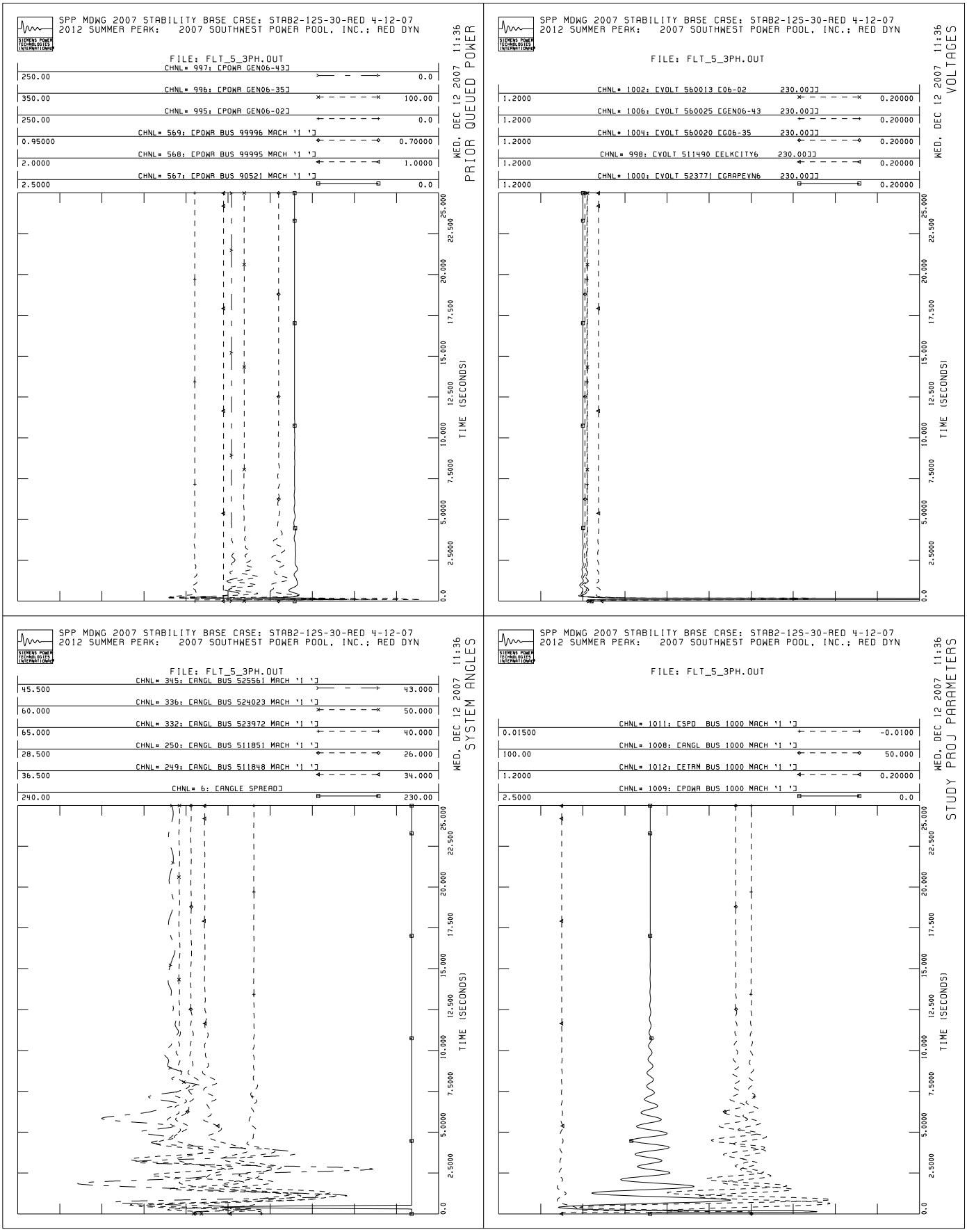
STUDY PROJ PARAMETERS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PRIOR QUEUED POWER
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CHNL= 249: CANGL BUS 511848 MACH '1 ']
CHNL= 6: CANGLE SPREAD]
SYSTEM ANGLES
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CHNL= 1008: CANGL BUS 1000 MACH '1 ']
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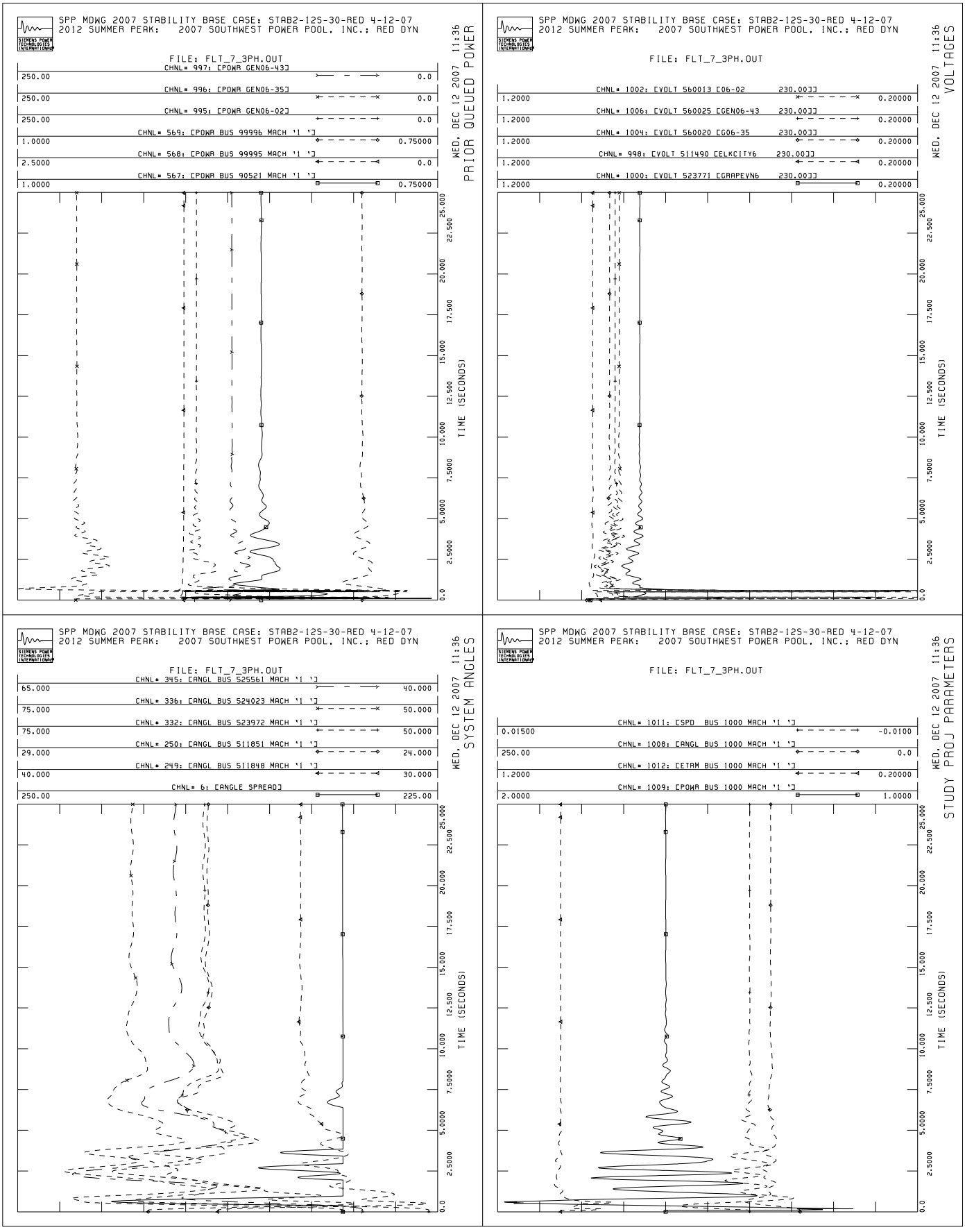
CHNL= 1009: CPOWR BUS 1000 MACH '1 ']
STUDY PROJ PARAMETERS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TIME (SECONDS)
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2012 SUMMER PEAK: 2007 SOUTHWEST POWER POOL, INC.; RED DYN
