System Impact Study Report
PID 207
1594 MW (1687 MW Gross) Plant, Grand Gulf, MS

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Revision: 2

Rev	Issue Date	Description of Revision	Revised By	Project Manager
0	11/16/2007	Final for Review	BMH	JDH
1	12/3/2007	Added Substation Redesign Estimated Cost	BMH	JDH
2	12/5/2007	Added Appendix IV	BMH	JDH

Objective:

This System Impact Study is the second step of the interconnection process and is based on PID-207 request for interconnection on Entergy's transmission system at Grand Gulf 500 kV substation. This report is organized in two sections, namely, Section – A, Energy Resource Interconnection Service (ERIS) and Section – B, Network Resource Interconnection Service (NRIS – Section B).

The scope for the ERIS section (Section – A) includes load flow (steady state) analysis, offsite nuclear analysis, and short circuit analysis as defined in FERC orders 2003, 2003A and 2003B. The NRIS section (Section – B) contains details of load flow (steady state) analysis only, however, offsite nuclear analysis and short circuit analysis of Section – A are also applicable to Section – B. Additional information on scope for the NRIS study can be found in Section – B.

Requestor for PID-207 did request NRIS but did not request ERIS, therefore, under Section – A (ERIS) load flow analysis was not performed.

PID-207 intends to install a nuclear unit facility with a maximum capacity of 1933 MVA. The scheduled gross power output of the plant is 1687 MW. An auxiliary/host load of approximately 90 MW is also expected at this site. PID-207 anticipates injecting a total of approximately 1594 MW into the Entergy transmission system.

The proposed in-service date for this facility is January 1, 2015.

Section – A

Energy Resource Interconnection Service

TABLE OF CONTENTS FOR SECTION – A (ERIS)

I. Introduction

This Energy Resource Interconnection Service (ERIS) is based on PID-207 request for interconnection on Entergy's transmission system at Grand Gulf 500 kV substation. The objective of this study is to assess the reliability impact of the new facility on the Entergy transmission system with respect to the steady state and transient stability performance of the system as well as its effects on the system's existing short circuit current capability. It is also intended to determine whether the transmission system meets standards established by NERC Reliability Standards and Entergy's planning guidelines when the plant is connected to Entergy's transmission system. If not, transmission improvements will be identified.

The System Impact Study process required a load flow analysis to determine if the existing transmission lines are adequate to handle the full output from the plant for simulated transfers to adjacent control areas. A short circuit analysis was performed to determine whether the generation would cause the available fault current to surpass the fault duty of existing equipment within the Entergy transmission system. A transient stability analysis was conducted to determine whether the new units would cause a stability problem on the Entergy system.

This ERIS System Impact Study was based on information provided by PID-207 and assumptions made by Southwest Power Pool, Independent Coordinator of Transmission. All supplied information and assumptions are documented in this report. If the actual equipment installed is different from the supplied information or the assumptions made, the results outlined in this report are subject to change.

II. Short Circuit Analysis / Breaker Rating Analysis

A. Model Information

The short circuit analysis was performed on the Entergy system short circuit model using ASPEN software. This model includes all generators interconnected to the Entergy system or interconnected to an adjacent system and having an impact on this interconnection request, IPP's with signed IOAs, and approved future transmission projects on the Entergy transmission system including the proposed PID-207 unit.

B. Short Circuit Analysis

The method used to determine if any short circuit problems would be caused by the addition of the PID-207 generation is as follows:

1. Three phase and single phase to ground faults were simulated on the Entergy base case short circuit model and the worst case short circuit level was determined at each station. The PID-207 generator as well as the necessary NRIS upgrades shown in Section B, IV were then modeled in the base case to generate a revised short circuit model. The base case short circuit results were then compared with the results from the revised model to identify any breakers that were under-rated as a result of additional short circuit contribution from PID-207 generation. The breakers identified to be upgraded through this comparison are *mandatory* upgrades.

C. Analysis Results

The results of the short circuit analysis indicates that the additional generation due to PID-207 generators does cause an increase in short circuit current such that they exceed the fault interrupting capability of the high voltage circuit breakers within the vicinity of PID-207 plant.

Table I illustrates the station name, worst case fault level, and the number of breakers that were found to be under-rated at the respective locations as a result of the additional short circuit current due to PID-207 generator and includes no priors.

Table I: Underrated Breakers Without Priors

Substation	Breaker	Max Fault w/o PID-207 (amps)	Max Fault with PID-207 (amps)	Interrupting Rating (amps)
LAKEOVER 115 kV	J3208	38915	40940	40000
	J3210	38915	40940	40000

Table II illustrates the station name, worst case fault level, and the number of breakers that were found to be under-rated at the respective locations as a result of the additional short circuit current due to PID-207 generator and includes prior PID's 197, 198, 202, 205 and 206.

Table II: Underrated Breakers With Priors Included

Substation	Breaker	Max Fault w/o PID-207 (amps)	Max Fault with PID-207 (amps)	Interrupting Rating (amps)
LAKEOVER 115 kV	J3208	38915	40940	40000
	J3210	38915	40940	40000

D. Problem Resolution

Table III illustrates the station name, and the cost associated with upgrading the breakers at each station both for mandatory and optional breaker upgrades.

Table III: Estimated Breaker Cost

Substation	Number of Breakers	Estimated cost of Breaker Upgrades ($)
LAKEOVER 115 kV	2	$570,000

The impact on breaker rating due to line upgrades will be evaluated during facilities study phase. The results are based upon the current configuration of the Entergy transmission system and Generation Interconnection Study queue. Therefore, they are subject to change.

III. Offsite Nuclear Analysis

Technical Report

Off Site Study for G. Gulf (PID-207)	Grid Systems Consulting	**Date** 6/22/2007	**Pages** 54

Author:	Reviewed by:	Approved by:
Amit Kekare	William Quaintance	Willie Wong

Executive Summary

Southwest Power Pool (SPP) has commissioned ABB Inc. to conduct an offsite power analysis of the proposed new nuclear unit (PID-207) at G. Gulf 500 kV. Offsite power is the preferred power source for nuclear power stations. The true capability of offsite power cannot be verified through direct readings of plant switchyard or safety bus voltages, but through analyses of grid and plant conditions considering the occurrence of severe contingencies representing the partial loss of grid support. The objective of this analysis is to identify if the Entergy System configuration will comply with the Code of Federal Regulations (CFR) specifically with respect to the grid voltage performance and the reliability of the Offsite Power Supply for PID-207.

The steady-state analysis was conducted to determine the voltage levels at G. Gulf 500 kV and 115 kV buses following various outage contingencies on the transmission system during projected 2012 summer peak and 2012 off-peak load conditions.

Per the '*Nuclear Management Manual ENS-DC-199 Rev-2*' the acceptable steady-state post-contingency voltage range at G. Gulf 115 kV is 0.975 p.u to 1.05 p.u. The results of the off-site analysis study indicate that the voltage at G. Gulf 115 kV was lowest with both G. Gulf units online and the Port Gibson Capacitor bank (30.5 MVAR) switched off. The voltage at G. Gulf 115 kV was 0.9782 p.u. for 2012 summer peak conditions and 0.9740 p.u. for 2012 off-peak conditions. Hence, there is a violation of the voltage criterion for Off-site Power supply for G. Gulf nuclear units. This was also observed during the PID-203 Off-site analysis. The results indicated that the voltage violation at G. Gulf 115 kV existed in Pre-Project case. Entergy Transmission Planning and G. Gulf substation personnel are addressing a solution for this situation.

Per the '*Nuclear Management Manual ENS-DC-199 Rev-2*' the acceptable steady-state post-contingency voltage range at G. Gulf 500 kV is 0.9820 p.u to 1.05 p.u. The results of the off-site analysis study indicate that the voltage at G. Gulf 500 kV was below the voltage criterion following two contingencies: 1) loss of G. Gulf - B. Wilson and G. Gulf – R. Braswell 500 kV lines and 2) loss of G. Gulf – B. Wilson and G. Gulf – Franklin 500 kV lines. The loss of two lines is considered strictly to obtain an insight as to robustness of the system under such severe conditions (multiple concurrent line contingencies), and meeting the voltage criteria is not required for these contingencies.

The G. Gulf (PID-207) does not have any significant impact on the Critical Clearing times at the G. Gulf, B. Wilson R. Braswell and Franklin 500 kV substations.

The results of this study are based on available data and assumptions made at the time this study was conducted. The results included in this report may not apply if any of the data and/or assumptions made in developing the study models change.

Rev No.	**Revision Description**	**Date**	**Authored by**	**Reviewed by**	**Approved by**
0	Draft Report	11/15/07	A. Kekare	W. Quaintance	W. Wong
1	FINAL REPORT	12/03/07	A. Kekare	W. Quaintance	W. Wong

DISTRIBUTION:

Brandon Hentschel, Southwest Power Pool
Mukund Chander, Entergy Services Inc.

IV. INTRODUCTION

Southwest Power Pool (SPP) has commissioned ABB Inc. to conduct steady state and stability analysis for PID-207 Grand Gulf, which is an interconnection request for a 1,594 MW nuclear unit at G. Gulf 500 kV substation on Entergy transmission system. ABB recently completed a system impact study[1] and an offsite analysis[2] for PID-203 G. Gulf. The proposed PID-207 is an interconnection request replacing original PID-203 interconnection request with 72 MW higher net output.

The objective of this analysis is to identify if the Entergy System configuration will comply with the Code of Federal Regulations (CFR) specifically with respect to the grid voltage performance and the reliability of the Offsite Power Supply for G. Gulf (PID-207).

Entergy proposes to install a nuclear unit facility with a maximum capacity of 1933 MVA. The gross power output of the generator is 1687 MW. An auxiliary/host load of approximately 93 MW is expected at this site. PID-207 will inject a net power of approximately 1594 MW into the Entergy transmission system. The proposed in-service date for this facility is January 2015. Figure IV-1 shows the bus configuration at G. Gulf 500 kV after interconnection of G. Gulf (PID-207). The following upgrades/changes identified for PID-207 were included in the study models (see Figure IV-2 for details).

Add a 48 mile 500 kV transmission line from Grand Gulf 500 kV to Ray Braswell 500 kV.

Remove the existing Baxter Wilson to Ray Braswell 500 kV line from Ray Braswell substation, and extend this line 22 miles to Lakeover 500 kV.

[1] A Final report 'PID-203_Rev_1_June_8_2007' issued on June 8, 2007
[2] A Final report 'PID-203-Off-site-analysis_FINAL_REPORT' issued on July 19, 2007

The steady-state analysis was conducted to determine the voltage levels at G. Gulf 500 kV and 115 kV buses during various outage contingencies on the transmission system at 2012 summer peak and 2012 off-peak load conditions. A Critical Clearing Time (CCT) assessment was performed for the substations adjacent to G. Gulf 500 kV i.e. the Point of Interconnection of PID-207.

The report is organized as follows

Section 2 - Model Development
Section 3 - Steady State analysis
Section 4 - Critical Clearing Time Analysis
Section 5 - Conclusions

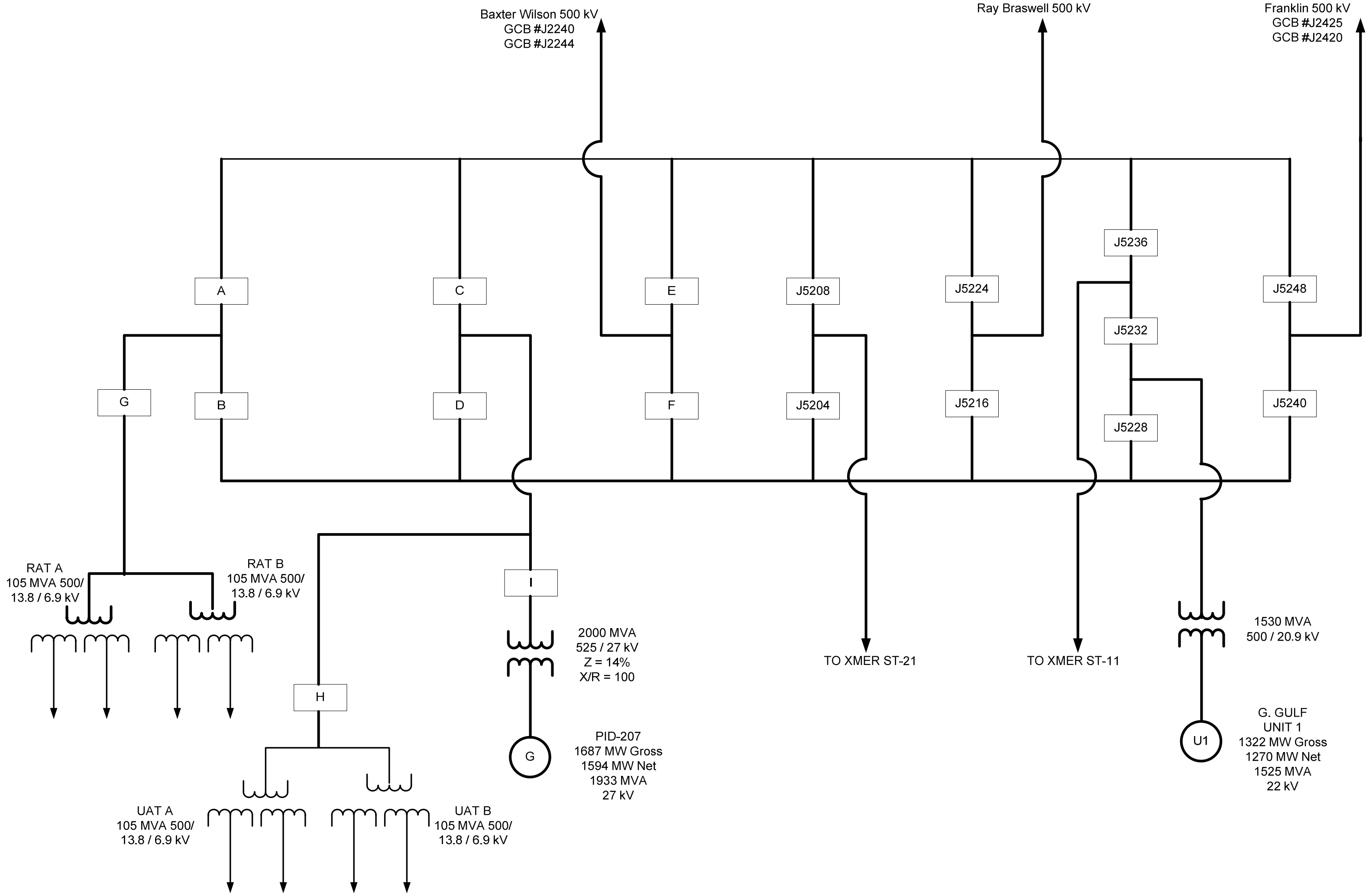


Figure IV-1: Bus Configuration of G. Gulf 500 kV substation after interconnection of G. Gulf (PID-207)

