TRANSMISSION LINE & SUBSTATION PROJECTS

COMPANY:ENTERGY SERVICES, INC.

CUSTOMER: PID 226

FACILITIES STUDY

EJO # F4PPMS0236

GENERATION INTERCONNECTION FACILITIES STUDY

PID226

Revision:
5

Rev	Issue Date	Description of Revision	Prepared By	Approved By
A	09/09/09	1st Draft	JWM	CN
B	09/09/09	2nd Draft to JET Members	JWM	CN
0	09/10/09	Approved Issue	JWM	CN
1	09/28/09	TPD Review	RB	BW
2	10/9/09	ICT Review and Classification	BEF	JDH
3A	01/19/10	Additional Item's 7-12 Draft by Project	JWM	CN
3B	02/15/10	Item's 7-12 Approved Issue	JWM	CN
3C	02/16/10	TPD	JRB	BW
3	2/26/10	ICT Review and Upgrade Classification	MEC	JDH
4	03/5/10	Report Edited to Include Stability Study	MEC	JDH
5	3/25/10	Revised and Posted	HDE	JDH

TABLE OF CONTENTS

PROJECT SUMMARY

1.1 Background and Project Need

The purpose of this Facilities Study is to evaluate the impact of uprating the existing generation at Grand Gulf Nuclear by 206MW. The net output at Grand Gulf is presently 1287MW (1157MW EMO designated network resource and 130MW SMEPA designated network resource). After the 206MW uprate, the net output at Grand Gulf will be 1493MW.

PID 226 only requested ERIS. Upgrades were identified for ERIS.

According to the FERC Large Generator Interconnection Agreement (LGIA), a generator interconnection customer is required to be capable of supplying at least 0.33 MVAR for each MW of power injected into the grid, in order to meet the specified 0.95 power factor requirement. When Grand Gulf is serving maximum power at 1503.5MW and 547.25MVAR, the power factor at the generator terminals is 0.940. After accounting for MW and MVAR losses in the customer's 500/20.9kV step-up transformer, the power reaching the POI is approximately 1443MW and 260MVAR, corresponding to a 0.979 power factor. In order to meet the LGIA power factor design criteria, 216MVAR of additional capacitor bank installations and upgrades are required.

Due to the large amount of reactive power support required, it is not feasible to place the capacitor banks at the generator terminal. Consequently, for this particular generator interconnection, it is more advantageous in terms of system reliability for distributed capacitor bank placements at the load centers. The conclusive findings of the attached Stability Analysis demonstrate that PID 226's 206MW uprate would not have any adverse impact on the Entergy transmission grid. The results of the revised stability study (performed as a part of the Facilities Study) with the updated stability data show that the proposed generator uprate from PID 226 was stable, both with and without Power System Stabilizer (PSS).

1.2 Scope Summary

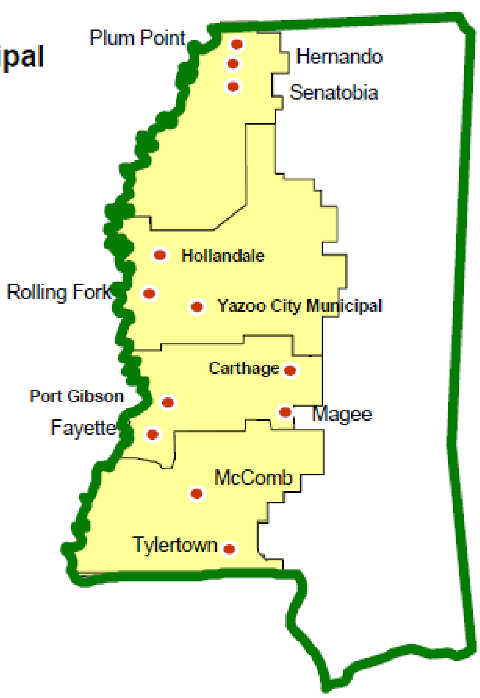
- The overall scope of this project is summarized as follows:
  - Install a 21.6MVAR capacitor bank at Rolling Fork 115kV.
  - Install a 21.6MVAR capacitor bank at Yazoo City Municipal 115kV.
  - Install a 21.6MVAR capacitor bank at Carthage 115kV.
  - Install a 21.6MVAR capacitor bank at Tylertown 115kV.
  - Install a 2nd capacitor at Magee 115kV, sized at 32.4MVAR.
  - Upgrade one of the 21.6MVAR capacitor banks at McComb 115kV to 32.4MVAR.

Revision 1; January 19, 2010 Additional items 7-12

- Install a 21.6MVAR capacitor bank at **Senatobia** 115kV.
- Install a 21.6MVAR capacitor bank at **Plum Point** 115kV.
- Split the existing 32.4MVAR capacitor bank at **Hernando** 115kV into two 21.6MVAR capacitor banks.
- Split the existing 32.4MVAR capacitor bank at **Hollandale** 115kV into two 21.6MVAR capacitor banks.
- Split the existing 32.4MVAR capacitor bank at **Port Gibson** 115kV into two 21.6MVAR capacitor banks.
- Split the existing 32.4MVAR capacitor bank at **Fayette**115kV into two 21.6MVAR capacitor banks.

2010 - 2012 Capacitor Bank Projects Location map
Supporting PID 226 and GGU

Rolling Fork
Yazoo City Municipal
Carthage
Tylertown
Magee
McComb
Senatobia
Plum Point
Hernando
Hollandale
Port Gibson
Fayette



1.3 Cost Summary

- The estimated total cost on projects presently not in construction is **$9,895,877.00.** This cost does not include Tax Gross Up which may apply. This is a good faith 20% estimate based on current conditions and the time frame allowed to complete the study.
- The ICT has assigned **$9,895,877.00** as Supplemental Upgrades based on Attachment "T" of Entergy's ICT (Independent Coordinator of Transmission) filing to the FERC.

1.4 Schedule Summary

Project/Station Description	Total Project	Construction Start	Construction Finish
Item 8 Plum Point 115kV Substation	$914,649.00	August 16,2010	February 07, 2011
Item 9 Hernando 115kV Substation	$1,112,844.00	Sept. 13, 2010	February 28, 2011
Item 7 Senatobia 115kV Substation	$1,023,537.00	October 18,2010	March 21,2011
Item 10 Hollandale 115kV Substation	$1,121,269.00	November 15,,2010	April 11,2011
Rolling Fork 115kV Substation	$652,418.00	January 24, 2011	April 07,2011
Yazoo City Municipal 115kV Sub.	$617,916.00	February 21 ,2011	May 23,2011
Carthage 115kV Substation	$844,708.00	February 07, 2011	June 13,2011
Tylertown 115kV Substation	$900,297.00	March 07,2011	October 14,2011
Item 12 Fayette 115kV Substation	$1,034,502.00	April 18,2011	November 07,2011
Item 11 Port Gibson 115kV Substation	$940,922.00	May 31, 2011	November 30, 2011
McComb 115kV Substation	$75,970.00	August 22, 2011	January 11, 2011
Magee 115kV Substation	$656,843.00	August 22, 2011	December 28, 2011

NOTE: Projects 1-12 In Service Dates are based on a ***preliminary, non-constrained (unbaselined) project schedules***, and include significant schedule assumptions, such as timing of funding authorization(s), outage approvals, ROW/permitting, etc.

Also, the dates above are construction start dates and *not* design package delivery dates. See the Construction area in Blue in the schedule attached in section 9.4

Automatic Generation Control

- Upgrades required by Entergy for AGC service are discussed in Entergy's OASIS posting "Entergy Transmission Guidelines for Automatic Generator Control Applications". See link below:

http://oasis.e-terrasolutions.com/documents/EES/AGC%20Guidelines%20for%20Entergy%20Transmission.pdf

SAFETY REQUIREMENTS

Safety is a priority with Entergy. Safety will be designed into substations and lines. The designs will be done with the utmost safety for personnel in mind for construction, operation, and maintenance of the equipment.

All employees working directly or indirectly for Entergy shall adhere to all rules and regulations outlined within the Entergy Safety manual. Entergy requires safety to be the highest priority for all projects. All Entergy and Contract employees must follow all applicable safe work procedures.

Should the work contained within this Facilities Study be approved, a detailed Safety Plan will be formulated and incorporated within the project plan.

GENERAL ASSUMPTIONS

A common assumption across all projects is that adequate space is available in all substation sites. When necessary work order specific assumptions will be included in the scope of work section below; otherwise

- Upon receipt of formal approval from customer authorizing design and construction, Entergy will prepare a detailed project execution plan with a definitive baselined schedule for each project.
- Where necessary wetland mitigation and SWPPP cost will be included in the work order scope of work.
- All permits will be attainable in a reasonable period.
- Due to timing and/or funding constraints, site visits, surveys, and soil borings were not performed in order to develop this facility study.
- All costs above represent good faith estimates in today's dollars. Price escalation for work in future years has not been included.
- Assumptions to meet a **March 1, 2012** in-service date on all projects is based on internal/external labor resources and funding availability allowing for executions of designs, material ordering and construction resources to be acquired in a timely manner.
- All Class 3 estimates are based on EMCC PERI Guidelines.

SCOPE OF WORK

4.1 Rolling Fork 115kV Substation: Install 21.6MVAR Capacitor Bank

Site Work

No Site Work Required.

Foundations

The following foundations are required. Foundation design will be based on existing foundations.

Install one (1) 115kV 21MVAR Capacitor Bank foundation
Install one (1) 115kV Cap Switcher Foundation
Install one (1) 115kV CE Tower foundation
Install three (3) 115kV Equipment Pedestal foundations

Electrical

Install one (1) fuseless 115 kV 21.6MVAR ungrounded wye capacitor bank. There are two parallel strings in each phase. Six (6) capacitor units in series and each capacitor has six (6) internal sections, giving 36 series sections per string. Each capacitor can has a rating of 600kVAR.

Install one (1) CE switch structure of 16ft.

Install one (1) Southern States Cap Switcher with pre-insertion resistor that includes its support structure (115kV, 1200A continuous rating).
Install one (1) vertical break disconnect switch (mounted on new CE tower).
Install three (3) new CVTs and their support structures between switch and Cap Switcher.

Relay and Settings Work

Capacitor Bank Control:

Install one (1) Capacitor Bank Control Panel The panel will use a SEL-451.
Install three (3) CVT, 115kV
Install one (1) Junction Box, CVT, Termination, Cable
Install one (1) Neutral PT
Install one (1) Neutral PT Junction Box, Termination, Cable
Settings will need to be derived for one capacitor bank control panel consisting of one SEL 451 relay.

Control House Equipment:

Upgrade RTU to MEII - Status cards & Control cards
Install one (1) Orion 5R
Install one(1) GPS SEL2407
One lot of control cable

Communications and SCADA Work

Existing M microprocessor board and Harris protocol - upgrade needed for this.

4.2 Yazoo City Municipal115kV Substation: Install 21.6MVAR Capacitor Bank

Site Work

No Site Work Required.

Foundations

The following foundations are required. Foundation design will be based on existing foundations.

Install six (6) 115kV Bus Support Foundation
Install one (1) 115kV 21MVAR Capacitor Bank foundation
Install one (1) 115kV Cap Switcher Foundation
Install one (1) 115kV CE Tower foundation
Install three (3) 115kV Equipment Pedestal foundations

Electrical

Install one (1) fuseless 115 kV 21.6MVAR ungrounded wye capacitor bank. There are two parallel strings in each phase. Six (6) capacitor units in series and each capacitor has six (6) internal sections, giving 36 series sections per string. Each capacitor can has a rating of 600kVAR.

Install one (1) CE switch structure of 16ft.
Install one (1) Southern States Cap Switcher with pre-insertion resistor that includes its support structure (115kV, 1200A continuous rating).
Install one (1) vertical break disconnect switch (mounted on new CE tower).
Install three (3) new CVTs and their support structures between switch and Cap Switcher.
Install six (6) new bus support structures with insulators.

Relay and Settings Work

Capacitor Bank Control:

Install one (1) Capacitor Bank Control Panel The panel will use a SEL-451.
Install three (3) CVT, 115kV
Install one (1) Junction Box, CVT, Termination, Cable
Install one (1) Neutral PT
Install one (1) Neutral PT Junction Box, Termination, Cable
Settings will need to be derived for one capacitor bank control panel consisting of one SEL 451 relay.

Control House Equipment:

Upgrade RTU - Status cards & Control cards
Install one (1) Orion 5R
Install one (1) GPS SEL2407
One Lot of Control Cable

Communications and SCADA Work

Existing microprocessor board and 8979 protocol – no upgrade at this time needed.

4.3 Carthage 115kV Substation: Install 21.6MVAR Capacitor Bank

Site Work

Significant site work will be required to expand the substation in order to accommodate the new capacitor bank. There is approximately 4' change in elevation in the new portion of the substation. Expand the Northeast corner of the substation by approximately 12,000 sq ft (84' to the east, 55' to the north, and 65' to the south.) The following materials are required to complete the site work:

2000 cu yds of fill
250 cu yds of soil stripping and disposal
1 acre seeded and mulched
110 ft of existing fence removal

358 ft of new fence

Foundations

The following foundations are required. Foundation design will be based on existing foundations.

Install twelve (12) 115kV Bus Support Foundations
Install one (1) 115kV 21MVAR Capacitor Bank foundation
Install one (1) 115kV Cap Switcher Foundation
Install one (1) 115kV CE Tower foundation
Install three (3) 115kV Equipment Pedestal foundations

Electrical

Install one (1) fuseless 115 kV 21.6MVAR ungrounded wye capacitor bank. There are two parallel strings in each phase. Six (6) capacitor units in series and each capacitor has six (6) internal sections, giving 36 series sections per string. Each capacitor has a rating of 600kVAR.

Install one (1) CE switch structure of 16ft.
Install one (1) Southern States Cap Switcher with pre-insertion resistor that includes its support structure (115kV, 1200A continuous rating).
Install one (1) vertical break disconnect switch (mounted on new CE tower).
Install three (3) new CVTs and their support structures between switch and Cap Switcher.
Install twelve (12) new bus support structures with insulators.

Relay and Settings Work

Capacitor Bank Control:

Install one (1) Capacitor Bank Control Panel The panel will use a SEL-451.
Install three (3) CVT, 115kV
Install one (1) Junction Box, CVT, Termination, Cable
Install one (1) Neutral PT
Install one (1) Neutral PT Junction Box, Termination, Cable
Install one (1) Trap – Capbank
Settings will need to be derived for one capacitor bank control panel consisting of one SEL 451 relay.

Control House Equipment:

Upgrade RTU to MEII - Status cards & Control cards
Install one (1) Orion 5R
One Lot of Control Cable

Communications and SCADA Work

Existing M++ microprocessor board and Harris protocol - upgrade needed for this.

4.4 Tylertown 115kV Substation: Install 21.6MVAR Capacitor Bank

Site Work

Significant site work will be required to expand the substation in order to accommodate the new capacitor bank. There is approximately 6' change in elevation in the new portion of the substation. Expand the northern most corner of the substation by 13,000 sq ft (41' to the West, 103' to the North, and 74' to the East.)

The following materials are required to complete the site work:

3500 cu yds of fill
300 cu yds of soil stripping and disposal
1 acre seeded and mulched
106 ft of existing fence removal
394 ft of new fence

Foundations

The following foundations are required. Foundation design will be based on existing foundations.