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CHNL= 1000: CVOLT 523771 CGRAPEVN6 230.00]
TIME (SECONDS)
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CHNL= 249: CANGL BUS 511848 MACH '1 ']
CHNL= 6: CANGLE SPREAD]
TIME (SECONDS)
SPP MDWG 2007 STABILITY BASE CASE: STAB2-12S-30-RED 4-12-07
2012 SUMMER PEAK: 2007 SOUTHWEST POWER POOL, INC.; RED DYN
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STUDY PROJ PARAMETERS
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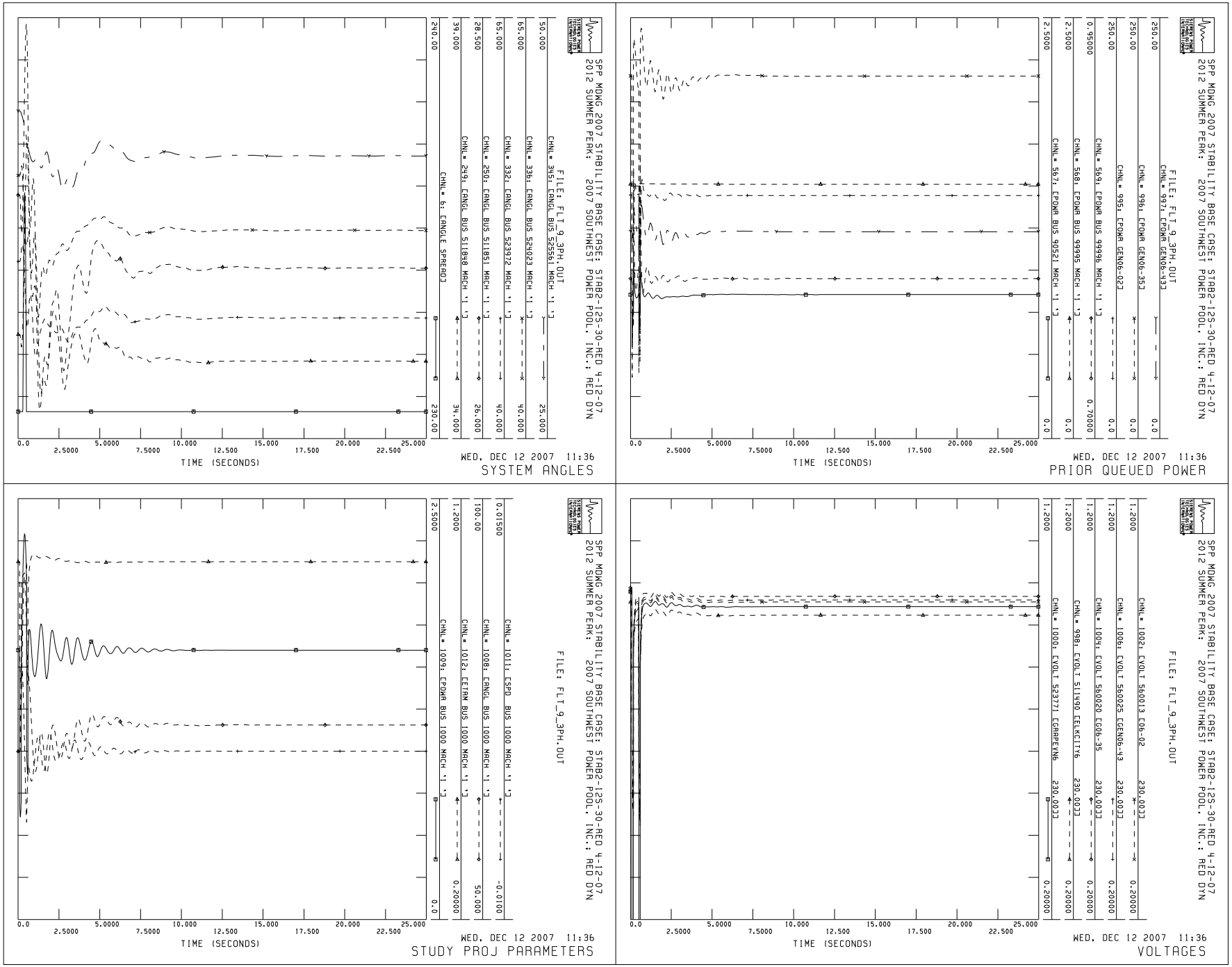
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CHNL = 998: EVOLT 511490 CELKC1T6 230.00JJ