Note: - Substation Layout diagram for G. Gulf 500 kV substation ***<u>without</u>*** *G. Gulf (PID-207) is included in Appendix III for reference.*

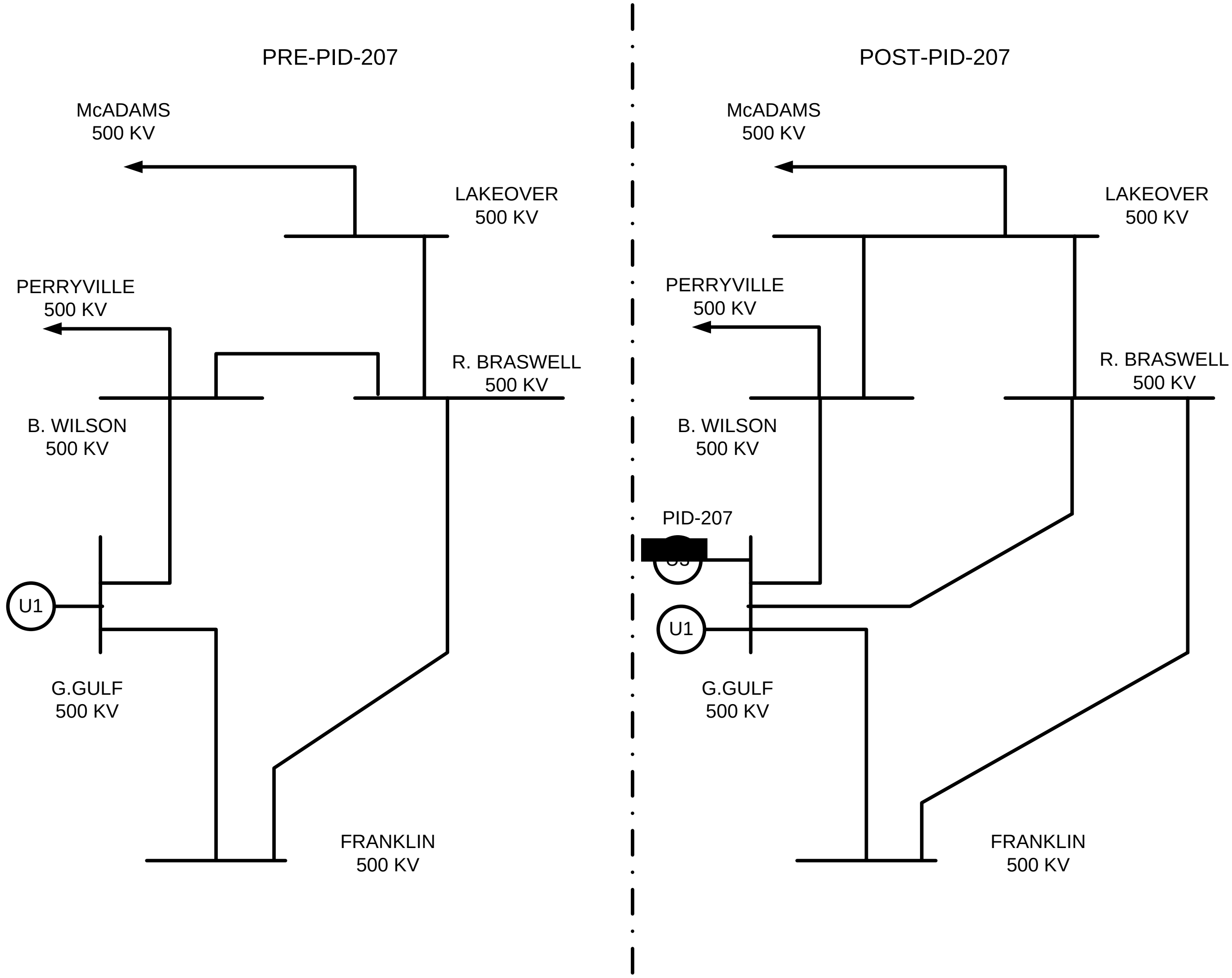


Figure IV-2: Transmission line configuration at G. Gulf 500 kV with and without PID-207

V. STUDY METHODOLOGY & ASSUMPTIONS

A. STUDY DATA

Entergy provided 2012 summer peak and 2012 off-peak load condition cases. The dynamic database (snapshot file) used for System Impact Study of PID-203 was used for the stability analysis.

The steady state and dynamic data for G. Gulf (PID-207) used in offsite analysis is listed in Appendix I for reference.

B. STEADY STATE ANALYSIS

In discussion with SPP/ICT, Entergy Transmission Planning, and G. Gulf substation personnel, the following scenarios were considered for steady state analysis

G. Gulf Unit #1 and (PID-207) on-line

G. Gulf (PID-207) off-line

G. Gulf Unit #1 and (PID-207) off-line

SPP provided the list of IPP generators in the Entergy system for dispatching G. Gulf Unit #1 and PID 207 during steady-state analysis. The list is included in Appendix II for reference.

There are two (2) offsite power supplies for G. Gulf Units – G. Gulf 500 kV and G. Gulf 115 kV. The voltages at G. Gulf 500 kV and G. Gulf 115 kV buses were monitored for system intact and contingency conditions. Table V-1 lists the contingencies simulated for steady state analysis. This list was provided by Entergy transmission planning group and the G. Gulf substation personnel.

Per the '*Nuclear Management Manual ENS-DC-199 Rev-2*' the steady-state voltage criteria for G. Gulf 500 kV and G. Gulf 115 kV are as follows:

BUS	**LOW**		**HIGH**	
	kV	**p.u.**	**kV**	**p.u.**
G. GULF 500 KV	491.000	0.982	525.000	1.050
G. GULF 115 KV	112.125	0.975	120.750	1.050

Table V-1: List of Contingencies for Steady State Analysis

CONTINGENCY NAME	DESCRIPTION	G. GULF		PORT GIBSON CAP
		UNIT #1	(PID-207)	
	BASE CASE (NORMAL)	ON	ON	ON
	BASE CASE (NORMAL)	ON	ON	OFF
	GGNS U1 OFF	OFF	ON	ON
	GGNS U1 OFF	OFF	ON	OFF
	GGNS PID 207 OFF	ON	OFF	ON
	GGNS PID 207 OFF	ON	OFF	OFF
	GGNS U1 & PID 207 OFF	OFF	OFF	ON
	GGNS U1 & PID 207 OFF	OFF	OFF	OFF
BW1	BAXTER WILSON UNIT 1	ON	OFF	ON
PT_GIB-S_VIC	PT. GIBSON TO BAXTER WILSON 115 OUT	ON	OFF	ON
PT_GIB-LORMN	PT GIBSON TO NATCHEZ 115 OUT	ON	OFF	ON
BW2	BAXTER WILSON UNIT 2	ON	OFF	ON
BW_500-115	BAXTER WILSON 500/115KV AUTO OUT	ON	OFF	ON
BW-PERRY	BAXTER WILSON TO PERRYVILLE 500 OUT	ON	OFF	ON
FRKLN-NTCHZ	FRANKLIN TO NATCHEZ 115KV OUT	ON	OFF	ON
FRKLN-RBRAS	FRANKLIN TO RAY BRASWELL 500 OUT	ON	OFF	ON
RBRAS-LAKEOVER	R. BRASWELL - LAKEOVER 500 KV	ON	OFF	ON
BW-LAKOVER	B. WILSON - LAKEOVER 500 KV	ON	OFF	ON
BW-GG	BAXTER WILSON TO GGNS 500KV OUT	ON	OFF	ON
RB-GG	RAY BRASWELL TO GGNS 500KV OUT	ON	OFF	ON
FRKLN-GG	FRANKLIN TO GGNS 500KV OUT	ON	OFF	ON
FRANK-MCKT	FRANKLIN TO McKNIGHT 500 kV OUT	ON	OFF	ON
BW-GG&RB-GG	BAXTER WILSON TO GGNS 500KV OUT & RAY BRASWELL TO GGNS 500KV OUT	ON	OFF	ON
BW-GG&FR-GG	BAXTER WILSON TO GGNS 500KV OUT & FRANKLIN TO GGNS 500KV OUT	ON	OFF	ON
RB-GG&FR-GG	RAY BRASWELL TO GGNS 500KV OUT & FRANKLIN TO GGNS 500KV OUT	ON	OFF	ON
FRANK-BOG	FRANKLIN TO ADAMS CREEK 500 kV OUT	ON	OFF	ON
BW-GG	BAXTER WILSON TO GGNS 500KV OUT	OFF	OFF	ON
RB-GG	RAY BRASWELL TO GGNS 500KV OUT	OFF	OFF	ON
FRKLN-GG	FRANKLIN TO GGNS 500KV OUT	OFF	OFF	ON
BW-GG&FR-GG	BAXTER WILSON TO GGNS 500KV OUT & FRANKLIN TO GGNS 500KV OUT	OFF	OFF	ON
RB-GG&FR-GG	RAY BRASWELL TO GGNS 500KV OUT & FRANKLIN TO GGNS 500KV OUT	OFF	OFF	ON
BW-GG&RB-GG	BAXTER WILSON TO GGNS 500KV OUT & RAY BRASWELL TO GGNS 500KV OUT	OFF	OFF	ON

C. CRITICAL CLEARING TIME

An evaluation of the critical clearing times was carried out for fault cases at the following substations:

G. Gulf 500 kV
Ray Braswell 500 kV
Baxter Wilson 500 kV
Franklin 500 kV

Critical Clearing Time assessment was performed on both 2012 summer peak and 2012 off-peak system conditions.

Critical Clearing Time (CCT) was calculated for a three-phase stuck-breaker (IPO: 3PH-1PH) fault for each element in the above four (4) substations. The Normal Clearing Time was kept equal to the normal value (5 cycles on 500 kV) and the backup clearing time was varied to find the CCT. All machines in the Entergy system were monitored for angle stability.

The results from PID-203 Off-site analysis were used for comparison.

VI. STEADY STATE ANALYSIS

The contingencies listed in Table V-1 were simulated on 2012 summer peak and 2012 off-peak load conditions. The voltages at G. Gulf 500 kV and G. Gulf 115 kV were monitored following the contingencies. Figure VI-1 and Figure VI-2 show the power flow diagrams for 2012 summer peak and 2012 off-peak system conditions with both G. Gulf units #1 and (PID-207) on-line.

Table VI-1 lists the voltages at G. Gulf 500 kV and 115 kV buses for all the simulated contingencies.

G. Gulf 115 kV

Per the '*Nuclear Management Manual ENS-DC-199 Rev-2*' the acceptable steady-state post-contingency voltage range at G. Gulf 115 kV is 0.975 p.u to 1.05 p.u. This criterion was violated in 4 scenarios, which are highlighted in red in Table VI-1. All 4 of these scenarios involve the outage of the Port Gibson 115 kV capacitor bank. The voltage at G. Gulf 115 kV was lowest with both G. Gulf units online and the Port Gibson Capacitor bank (30.5 MVAR) switched off. The voltage at G. Gulf 115 kV was 0.9782 p.u. for 2012 summer peak conditions and 0.9740 p.u. for 2012 off-peak conditions.

The PID-203 Off-site analysis indicated the similar voltage criterion violation in system intact conditions as shown below

DESCRIPTION	G. GULF UNIT #1	PORT GIBSON CAP	G. GULF 115 kV VOLTAGE (in p.u.)
BASE CASE (NORMAL)	ON	OFF	0.9969
	OFF	OFF	**0.9674**

The low voltage at G. Gulf 115 kV is an existing situation without PID 207. Entergy transmission planning and G. Gulf Substation personnel are addressing this situation. Hence PID-207 does not have a significant impact on G. Gulf 115 kV bus voltage.

G. Gulf 500 kV

Per the '*Nuclear Management Manual ENS-DC-199 Rev-2*' the acceptable steady-state post-contingency voltage range at G. Gulf 500 kV is 0.9820 p.u to 1.05 p.u. The voltage at G. Gulf 500 kV was below the voltage criterion following two contingencies: 1) loss of G. Gulf - B. Wilson and G. Gulf – R. Braswell 500 kV lines and 2) loss of G. Gulf – B. Wilson and G. Gulf – Franklin 500 kV lines, (see Table VI-1). The loss of two lines is considered strictly to obtain an insight as to robustness of the system under such severe conditions (multiple concurrent line contingencies), and meeting the voltage criteria is not required for these contingencies. Following loss of any two lines, G. Gulf 500 kV is radially connected to the remaining 500 kV substation.