Install twelve (12) 115kV Bus Support Foundations
Install one (1) 115kV 21MVAR Capacitor Bank foundation
Install one (1) 115kV Cap Switcher Foundation
Install one (1) 115kV CE Tower foundation
Install three (3) 115kV Equipment Pedestal foundations

Electrical

Install one (1) fuseless 115 kV 21.6MVAR ungrounded wye capacitor bank. There are two parallel strings in each phase. Six (6) capacitor units in series and each capacitor has six (6) internal sections, giving 36 series sections per string. Each capacitor can has a rating of 600kVAR.

Install one (1) CE switch structure of 16ft.
Install one (1) Southern States Cap Switcher with pre-insertion resistor that includes its support structure (115kV, 1200A continuous rating).
Install one (1) vertical break disconnect switch (mounted on new CE tower).
Install three (3) new CVTs and their support structures between switch and Cap Switcher.
Install twelve (12) new bus support structures with insulators.

Relay and Settings Work

Capacitor Bank Control:

Install one (1) Capacitor Bank Control Panel The panel will use a SEL-451.

Install three (3) CVT, 115kV.
Install one (1) Junction Box, CVT, Termination, Cable
Install one (1) Neutral PT
Settings will need to be derived for one capacitor bank control panel consisting of one SEL 451 relay.

Control House Equipment:
Upgrade RTU to MEII - Status cards & Control cards
Install one (1) Orion 5R
Install one (1) GPS SEL2407
One Lot of Control Cable

Communications and SCADA Work

Existing M microprocessor board and 8979 protocol - upgrade needed for this.

4.5 Magee 115kV Substation: Install a second 32.4MVAR Capacitor Bank

Site Work

No Site Work Required.

Foundations

The following foundations are required. Foundation design will be based on existing foundations.
Install one (1) 115kV 32.4MVAR Capacitor Bank foundation.
Install one (1) 115kV Cap Switcher Foundation.
Install one (1) 115kV CE Tower foundation.
Install three (3) 115kV Equipment Pedestal foundations.

Electrical

Install one (1) fuseless 115 kV 32.4MVAR ungrounded wye capacitor bank. There are two parallel strings in each phase. Six (6) capacitor units in series and each capacitor has six (6) internal sections, giving 36 series sections per string. Each capacitor can has a rating of 600kVAR.

Install one (1) CE switch structure of 16ft.
Install one (1) Southern States Cap Switcher with pre-insertion resistor that includes its support structure (115kV, 1200A continuous rating).
Install one (1) vertical break disconnect switch (mounted on new CE tower).
Install three (3) new CVTs and their support structures between switch and Cap Switcher.
Install an additional pre-insertion resistor on existing Mark IV.

Relay and Settings Work

Capacitor Bank Control:

Install one (1) Capacitor Bank Control Panel The panel will use a SEL-451.
Install three (3) CVT, 115kV.
Install one (1) Junction Box, CVT, Termination, Cable.
Install one (1) Neutral PT.
Install one (1) Neutral PT Junction Box, Termination, Cable.
Settings will need to be derived for one capacitor bank control panel consisting of one SEL 451 relay.

Control House Equipment:
Upgrade RTU to MEII - Status cards & Control cards.
Install one (1) Orion 5R.
Install one (1) GPS SEL2407.
One Lot of Control Cable.

Communications and SCADA Work

Existing M+ microprocessor board and 8979 protocol - upgrade needed for this.

4.6 McComb 115kV Substation: Upgrade one of the 21.6MVAR capacitor banks to 32.4MVAR

Site Work

No Site Work Required.

Foundations

No Site Work Required.

Electrical

The existing 21.6MVAR capacitor bank will be up graded to 32.4MVAR's by adding an addition 18 cans, rated at 600kVAR each.

Relay and Settings Work

Settings will need to be derived for capacitor bank control panel consisting of one ZIV relay.

4.7 Item 7 - Senatobia 115kV Substation: Install 21.6MVAR Capacitor Bank

Site Work

There are minor elevation changes in the area of expansion. Assume the top 12" of soil will need to be stripped and replaced with fill material. The site work will require the following materials:

500 cu yds of fill dirt
500 cu yds of cut
1 acre of seed and mulch
250 ft of new fence

110 ft of removal of existing fence

Foundation Work

The following foundations will need to be installed totaling 31 cu yards of concrete:

One (1) 3 phase capacitor bank foundation
One (1) 115kV Cap switcher foundation
Nine (9) 115kV Low elevation bus support foundations
One (1) 115kV Low elevation switch support foundation
Three (3) 115kV Tubular CVT support foundations

Install approximately 1600 ft of grounding to expand the station
Install approximately 2180 ft of conduit.
Install one (1) Pull box

Steel and Electrical Work

Capacitor Bank Bay

- Install one (1) Shunt, Fuseless, 115kV; 21.6MVAR Capacitor Bank connected ungrounded wye. This bank will have a rated voltage of 118.47kV. It will consist of six (6) cans in each series section (each capacitor has six (6) internal sections), and two (2) series in parallel per phase, which is a total of 36 series sections per string. Each capacitor unit is rated 11.4kV, 600kvVAR per can.
    - Install one (1) 69kV Neutral PT and junction box (both ordered by relay designer) which will be mounted on the capacitor bank.
- Install three (3) CVT Support Structures
- Install three (3) CVTs (ordered by relay designer) in between the vertical break switch and cap switcher. They will be mounted on CVT Support Structures
- Install one (1) 123kV, 550kV BIL, 650A Southern States Cap Switcher with a 150Ω Pre-Insertion Resistor, which has a Primary Fault Interrupting Current of 40kA.
- Install one (1) "CE" 16' Switch Tower (DWG# SSCETW01)
- Install one (1) 115kV, 2000A Vertical Break Disconnect Switch with a Motor Operator mounted on the "CE" Tower
    - Install nine (9) porcelain insulators (TR#286) on switch
- Install 180' of 336 ACSR (Linnet) for the jumpers to connect above equipment

115kV Bus

- Install nine (9) 13' lally columns to extend the 115kV Operating bus to the north
    - Install nine (9) porcelain insulators mounted on new lally columns

- Install approx. 250’ of 2½” Sch. 40 aluminum to extend the 115kV Operating Bus and approx. 42’ of 1½” Sch. 40 aluminum for the A-Frames
    - To minimize outages, the bus should include splices in between the existing bus and new bus that will be installed.
- Install approx. 250’ of 336 ACSR (Linnet) for bus damping
- Install one (1) yard light

Relay and Settings Work

Capacitor Bank Control:

Install one (1) 48VDC Capacitor Bank Control Panel The panel will use a SEL-451.
Install three (3) CVT, 115kv
Install one (1) Junction Box, CVT, Termination, Cable
Install one (1) Neutral PT
Install one (1) Neutral PT Junction Box, Termination, Cable
Install one (1) Line Trap
Settings will need to be derived for one capacitor bank control panel consisting of one SEL 451 relay.

Control House Equipment:

Upgrade RTU - Status cards & Control cards
Install one (1) Orion.
One Lot of Control Cable

Communications and SCADA Work

This RTU will be upgraded to MEII/8979 this year (Mike Hendrix is doing this project). Sufficient capacity for a typical capacitor bank addition exists.

4.8 Item 8 - Plum Point 115kV Substation: Install 21.6MVAR Capacitor Bank

Site Work

No Site work is required. Small amount of limestone to replace around new foundations:

100 tons of limestone

Foundation Work

The following foundations will need to be installed totaling 31 cu yards of concrete:

One (1) 3 phase capacitor bank foundation
One (1) 115kV Cap switcher foundation
Nine (9) 115kV Low elevation bus support foundations
One (1) 115kV Low elevation switch support foundation
Three (3) 115kV Tubular CVT support foundations

Install approximately 1300 ft of grounding to expand the station
Install approximately 1850 ft of conduit

Install one (1) Pull box

Steel and Electrical Work

Capacitor Bank Bay

- Install one (1) Shunt, Fuseless, 115kV; 21.6MVAR Capacitor Bank connected ungrounded wye. This bank will have a rated voltage of 118.47kV. It will consist of six (6) cans in each series section (each capacitor has six (6) internal sections), and two (2) series in parallel per phase, which is a total of 36 series sections per string. Each capacitor unit is rated 11.4kV, 600kVAR per can.
    - Install one (1) 69kV Neutral PT and junction box (both ordered by relay designer) which will be mounted on the capacitor bank.
- Install three (3) CVT Support Structures.
- Install three (3) CVTs (ordered by relay designer) in between the vertical break switch and cap switcher. They will be mounted on CVT Support Structures.
- Install one (1) 123kV, 550kV BIL, 650A Southern States Cap Switcher with a 150Ω Pre-Insertion Resistor, which has a Primary Fault Interrupting Current of 40kA.
- Install one (1) "CE" 16' Switch Tower (DWG# SSCETW01).
- Install one (1) 115kV, 2000A Vertical Break Disconnect Switch with a Motor Operator mounted on the "CE" Tower.
    - Install nine (9) porcelain insulators (TR#286) on switch
- Install 120' of 336 ACSR (Linnet) for the jumpers to connect above equipment.

115kV Bus

- Install nine (9) 13' lally columns to extend the 115kV Operating bus to the north.
    - Install nine (9) porcelain insulators mounted on new lally columns.
- Install approx. 230' of 2½" Sch. 40 aluminum to extend the 115kV Operating Bus and approx. 42' of 1½" Sch. 40 aluminum for the A-Frames.
    - To minimize outages, the bus should include splices in between the existing bus and new bus that will be installed.
- Install approx. 230' of 336 ACSR (Linnet) for bus damping.
- Install one (1) yard light.

Relay and Settings Work

Capacitor Bank Control:

Install one (1) Capacitor Bank Control Panel. The panel will use a SEL-451.

Install three (3) CVT, 115kv

Install one (1) Junction Box, CVT, Termination, Cable

Install one (1) Neutral PT
Install one (1) Neutral PT Junction Box, Termination, Cable
Settings will need to be derived for one capacitor bank control panel consisting of one SEL 451 relay.

Control House Equipment:
Upgrade RTU - Status cards & Control cards
Install one (1) Orion Comm Pro.
Install one(1) GPS SEL2407
One Lot of Control Cable

Communications and SCADA Work

This RTU will be upgraded to MEII/8979 this year (Mike Hendrix is doing this project). Sufficient capacity for a typical capacitor bank addition exists.

4.9 Item 9 - Hernando 115kV Substation: Split the existing 32.4MVAR bank into two (2) 21.6MVAR Capacitor Banks

Site Work

There is a significant change in elevation of approximately 5' in the area of expansion. Assume 12" of topsoil will be stripped. The following material will be required to complete the site work:
600 cu yds of fill dirt
100 cu yds of cut
1 acre of seed and mulch
190 ft of new fence
110 ft of removal of existing fence

Foundation Work

The following foundations will need to be installed totaling 31 cu yards of concrete:
One (1) 3 phase capacitor bank foundation
One (1) 115kV Cap switcher foundation
Nine (9) 115kV Low elevation bus support foundations
One (1) 115kV Low elevation switch support foundation
Three (3) 115kV Tubular CVT support foundations
Install approximately 1650 ft of grounding to expand the station
Install approximately 2450 ft of conduit
Install one (1) Pull box

Steel and Electrical Work

Existing Capacitor Bank Bay

- The existing bank is a fused 31.5MVAR bank. Each can is rated about 150kVAR. It has five (5) parallel groups with 14 cans each.
    - 150kVAR * 14(cans) * 5(parallel) * 3(phases) = 31.5MVAR

- So we will remove five (5) cans per group to get 20.25MVAR which is 1.35MVAR less than the desired 21.6MVAR.
    - 150kVAR * 9(cans) * 5(parallel) * 3(phases) = 20.25MVAR

<u>New 21.6MVAR Capacitor Bank Bay</u>

- Install one (1) Shunt, Fuseless, 115kV, 21.6MVAR Capacitor Bank connected ungrounded wye. This bank will have a rated voltage of 118.47kV. It will consist of six (6) cans in each series section (each capacitor has six (6) internal sections), and two (2) series in parallel per phase, which is a total of 36 series sections per string. Each capacitor unit is rated 11.4kV, 600kVAR per can.
    - Install one (1) 69kV Neutral PT and junction box (both ordered by relay designer) which will be mounted on the capacitor bank.
- Install three (3) CVT Support Structures
- Install three (3) CVTs (ordered by relay designer) in between the vertical break switch and cap switcher. They will be mounted on CVT Support Structures.
- Install one (1) 123kV, 550kV BIL, 650A Southern States Cap Switcher with a 150Ω Pre-Insertion Resistor, which has a Primary Fault Interrupting Current of 40kA.
- Install one (1) “CE” 16’ Switch Tower (DWG# SSCETW01)
- Install one (1) 115kV, 2000A Vertical Break Disconnect Switch with a Motor Operator mounted on the “CE” Tower.
    - Install nine (9) porcelain insulators (TR#286) on switch
- Install 120’ of 336 ACSR (Linnet) for the jumpers to connect above equipment

<u>115kV Bus</u>

- Install nine (9) 13’ lally columns to extend the 115kV Operating bus to the north
    - Install nine (9) porcelain insulators mounted on new lally columns
- Install approx. 230’ of 2½” Sch. 40 aluminum to extend the 115kV Operating Bus and approx. 42’ of 1½” Sch. 40 aluminum for the A-Frames
    - To minimize outages, the bus should include splices in between the existing bus and new bus that will be installed.
- Install approx. 230’ of 336 ACSR (Linnet) for bus damping
- Install one (1) yard light

Relay and Settings Work

Capacitor Bank Control:

Install one (1) 48VDC OUTDOOR dual Capacitor Bank Control Panel. The panel will use a SEL-451.

Install three (3) CVT, 115kV

Install one (1) Junction Box, CVT, Termination, Cable
Install one (1) Neutral PT
Install one (1) Neutral PT Junction Box, Termination, Cable
Settings will need to be derived for one capacitor bank control panel consisting of one SEL 451 relay.

Control House Equipment:
Upgrade RTU - Status cards & Control cards
Install one (1) Orion Comm Pro
One Lot of Control Cable

Communications and SCADA Work

This RTU will be upgraded to MEII/8979 this year (Mike Hendrix is doing this project). Sufficient capacity for a typical capacitor bank addition exists.