CHNL = 1000: EVOLT 523771 CGRAPEVN6 230.00JJ
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STUDY PROJ PARAMETERS
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CHNL = 995: CPOWR GEN06-023
CHNL = 996: CPOWR GEN06-357
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PRIOR QUEUED POWER
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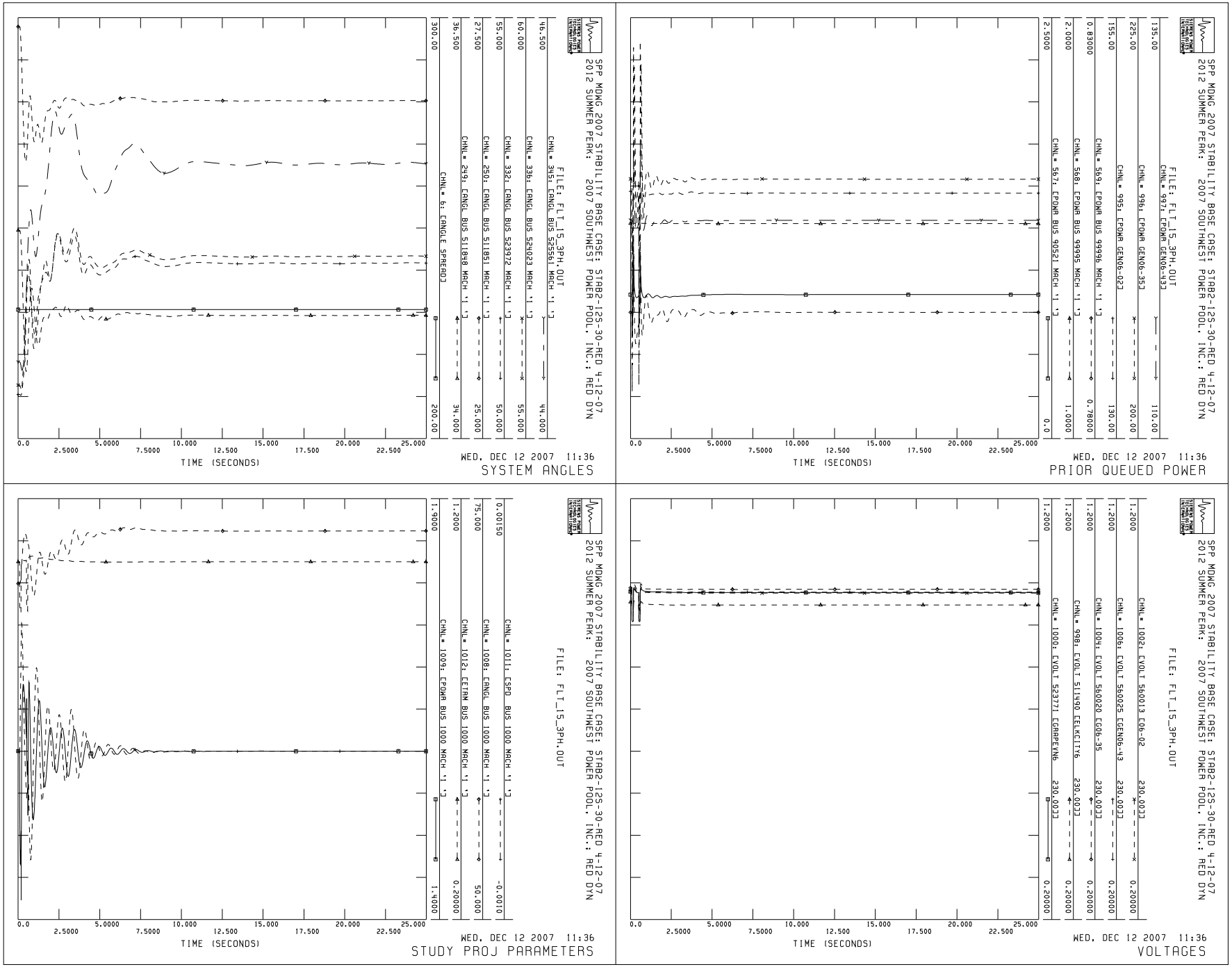
SYSTEM ANGLES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VOLTAGES
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CHNL = 1012: CETRM BUS 1000 MACH '1 '