Table VI-1: Results of Steady State Analysis

CONTINGENCY NAME	DESCRIPTION	G. GULF		PORT GIBSON CAP	VOLTAGE (in p.u.)			
					2012 SUMMER PEAK		2012 OFF-PEAK	
		UNIT #1	(PID-207)		G. GULF 115 KV	G. GULF 500 KV	G. GULF 115 KV	G. GULF 500 KV
	BASE CASE (NORMAL)	ON	ON	ON	0.9908	1.0200	1.0129	1.0200
	BASE CASE (NORMAL)	ON	ON	OFF	**0.9624**	1.0200	0.9812	1.0200
	GGNS U1 OFF	OFF	ON	ON	0.9939	1.0200	1.0124	1.0200
	GGNS U1 OFF	OFF	ON	OFF	**0.9644**	1.0200	0.9782	1.0200
	GGNS PID 207 OFF	ON	OFF	ON	0.9950	1.0132	1.0138	1.0151
	GGNS PID 207 OFF	ON	OFF	OFF	**0.9654**	1.0132	0.9789	1.0149
	GGNS U1 & PID 207 OFF	OFF	OFF	ON	0.9971	1.0120	1.0156	1.0146
	GGNS U1 & PID 207 OFF	OFF	OFF	OFF	**0.9666**	1.0119	0.9803	1.0145
BW1	BAXTER WILSON UNIT 1	ON	OFF	ON	1.0041	1.0136	1.0221	1.0161
PT_GIB-S_VIC	PT. GIBSON TO BAXTER WILSON 115 OUT	ON	OFF	ON	1.0044	1.0127	1.0094	1.0146
PT_GIB-LORMN	PT GIBSON TO NATCHEZ 115 OUT	ON	OFF	ON	1.0064	1.0130	1.0402	1.0149
BW2	BAXTER WILSON UNIT 2	ON	OFF	ON	0.9950	1.0089	1.0163	1.0169
BW_500-115	BAXTER WILSON 500/115KV AUTO OUT	ON	OFF	ON	0.9974	1.0131	1.0125	1.0151
BW-PERRY	BAXTER WILSON TO PERRYVILLE 500 OUT	ON	OFF	ON	0.9915	1.0125	1.0130	1.0146
FRKLN-NTCHZ	FRANKLIN TO NATCHEZ 115KV OUT	ON	OFF	ON	0.9871	1.0135	1.0106	1.0152
FRKLN-RBRAS	FRANKLIN TO RAY BRASWELL 500 OUT	ON	OFF	ON	0.9954	1.0119	1.0121	1.0129
RBRAS-LAKOVER	R. BRASWELL - LAKEOVER 500 KV	ON	OFF	ON	0.9945	1.0093	1.0125	1.0117
BW-LAKOVER	B. WILSON - LAKEOVER 500 KV	ON	OFF	ON	0.9925	1.0098	1.0105	1.0112
BW-GG	BAXTER WILSON TO GGNS 500KV OUT	ON	OFF	ON	0.9947	0.9965	1.0101	1.0047
RB-GG	RAY BRASWELL TO GGNS 500KV OUT	ON	OFF	ON	0.9937	1.0152	1.0118	1.0148
FRKLN-GG	FRANKLIN TO GGNS 500KV OUT	ON	OFF	ON	0.9916	1.0127	1.0055	1.0130
FRANK-MCKT	FRANKLIN TO McKNIGHT 500 kV OUT	ON	OFF	ON	0.9959	1.0114	1.0115	1.0118
BW-GG&RB-GG	BAXTER WILSON TO GGNS 500KV OUT & RAY BRASWELL TO GGNS 500KV OUT	ON	OFF	ON	0.9966	**0.9801**	1.0091	0.9905
BW-GG&FR-GG	BAXTER WILSON TO GGNS 500KV OUT & FRANKLIN TO GGNS 500KV OUT	ON	OFF	ON	0.9922	**0.9745**	1.0041	**0.9777**
RB-GG&FR-GG	RAY BRASWELL TO GGNS 500KV OUT & FRANKLIN TO GGNS 500KV OUT	ON	OFF	ON	0.9870	1.0190	0.9976	1.0188
FRANK-BOG	FRANKLIN TO ADAMS CREEK 500 kV OUT	ON	OFF	ON	0.9943	1.0141	1.0122	1.0159
BW-GG	BAXTER WILSON TO GGNS 500KV OUT	OFF	OFF	ON	0.9929	0.9941	1.0068	1.0001
FRKLN-GG	FRANKLIN TO GGNS 500KV OUT	OFF	OFF	ON	0.9964	1.0119	1.0112	1.0133

CONTINGENCY NAME	DESCRIPTION	G. GULF		PORT GIBSON CAP	VOLTAGE (in p.u.)			
					2012 SUMMER PEAK		2012 OFF-PEAK	
		UNIT #1	(PID-207)		G. GULF 115 KV	G. GULF 500 KV	G. GULF 115 KV	G. GULF 500 KV
RB-GG	RAY BRASWELL TO GGNS 500KV OUT	OFF	OFF	ON	0.9965	1.0137	1.0144	1.0144
BW-GG&FR-GG	BAXTER WILSON TO GGNS 500KV OUT & FRANKLIN TO GGNS 500KV OUT	OFF	OFF	ON	0.9933	**0.9813**	1.0051	0.9861
BW-GG&RB-GG	BAXTER WILSON TO GGNS 500KV OUT & RAY BRASWELL TO GGNS 500KV OUT	OFF	OFF	ON	0.9925	0.9883	1.0045	0.9933
RB-GG&FR-GG	RAY BRASWELL TO GGNS 500KV OUT & FRANKLIN TO GGNS 500KV OUT	OFF	OFF	ON	0.9942	1.0164	1.0065	1.0164

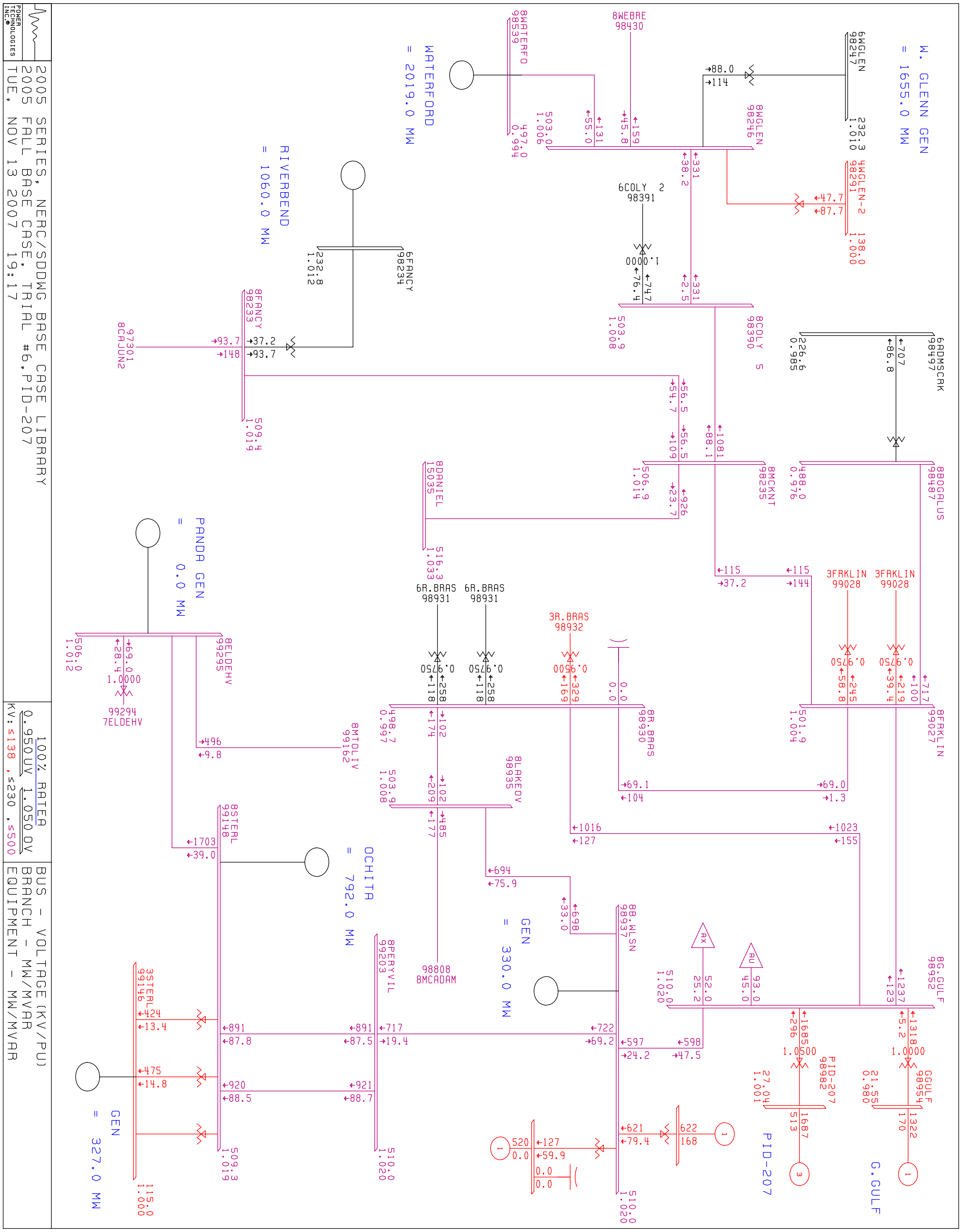


Figure VI-1: Power flow on transmission system near G. Gulf 500 kV – 2012 Summer Peak

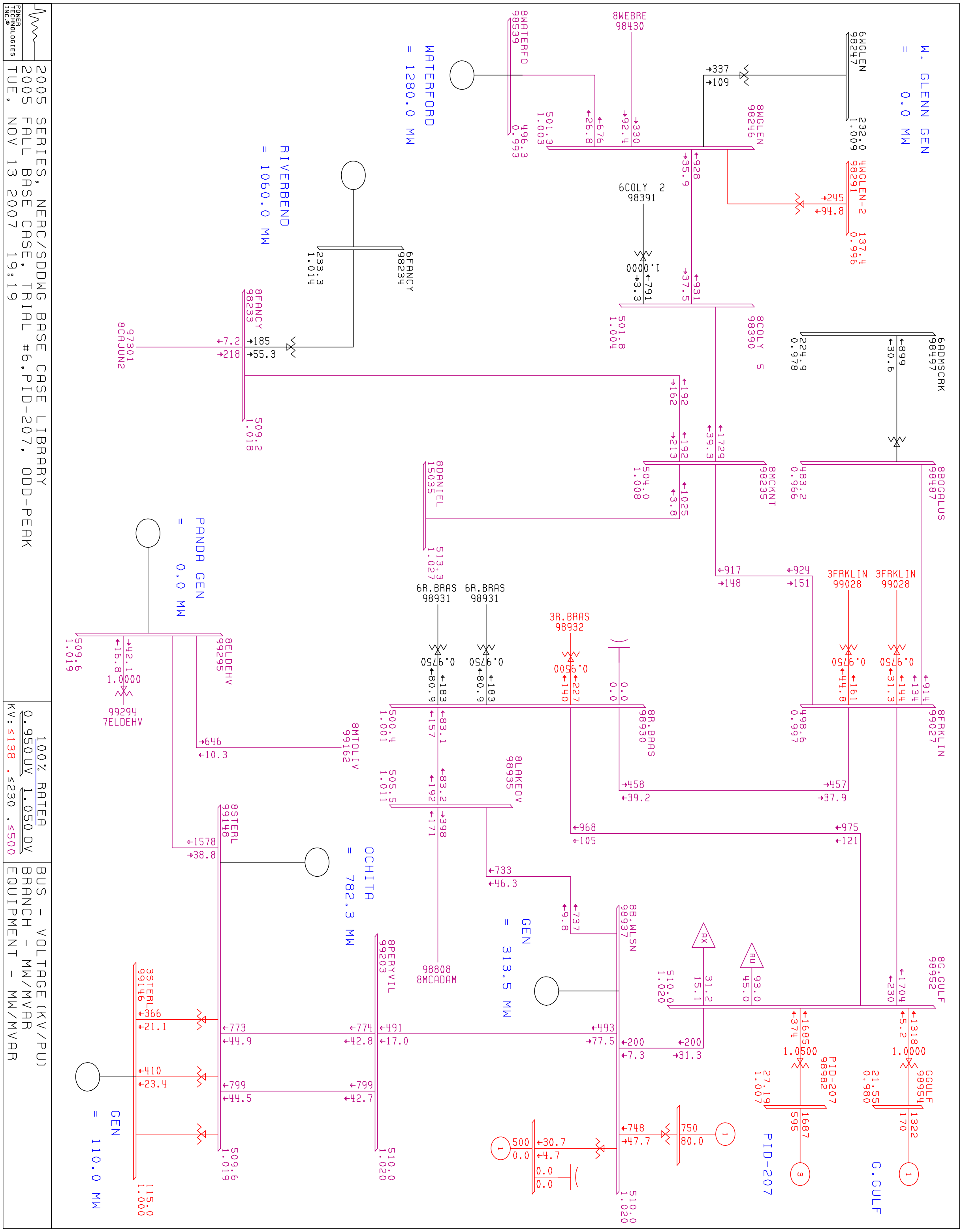


Figure VI-2: Power flow on transmission system near G. Gulf 500 kV – 2012 Off-Peak

VII. Critical Clearing Time Analysis

Evaluation of Critical Clearing Time (CCT) was carried out for faults at the following four (4) substations:

- G. Gulf 500 kV
- Ray Braswell 500 kV
- Baxter Wilson 500 kV
- Franklin 500 kV

Critical Clearing Time Analysis was performed on both 2012 summer peak and 2012 off-peak system conditions.

Table VII-1 shows the list of faults simulated at the above four (4) substations for Critical Clearing Time assessment.

Critical Clearing Time (CCT) was calculated for a three-phase stuck-breaker (IPO: 3PH-1PH) fault for each transmission line and transformer in the above four (4) substations. The Normal Clearing Time was kept equal to the normal value (5 cycles on 500 kV) and the backup clearing time was varied to find the CCT. If the system is found to be stable with 5+120 cycles delayed clearing time, then the analysis is stopped and the critical clearing time is listed 5+120 cycles.