4.10 Item 10 - Hollandale 115kV Substation: Split the existing 32.4MVAR bank into two (2) 21.6MVAR Capacitor Banks

Site Work

Expansion of the substation area won't require much fill as the land looks relatively flat. Assume 12" of topsoil will be stripped. The following materials are required to complete the site work:
200 cu yds of fill dirt
200 cu yds of cut
1 acre of seed and mulch
320 ft of new fence
160 ft of removal of existing fence

Foundation Work

The following foundations will need to be installed totaling 31 cu yards of concrete:
One (1) 3 phase capacitor bank foundation
One (1) 115kV Cap switcher foundation
One (1) 115kV Transformer "A" Tower deadend
One (1) 115kV Low elevation switch support foundation
Three (3) 115kV Tubular CVT support foundations
Install approximately 2000 ft of grounding to expand the station
Install approximately 3600 ft of conduit.
Install two (2) Pull boxes

Steel and Electrical Work

<u>Existing Capacitor Bank Bay</u>

- The existing bank is a General Electric Fuseless 32.4MVAR bank with a rated voltage of 118.47kV. Each can is rated about

600kVAR. It has three (3) parallel groups with six (6) cans each, a total of 54 cans.
  - o 600kVAR * 6(cans) * 3(parallel) * 3(phases) = 32.4MVAR
- So we will remove one (1) series in parallel group (6 cans) per phase to get the desired 21.6MVAR, leaving a total of 36 cans.
  - o 600kV * 6(cans) * 2(parallel) * 3(phases) = 21.6MVAR
- The existing Interrupting Device for the cap bank is an S&C Mark V with no pre-insertion device, so in order to lower the back-to-back switching current transients to levels that are acceptable, a 40mH, 5.5Ω Standard-Duty Pre-Insertion Inductor will need to be installed on this Circuit Switcher.

<u>New 21.6MVAR Capacitor Bank Bay</u>
- Install one (1) Shunt, Fuseless, 115kV, 21.6MVAR Capacitor Bank connected ungrounded wye. This bank will have a rated voltage of 118.47kV. It will consist of six (6) cans in each series section (each capacitor has six (6) internal sections), and two (2) series in parallel per phase, which is a total of 36 series sections per string. Each capacitor unit is rated 11.4kV, 600kVAR per can.
  - o Install one (1) 69kV Neutral PT and junction box (both ordered by relay designer) which will be mounted on the capacitor bank.
- Install three (3) CVT Support Structures
- Install three (3) CVTs (ordered by relay designer) connected to the bus via jumpers. They will be mounted on CVT Support Structures
- Install one (1) 123kV, 550kV BIL, 650A Southern States Cap Switcher with a 150Ω Pre-Insertion Resistor, which has a Primary Fault Interrupting Current of 40kA.
- Install one (1) "CE" 16' Switch Tower (DWG# SSCETW01)
- Install one (1) 115kV, 2000A Vertical Break Disconnect Switch with a Motor Operator mounted on the "CE" Tower
  - o Install nine (9) porcelain insulators (TR#286) on switch
- Install 150' of 336 ACSR (Linnet) for the jumpers to connect above equipment

<u>115kV Bus</u>
- Install one (1) "A" Tower in between the Greenville line coming in and Switch #J0491.
  - o Install six (6) 115kV Suspension Insulators, 3 on each side of the "A" Tower
- Install one (1) 115kV, 2000A Vertical Break, Three Phase Disconnect Switch with a Motor Operator mounted on the "A" Tower.
  - o Install nine (9) porcelain insulators (TR#286) on switch
  - o This switch should also include a LLS Interrupting Device along with a Ground Switch (when ordering this ground

switch, make sure that the hand crank pipe is long enough because the “A” Tower is significantly taller than the “CE” Tower which is typically used as a switch support.)

- Install approx. 300’ of 336 ACSR (Linnet) to extend the bus and tap off of the Greenville line side in order to install the new Cap Bank Bay.
- Install one (1) yard light

Relay and Settings Work

Capacitor Bank Control:

Install two (2) 48VDC OUTDOOR Capacitor Bank Control Panel. The panel will use a SEL-451.
Install three (3) CVT, 115kv
Install one (1) Junction Box, CVT, Termination, Cable
Install one (1) Neutral PT
Install one (1) Neutral PT Junction Box, Termination, Cable
Settings will need to be derived for one capacitor bank control panel consisting of one SEL 451 relay.

Control House Equipment:

Upgrade RTU - Status cards & Control cards
Install one (1) Orion
One Lot of Control Cable

Communications and SCADA Work

This RTU will be upgraded to MEII/8979 this year (Mike Hendrix is doing this project). Sufficient capacity for a typical capacitor bank addition exists.

4.11 Item 11 - Port Gibson 115kV Substation: Split the existing 32.4MVAR bank into two (2) 21.6MVAR Capacitor Banks

Site Work

The land appears relatively flat from the pictures we have available. The expanded area will need to accommodate both capacitor banks. The following material will be required to complete the site work:

250 cu yds of fill dirt
150 cu yds of cut
1 acre seed and mulch
250 ft of new fence
110 ft of removal of existing fence

Foundation Work

The following foundations will need to be installed totaling 31 cu yards of concrete:

One (1) 3 phase capacitor bank foundation
One (1) 115kV Cap switcher foundation

Nine (9) 115kV Low elevation bus support foundations
One (1) 115kV Low elevation switch support foundation
Three (3) 115kV Tubular CVT support foundations

Install approximately 1500 ft of grounding to expand the station
Install approximately 1690 ft of conduit
Install one (1) Pull box

Steel and Electrical Work

Existing Capacitor Bank Bay

- The existing bank is a General Electric Fuseless 32.4MVAR bank with a rated voltage of 118.47kV. Each can is rated about 600kvVAR. It has three (3) parallel groups with six (6) cans each, a total of 54 cans.
    - 600kVAR * 6(cans) * 3(parallel) * 3(phases) = 32.4MVAR
- So we will remove one (1) series in parallel group (6 cans) per phase to get the desired 21.6MVAR, leaving a total of 36 cans.
    - 600kVAR * 6(cans) * 2(parallel) * 3(phases) = 21.6MVAR

New 21.6MVAR Capacitor Bank Bay

- Install one (1) Shunt, Fuseless, 115kV, 21.6MVAR Capacitor Bank connected ungrounded wye. This bank will have a rated voltage of 118.47kV. It will consist of 6 cans in each series section (each capacitor has 6 internal sections), and 2 series in parallel per phase, which is a total of 36 series sections per string. Each capacitor unit is rated 11.4kV, 600kVAR per can.
    - Install one (1) 69kV Neutral PT and junction box (both ordered by relay designer) which will be mounted on the capacitor bank.
- Install three (3) CVT Support Structures
- Install three (3) CVTs (ordered by relay designer) which will be connected to the 115kV Transfer bus. They will be mounted on CVT Support Structures
- Install one (1) 123kV, 550kV BIL, 650A Southern States Cap Switcher with a 150Ω Pre-Insertion Resistor, which has a Primary Fault Interrupting Current of 40kA.
- Install one (1) "CE" 16' Switch Tower (DWG# SSCETW01)
- Install one (1) 115kV, 2000A Vertical Break Disconnect Switch mounted on the "CE" Tower
    - Install nine (9) porcelain insulators (TR#286) on switch
- Install 120' of 336 ACSR (Linnet) for the jumpers to connect above equipment

115kV Bus

- Install nine (9) 13' lally columns to extend the 115kV transfer bus one bay to the north of the existing cap bank bay

- Install nine (9) porcelain insulators mounted on new lally columns
- Install approx. 230’ of 2½” Sch. 40 aluminum to extend the 115kV Transfer Bus and approx. 42’ of 1½” Sch. 40 aluminum for the A-Frames.
  - To minimize outages, the bus should include splices in between the existing bus and new bus that will be installed.
- Install approx. 230’ of 336 ACSR (Linnet) for bus damping
- Install one (1) yard light

Relay and Settings Work

Capacitor Bank Control:

Install one (1) Capacitor Bank Control Panel. The panel will use a SEL-451.
Install three (3) CVT, 115kv
Install one (1) Junction Box, CVT, Termination, Cable
Install one (1) Neutral PT
Install one (1) Neutral PT Junction Box, Termination, Cable
Settings will need to be derived for one capacitor bank control panel consisting of one SEL 451 relay.

Control House Equipment:

Upgrade RTU - Status cards & Control cards
Install one (1) Orion .
One Lot of Control Cable

Contingency – Line traps may be need for this substation – Transfer Trip Comm. to GGN via Baxter Wilson

Communications and SCADA Work

This RTU will be upgraded to MEII/8979 this year (Mike Hendrix is doing this project). Sufficient capacity for a typical capacitor bank addition exists.

4.12 Item 12 - Fayette 115kV Substation: Split the existing 32.4MVAR bank into two (2) 21.6MVAR Capacitor Banks

Site Work

The substation site is large enough to accommodate the new capacitor bank; however, there is a substantial change in elevation of approximately 10 ft inside of the fenced in area. Therefore, although there is significant site work required, no fence lines will need to be removed. The following materials are required to complete the site work:

1000 cu yds of fill dirt
200 cu yds of cut

1 acre of seed and mulch

Foundation Work

The following foundations will need to be installed totaling 31 cu yards of concrete:

One (1) 3 phase capacitor bank foundation
One (1) 115kV Cap switcher foundation
Nine (9) 115kV Low elevation bus support foundations
One (1) 115kV Low elevation switch support foundation
Three (3) 115kV Tubular CVT support foundations

Install approximately 1600 ft of grounding to expand the station
Install approximately 4190 ft of conduit.
Install two (2) Pull boxes

Steel and Electrical Work

Existing Capacitor Bank Bay

- The existing bank is a General Electric Fuseless 32.4MVAR bank with a rated voltage of 118.47kV. Each can is rated about 600kVAR. It has three (3) parallel groups with six (6) cans each, a total of 54 cans.
  - 600kVAR * 6(cans) * 3(parallel) * 3(phases) = 32.4MVAR
- So we will remove one (1) series in parallel group (6 cans) per phase to get the desired 21.6MVAR, leaving a total of 36 cans.
  - 600kVAR * 6(cans) * 2(parallel) * 3(phases) = 21.6MVAR

New 21.6MVAR Capacitor Bank Bay

- Install one (1) Shunt, Fuseless, 115kV, 21.6MVAR Capacitor Bank connected ungrounded wye. This bank will have a rated voltage of 118.47kV. It will consist of six (6) cans in each series section (each capacitor has six (6) internal sections), and two (2) series in parallel per phase, which is a total of 36 series sections per string. Each capacitor unit is rated 11.4kV, 600kVAR per can.
  - Install one (1) 69kV Neutral PT and junction box (both ordered by relay designer) which will be mounted on the capacitor bank.
- Install three (3) CVT Support Structures
- Install three (3) CVTs (ordered by relay designer) in between the vertical break switch and the cap switcher. They will be mounted on CVT Support Structures
- Install one (1) 123kV, 550kV BIL, 650A Southern States Cap Switcher with a 150Ω Pre-Insertion Resistor, which has a Primary Fault Interrupting Current of 40kA.
- Install one (1) "CE" 16' Switch Tower (DWG# SSCETW01)
- Install one (1) 115kV, 2000A Vertical Break Disconnect Switch with a Motor Operator mounted on the "CE" Tower
  - Install nine (9) porcelain insulators (TR#286) on switch

- Install 120' of 336 ACSR (Linnet) for the jumpers to connect above equipment

<u>115kV Bus</u>

- Install nine (9) 13' lally columns to extend the 115kV Operating bus to the south west
  - Install nine (9) porcelain insulators mounted on new lally columns
- Install approx. 230' of 2½" Sch. 40 aluminum to extend the 115kV Operating Bus and approx. 42' of 1½" Sch. 40 aluminum for the A-Frames
  - To minimize outages, the bus should include splices in between the existing bus and new bus that will be installed.
- Install approx. 230' of 336 ACSR (Linnet) for bus damping
- Install one (1) yard light

Relay and Settings Work

Capacitor Bank Control:

Install one (1) 48VDC OUTDOOR Capacitor Bank Control Panel. The panel will use a SEL-451.
Install three (3) CVT, 115kv
Install one (1) Junction Box, CVT, Termination, Cable
Install one (1) Neutral PT
Install one (1) Neutral PT Junction Box, Termination, Cable
Settings will need to be derived for one capacitor bank control panel consisting of one SEL 451 relay.

Control House Equipment:

Upgrade RTU - Status cards & Control cards
One Lot of Control Cable

Communications and SCADA Work

This RTU will be upgraded to MEII/8979 this year (Mike Hendrix is doing this project). Sufficient capacity for a typical capacitor bank addition exists.

COST

The ICT has reviewed and determined whether each required upgrade will be considered a Base Plan Upgrade or a Supplemental Upgrade. For more information on cost responsibility for Base Plan and Supplemental Upgrades, see Attachment T to Entergy's OATT.

The costs shown in the table include overheads and AFUDC, but do not include tax gross up. Entergy incurs a tax liability proportional to the amount of customer contributions. In addition to proposed project costs, the customer may be charged a "Tax gross-up" (TGU) at applicable rates. Rates are subject to change. TGU is not included in any of the estimates.

Cost Analysis

Project/Station Description	Base Plan	Supplemental	Total Project	Reference
Rolling Fork 115kV Substation		$652,418.00	$652,418.00	4.1
Yazoo City Municipal 115kV Sub.		$617,916.00	$617,916.00	4.2
Carthage 115kV Substation		$844,708.00	$844,708.00	4.3
Tylertown 115kV Substation		$900,297.00	$900,297.00	4.4
Magee 115kV Substation		$656,843.00	$656,843.00	4.5
McComb 115kV Substation		$75,970.00	$75,970.00	4.6
Senatobia 115kV Substation		$1,023,537.00	$1,023,537.00	4.7
Plum Point 115kV Substation		$914,650.00	$914,650.00	4.8
Hernando 115kV Substation		$1,112,844.00	$1,112,844.00	4.9
Hollandale 115kV Substation		$1,121,269.00	$1,121,269.00	4.10
Port Gibson 115kV Substation		$940,923.00	$940,923.00	4.11
Fayette 115kV Substation		$1,034,502.00	$1,034,502.00	4.12
Grand Totals		**$9,895,877.00**	**$9,895,877.00**	

SCHEDULE

A detailed schedule will be prepared subsequent to customer approval to proceed with the project. Based on the Task duration schedules listed below, the overall project in-service date is projected to be **March 1, 2012.** ***Note: see General Assumption in Section 3.*** The projects listed in "RED" below are presently being constructed; the projects in "Black" have estimated dates with schedules subject to change.

Task Name	**Proposed Construction Start Date**	**Proposed ISD (Preliminary, unbaseline)**
Item 8 Plum Point 115kV Substation	August 16,2010	February 07, 2011
Item 9 Hernando 115kV Substation	Sept. 13, 2010	February 28, 2011
Item 7 Senatobia 115kV Substation	October 18,2010	March 21,2011
Item 10 Hollandale 115kV Substation	November 15,,2010	April 11,2011
Rolling Fork 115kV Substation	January 24, 2011	April 07,2011
Yazoo City Municipal 115kV Sub.	February 21 ,2011	May 23,2011
Carthage 115kV Substation	February 07, 2011	June 13,2011
Tylertown 115kV Substation	March 07,2011	October 14,2011
Item 12 Fayette 115kV Substation	April 18,2011	November 07,2011
Item 11 Port Gibson 115kV Substation	May 31, 2011	November 30, 2011
McComb 115kV Substation	August 22, 2011	January 11, 2011
Magee 115kV Substation	August 22, 2011	December 28, 2011

Notes to Duration Schedules:

- All construction work requiring outages will be performed during acceptable periods of system load flow, which most often is the off-peak load season. Line outages will be discussed with the SOC and TOC and the assumption is made that line outages will be executed as planned. However, last minute denial of outages by the SOC/TOC along with resulting schedule delay is possible.
- Substation construction will be coordinated with the transmission line outages when possible.
- Construction resources are available when required.
- Transmission Line and Substation projects will begin subsequent to Definition phase Project Execution Plan.
- In Service Dates are based on a ***preliminary, non-constrained (unbaselined) project schedules***, and state significant schedule assumptions, such as timing of funding authorization(s), outage approvals, ROW/permitting, etc.
- This schedule does not account for adverse weather conditions.