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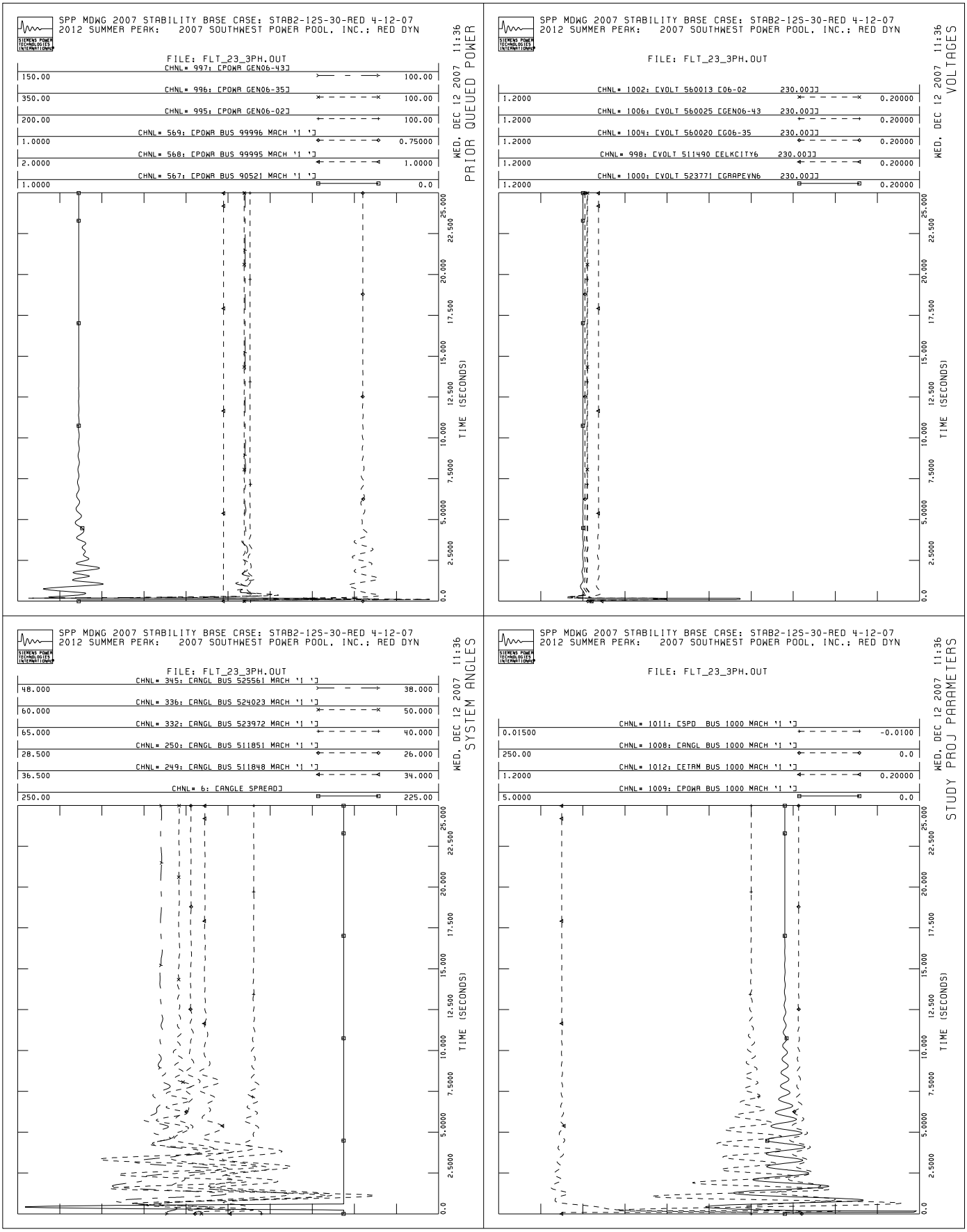
SPP MDWG 2007 STABILITY BASE CASE: STAB2-12S-30-RED 4-12-07
2012 SUMMER PEAK: 2007 SOUTHWEST POWER POOL, INC.; RED DYN
FILE: FLT_23_3PH.OUT
CHNL= 997: CPOWR GEN06-43
150.00
100.00
CHNL= 996: CPOWR GEN06-35
350.00
100.00
CHNL= 995: CPOWR GEN06-02
200.00
100.00
CHNL= 569: CPOWR BUS 99996 MACH '1 '
1.0000
0.75000
CHNL= 568: CPOWR BUS 99995 MACH '1 '
2.0000
1.0000
CHNL= 567: CPOWR BUS 90521 MACH '1 '
1.0000
0.0
WED, DEC 12 2007 11:36
PRIOR QUEUED POWER
TIME (SECONDS)
SPP MDWG 2007 STABILITY BASE CASE: STAB2-12S-30-RED 4-12-07
2012 SUMMER PEAK: 2007 SOUTHWEST POWER POOL, INC.; RED DYN