Table VII-1: List of faults for Critical Clearing Times assessment

CASE	LOCATION	TYPE	SLG FAULT IMPEDANCE (MVA)	STUCK BRK #	PRIMARY BRK TRIP #	SECONDARY BRK TRIP	TRIPPED FACILITIES
FAULT-1a	G. Gulf - B. Wilson 500 kV	3PH-1PH	676.3-j10952.6	BRK F	GCB #J2240, GCB #J2244, BRK E	BRK B, BRK D, J5204, J5216, J5228, J5240	G. Gulf - B. Wilson 500 kV
FAULT-2a	G. Gulf - Ray Braswell 500 kV	3PH-1PH	757.64-j12428.13	J5216	J5224, BRK @ R. Braswell 500 kV	BRK B, BRK D, BRK F, J5204, J5228, J5240	G. Gulf - Ray Braswell 500 kV
FAULT-3a	G. Gulf - Franklin 500 kV	3PH-1PH	747.49-j12168.96	J5240	GCB #J2425, GCB #J2420, J5248	BRK B, BRK D, BRK F, J5204, J5228, J5216	G. Gulf - Franklin 500 kV
FAULT-4a	G. Gulf Unit 1	3PH-1PH	685.12-j10580.69	J5228	J5232	BRK B, BRK D, BRK F, J5204, J5216, J5240	G. Gulf Unit 1
FAULT-5a	R. Braswell - Lakeover 500 kV	3PH-1PH	613.93-j5487.74	J4908	GCB#J9218, GCB#J9234, J4928	J4904, J4944, J4932	R. Braswell - Lakeover 500 kV
FAULT-6a	R. Braswell - Franklin 500 kV	3PH-1PH	682.21-j6058.8	J4944	J4914, GCB#J2404, GCB#J2412	J4908, J4904, J4932	R. Braswell - Franklin 500 kV
FAULT-6b	R. Braswell - Franklin 500 kV	3PH-1PH	682.21-j6058.8	J4914	J4944, GCB#J2404, GCB#J2412	J4952, R. Braswell 500/ 230 kV transformer breakers	R. Braswell - Franklin 500 kV, R. Braswell 500/230 kV transformer
FAULT-7a	R. Braswell 500/230 kV	3PH-1PH	837.76-j6604.71	J4914	J4952,R. Braswell 500/ 230 kV transformer breakers	J4944, GCB#J2404, GCB#J2412	R. Braswell 500/230 kV transformer, R. Braswell - Franklin 500 kV
FAULT-8a	R. Braswell 500/115 kV	3PH-1PH	831.67-j6512	J4917	J4904, R. Braswell 500/ 115 kV transformer breakers	J4936, J4952	R. Braswell 500/115 kV transformer
FAULT-9a	B. Wilson - Lakeover 500 kV	3PH-1PH	683.25-j7960.37	J2233	GCB#J4928, GCB#J4920, J2230	GCB#R7372, GCB#R9872, J2218	B. Wilson - Lakeover 500 kV, B. Wilson Perryville 500 kV
FAULT-10a	B. Wilson - Perryville 500 kV	3PH-1PH	633.39-j7578.34	J2233	GCB#R7372, GCB#R9872, J2218	GCB#J4928, GCB#J4920, J2230	B. Wilson Perryville 500 kV, B. Wilson - Lakeover 500 kV
FAULT-11a	Franklin - McKnight 500 kV	3PH-1PH	633.2-j4470.79	J2416	GCB#21105, GCB#21110, J2412	GCB#S4402, GCB#S4405, J2420	Franklin - McKnight 500 kV, Franklin - Bogalusa 500 kV
FAULT-11b	Franklin - McKnight 500 kV	3PH-1PH	633.2-j4470.79	J2412	GCB#21105, GCB#21110, J2416	J2408, Franklin 500/115 kV transformer #2 breakers	Franklin - McKnight 500 kV, Franklin 500/115kV

CASE	LOCATION	TYPE	SLG FAULT IMPEDANCE (MVA)	STUCK BRK #	PRIMARY BRK TRIP #	SECONDARY BRK TRIP	TRIPPED FACILITIES
FAULT-12a	Franklin - Bogalusa 500 kV	3PH-1PH	761.49-j5335.06	J2416	GCB#S4402, GCB#S4405, J2420	GCB#21105, GCB#21110, J2412	Franklin - McKnight 500 kV, Franklin - Bogalusa 500 kV
FAULT-13a	Franklin - Ray Braswell 500 kV	3PH-1PH	698.49-j5019.49	J2408	J2404, GCB#J4904, GCB#4908	J2412, Franklin 500/115 kV transformer #2 breakers	Franklin - Ray Braswell 500 kV, Franklin 500/115 kV
FAULT-14a	Franklin 500 / 115 kV	3PH-1PH	893.67-j5769.68	J2412	500/115 kV transformer breakers, J2408	GCB#21105, GCB#21110, J2416	Franklin 500 / 115 kV, Franklin - McKnight 500 kV
FAULT-14b	Franklin 500 / 115 kV	3PH-1PH	893.67-j5769.68	J2408	500/115 kV transformer breakers, J2412	GCB#J4904, GCB#4908, J2404	Franklin 500 / 115 kV, Franklin - R. Braswell 500 kV
FAULT-15a	B. Wilson 500/115 kV transformer #1	3PH-1PH	827.73-j8092.32	J2214	500/115 kV transformer breakers, J2222	J2218, J2252, J2225	B. Wilson 500/115 kV transformer #1
FAULT-16a	Lakeover - McAdams 500 kV	3PH-1PH	596.23-j4595.27	J9234	J9214, GCB#J3924, GCB#3920	J2918, GCB#4908, GCB#4928	Lakeover - McAdams 500 kV, Lakeover- R. Braswell 500 kV
FAULT-16b	Lakeover - McAdams 500 kV	3PH-1PH	596.23-j4595.27	J9214	J9234, GCB#J3924, GCB#3920	J9218, J3214,	Lakeover - McAdams 500 kV, Lakeover 500/115 kV transformer
FAULT-17a	G. Gulf 500/27 kV (PID-207 GSU)	3PH-1PH	862.4-j13565.41	BRK I	BRK H, D, C		G. Gulf 500/27 kV GSU and G. Gulf (PID-207)
FAULT-23a	R. Braswell - G. Gulf 500 kV	3PH-1PH	592.76-j5471.4	J4928	GCB#J2230, GCB#J2233, J4920	GCB#J9218, GCB#9234, J4908	R. Braswell - G. Gulf 500 kV, R. Braswell - Lakeover 500 kV
FAULT-24a	B. Wilson - G. Gulf 500 kV	3PH-1PH	397.89-j6096.7	J2244	GCB#J5224, GCB#J5216, J2240	GCB#52L2, GCB#52L1, J2252	B. Wilson - G. Gulf 500 kV, Warren Power Generation
FAULT-25a	B. Wilson - EPG 500 kV	3PH-1PH	797.3-j8305.27	J2244	GCB#52L2, GCB#52L1, J2244	GCB#J5224, GCB#J5216, J2240	Warren Power Generation, B. Wilson - EPG 500 kV
FAULT-26a	Franklin - G. Gulf 500 kV	3PH-1PH	594.84-j4456.09	J2420	GCB#J5248, GCB#J5240 J2425,	GCB#S4402, GCB#S4405, J2416	Franklin - G. Gulf 500 kV, Franklin - Bogalusa 500 kV
FAULT-26b	Franklin - G. Gulf 500 kV	3PH-1PH	594.84-j4456.09	J2425	GCB#J5248, GCB#J5240, J2420	J2404, Low side BRK for Franklin 115 kV	Franklin - G. Gulf 500 kV, Franklin 500/115 kV transformer #1

The results for critical clearing time assessment are listed in below in Table VII-2.

Table VII-2: Results of Critical Clearing Time assessment

CASE	PRIMARY	Delayed Clearing			
		SUMMER PEAK		OFF-PEAK	
		PID-203	PID-207	PID-203	PID-207
FAULT-1a	5	12	11	19	10
FAULT-2a	5	14	14	22	11
FAULT-3a	5	11	11	20	8
FAULT-4a	5	33	31	120	24
FAULT-5a	5	120	120	120	120
FAULT-6a	5	120	120	120	120
FAULT-6b	5	120	120	120	120
FAULT-7a	5	120	120	120	120
FAULT-8a	5	120	120	120	120
FAULT-9a	5	113	120	120	15
FAULT-10a	5	19	19	120	11
FAULT-11a	5	120	120	120	120
FAULT-11b	5	120	120	120	120
FAULT-12a	5	120	120	120	120
FAULT-13a	5	120	120	120	120
FAULT-14a	5	120	120	120	120
FAULT-14b	5	120	120	120	120
FAULT-15a	5	120	120	120	18
FAULT-16a	5	120	120	120	120
FAULT-16b	5	120	120	120	120
FAULT-17a	5	17	18	21	15
FAULT-23a	5	120	120	120	120
FAULT-24a	5	120	120	120	14
FAULT-25a	5	120	120	120	15
FAULT-26a	5	120	120	120	120
FAULT-26b	5	120	120	120	120

It can be seen from the above results that the Critical Clearing time (CCT) is 5+120 cycles for most of the 3 Phase IPO stuck-breaker faults. The lowest CCTs are for Fault-3a and Fault-1a. The lowest CCT observed for summer peak system condition was 5+11 cycles and for off-peak system condition was 5+8 cycles. These are slightly longer than Entergy’s 500 kV minimum clearing time of 4+8 cycles, and thus all of the CCTs determined in this study are considered acceptable.

As the generation in the system is one of the most limiting elements for CCT, more local generators in the G. Gulf area were kept on-line, as compared to the PID-203 study, for a conservative approach in both Summer Peak and Off-peak system conditions. Approximately 1500 MW generation, which was off-line for the PID-203 study models, was turned ON in the G. Gulf area.

The CCTs were compared against those observed during PID-203 Off-site analysis. The lower CCTs compared to PID-203 off-site analysis were observed due to the conservative approach followed in the PID-207 powerflow case development by turning ON the local area generation.

VIII. CONCLUSIONS

Southwest Power Pool (SPP) has commissioned ABB Inc. to conduct an offsite power analysis of the proposed new nuclear unit (PID-207) at G. Gulf 500 kV. Offsite power is the preferred power source for nuclear power stations. The true capability of offsite power cannot be verified through direct readings of plant switchyard or safety bus voltages, but through analyses of grid and plant conditions considering the occurrence of severe contingencies representing the partial loss of grid support. The objective of this analysis is to identify if the Entergy System configuration will comply with the Code of Federal Regulations (CFR) specifically with respect to the grid voltage performance and the reliability of the Offsite Power Supply for G. Gulf (PID-207).

The steady-state analysis was conducted to determine the voltage levels at G. Gulf 500 kV and 115 kV buses following various outage contingencies on the transmission system during projected 2012 summer peak and 2012 off-peak load conditions. The System Impact Study for PID-207 was performed on summer peak 2012 load conditions. The results of the stability analysis for the summer peak 2012 system conditions from System Impact Study are also applicable for this offsite analysis. Hence, stability analysis was performed only on 2012 off-peak load conditions. Critical Clearing Time assessment was performed to determine the critical clearing times for faults at the G. Gulf 500 kV and adjacent substations.

Per the '*Nuclear Management Manual ENS-DC-199 Rev-2*' the acceptable steady-state post-contingency voltage range at G. Gulf 115 kV is 0.975 p.u to 1.05 p.u. The results of the off-site analysis study indicate that the voltage at G. Gulf 115 kV was lowest with both G. Gulf units online and the Port Gibson Capacitor bank (30.5 MVAR) switched off. The voltage at G. Gulf 115 kV was 0.9782 p.u. for 2012 summer peak conditions and 0.9740 p.u. for 2012 off-peak conditions. Hence, there is a violation of the voltage criterion for Off-site Power supply for G. Gulf nuclear units. This was also observed during the PID-203 Off-site analysis. The results indicated that the voltage violation at G. Gulf 115 kV existed in Pre-Project case. Entergy Transmission Planning and G. Gulf substation personnel are addressing a solution for this situation.

Per the ‘*Nuclear Management Manual ENS-DC-199 Rev-2*’ the acceptable steady-state post-contingency voltage range at G. Gulf 500 kV is 0.9820 p.u to 1.05 p.u. The results of the off-site analysis study indicate that the voltage at G. Gulf 500 kV was below the voltage criterion following two contingencies: 1) loss of G. Gulf - B. Wilson and G. Gulf – R. Braswell 500 kV lines and 2) loss of G. Gulf – B. Wilson and G. Gulf – Franklin 500 kV lines. The loss of two lines is considered strictly to obtain an insight as to robustness of the system under such severe conditions (multiple concurrent line contingencies), and meeting the voltage criteria is not required for these contingencies.

The G. Gulf (PID-207) does not have any significant impact on the Critical Clearing times at the G. Gulf, B. Wilson R. Braswell and Franklin 500 kV substations.

The results of this study are based on available data and assumptions made at the time this study was conducted. The results included in this report may not apply if any of the data and/or assumptions made in developing the study models change.