- Schedule durations are high level estimates at this time. A detailed schedule will be prepared upon project approval.

RISK ASSESSMENT

Identify risk events that may impact cost and/or schedule during execution of the project.

Risk	Comment	Impact
Underground site issues (Pipelines, wells, containments)	Unknown underground factors will add mitigation costs and may impact schedule	***
Substation Site will require minimal site work	Site may be in flood plain, wetlands, Soil Contamination	**
Material transportation could affect cost/schedule	Large transformers(other equipment) may require special transport to substation site	**
Material costs steel & Equipment	Rising steel, copper, fuel and other market conditions could greatly affect estimated cost.	****
Storm-water plan implementation	Best guess on SWPPP creation, implementation and monitoring can vary greatly dependant on outcome of environmental study.	**
Weather & Equipment Lead Times (Transformer, Poles)	Unexpected delays on material lead times, unusually inclement weather will impact schedule but might impact AFUDC costs as well.	**
Wetland mitigation	Undetermined until environmental analysis is complete.	***
Outages may not be available	Preliminary schedule only considers general outage constraints. Specific project schedule may be delayed by days, weeks or months dependant on system conditions. Delays of months = increased project costs.	**
Scope based on design assumptions which may change	Varied impact on cost and schedule.	***

*-low impact to cost, ** - moderate impact to cost, ***- high impact to cost, **** - very high impact to cost.

CONFIRMED RESERVATIONS

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

- Confirmed firm transmission reservations were modeled.
- Approved transmission reliability upgrades for 2009 – 2011 were included in the base case. These upgrades can be found at Entergy's OASIS web page, http://oasis.e-terrasolutions.com/OASIS/EES, under ICT Planning Studies and Related Documents.

Prior generator interconnection requests that were included in this study:

PID	Substation	MW	In-Service Date
PID 211	Lewis Creek	570	6/1/2011
PID 216	Wilton 230kV	251	1/1/2010
PID 221	Wolf Creek	875	In-Service
PID 222	Ninemile	570	10/1/2012
PID 223	PID-223 Tap	125	10/1/2010
PID 224	PID-224 Tap	100	12/1/2009
PID 225	Big Cajun 2 Unit 3	13	7/31/2009

Prior transmission service requests that were included in this study:

OASIS #		PSE	MW	Begin	End
1604055		Westar Energy Gen & Mktg	15	6/1/2010	6/1/2015
1615068		NRG Power Marketing	52	1/1/2010	1/1/2011

Pre-888 Transactions

See the following hyperlink for a complete listing of all Pre-888 transactions.

http://oasis.e-terrasolutions.com/documents/EES/Pre-Order888Transactions.xls

ATTACHMENTS

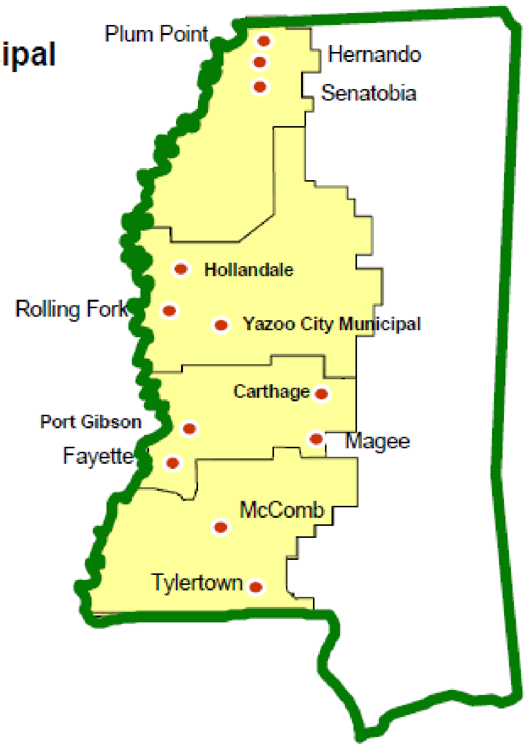
A. Table of Acronyms

ACSR	**Aluminum Conductor Steel Reinforced**
ACSS	**Aluminum Conductor Steel Supported**
ADEQ	**Arkansas Department of Environmental Quality**
AFUDC	**Allowance for Funds Used During Construction**
ATC	**Available Transfer Capability**
EES	**Entergy Control Area**
EHV	**Extra-High Voltage**
ICT	**Independent Coordinator of Transmission**
kV	**Kilo-Volt**
MCM	**(M) Thousand Circular Mils**
MVA	**Mega-Volt Amp**
MW	**Mega-Watt**
NPDES	**National Pollution Discharge Elimination System**
NOI	**Notice of Intent**
OASIS	**Online Access and Same-time Information System**
OATT	**Open Access Transmission Tariff**
OG&E	**Oklahoma Gas & Electric**
POD	**Point of Delivery**
POR	**Point of Receipt**
SES	**Steam Electric Station**
SOC	**System Operations Center**
SHPO	**Arkansas State Historic Preservation Office**
SHV	**Super High Voltage**
SW	**Switch Station**
SWEPCO	**Southwest Electric Power Company**
TOC	**Transmission Operations Center**
WMUC	**City of West Memphis Control Area**

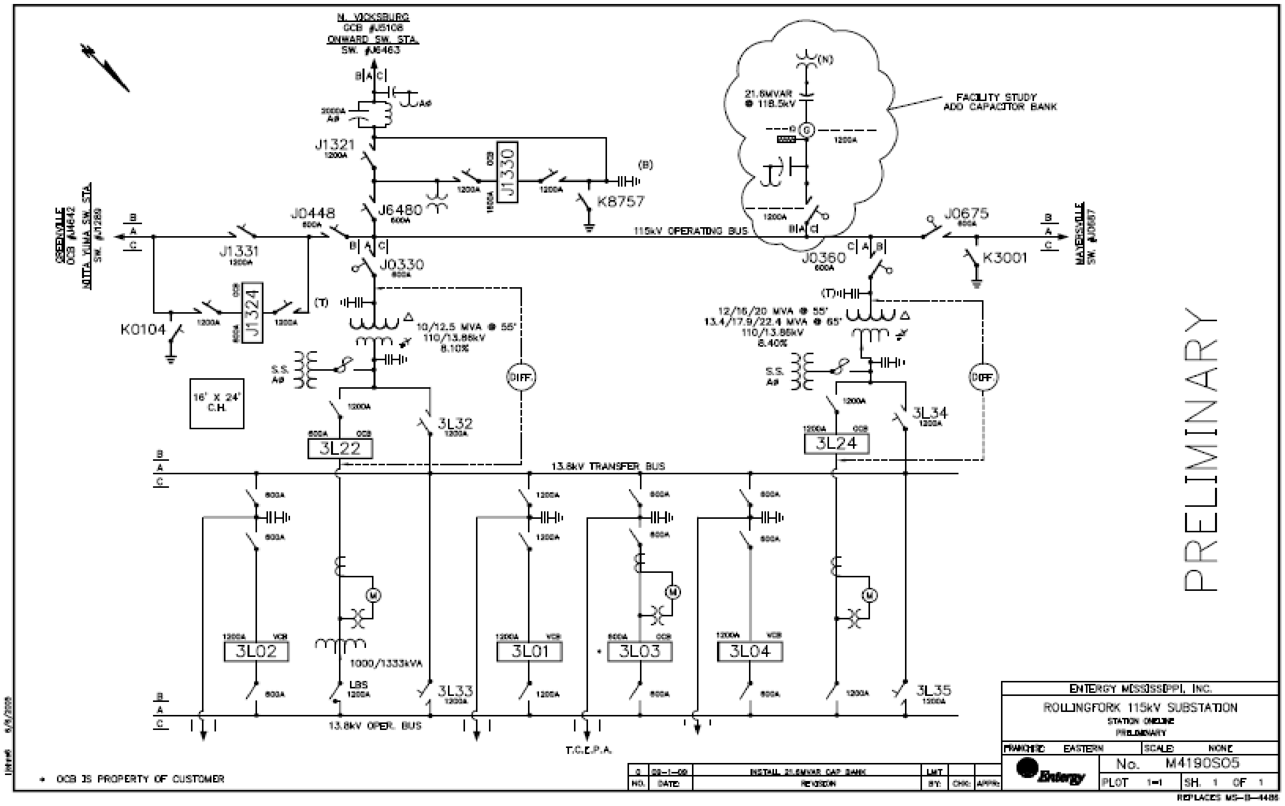
B. Scope Summary Diagram / Area Map

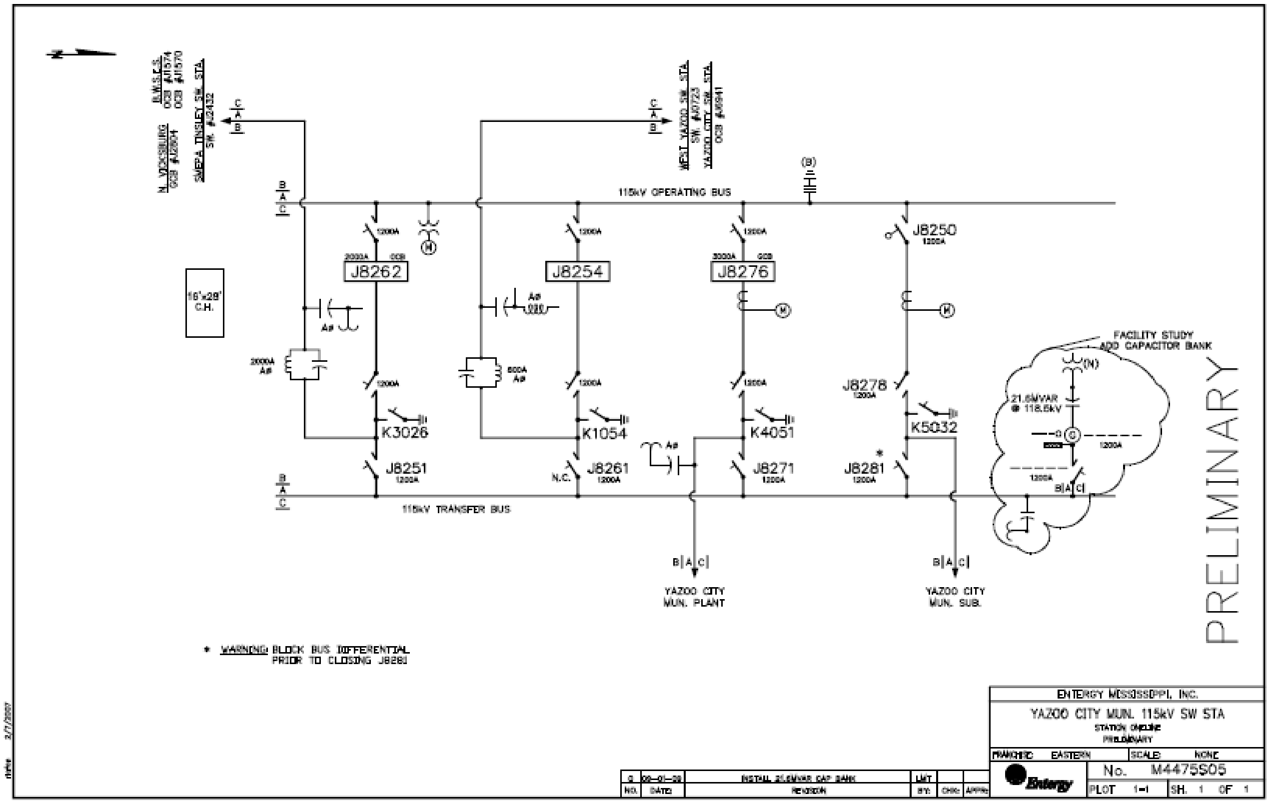
2010 - 2012 Capacitor Bank Projects Location map Supporting PID 226 and GGU

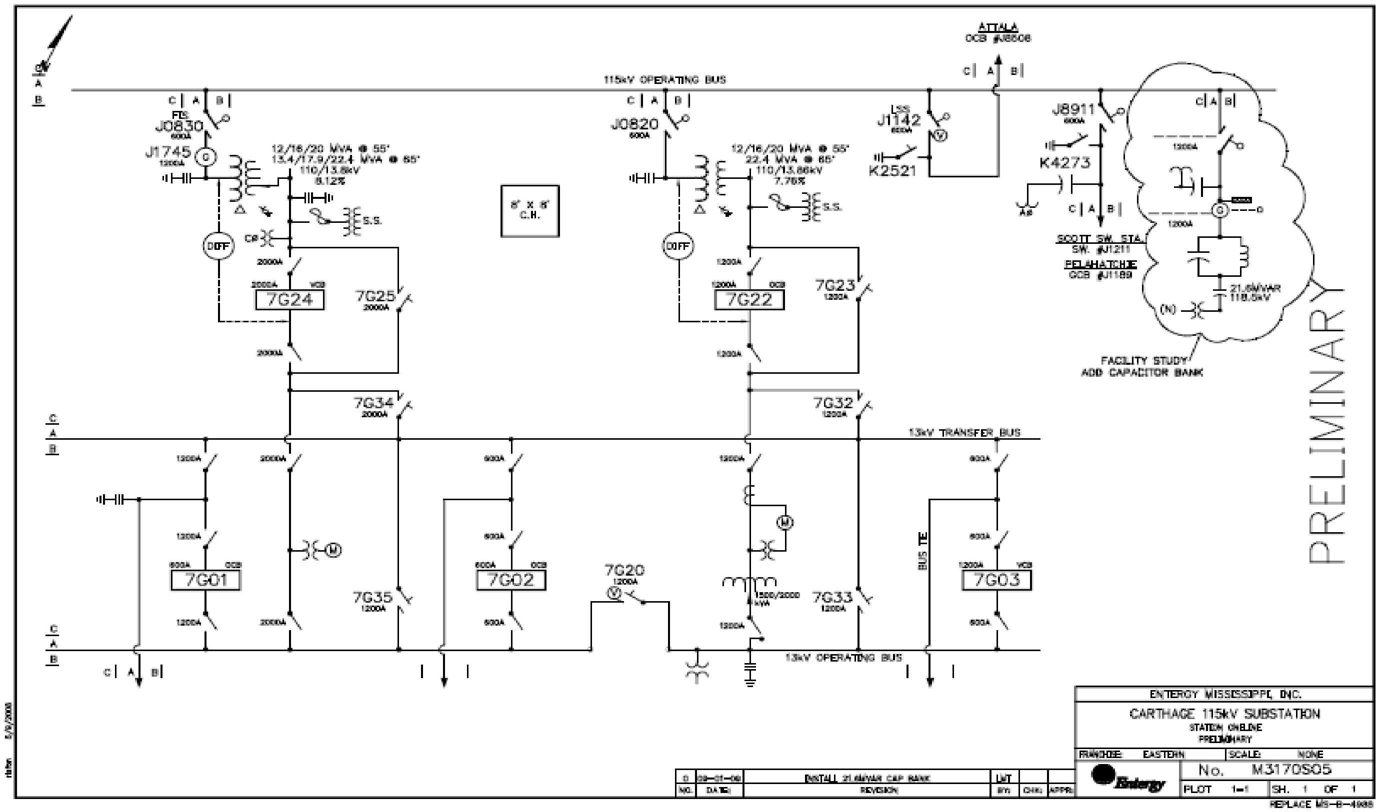
Rolling Fork
Yazoo City Municipal
Carthage
Tylertown
Magee
McComb
Senatobia
Plum Point
Hernando
Hollandale
Port Gibson
Fayette