FILE: FLT_23_3PH.OUT
CHNL= 1002: CVOLT 560013 C06-02 230.00]]
1.2000
0.20000
CHNL= 1006: CVOLT 560025 CGEN06-43 230.00]]
1.2000
0.20000
CHNL= 1004: CVOLT 560020 CG06-35 230.00]]
1.2000
0.20000
CHNL= 998: CVOLT 511490 CELKCITY6 230.00]]
1.2000
0.20000
CHNL= 1000: CVOLT 523771 CGRAPEVN6 230.00]]
1.2000
0.20000
WED, DEC 12 2007 11:36
VOLTAGES
TIME (SECONDS)
SPP MDWG 2007 STABILITY BASE CASE: STAB2-12S-30-RED 4-12-07
2012 SUMMER PEAK: 2007 SOUTHWEST POWER POOL, INC.; RED DYN
FILE: FLT_23_3PH.OUT
CHNL= 345: CANGL BUS 525561 MACH '1 '
48.000
38.000
CHNL= 336: CANGL BUS 524023 MACH '1 '
60.000
50.000
CHNL= 332: CANGL BUS 523972 MACH '1 '
65.000
40.000
CHNL= 250: CANGL BUS 511851 MACH '1 '
28.500
26.000
CHNL= 249: CANGL BUS 511848 MACH '1 '
36.500
34.000
CHNL= 6: CANGLE SPREAD]
250.00
225.00
WED, DEC 12 2007 11:36
SYSTEM ANGLES
TIME (SECONDS)
SPP MDWG 2007 STABILITY BASE CASE: STAB2-12S-30-RED 4-12-07
2012 SUMMER PEAK: 2007 SOUTHWEST POWER POOL, INC.; RED DYN
FILE: FLT_23_3PH.OUT
CHNL= 1011: CSPD BUS 1000 MACH '1 '
0.01500
-0.0100
CHNL= 1008: CANGL BUS 1000 MACH '1 '
250.00
0.0
CHNL= 1012: CETRM BUS 1000 MACH '1 '
1.2000
0.20000
CHNL= 1009: CPOWR BUS 1000 MACH '1 '
5.0000
0.0
WED, DEC 12 2007 11:36
STUDY PROJ PARAMETERS
TIME (SECONDS)