APPENDIX I - DATA FOR G. GULF UNIT #1 & PID-207

APPENDIX I.1 LOADFLOW DATA

98954,'GGULF ', 22.0000,2, 0.000, 0.000, 151, 151,0.97960, 10.1181, 1
98982,'PID-207 ', 27.0000,2, 0.000, 0.000, 151, 151,1.00131, 9.9701, 1
0 / END OF BUS DATA, BEGIN LOAD DATA
98952,'AL',0, 151, 451, 76.000, 37.000, 0.000, 0.000, 0.000, 0.000, 1
98952,'AU',1, 151, 451, 93.000, 45.040, 0.000, 0.000, 0.000, 0.000, 1
98952,'AX',1, 151, 451, 52.000, 25.200, 0.000, 0.000, 0.000, 0.000, 1
0 / END OF LOAD DATA, BEGIN GENERATOR DATA
98954,'1 ', 1321.997, 170.000, 170.000, -170.000,1.02000,98952, 1525.000, 0.00000, 0.30230, 0.00000, 0.00000,1.00000,1,
100.0, 1338.000, 150.000, 1,1.0000
98982,'3 ', 1687.000, 512.783, 842.000, -603.000,1.02000,98952, 1933.000, 0.00000, 0.28000, 0.00000, 0.00000,1.00000,1,
100.0, 1612.000, 0.000, 1,1.0000
0 / END OF GENERATOR DATA, BEGIN BRANCH DATA
0 / END OF BRANCH DATA, BEGIN TRANSFORMER DATA
98952,98954, 0,'1 ',2,2,1, 0.00000, 0.00000,2,' ',1, 1,1.0000
0.00290, 0.13460, 1365.00
500.000, 500.000, 0.000, 1530.00, 1530.00, 1530.00, 0, 0,537.5000,487.5000, 1.50000, 0.51000, 5, 0, 0.00000, 0.00000
20.9000, 20.900
98952,98982, 0,'1 ',2,2,1, 0.00000, 0.00000,2,' ',1, 1,1.0000
0.00140, 0.14000, 2000.00
525.000, 525.000, 0.000, 2000.00, 2000.00, 2000.00, 0, 0,551.2500,498.7500, 1.05000, 0.95000, 5, 0, 0.00000, 0.00000
27.0000, 27.000
0 / END OF TRANSFORMER DATA, BEGIN AREA DATA
0 / END OF AREA DATA, BEGIN TWO-TERMINAL DC DATA
0 / END OF TWO-TERMINAL DC DATA, BEGIN VSC DC LINE DATA
0 / END OF VSC DC LINE DATA, BEGIN SWITCHED SHUNT DATA
0 / END OF SWITCHED SHUNT DATA, BEGIN IMPEDANCE CORRECTION DATA
0 / END OF IMPEDANCE CORRECTION DATA, BEGIN MULTI-TERMINAL DC DATA
0 / END OF MULTI-TERMINAL DC DATA, BEGIN MULTI-SECTION LINE DATA
0 / END OF MULTI-SECTION LINE DATA, BEGIN ZONE DATA
0 / END OF ZONE DATA, BEGIN INTER-AREA TRANSFER DATA
0 / END OF INTER-AREA TRANSFER DATA, BEGIN OWNER DATA
0 / END OF OWNER DATA, BEGIN FACTS DEVICE DATA
0 / END OF FACTS DEVICE DATA

APPENDIX I.2 DYNAMICS DATA

```
    PTI INTERACTIVE POWER SYSTEM SIMULATOR--PSS/E      THU, NOV 08 2007  16:40
2005 SERIES, NERC/SDDWG BASE CASE LIBRARY
2005 FALL BASE CASE, TRIAL #6,PID-207

PLANT MODELS

REPORT FOR ALL MODELS                     BUS 98954 [GGULF   22.000] MODELS


** GENROU **  BUS X-- NAME --X BASEKV MC    C O N S     S T A T E S
        98954     GGULF     22.000 1   80805-80818   30976-30981

        MBASE     Z S O R C E        X T R A N      GENTAP
       1525.0  0.00000+J 0.30230  0.00000+J 0.00000  1.00000

 T'D0 T"D0  T'Q0 T"Q0     H   DAMP   XD     XQ     X'D    X'Q   X"D    XL
 7.74 0.046  0.86 0.068   4.90  0.00 1.4463 1.4081 0.3855 0.5759 0.3023 0.0000

                     S(1.0)  S(1.2)
                     0.1740  0.5210


** ESAC5A **  BUS X-- NAME --X BASEKV MC    C O N S     S T A T E S     VAR
        98954     GGULF     22.000 1   80865-80879   30992-30996    4004

  TR      KA     TA   VRMAX   VRMIN     KE     TE     KF     TF1    TF2    TF3
 0.200  600.00  0.100  6.400  -6.400   1.000  0.220  0.020  1.000  0.130  0.000

             E1     S(E1)    E2     S(E2)        KE VAR
           2.8000  0.7300  3.7000  0.7300        0.0000


** IEEEG1 **  BUS X-- NAME --X BASEKV MC    C O N S     S T A T E S     V A R S
        98954 GGULF       22.000 1   80894-80913   31001-31006    4007-4008

   K      T1      T2      T3     UO      UC    PMAX   PMIN     T4      K1
 12.00   0.000   0.000   0.075  0.600  -0.600 0.9000 0.0000   0.250   0.350

  K2      T5      K3      K4      T6      K5      K6      T7      K7      K8
 0.000   2.750   0.650   0.000   0.000   0.000   0.000   0.000   0.000   0.000

    PTI INTERACTIVE POWER SYSTEM SIMULATOR--PSS/E      THU, NOV 08 2007  16:40
2005 SERIES, NERC/SDDWG BASE CASE LIBRARY
2005 FALL BASE CASE, TRIAL #6,PID-207

PLANT MODELS

REPORT FOR ALL MODELS                     BUS 98982 [PID-207 27.000] MODELS


** GENROU **  BUS X-- NAME --X BASEKV MC    C O N S     S T A T E S
        98982     PID-207  27.000 3   81303-81316   31171-31176

        MBASE     Z S O R C E        X T R A N      GENTAP
       1933.0  0.00000+J 0.28000  0.00000+J 0.00000  1.00000

 T'D0 T"D0  T'Q0 T"Q0     H   DAMP   XD     XQ     X'D    X'Q   X"D    XL
11.30 0.038  0.53 0.068   4.84  0.00 2.0600 1.9400 0.3650 0.5500 0.2800 0.2250

                     S(1.0)  S(1.2)
                     0.3750  1.1000


** PSS2A **   BUS X-- NAME --X BASEKV MC    C O N S     S T A T E S     V A R S     I C O N S
```

98982	PID-207	27.000	3	81317-81333	31177-31192	5606-5609	2897-2902

IC1	REMBUS1	IC2	REMBUS2	M	N
1	0	3	0	5	1

TW1	TW2	T6	TW3	TW4	T7	KS2	KS3
2.000	2.000	0.000	2.000	0.000	2.000	0.207	1.000

T8	T9	KS1	T1	T2	T3	T4	VSTMAX	VSTMIN
0.500	0.100	4.000	0.150	0.030	0.150	0.030	0.100	-0.100

** ESST4B ** BUS X-- NAME --X BASEKV MC C O N S S T A T E S
98982 PID-207 27.000 3 81334-81350 31193-31196

TR	KPR	KIR	VRMAX	VRMIN	TA	KPM	KIM	VMMAX	VMMIN
0.000	2.660	2.660	1.000	-0.800	0.010	1.000	0.000	1.000	-0.800

KG	KP	KI	VBMAX	KC	XL	THETAP
0.000	7.530	0.000	9.410	0.300	0.0000	0.000

** IEEEG1 ** BUS X-- NAME --X BASEKV MC C O N S S T A T E S V A R S
98982 PID-207 27.000 3 81351-81370 31197-31202 5610-5611

K	T1	T2	T3	UO	UC	PMAX	PMIN	T4	K1
20.00	0.000	0.000	0.150	0.120	-0.120	1.0000	0.0000	0.500	0.340

K2	T5	K3	K4	T6	K5	K6	T7	K7	K8
0.000	0.350	0.660	0.000	0.000	0.000	0.000	0.000	0.000	0.000

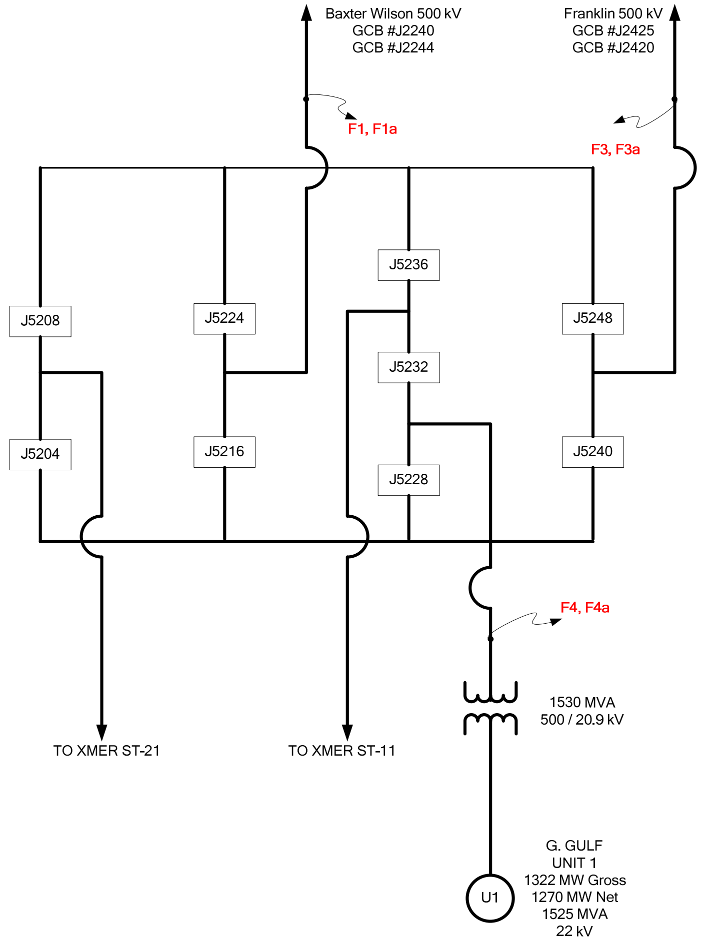
APPENDIX II - LIST OF IPP GENERATION FOR DISPATCH

```
TEXT  ** File created on 8/23/2006 9:29:03 AM
TEXT  ** Excess generation of  1450  MW met by IPPs for 2012 case **
TEXT  ** Total PMAX of all IPPs that participate in matching excess load is  7251.2  MW  **
RDCH
1
0
0
97772,1,41.50,,25.00,,,,,,,,,1,,41.50,0  /*  BAYOR U1
97773,1,41.50,,25.00,,,,,,,,,1,,41.50,0  /*  BAYOR U2
97774,1,13.67,,8.47,,,,,,,,,1,,32.00,0  /*  BAYOR U3
98495,1,96.67,,59.91,,,,,,,,,1,,255.00,0  /*  S1CALBOG
98494,1,0.00,,0.00,,,,,,,,,0,,175.00,0  /*  G2CALBOG
98493,1,0.00,,0.00,,,,,,,,,0,,175.00,0  /*  G1CALBOG
98435,1,96.67,,59.91,,,,,,,,,1,,187.00,0  /*  IC1CARVL
98436,1,0.00,,0.00,,,,,,,,,0,,187.00,0  /*  IC2CARVL
98437,1,0.00,,0.00,,,,,,,,,0,,181.00,0  /*  IS1CARVL
97785,1,96.67,,59.91,,,,,,,,,1,,185.00,0  /*  G1CONOCO
97786,1,0.00,,0.00,,,,,,,,,0,,185.00,0  /*  G2CONOCO
98324,1,96.67,,59.91,,,,,,,,,1,,200.00,0  /*  DOWAEP5
98321,1,0.00,,0.00,,,,,,,,,0,,177.00,0  /*  DOWAEP2
98322,1,0.00,,0.00,,,,,,,,,0,,177.00,0  /*  DOWAEP3
98323,1,0.00,,0.00,,,,,,,,,0,,177.00,0  /*  DOWAEP4
98320,1,0.00,,0.00,,,,,,,,,0,,177.00,0  /*  DOWAEP1
98840,1,80.00,,40.00,,,,,,,,,1,,80.00,0  /*  G3DUKEFRPT
98841,1,16.67,,10.33,,,,,,,,,1,,80.00,0  /*  G4DUKEFRPT
98842,1,0.00,,0.00,,,,,,,,,0,,80.00,0  /*  G5DUKEFRPT
98843,1,0.00,,0.00,,,,,,,,,0,,80.00,0  /*  G6DUKEFRPT
98844,1,0.00,,0.00,,,,,,,,,0,,80.00,0  /*  G7DUKEFRPT
98845,1,0.00,,0.00,,,,,,,,,0,,80.00,0  /*  G8DUKEFRPT
98970,1,96.67,,59.91,,,,,,,,,1,,198.00,0  /*  IS1DUKEH
98969,1,0.00,,0.00,,,,,,,,,0,,176.60,0  /*  IG2DUKEH
98968,1,0.00,,0.00,,,,,,,,,0,,176.60,0  /*  IG1DUKEH
98095,1,96.67,,59.91,,,,,,,,,1,,175.00,0  /*  G1DYNEGY
98096,1,0.00,,0.00,,,,,,,,,0,,175.00,0  /*  G2DYNEGY
98834,1,96.67,,59.91,,,,,,,,,1,,256.00,0  /*  S1GPMCAD
98833,1,0.00,,0.00,,,,,,,,,0,,168.50,0  /*  G2GPMCAD
98832,1,0.00,,0.00,,,,,,,,,0,,168.50,0  /*  G1GPMCAD
97824,1,96.67,,59.91,,,,,,,,,1,,187.50,0  /*  1G3INTHB
97826,1,0.00,,0.00,,,,,,,,,0,,187.50,0  /*  1G4INTHB
97819,1,0.00,,0.00,,,,,,,,,0,,125.00,0  /*  1S1INTHB
97825,1,0.00,,0.00,,,,,,,,,0,,125.00,0  /*  1S3INTHB
97821,1,0.00,,0.00,,,,,,,,,0,,125.00,0  /*  1S2INTHB
97827,1,0.00,,0.00,,,,,,,,,0,,125.00,0  /*  1S4INTHB
98850,1,75.00,,46.48,,,,,,,,,1,,75.00,0  /* IMEPCLG1
98851,1,21.67,,13.43,,,,,,,,,1,,75.00,0  /* IMEPCLG2
98852,1,0.00,,0.00,,,,,,,,,0,,75.00,0  /* IMEPCLG3
98853,1,0.00,,0.00,,,,,,,,,0,,75.00,0  /* IMEPCLG4
99422,1,96.67,,59.91,,,,,,,,,1,,180.00,0  /* 1SKY U1
99423,1,0.00,,0.00,,,,,,,,,0,,50.00,0  /* 1SKY U2
98090,5,96.67,,59.91,,,,,,,,,1,,185.00,0  /*  RSCO R5
98091,4,0.00,,0.00,,,,,,,,,0,,80.00,0  /*  RSCO R4
98574,1,96.67,,59.91,,,,,,,,,1,,170.00,0  /* 1GOXY U1
98575,1,0.00,,0.00,,,,,,,,,0,,170.00,0  /* 1GOXY U2
98576,1,0.00,,0.00,,,,,,,,,0,,170.00,0  /* 1GOXY U3
99649,1,96.67,,59.91,,,,,,,,,1,,544.00,0  /* RITC U2
Q
echo
@end
```