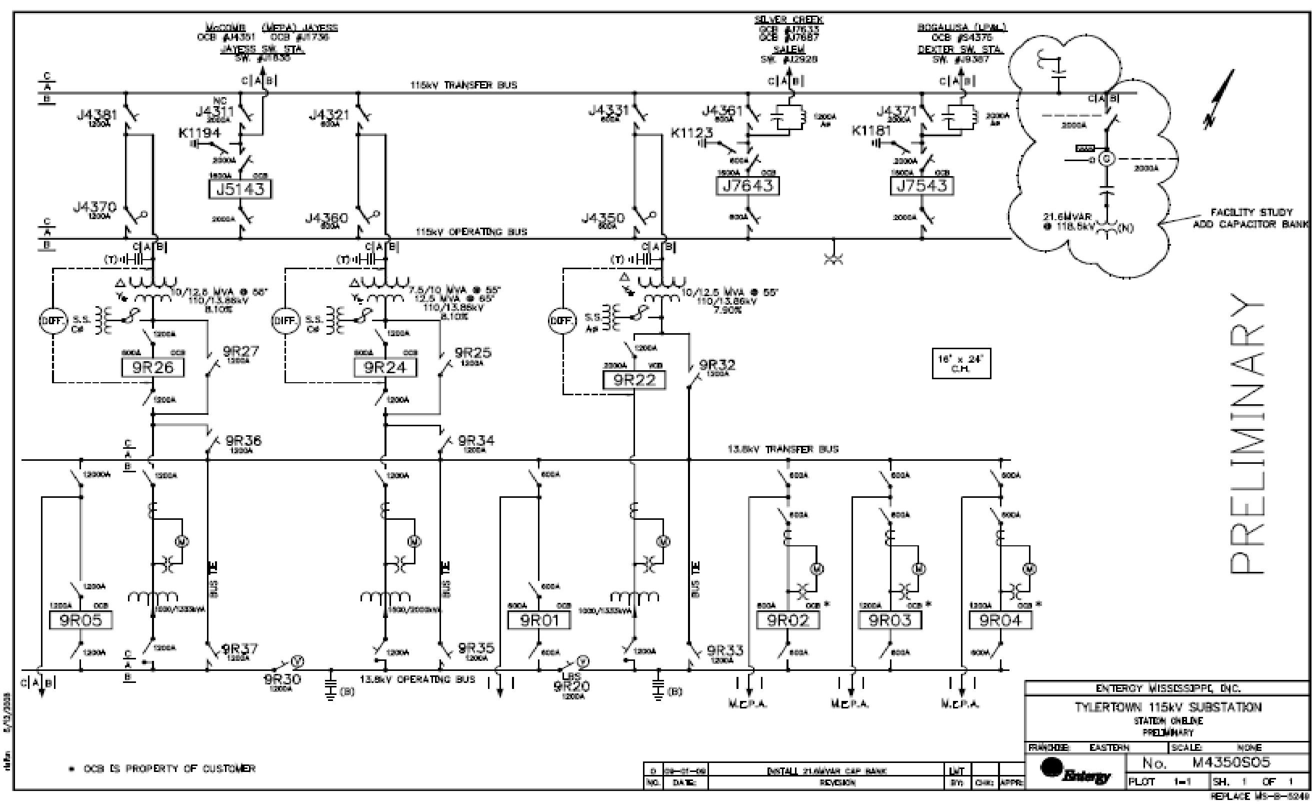


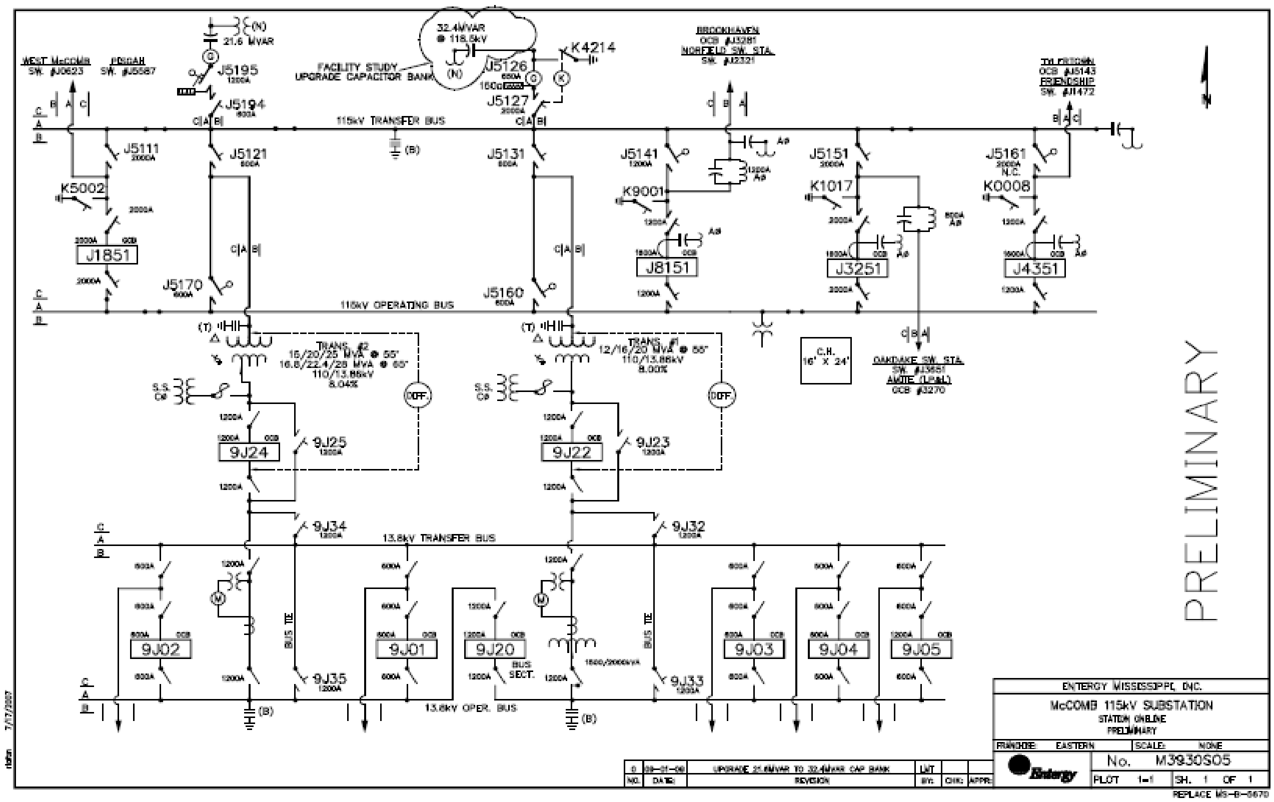
C. One Line Drawings

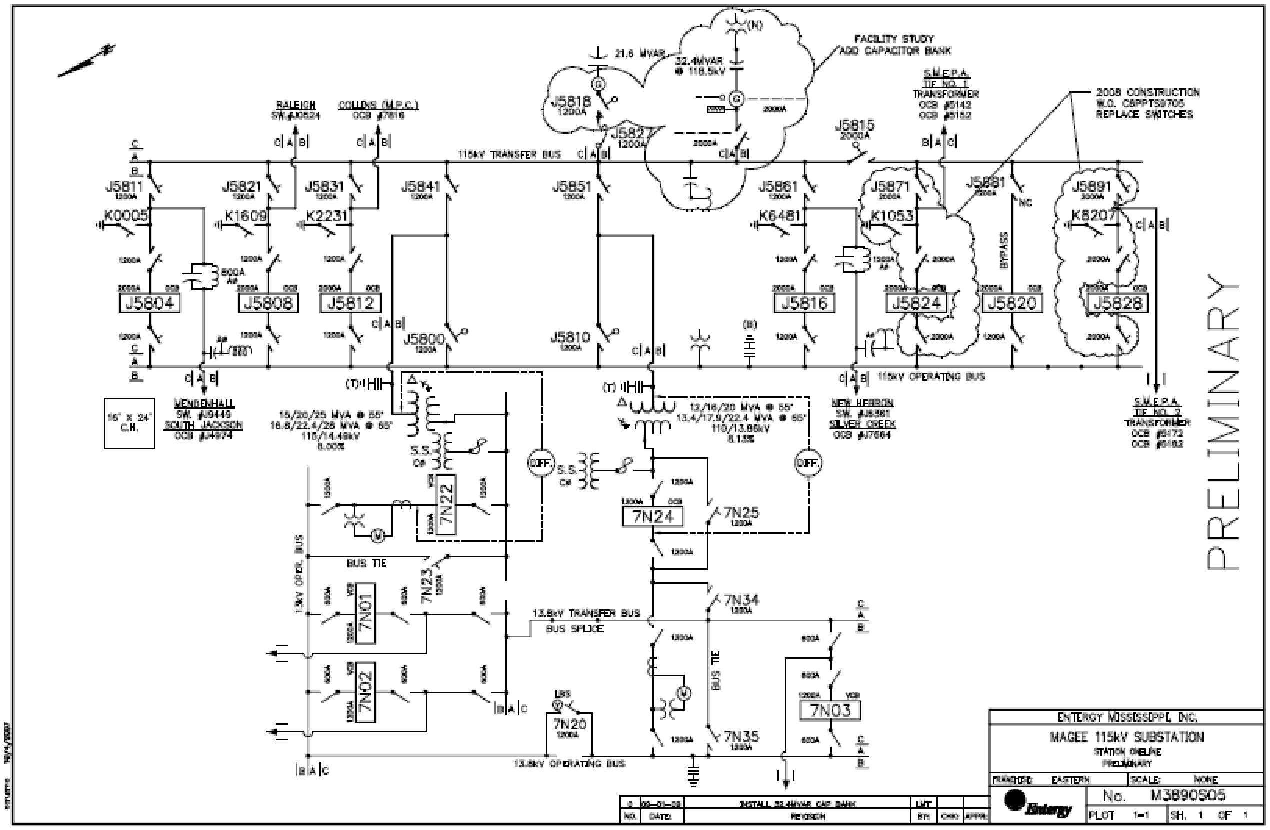



115kV OPERATING BUS
115kV TRANSFER BUS
J8262
J8254
J8276
J8250
J8278
K3026
K1054
K4051
K5032
J8251
J8261
J8271
J8281
N.C.
FACILITY STUDY
ADD CAPACITOR BANK
21.6MVAR
@ 118.6kV
YAZOO CITY
MUN. PLANT
YAZOO CITY
MUN. SUB.
PRELIMINARY
* WARNING: BLOCK BUS DIFFERENTIAL
PRIOR TO CLOSING J8281
ENTERGY MISSISSIPPI, INC.
YAZOO CITY MUN. 115kV SW STA
STATION ONELINE
PRELIMINARY
EASTERN
SCALE
NONE
No. M4475S05
INSTALL 21.6MVAR CAP BANK

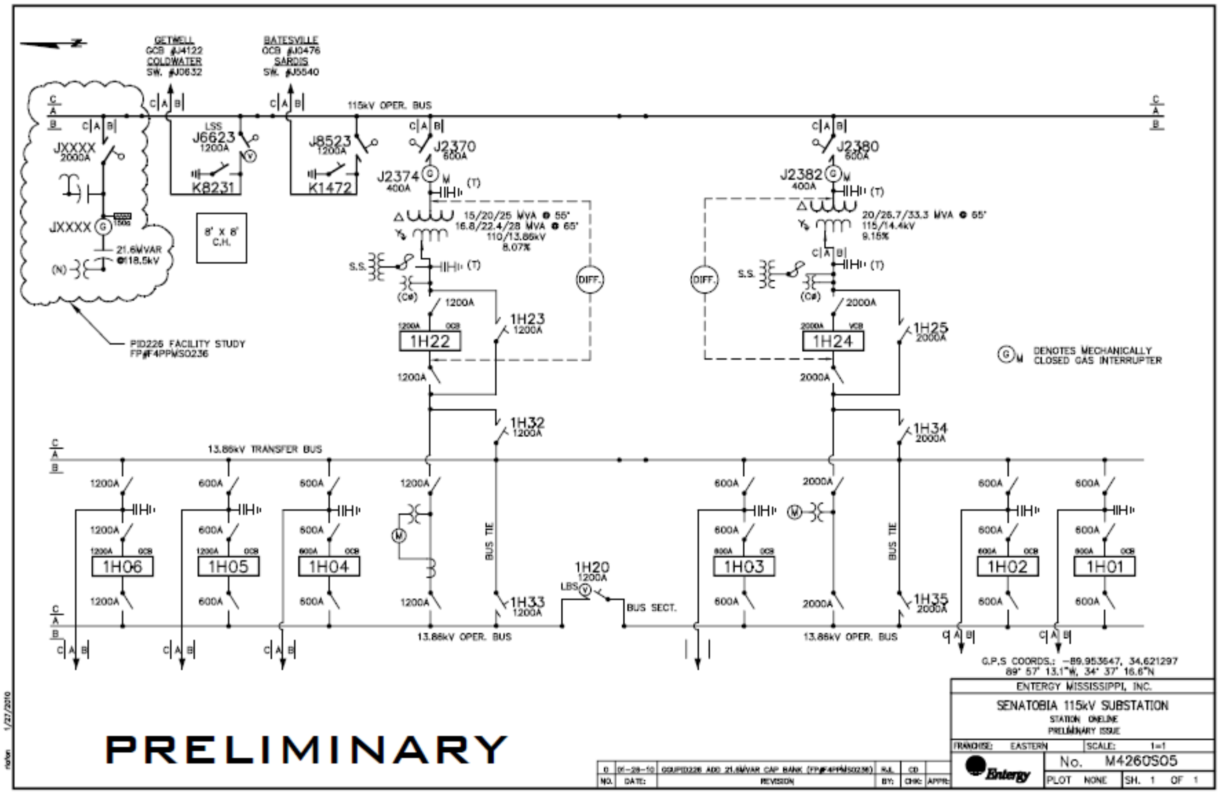

ATTALA
115kV OPERATING BUS
J0830
J1745
12/16/20 MVA @ 55°
13.4/17.9/22.4 MVA @ 65°
110/13.8kV
8.12%
J0820
12/16/20 MVA @ 55°
22.4 MVA @ 65°
110/13.86kV
7.76%
J1142
K2521
J8911
K4273
SCOTT SW. STA.
PELAHATCHIE
21.6MVAR
118.5kV
FACILITY STUDY
ADD CAPACITOR BANK
8' x 8' C.H.
7G24
7G25
7G22
7G23
7G34
7G32
13kV TRANSFER BUS
7G01
7G02
7G20
7G35
7G33
7G03
BUS TIE
13kV OPERATING BUS
PRELIMINARY
ENTERGY MISSISSIPPI, INC.
CARTHAGE 115kV SUBSTATION
STATION ONELINE
PRELIMINARY
INSTALL 21.6MVAR CAP BANK
No. M3170S05