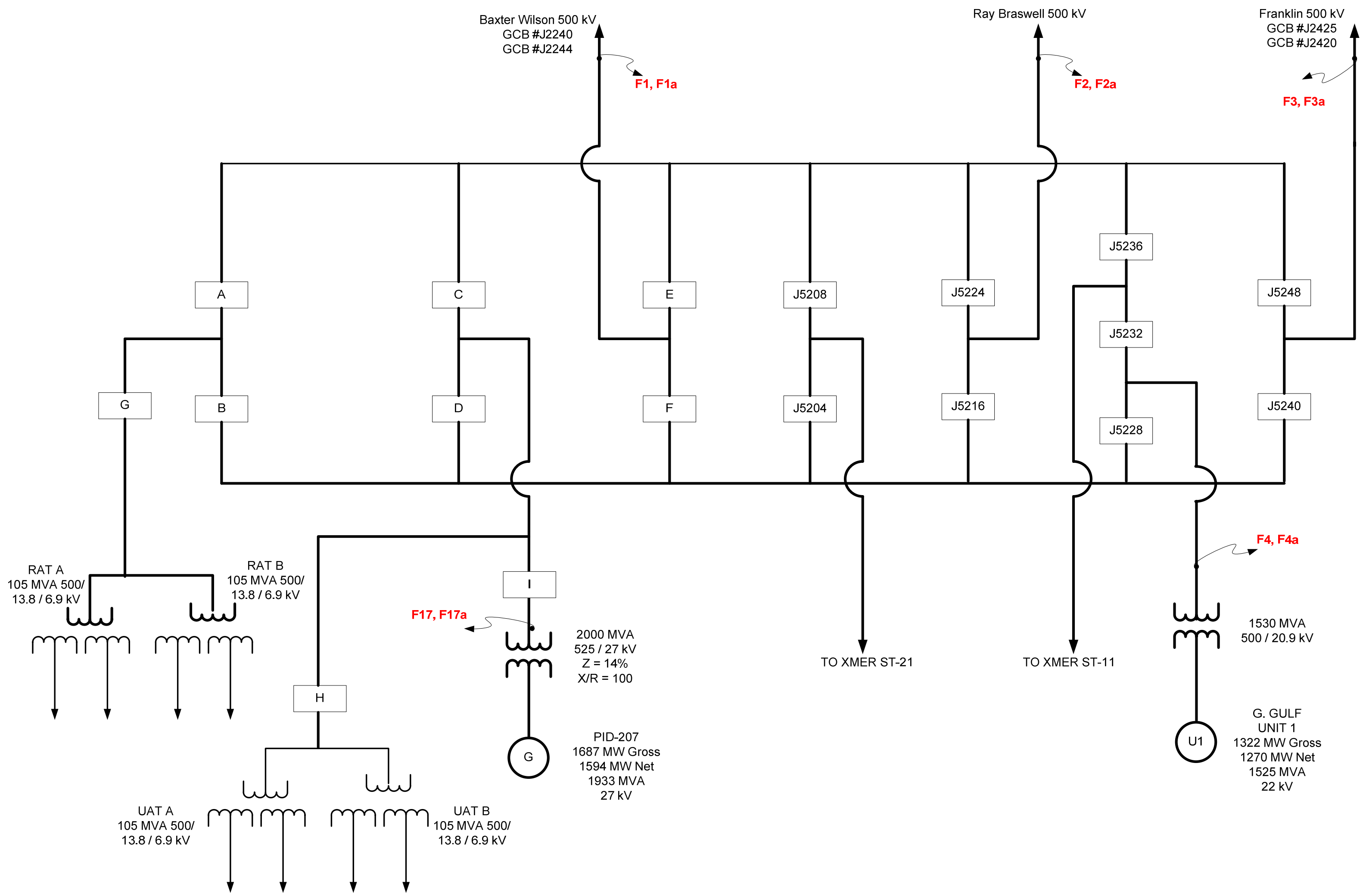
APPENDIX III - SUBSTATION LAYOUT DIAGRAMS

Substation layout diagrams indicating the Fault Locations are included below

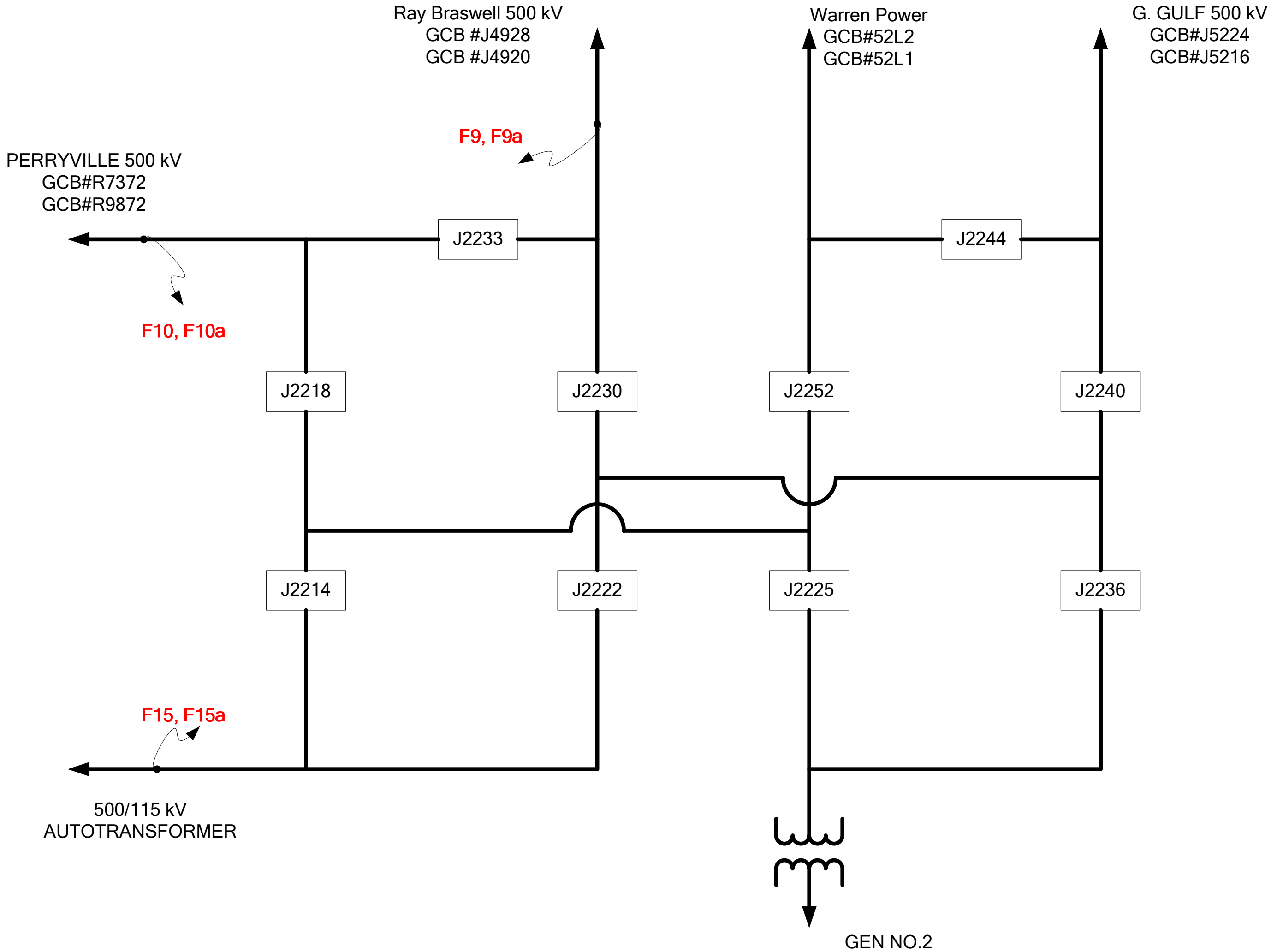
Bus configuration for G. Gulf 500 kV substation PRE-PID-207



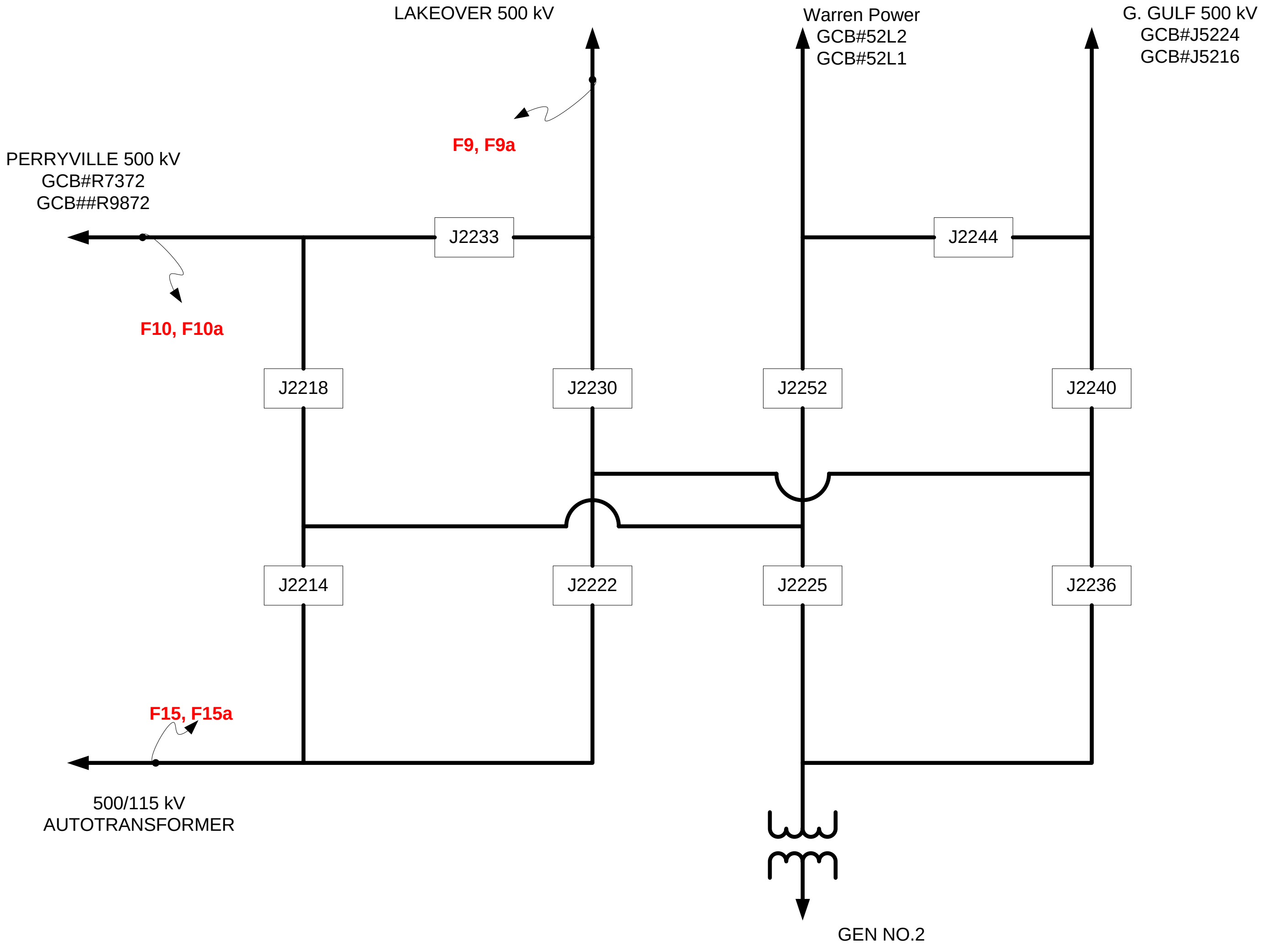
Bus configuration for G. Gulf 500 kV substation POST-PID-207



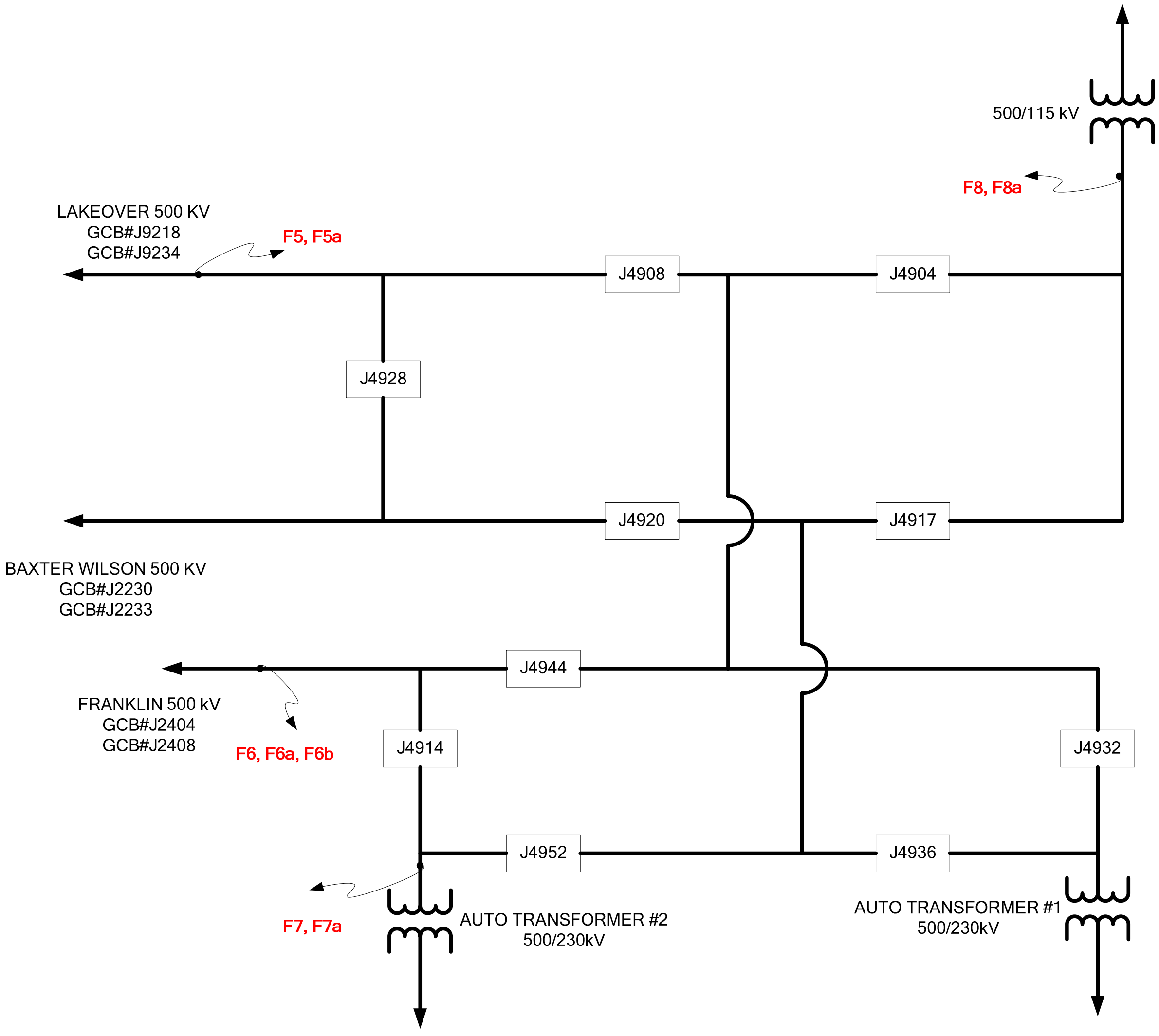
Bus configuration for B. Wilson 500 kV substation PRE-PID-207