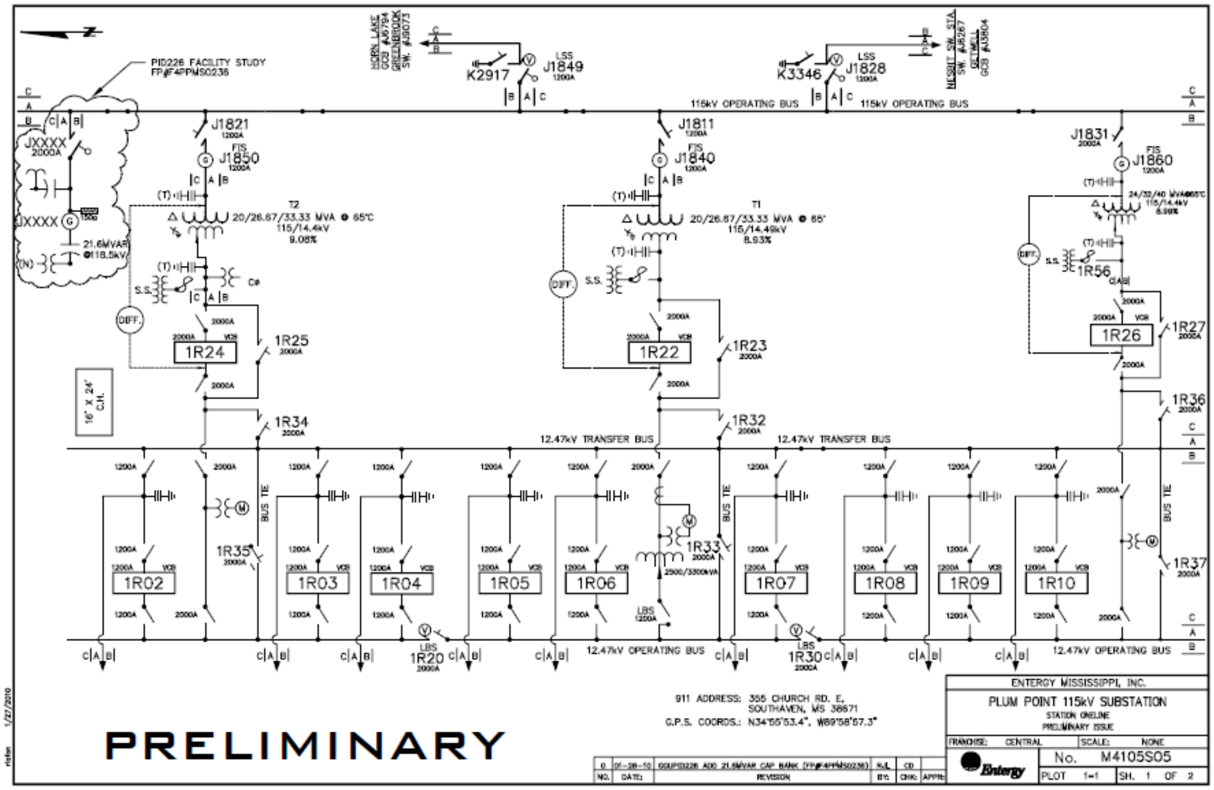

McCOMB
JAYESS SW. STA.
SILVER CREEK
SALEM
BOGALUSA
DEXTER SW. STA.
115kV TRANSFER BUS
J4381
J4311
J4321
J4331
J4361
J4371
K1194
K1123
K1181
J5143
J7643
J7543
J4370
J4360
J4350
115kV OPERATING BUS
21.6MVAR
@ 118.5kV
FACILITY STUDY
ADD CAPACITOR BANK
10/12.5 MVA @ 55°
110/13.86kV
8.10%
7.5/10 MVA @ 55°
12.5 MVA @ 65°
110/13.86kV
8.10%
10/12.5 MVA @ 55°
110/13.86kV
7.90%
9R26
9R27
9R24
9R25
9R22
9R32
16' x 24' C.H.
9R36
9R34
13.8kV TRANSFER BUS
9R05
9R01
9R02
9R03
9R04
9R37
9R30
9R35
9R20
9R33
13.8kV OPERATING BUS
M.E.P.A.
PRELIMINARY
* OCB IS PROPERTY OF CUSTOMER
ENTERGY MISSISSIPPI, INC.
TYLERTOWN 115kV SUBSTATION
STATION ONELINE
PRELIMINARY
INSTALL 21.6MVAR CAP BANK
No. M4350S05

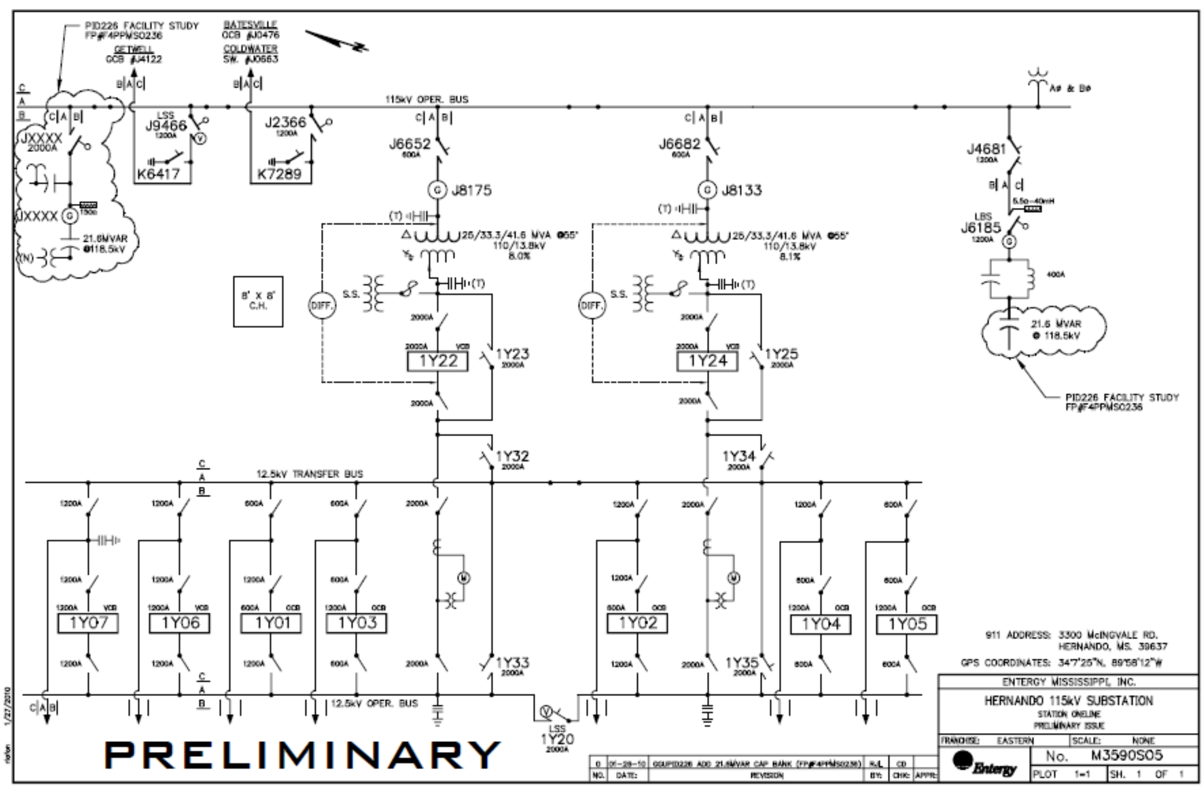

32.4MVAR @ 118.5kV
21.6 MVAR
FACILITY STUDY UPGRADE CAPACITOR BANK
K4214
J5195
J5194
J5126
J5127
115kV TRANSFER BUS
115kV OPERATING BUS
J5111
J5121
J5131
J5141
J5151
J5161
K5002
K9001
K1017
K0008
J1851
J8151
J3251
J4351
J5170
J5160
9J24
9J25
9J22
9J23
9J34
9J32
13.8kV TRANSFER BUS
9J02
9J01
9J20
9J03
9J04
9J05
9J35
9J33
13.8kV OPER. BUS
BUS TIE
BUS SECT.
PRELIMINARY
ENTERGY MISSISSIPPI, INC.
McCOMB 115kV SUBSTATION
M3930S05
UPGRADE 21.6MVAR TO 32.4MVAR CAP BANK

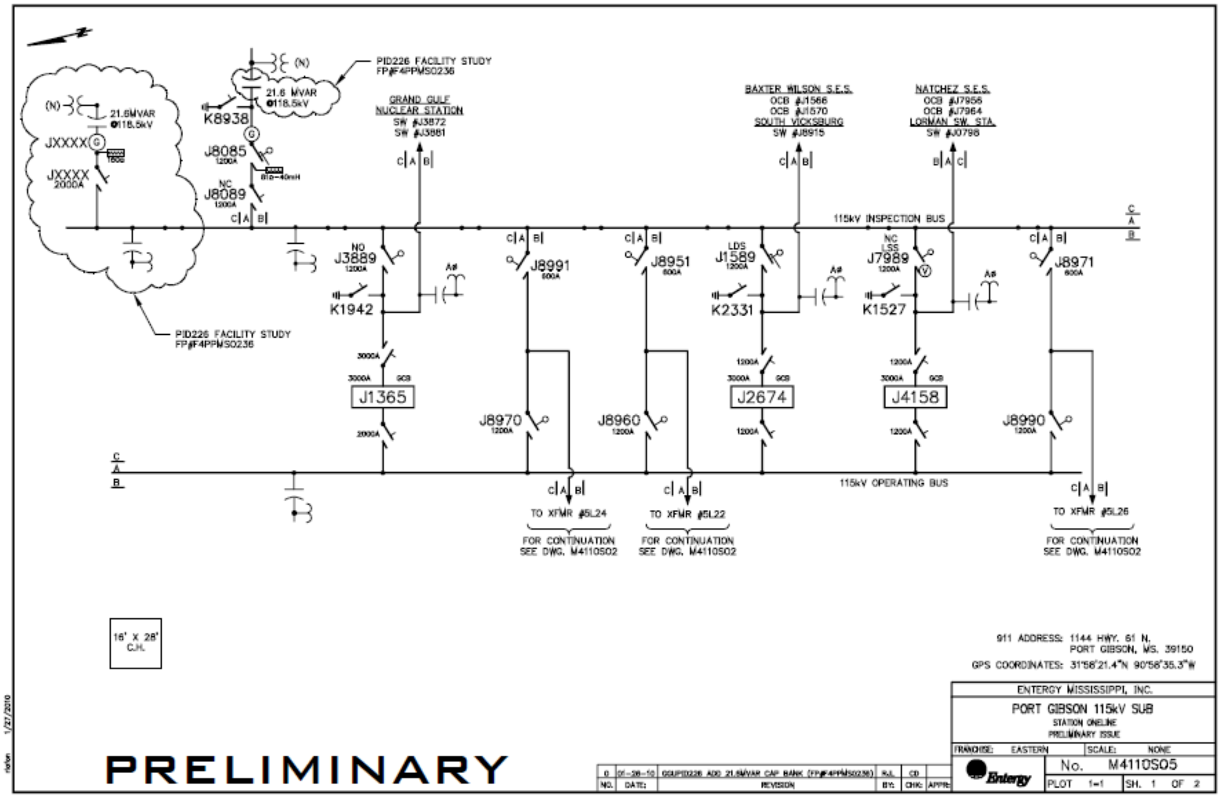


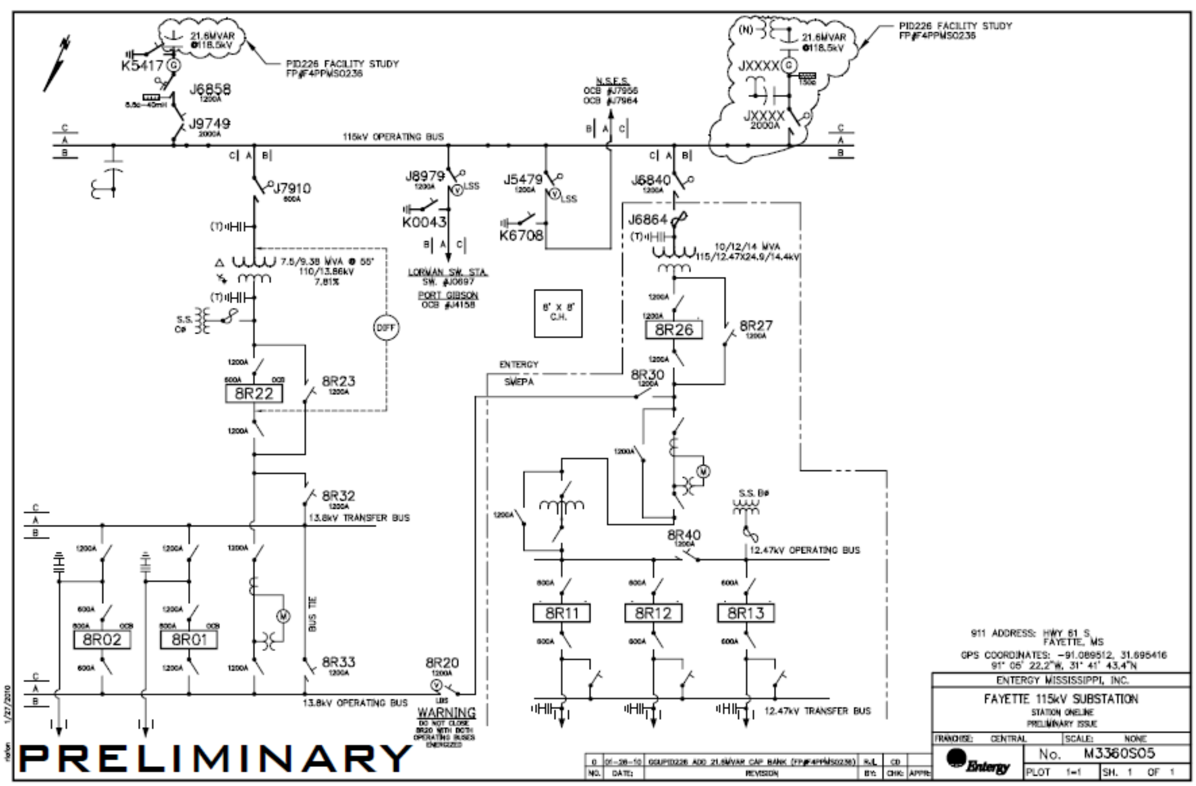
FACILITY STUDY ADD CAPACITOR BANK
21.6 MVAR
32.4MVAR @ 118.5kV
2008 CONSTRUCTION W.O. C5PPTS9705 REPLACE SWITCHES
S.M.E.P.A. TIE NO. 1 TRANSFORMER
RALEIGH
COLLINS (M.P.C.)
115kV TRANSFER BUS
115kV OPERATING BUS
J5811
J5821
J5831
J5841
J5851
J5861
J5871
J5881
J5891
J5818
J5827
J5815
K0005
K1609
K2231
K6481
K1053
K8207
J5804
J5808
J5812
J5816
J5824
J5820
J5828
J5800
J5810
BYPASS
MENDENHALL
SOUTH JACKSON
NEW HEBRON
SILVER CREEK
S.M.E.P.A. TIE NO. 2 TRANSFORMER
15/20/25 MVA @ 55°
12/16/20 MVA @ 55°
DIFF.
7N22
7N24
7N25
7N23
7N01
7N02
7N34
7N35
7N03
7N20
BUS TIE
13.8kV TRANSFER BUS
BUS SPLICE
13.8kV OPERATING BUS
PRELIMINARY
ENTERGY MISSISSIPPI, INC.
MAGEE 115kV SUBSTATION
STATION ONELINE
INSTALL 32.4MVAR CAP BANK
M3890S05

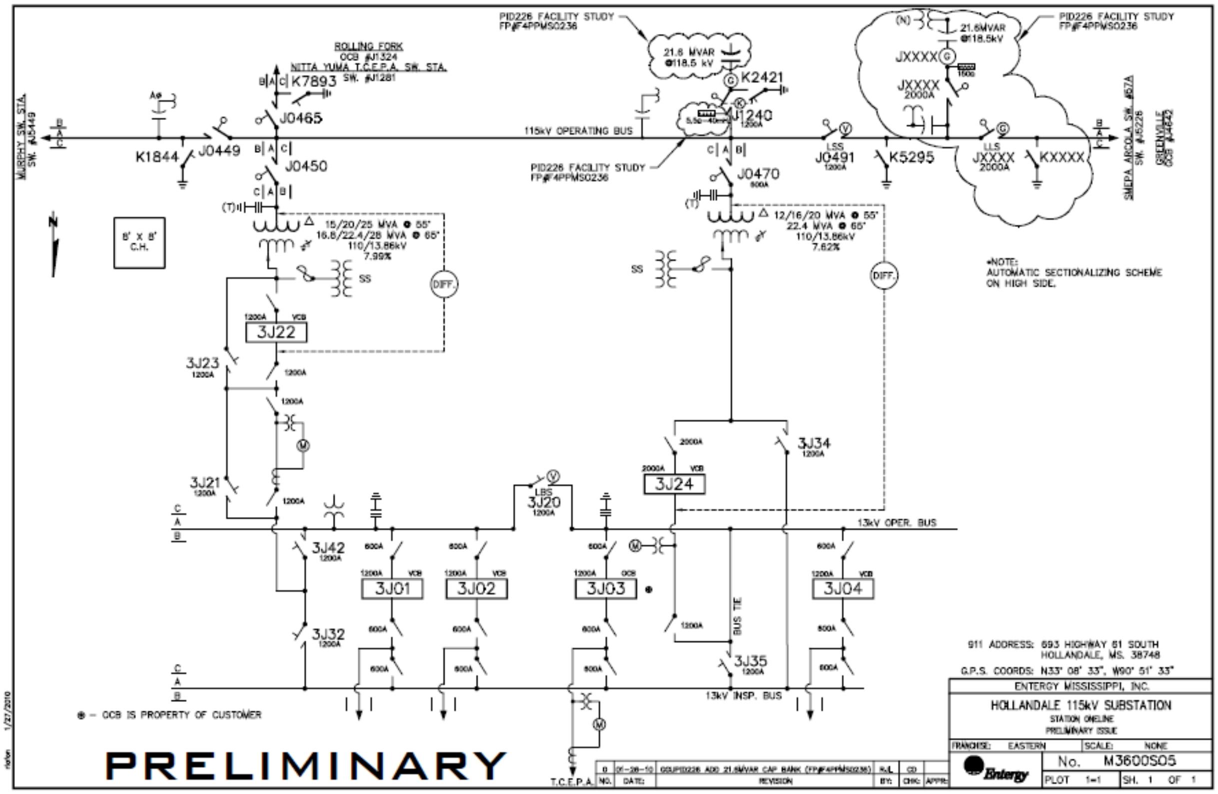

GETWELL
GCB #J4122
COLDWATER
SW. #J0632
BATESVILLE
OCB #J0476
SARDIS
SW. #J5540
115kV OPER. BUS
LSS
J6623
1200A
K8231
J8523
1200A
K1472
J2370
600A
J2374
400A
JXXXX
2000A
JXXXX
21.6MVAR
@118.5kV
8' X 8'
C.H.
15/20/25 MVA @ 55°
16.8/22.4/28 MVA @ 65°
110/13.86kV
8.07%
S.S.
DIFF.
1H22
1H23
1200A
1H32
1200A
PID226 FACILITY STUDY
FP#F4PPMSO236
J2380
600A
J2382
400A
20/26.7/33.3 MVA @ 65°
115/14.4kV
9.15%
1H24
1H25
2000A
1H34
2000A
DENOTES MECHANICALLY CLOSED GAS INTERRUPTER
13.86kV TRANSFER BUS
1H06
1H05
1H04
BUS TIE
1H20
1200A
LBS
BUS SECT.
1H33
1200A
13.86kV OPER. BUS
1H03
1H35
2000A
1H02
1H01
G.P.S COORDS.: -89.953647, 34.621297
89° 57' 13.1"W, 34° 37' 16.6"N
ENTERGY MISSISSIPPI, INC.
SENATOBIA 115kV SUBSTATION
STATION ONELINE
PRELIMINARY ISSUE
FRANCHISE: EASTERN
SCALE: 1=1
No. M4260S05
PLOT NONE
SH. 1 OF 1
Entergy
PRELIMINARY


PID226 FACILITY STUDY
FP#F4PPMS0236
115kV OPERATING BUS
12.47kV TRANSFER BUS
12.47kV OPERATING BUS
911 ADDRESS: 355 CHURCH RD. E, SOUTHAVEN, MS 38671
ENTERGY MISSISSIPPI, INC.
PLUM POINT 115kV SUBSTATION
STATION ONELINE
PRELIMINARY ISSUE
No. M4105S05
PRELIMINARY


PID226 FACILITY STUDY
FP#F4PPMS0236
115kV OPER. BUS
12.5kV TRANSFER BUS
12.5kV OPER. BUS
21.6 MVAR @ 118.5kV
911 ADDRESS: 3300 McINGVALE RD. HERNANDO, MS. 38637
ENTERGY MISSISSIPPI, INC.
HERNANDO 115kV SUBSTATION
STATION ONELINE
PRELIMINARY ISSUE
No. M3590S05
PRELIMINARY


PID226 FACILITY STUDY
FP#F4PPMS0236
21.6 MVAR @118.5kV
21.6MVAR @118.5kV
K8938
JXXXX
JXXXX 2000A
J8085 1200A
J8089 1200A
GRAND GULF NUCLEAR STATION
SW #J3872
SW #J3881
BAXTER WILSON S.E.S.
OCB #J1566
OCB #J1570
SOUTH VICKSBURG
SW #J8915
NATCHEZ S.E.S.
OCB #J7956
OCB #J7964
LORMAN SW. STA.
SW #J0798
115kV INSPECTION BUS
J3889 1200A
K1942
J8991 600A
J8951 600A
J1589 1200A
K2331
J7989 1200A
K1527
J8971 600A
J1365
J2674
J4158
J8970 1200A
J8960 1200A
J8990 1200A
115kV OPERATING BUS
TO XFMR #5L24
TO XFMR #5L22
TO XFMR #5L26
FOR CONTINUATION SEE DWG. M4110S02
16' X 28' C.H.
911 ADDRESS: 1144 HWY. 61 N. PORT GIBSON, MS. 39150
GPS COORDINATES: 31°58'21.4"N 90°58'35.3"W
ENTERGY MISSISSIPPI, INC.
PORT GIBSON 115kV SUB
STATION ONELINE
PRELIMINARY ISSUE
FRANCHISE: EASTERN
SCALE: NONE
No. M4110S05
PLOT 1=1
SH. 1 OF 2
PRELIMINARY
REVISION


21.6MVAR @118.5kV
K5417
PID226 FACILITY STUDY
FP#F4PPMS0236
J6858 1200A
J9749 2000A
115kV OPERATING BUS
N.S.E.S.
OCB #J7956
OCB #J7964
JXXXX
JXXXX 2000A
J7910 600A
J8979 1200A
K0043
J5479 1200A
K6708
J6840 1200A
J6864
7.5/9.38 MVA @ 55° 110/13.86kV 7.81%
10/12/14 MVA 115/12.47X24.9/14.4kV
LORMAN SW. STA. SW. #J0697
PORT GIBSON OCB #J4158
6' X 8' C.H.
8R26
8R27
ENTERGY
SMEPA
8R30
8R22
8R23
8R32
13.8kV TRANSFER BUS
8R40
12.47kV OPERATING BUS
8R11
8R12
8R13
8R02
8R01
BUS TIE
8R33
8R20
13.8kV OPERATING BUS
WARNING
12.47kV TRANSFER BUS
911 ADDRESS: HWY 61 S. FAYETTE, MS
GPS COORDINATES: -91.089512, 31.695416
ENTERGY MISSISSIPPI, INC.
FAYETTE 115kV SUBSTATION
STATION ONELINE
PRELIMINARY ISSUE
FRANCHISE: CENTRAL
SCALE: NONE
No. M3360S05
PLOT 1=1
SH. 1 OF 1
PRELIMINARY
REVISION

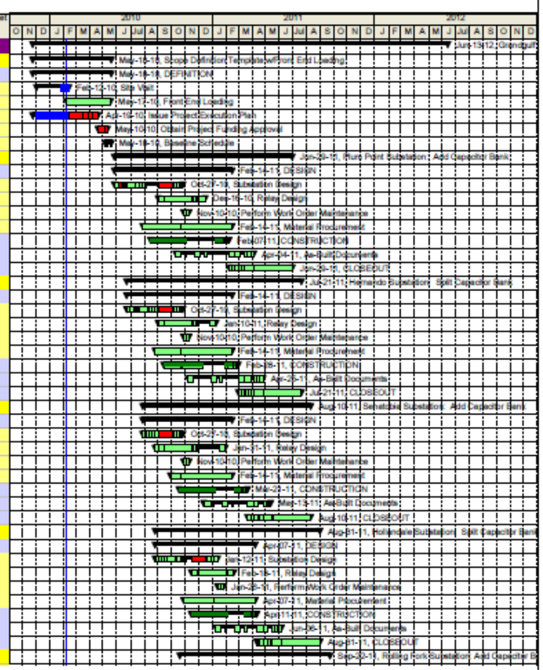


D. Duration Schedule

Grandgulf Uprate PID 226

As of Feb-07-10

Activity ID	EMCC WO/EJO Number	Activity Name	Original Duration	Start	Finish	EMCC Target Start	EMCC Target Finish
		Grandgulf Uprate PID 226	610d	Nov-23-09 A	Jun-13-12	Nov-23-09	Apr-21-10
		Scope Definition Template w/Front End Loading	87d	Nov-23-09 A	May-18-10	Nov-23-09	Apr-21-10
		DEFINITION	87d	Nov-23-09 A	May-18-10	Nov-23-09	Apr-21-10
		Site Visit	51d	Dec-02-09 A	Feb-12-10	Dec-02-09	Jan-18-10
		Front End Loading	71d	Feb-08-10	May-17-10	Dec-02-09	Mar-15-10
		Issue Project Execution Plan	66d	Nov-23-09 A	Apr-19-10	Nov-23-09	Mar-23-10
		Obtain Project Funding Approval	15d	Apr-20-10	May-10-10	Mar-23-10	Apr-13-10
		Baseline Schedule	9d	May-06-10	May-18-10	Apr-08-10	Apr-21-10
		Plum Point Substation: Add Capacitor Bank	277d	May-28-10	Jun-29-11		
		DESIGN	181d	May-28-10	Feb-14-11		
		Substation Design	108d	May-28-10	Oct-27-10		
		Relay Design	74d	Sep-01-10	Dec-16-10		
		Perform Work Order Maintenance	10d	Oct-28-10	Nov-10-10		
		Material Procurement	137d	Jul-29-10	Feb-14-11		
		CONSTRUCTION	120d	Aug-16-10	Feb-07-11		
		As-Built Documents	121d	Oct-11-10	Apr-04-11		
		CLOSEOUT	101d	Feb-08-11	Jun-29-11		
		Hernando Substation: Split Capacitor Bank	273d	Jun-23-10	Jul-21-11		
		DESIGN	162d	Jun-23-10	Feb-14-11		
		Substation Design	89d	Jun-23-10	Oct-27-10		
		Relay Design	88d	Sep-01-10	Jan-10-11		
		Perform Work Order Maintenance	10d	Oct-28-10	Nov-10-10		
		Material Procurement	117d	Aug-26-10	Feb-14-11		
		CONSTRUCTION	116d	Sep-13-10	Feb-28-11		
		As-Built Documents	116d	Nov-08-10	Apr-25-11		
		CLOSEOUT	101d	Mar-01-11	Jul-21-11		
		Senatobia Substation: Add Capacitor Bank	262d	Jul-29-10	Aug-10-11		
		DESIGN	137d	Jul-29-10	Feb-14-11		
		Substation Design	64d	Jul-29-10	Oct-27-10		
		Relay Design	108d	Aug-25-10	Jan-31-11		
		Perform Work Order Maintenance	10d	Oct-28-10	Nov-10-10		
		Material Procurement	93d	Sep-30-10	Feb-14-11		
		CONSTRUCTION	106d	Oct-18-10	Mar-21-11		
		As-Built Documents	106d	Dec-13-10	May-13-11		
		CLOSEOUT	100d	Mar-22-11	Aug-10-11		
		Hollandale Substation: Split Capacitor Bank	258d	Aug-25-10	Aug-31-11		
		DESIGN	156d	Aug-25-10	Apr-07-11		
		Substation Design	96d	Aug-25-10	Jan-12-11		
		Relay Design	64d	Nov-15-10	Feb-18-11		
		Perform Work Order Maintenance	10d	Jan-13-11	Jan-26-11		
		Material Procurement	111d	Oct-28-10	Apr-07-11		
		CONSTRUCTION	101d	Nov-15-10	Apr-11-11		
		As-Built Documents	104d	Jan-10-11	Jun-06-11		
		CLOSEOUT	100d	Apr-12-11	Aug-31-11		
		Rolling Fork Substation: Add Capacitor Bank	234d	Oct-20-10	Sep-22-11		



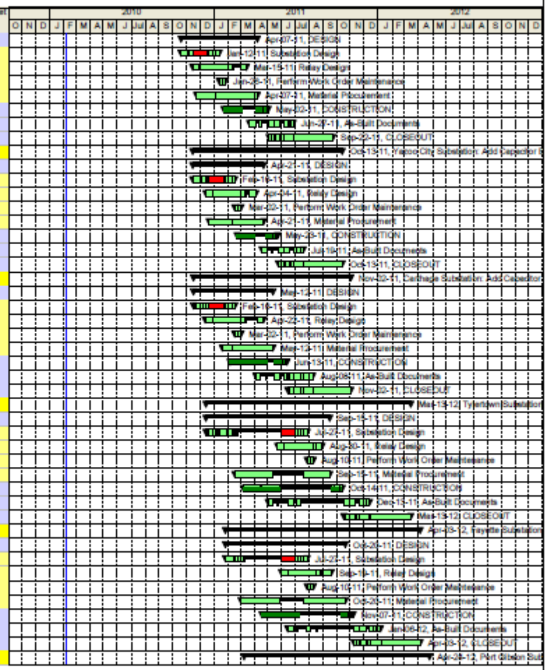
Remaining Level of Effort — Actual Work — Cr...
Actual Level of Effort — Remaining Work ◆ — ◆ MI...