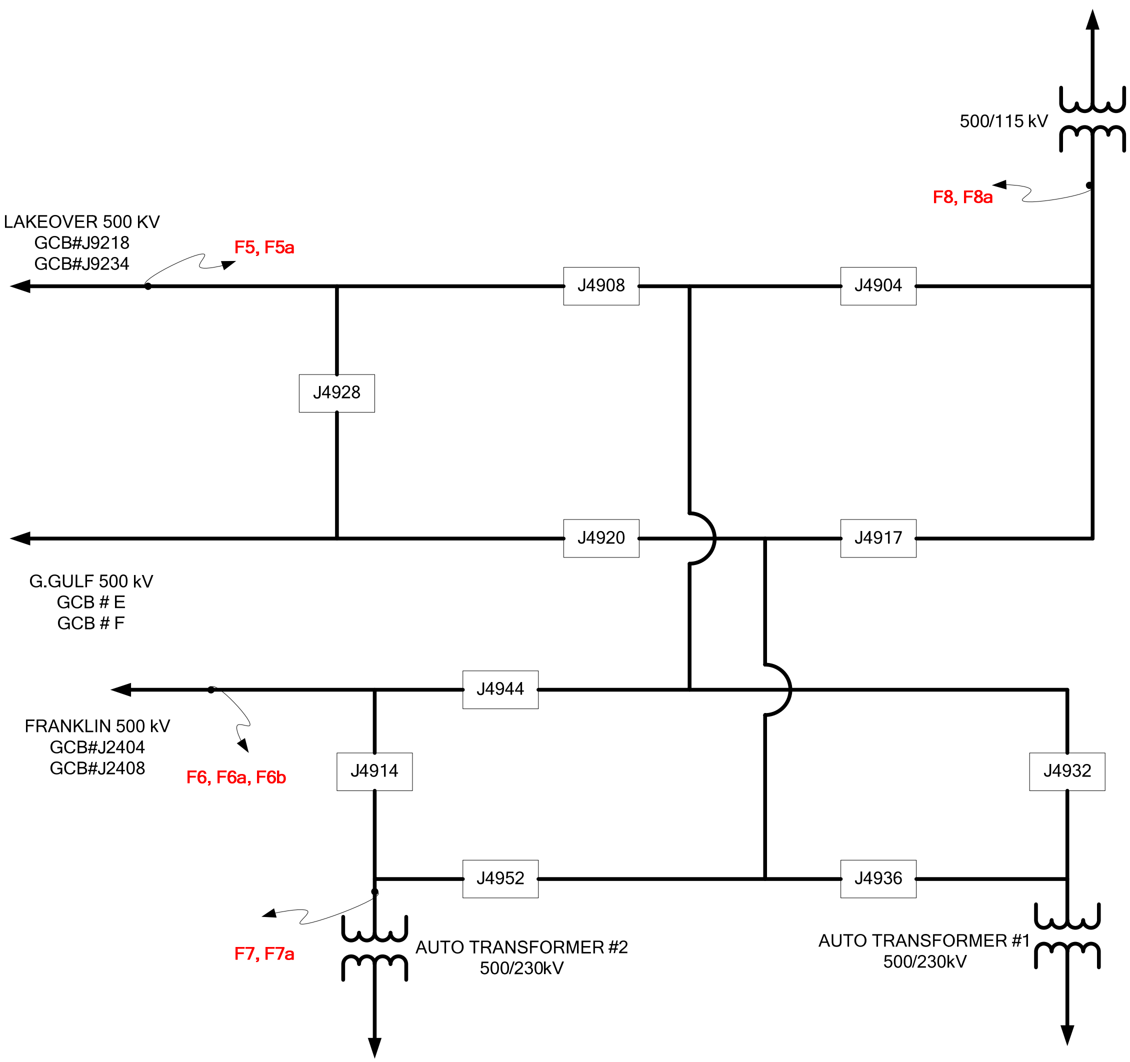
Bus configuration for B. Wilson 500 kV substation POST-PID-207



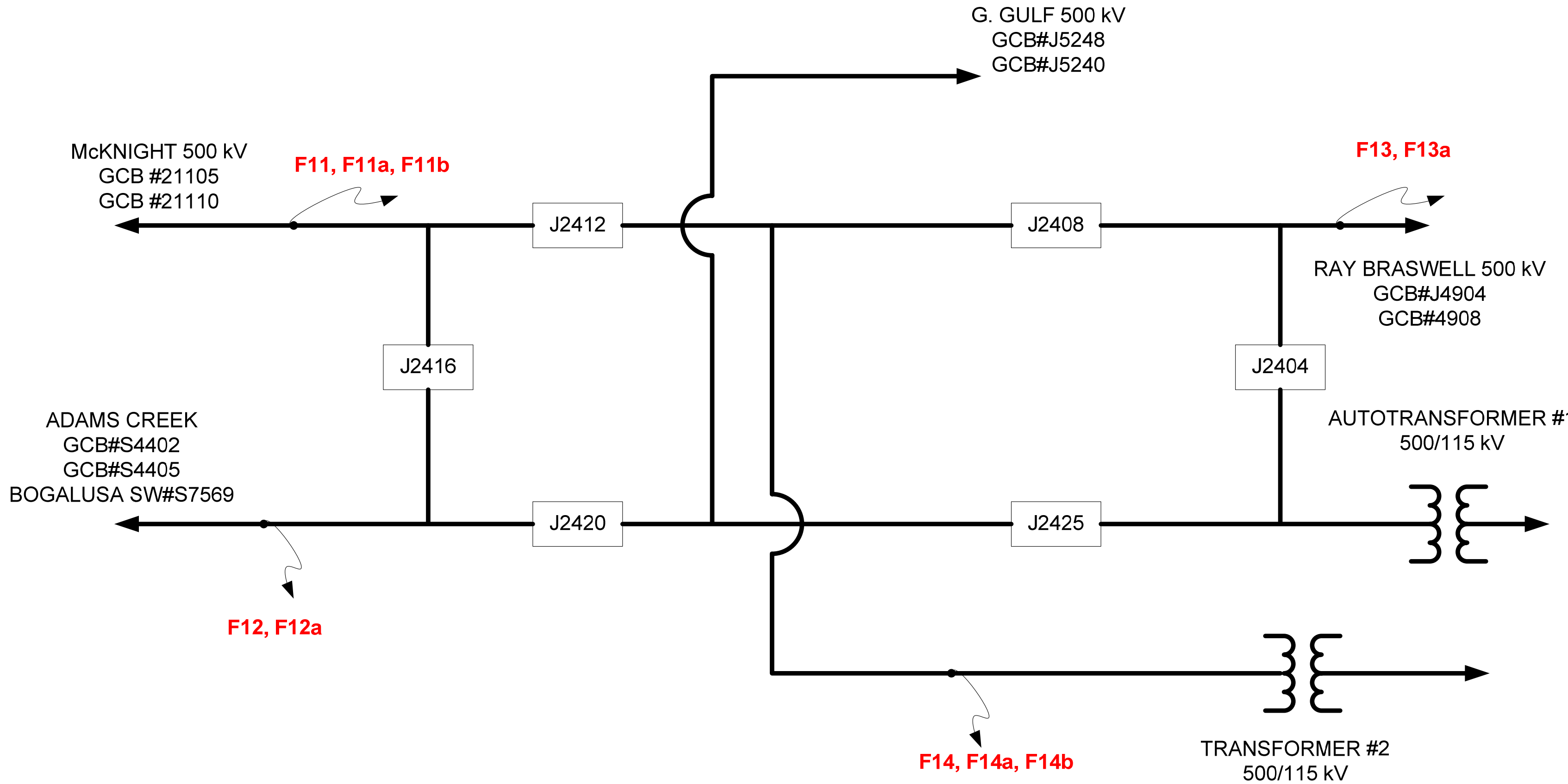
Bus configuration for Ray Braswell 500 kV substation PRE-PID-207



Bus configuration for Ray Braswell 500 kV substation POST-PID-207



Bus configuration for Franklin 500 kV substation



APPENDIX IV - GENERATION FOR DISPATCH COMAPRE TO PID-203 MODELS

2012 Summer Peak

BUS NO	BUS NAME	PID-207 BASECASE (MW)	PID-203 BASECASE (MW)	DIFF (MW)	DIFF %
98970	[IS1DUKEH18.0]	198	0	-198	100
98244	[G4WGLEN 24.0]	568	374	-194	34.2
99206	[1C3PERYV18.0]	185	0	-185	100
99207	[1C4PERYV18.0]	185	0	-185	100
98968	[IG1DUKEH18.0]	176	0	-176	100
98969	[IG2DUKEH18.0]	176	0	-176	100
98245	[G5WGLEN 20.0]	550	384	-166	30.2
99211	[1G1OCHIT18.0]	164	0	-164	100
99215	[1G3OCHIT18.0]	164	0	-164	100
99212	[1S1OCHIT13.8]	100	0	-100	100
99214	[1S2OCHIT13.8]	100	0	-100	100
99216	[1S3OCHIT13.8]	100	0	-100	100
99213	[1G2OCHIT18.0]	164	70	-94	57.3
98963	[1EPG U2 13.8]	85	0	-85	100
98964	[1EPG U3 13.8]	85	0	-85	100
98965	[1EPG U4 13.8]	85	0	-85	100
97359	[IG1BAYOU13.8]	80	0	-80	100
97360	[IG2BAYOU13.8]	80	0	-80	100
97361	[IG3BAYOU13.8]	80	0	-80	100
97362	[IG4BAYOU13.8]	80	0	-80	100
98535	[WAT U1 26.0]	411	365	-46	11.2
99649	[RITC U2 13.8]	46	0	-46	100
98536	[WAT U2 26.0]	411	366	-45	10.9

2012 Off-peak

NO	NAME	PID-207 BASECASE (MW)	PID-203 BASECASE (MW)	DIFF (MW)	DIFF %
98940	[2B.WLSNI69.0]	750	250	-500	66.7
98970	[IS1DUKEH18.0]	198.1	0	-198.1	100
99206	[1C3PERYV18.0]	178.4	0	-178.4	100
99207	[1C4PERYV18.0]	178.4	0	-178.4	100
98968	[IG1DUKEH18.0]	176.2	0	-176.2	100
98969	[IG2DUKEH18.0]	173.2	0	-173.2	100
99211	[1G1OCHIT18.0]	160.1	0	-160.1	100
99215	[1G3OCHIT18.0]	160.1	0	-160.1	100
99213	[1G2OCHIT18.0]	160.1	45	-115.1	71.9
99212	[1S1OCHIT13.8]	100.6	0	-100.6	100
99214	[1S2OCHIT13.8]	100.6	0	-100.6	100
99216	[1S3OCHIT13.8]	100.6	0	-100.6	100
98963	[1EPG U2 13.8]	79.8	0	-79.8	100
98964	[1EPG U3 13.8]	79.8	0	-79.8	100
98965	[1EPG U4 13.8]	79.8	0	-79.8	100
99649	[RITC U2 13.8]	27	0	-27	100
98962	[1EPG U1 13.8]	74	48.2	-25.7	34.8

Section – B

Network Resource Interconnection Service

TABLE OF CONTENTS FOR SECTION –B (NRIS)

I. Introduction

A Network Resource Interconnection Services (NRIS) study was requested by PID-207 to serve 1594 MW of Entergy network load. The expected in service date for this NRIS generator is January 1, 2015. The tests were performed with only confirmed transmission reservations and existing network generators and with transmission service requests in study mode.

Two tests were performed, a deliverability to generation test and a deliverability to load test. The deliverability to generation (DFAX) test ensures that the addition of this generator will not impair the deliverability of existing network resources and units already designated as NRIS while serving network load. The deliverability to load test determines if the tested generator will reduce the import capability level to certain load pockets (Amite South, WOTAB and Western Region) on the Entergy system. A more detailed description for these two tests is described in Appendix B-A and Appendix B-B.

Also, it is understood that the NRIS status provides the Interconnection Customer with the capability to deliver the output of the Generating Facility into the Transmission System. NRIS in and of itself does not convey any right to deliver electricity to any specific customer or Point of Delivery

II. Load Flow Analysis

A. Models

The models used for this analysis were the 2012 summer and winter peak cases developed in September 2006.

The following modifications were made to the base cases to reflect the latest information available:

- Non-Firm IPPs within the local region of the study generator were turned off and other non-firm IPPs outside the local area were increased to make up the difference.
- Confirmed firm transmission reservations were modeled for the year 2015. These request are shown below.

OASIS#	PSE	POR	POD	Sink	MW	Service	Begin	End
1412068	NRG	EES	AMRN	AMRN	103	Long-Term Firm PTP	01/01/07	01/01/08
1413110	NRG	EES	LAGN	LAGN	100	Yearly Network - Designated Resources	01/01/07	01/01/09
1416650	NRG	AMRN	LAGN	LAGN	100	Yearly Network - Designated Resources	01/01/07	01/01/08
1422496	Constellation Commodities Group	EES	DENL	DENL	57	Yearly Network - Designated Resources	01/01/07	01/01/08
1424384	Constellation Commodities Group	TVA	DENL	DENL	100	Yearly Network - Designated Resources	01/01/07	01/01/08
1431165	Cargill Alliant	AMRN	SOCO	SOCO	103	Long-Term Firm PTP	01/01/08	01/01/09
1435973	Entergy Services, Inc. (EMO)	EES	EES	EES	135	Yearly Network - Designated Resources	05/01/08	05/01/10
1440358	NRG	TVA	LAGN	LAGN	100	Yearly Network - Designated Resources	03/01/07	03/01/08
1442295	NRG	LEPA	LAGN	LAGN	3	Yearly Network - Designated Resources	07/01/07	07/01/09
1442453	NRG	LAGN	LAGN	LAGN	320	Yearly Network - Designated Resources	06/01/07	06/01/26
1449495	Entergy Services (EMO)	EES	EES	EES	322	Yearly Network - Designated Resources	06/01/09	06/01/59
1449881	Cargill Power Markets, LLC	AMRN	SOCO	SOCO	103	Long-Term Firm PTP	01/01/08	01/01/09
1452307	NRG	AMRN	LAGN	LAGN	100	Yearly Network - Designated Resources	01/01/08	01/01/09
1452308	NRG	AMRN	LAGN	LAGN	100	Yearly Network - Designated Resources	01/01/08	01/01/09
1452603	NRG	AMRN	LAGN	LAGN	100	Yearly Network - Designated Resources	09/01/07	09/01/08
1453402	NRG	AMRN	SOCO	SOCO	40	Long-Term Firm PTP	01/01/09	01/01/10
1456636	CLECO Power LLC	OKGE	CLECO	CLECO	10	Yearly Network - Designated Resources	10/01/07	10/01/12
1464028	East Texas Electric Coop.	EES	EES	EES	168	Yearly Network - Designated Resources	01/01/10	01/01/40
1470811	East Texas Electric Coop.	EES	EES	EES	168	Yearly Network - Designated Resources	01/01/10	01/01/40

- Approved transmission reliability upgrades for 2007 - 2010 were included in the base case. These upgrades can be found at Entergy's OASIS web page, http://oasis.e-terrasolutions.com/documents/EES/Disclaimer.html under approved future projects.
- Increased the output of Big Cajun 2 units to reflect there NITS and firm point to point transfers from that unit. To do this, the output of Bayou Cove and Ouachita were reduced to 0MW.
- Reduced the load in zones 100 – 199 and 500 -998 by 848MW. Turned off all of the non-firm IPPs and reduced the output of Baxter Wilson Unit 1 and 2 to their firm level, 1142MW.

In setting up the cases, all non-firm generators serving EES load, in close proximity to the study generator were dispatched to their confirmed generation output. The loads in zones 100 -199 and 500 -998 were reduced from 24,951MW by 848MW to 24,103MW. This allowed for turning off all non-firm IPP generation and reduced local generators to their confirmed network service levels in the model. A 1594MW transfer analysis was then simulated to zones 100 -199 and 500 -998 using MUST.
A 5% transmission reliability margin (TRM) is used for the MUST DC analysis, effectively reducing equipment rating to 95%.

There are no prior transmission service requests that are in study mode, all prior transmission service requests that were in study mode have either confirmed their transmission service or withdrawn/retracted the transmission service requested.

B. Contingencies and Monitored Elements

Single contingency analyses on Entergy's transmission facilities (including tie lines) 115kV and above were considered. All transmission facilities on Entergy transmission system above 100 kV were monitored.

C. Generation used for the transfer

The Grand Gulf unit 2, 1594MW generator was used as the source for the "from generation."

III. Results

A. Deliverability to Generation (DFAX) Test:

The deliverability to generation (DFAX) test ensures that the addition of this generator will not impair the deliverability of existing network resources and units already designated as NRIS while serving network load. A more detailed description for these two tests is described in Appendix B-A and Appendix B-B.

Table III-1 Summary of Results of DFAX Test

Study Case
Baxter Wilson - Grand Gulf 500kV
Baxter Wilson - Ray Braswell 500kV
Franklin - Grand Gulf 500kV
Sterlington 500/115kV transformer 2
Sterlington 500/115kV transformer 1
Webre - Wells 500kV
Wells 500/230kV transformer

Table III-2 DFAX Study Case Results without priors:

Limiting Element	Contingency Element	ATC(MW)
Sterlington 500/115kV transformer 2	Sterlington 500/115kV transformer 1	0
Sterlington 500/115kV transformer 1	Sterlington 500/115kV transformer 2	0
Webre - Wells 500kV	Eldorado EHV - Mount Olive 500kV	158
Wells 500/230kV transformer	Richard - Wells 500kV	276
Webre - Wells 500kV	Baxter Wilson - Perryville 500kV	422
Webre - Wells 500kV	Hartburg - Mount Olive 500kV	512
Baxter Wilson - Ray Braswell 500kV	Franklin - Grand Gulf 500kV	521
Webre - Wells 500kV	Baxter Wilson - Grand Gulf 500kV	676
Webre - Wells 500kV	Eldorado EHV - Sterlington 500kV	688
Webre - Wells 500kV	Livonia - Wilbert 138kV	757
Webre - Wells 500kV	Livonia - Line 642 Tap 138kV	981
Webre - Wells 500kV	Krotz Spring - Line 642 Tap 138kV	1012
Webre - Wells 500kV	Greenwood - Terrebone 115kV	1081
Webre - Wells 500kV	Crockett - Grimes 345kV	1113
Baxter Wilson - Grand Gulf 500kV	Franklin - Grand Gulf 500kV	1204
Franklin - Grand Gulf 500kV	Baxter Wilson - Grand Gulf 500kV	1204
Sterlington 500/115kV transformer 2	Eldorado EHV - Sterlington 500kV	1464
Baxter Wilson - Ray Braswell 500kV	Baxter Wilson - Perryville 500kV	1486

To alleviate the constrained identified in Table III-2 a second iteration of DFAX test was performed with the following upgrades included in the model and results are listed in Table III-3:

1. Build 48 miles 500kV transmission line from Grand Gulf 500kV to Ray Braswell 500kV.
2. Remove the existing Baxter Wilson to Ray Braswell 500kV line from Ray Braswell substation, and extend this line 22 miles to Lake Over 500kV.
3. Build 56mile 500kV line from Webre 500kV to Richard 500kV

Table III-3 DFAX Study Case Results without Priors:

Limiting Element	Contingency Element	ATC(MW)
Sterlington 500/115kV transformer 2	Sterlington 500/115kV transformer 1	0
Sterlington 500/115kV transformer 1	Sterlington 500/115kV transformer 2	0

D. Deliverability to Load Test:

The deliverability to load test determines if the tested generator will reduce the import capability level to certain load pockets (Amite South, WOTAB and Western Region) on the Entergy system. A more detailed description for these two tests is described in Appendix B-A and Appendix B-B.

Amite South: Passed

WOTAB: Passed

Western Region: Passed

IV. Required Upgrades for NRIS

Preliminary Estimates of Direct Assignment of Facilities and Network Upgrades

Limiting Element	Planning Estimate for Upgrade
Baxter Wilson - Grand Gulf 500kV	Build 48 miles 500kV from Grand Gulf to Ray Braswell, $97,000,000 Remove Baxter Wilson – Ray Braswell 500kV line from Ray Braswell and extend it 22 miles to Lake Over 500kV, $44,000,000
Baxter Wilson - Ray Braswell 500kV	
Franklin - Grand Gulf 500kV	
Webre - Wells 500kV	Build 56 miles 500kV line from Webre 500kV to Richard 500kV, $151,000,000
Wells 500/230kV transformer	
Sterlington 500/115kV transformer 1	Identified for a prior transmission service request. Split Sterlington 115kV bus, add a 4th 500/115kV transformer, upgrade Drew – Sterlington and Walnut – Swartz, $48,000,000
Sterlington 500/115kV transformer 2	

The costs of the upgrades are planning estimates only. Detailed cost estimates, accelerated costs and solutions for the limiting elements will be provided in the facilities study.

In addition to the cost contained in this report, the order of magnitude cost estimate for rework inside the Grand Gulf substation has been estimated at $8,000,000. Please note that these estimated costs do not contain overheads or tax gross ups. These numbers are subject to change as more detailed options will be evaluated during the facility study.

APPENDIX B.A - Deliverability Test for Network Resource Interconnection Service Resources

1. Overview

Entergy will develop a two-part deliverability test for customers (Interconnection Customers or Network Customers) seeking to qualify a Generator as an NRIS resource: (1) a test of deliverability "from generation", that is out of the Generator to the aggregate load connected to the Entergy Transmission system; and (2) a test of deliverability "to load" associated with sub-zones. This test will identify upgrades that are required to make the resource deliverable and to maintain that deliverability for a five year period.

1.1 The "From Generation" Test for Deliverability

In order for a Generator to be considered deliverable, it must be able to run at its maximum rated output without impairing the capability of the aggregate of previously qualified generating resources (whether qualified at the NRIS or NITS level) in the local area to support load on the system, taking into account potentially constrained transmission elements common to the Generator under test and other adjacent qualified resources. For purposes of this test, the resources displaced in order to determine if the Generator under test can run at maximum rated output should be resources located outside of the local area and having insignificant impact on the results. Existing Long-term Firm PTP Service commitments will also be maintained in this study procedure.

1.2 The "To Load" Test for Deliverability

The Generator under test running at its rated output cannot introduce flows on the system that would adversely affect the ability of the transmission system to serve load reliably in import-constrained sub-zones. Existing Long-term Firm PTP Service commitments will also be maintained in this study procedure.

1.3 Required Upgrades.

Entergy will determine what upgrades, if any, will be required for an NRIS applicant to meet deliverability requirements pursuant to Appendix B-B.

Appendix B.B – NRIS Deliverability Test

Description of Deliverability Test

Each NRIS resource will be tested for deliverability at peak load conditions, and in such a manner that the resources it displaces in the test are ones that could continue to contribute to the resource adequacy of the control area in addition to the studied resources. The study will also determine if a unit applying for NRIS service impairs the reliability of load on the system by reducing the capability of the transmission system to deliver energy to load located in import-constrained sub-zones on the grid. Through the study, any transmission upgrades necessary for the unit to meet these tests will be identified.

Deliverability Test Procedure:

The deliverability test for qualifying a generating unit as a NRIS resource is intended to ensure that 1) the generating resource being studied contributes to the reliability of the system as a whole by being able to, in conjunction with all other Network Resources on the system, deliver energy to the aggregate load on the transmission system, and 2) collectively all load on the system can still be reliably served with the inclusion of the generating resource being studied.

The tests are conducted for “peak” conditions (both a summer peak and a winter peak) for each year of the 5-year planning horizon commencing in the first year the new unit is scheduled to commence operations.

1) Deliverability of Generation

The intent of this test is to determine the deliverability of a NRIS resource to the aggregate load on the system. It is assumed in this test that all units previously qualified as NRIS and NITS resources are deliverable. In evaluating the incremental deliverability of a new resource, a test case is established. In the test case, all existing NRIS and NITS resources are dispatched at an expected level of generation (as modified by the DFAX list units as discussed below). Peak load withdrawals are also modeled as well as net imports and exports. The output from generating resources is then adjusted so as to “balance” overall load and generation. This sets the baseline for the test case in terms of total system injections and withdrawals.

Incremental to this test case, injections from the proposed new generation facility are then included, with reductions in other generation located outside of the local area made to maintain system balance.

Generator deliverability is then tested for each transmission facility. There are two steps to identify the transmission facilities to be studied and the pattern of generation on the system:

1) Identify the transmission facilities for which the generator being studied has a 3% or greater distribution factor.

2) For each such transmission facility, list all existing qualified NRIS and NITS resources having a 3% or greater distribution factor on that facility. This list of units is called the Distribution Factor or DFAX list.

For each transmission facility, the units on the DFAX list with the greatest impact are modeled as operating at 100% of their rated output in the DC load flow until, working down the DFAX list, a 20% probability of all units being available at full output is reached (e.g. for 15 generators with a Forced Outage Rate of 10%, the probability of all 15 being available at 100% of their rated output is 20.6%). Other NRIS and NITS resources on the system are modeled at a level sufficient to serve load and net interchange.

From this new baseline, if the addition of the generator being considered (coupled with the matching generation reduction on the system) results in overloads on a particular transmission facility being examined, then it is not "deliverable" under the test.

2) Deliverability to Load

The Entergy transmission system is divided into a number of import constrained sub-zones for which the import capability and reliability criteria will be examined for the purposes of testing a new NRIS resource. These sub-zones can be characterized as being areas on the Entergy transmission system for which transmission limitations restrict the import of energy necessary to supply load located in the sub-zone.

The transmission limitations will be defined by contingencies and transmission constraints on the system that are known to limit operations in each area, and the sub-zones will be defined by the generation and load busses that are impacted by the contingent transmission lines. These sub-zones may change over time as the topology of the transmission system changes or load grows in particular areas.

An acceptable level of import capability for each sub-zone will have been determined by Entergy Transmission based on their experience and modeling of joint transmission and generating unit contingencies. Typically the acceptable level of transmission import capacity into the sub-zones will be that which is limited by first-contingency conditions

on the transmission system when generating units within the sub-region are experiencing an abnormal level of outages and peak loads.

The "deliverability to load" test compares the available import capability to each sub-zone that is required for the maintaining of reliable service to load within the sub-zone both with and without the new NRIS resource operating at 100% of its rated output. If the new NRIS resource does not reduce the sub-zone import capability so as to reduce the reliability of load within the sub-zone to an unacceptable level, then the deliverability to load test for the unit is satisfied. This test is conducted for a 5-year planning cycle. When the new NRIS resource fails the test, then transmission upgrades will be identified that would allow the NRIS unit to operate without degrading the sub-zone reliability to below an acceptable level.

Other Modeling Assumptions:

1) Modeling of Other Resources

Generating units outside the control of Entergy (including the network resources of others, and generating units in adjacent control areas) shall be modeled assuming "worst case" operation of the units – that is, a pattern of dispatch that reduces the sub-zone import capability, or impact the common limiting flowgates on the system to the greatest extent for the "from generation" deliverability test.

2) Must-run Units

Must-run units in the control area will be modeled as committed and operating at a level consistent with the must-run operating guidelines for the unit.

3) Base-line Transmission Model

The base-line transmission system will include all transmission upgrades approved and committed to by Entergy Transmission over the 5-year planning horizon. Transmission line ratings will be net of TRM and current CBM assumptions will be maintained.