Page 1 of 3

TASK filter: All Activities

Grandgulf Uprate PID 226 As of Feb-07-10

Activity ID	EMCC WO / EJO Number	Activity Name	Original Duration	Start	Finish	EMCC Target Start	EMCC Target Finish
		DESIGN	117d	Oct-20-10	Apr-07-11		
		Substation Design	57d	Oct-20-10	Jan-12-11		
		Relay Design	81d	Nov-15-10	Mar-15-11		
		Perform Work Order Maintenance	10d	Jan-13-11	Jan-26-11		
		Material Procurement	92d	Nov-24-10	Apr-07-11		
		CONSTRUCTION	70d	Jan-24-11	May-02-11		
		As-Built Documents	69d	Mar-22-11	Jun-27-11		
		CLOSEOUT	100d	May-03-11	Sep-22-11		
		Yazoo City Substation: Add Capacitor Bank	231d	Nov-15-10	Oct-13-11		
		DESIGN	109d	Nov-15-10	Apr-21-11		
		Substation Design	63d	Nov-15-10	Feb-16-11		
		Relay Design	75d	Dec-14-10	Apr-04-11		
		Perform Work Order Maintenance	10d	Feb-17-11	Mar-02-11		
		Material Procurement	84d	Dec-21-10	Apr-21-11		
		CONSTRUCTION	66d	Feb-21-11	May-23-11		
		As-Built Documents	65d	Apr-18-11	Jul-19-11		
		CLOSEOUT	100d	May-24-11	Oct-13-11		
		Carthage Substation: Add Capacitor Bank	243d	Nov-17-10	Nov-02-11		
		DESIGN	122d	Nov-17-10	May-12-11		
		Substation Design	61d	Nov-17-10	Feb-16-11		
		Relay Design	90d	Dec-13-10	Apr-22-11		
		Perform Work Order Maintenance	10d	Feb-17-11	Mar-02-11		
		Material Procurement	80d	Jan-20-11	May-12-11		
		CONSTRUCTION	90d	Feb-07-11	Jun-13-11		
		As-Built Documents	89d	Apr-04-11	Aug-08-11		
		CLOSEOUT	100d	Jun-14-11	Nov-02-11		
		Tylertown Substation: Add Capacitor Bank	314d	Dec-14-10	Mar-13-12		
		DESIGN	191d	Dec-14-10	Sep-15-11		
		Substation Design	156d	Dec-14-10	Jul-27-11		
		Relay Design	70d	May-23-11	Aug-30-11		
		Perform Work Order Maintenance	10d	Jul-28-11	Aug-10-11		
		Material Procurement	148d	Feb-17-11	Sep-15-11		
		CONSTRUCTION	157d	Mar-07-11	Oct-14-11		
		As-Built Documents	158d	May-02-11	Dec-13-11		
		CLOSEOUT	102d	Oct-17-11	Mar-13-12		
		Fayette Substation: Split Capacitor Bank	300d	Jan-27-11	Apr-03-12		
		DESIGN	187d	Jan-27-11	Oct-20-11		
		Substation Design	127d	Jan-27-11	Jul-27-11		
		Relay Design	76d	Jun-01-11	Sep-19-11		
		Perform Work Order Maintenance	10d	Jul-28-11	Aug-10-11		
		Material Procurement	163d	Mar-03-11	Oct-20-11		
		CONSTRUCTION	143d	Apr-18-11	Nov-07-11		
		As-Built Documents	143d	Jun-14-11	Jan-06-12		
		CLOSEOUT	101d	Nov-08-11	Apr-03-12		
		Port Gibson Substation: Split Capacitor Bank	286d	Mar-10-11	Apr-24-12		



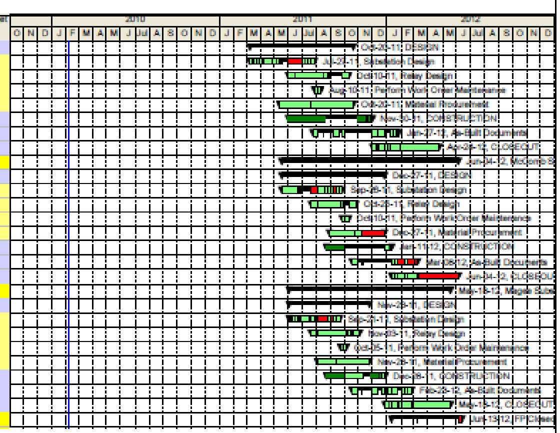
Remaining Level of Effort | Actual Work | Cr... | Actual Level of Effort | Remaining Work ◆ | ◆ Mi...

Page 2 of 3

TASK filter: All Activities

Grandgulf Uprate PID 226 As of Feb-07-10

Activity ID	EMCC WO / EJO Number	Activity Name	Original Duration	Start	Finish	EMCC Target Start	EMCC Target Finish
		DESIGN	158d	Mar-10-11	Oct-20-11		
		Substation Design	98d	Mar-10-11	Jul-27-11		
		Relay Design	91d	Jun-01-11	Oct-10-11		
		Perform Work Order Maintenance	10d	Jul-28-11	Aug-10-11		
		Material Procurement	113d	May-12-11	Oct-20-11		
		CONSTRUCTION	129d	May-31-11	Nov-30-11		
		As-Built Documents	130d	Jul-25-11	Jan-27-12		
		CLOSEOUT	100d	Dec-01-11	Apr-24-12		
		McComb Substation: Upgrade Capacitor Bank	265d	May-18-11	Jun-04-12		
		DESIGN	154d	May-18-11	Dec-27-11		
		Substation Design	91d	May-18-11	Sep-26-11		
		Relay Design	67d	Jul-21-11	Oct-25-11		
		Perform Work Order Maintenance	10d	Sep-27-11	Oct-10-11		
		Material Procurement	83d	Aug-29-11	Dec-27-11		
		CONSTRUCTION	98d	Aug-22-11	Jan-11-12		
		As-Built Documents	99d	Oct-17-11	Mar-08-12		
		CLOSEOUT	101d	Jan-12-12	Jun-04-12		
		Magee Substation: Add Capacitor Bank	245d	Jun-02-11	May-18-12		
		DESIGN	123d	Jun-02-11	Nov-23-11		
		Substation Design	78d	Jun-02-11	Sep-21-11		
		Relay Design	75d	Jul-20-11	Nov-03-11		
		Perform Work Order Maintenance	10d	Sep-22-11	Oct-05-11		
		Material Procurement	79d	Aug-04-11	Nov-23-11		
		CONSTRUCTION	89d	Aug-22-11	Dec-28-11		
		As-Built Documents	89d	Oct-17-11	Feb-23-12		
		CLOSEOUT	100d	Dec-29-11	May-18-12		
		FP Closeout / ISD	108d	Jan-11-12	Jun-13-12		



Remaining Level of Effort | Actual Work | Cr... | Actual Level of Effort | Remaining Work ◆ | ◆ Mi...

Page 3 of 3

TASK filter: All Activities

E. Stability Study Report

POWER SYSTEMS DIVISION
GRID SYSTEMS CONSULTING

STABILITY ANALYSIS FOR FACILITY STUDY OF PID-226

FINAL REPORT

REPORT NO.: 2009-E3350-R1
Issued On: August 19, 2009
Revised on: August 27, 2009
Revised on: February 19, 2010

Prepared for:
Southwest Power Pool, Inc.

ABB Inc.
Power Systems Division
Grid Systems Consulting
940 Main Campus Drive, Suite 300
Raleigh, NC 27606

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

Southwest Power Pool, Inc.	**No.** 2009-E3350-R1	
Facility Study for PID-226	Date: 8/21/2009	# Pages 45

Author(s):	**Reviewed by:**	**Approved by:**
Trinadh Dwibhashyam	Amit Kekare	Willie Wong

Executive Summary

Southwest Power Pool, Inc (SPP) at the request of Entergy Services Inc. has commissioned ABB Inc. to perform a stability analysis for Facility study of PID-226, which is a request for 206 MW uprate of existing G. Gulf Unit #1 in the Entergy transmission system.

A system impact study for the PID-226 has previously been completed. The objective of this study was to supplement the stability analysis performed in the system impact study for PID-226 Project. To that end, selected faults at G. Gulf 500 kV substation were simulated and a Critical Clearing Time Analysis was performed at G. Gulf 500 kV substation. The study was performed on 2012 Summer Peak case, provided by SPP/Entergy.

The system was stable following all simulated normally cleared and stuck-breaker faults. No voltage criteria violation was observed following simulated faults.

The Critical Clearing times at G. Gulf 500 kV substations are within the capabilities of the existing protection systems. The smallest CCT at G. Gulf 500 kV substation was 5 + 15 cycles for a fault involving loss of G. Gulf – B. Wilson 500 kV.

Based on the results of stability analysis it can be concluded that proposed PID-226 project does not adversely impact the stability of the Entergy System in the local area. Also, PID-226 does not adversely impact the Critical Clearing time at G. Gulf 500 kV substations. Hence, no transmission reinforcements and/ or upgrades were identified for the interconnection of the PID-226 project.

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

Rev No.	Revision Description	Date	Authored by	Reviewed by	Approved by
0	Draft Report	8/21/09	Trinadh	A. Kekare	W. Wong
1	Updated per Entergy comments	8/27/09	Trinadh	A. Kekare	W. Wong
2	Updated for Ray Braswell 500 kV fault results	02/19/10	Trinadh	A. Kekare	W. Wong
DISTRIBUTION: Daniel Epperson – Southwest Power Pool, Inc. Brad Finkbeiner – Southwest Power Pool, Inc. Mukund Chander – Entergy Services Inc.					

TABLE OF CONTENTS

1 INTRODUCTION

Southwest Power Pool, Inc. (SPP) at the request of Entergy Services Inc. has commissioned ABB Inc. to perform a stability analysis for Facility Study of PID-226, which is a request for 206 MW uprate of the existing G. Gulf Unit in the Entergy transmission system.

A system impact study[1] for the PID-226 has previously been completed. The objective of this study was to supplement the stability analysis performed in the system impact study for PID-226 Project. The study was performed on 2012 Summer Peak case, provided by Entergy. Figure 1-1 shows the location of the G. Gulf Unit with proposed 206 MW increase of generation.

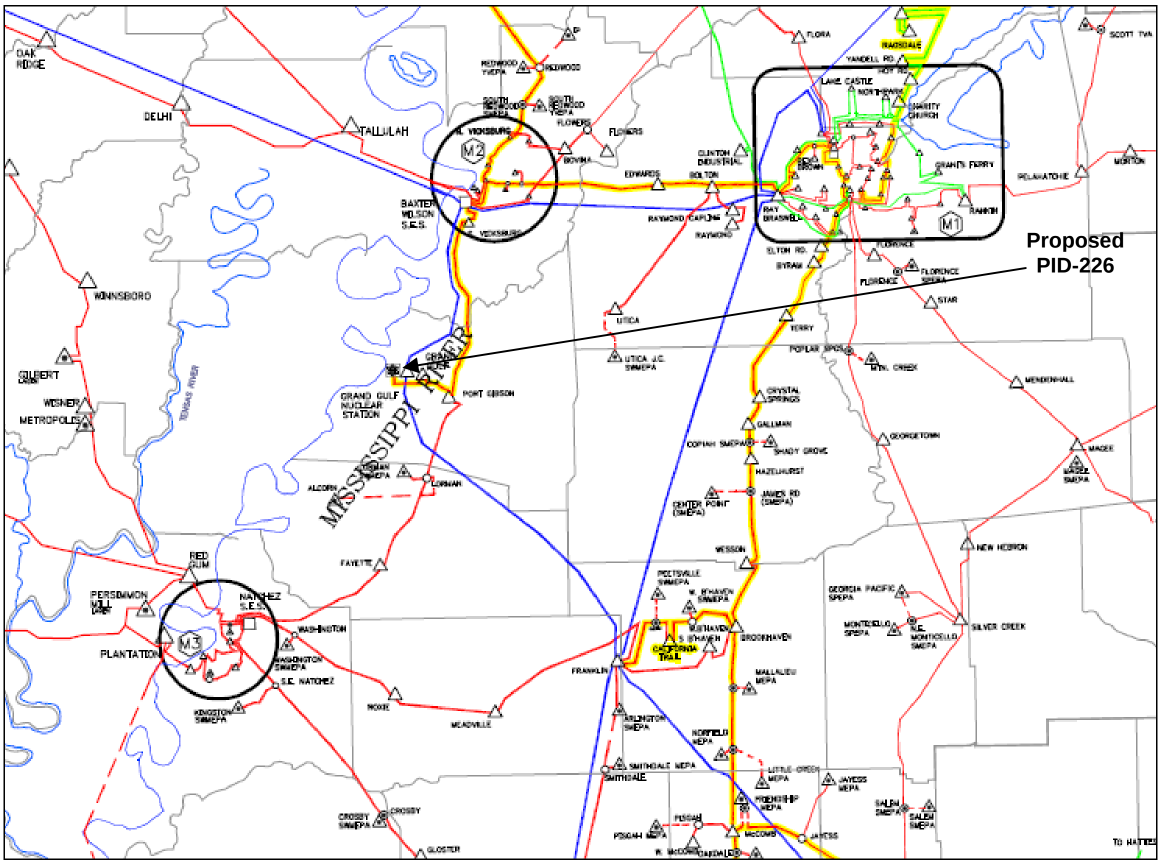


Figure 1-1 PID 226 Project location

[1] "Stability Analysis for PID-226 System Impact study", March 30, 2009

2 STABILITY ANALYSIS

2.1 STABILITY ANALYSIS METHODOLOGY

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

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

Stability analysis was performed using Siemens-PTI's PSS/E^{TM} dynamics program V30.3.2. Three-phase and single-phase line faults were simulated for the specified duration and synchronous machine rotor angles and wind turbine generator speeds were monitored to check whether synchronism is maintained following fault removal.

Based on the Entergy study criteria, three-phase faults with normal clearing and delayed clearing were simulated.

Stability analysis was performed using the PSS/E dynamics program, which only simulates the positive sequence network. Unbalanced faults involve the positive, negative, and zero sequence networks. For unbalanced faults, the equivalent fault admittance must be inserted in the PSS/E positive sequence model between the faulted bus and ground to simulate the effect of the negative and zero sequence networks. For a single-line-to-ground (SLG) fault, the fault admittance equals the inverse of the sum of the positive, negative and zero sequence Thevenin impedances at the faulted bus. Since PSS/E inherently models the positive sequence fault impedance, the sum of the negative and zero sequence Thevenin impedances needs to be added and entered as the fault impedance at the faulted bus.

For three-phase faults, a fault admittance of –j2E9 is used (essentially infinite admittance or zero impedance). For the single phase stuck breaker faults, the fault admittances considered are mentioned in Table 2-4.

Transient Voltage Criteria

In addition to criteria for the stability of the machines, Entergy has evaluation criteria for the transient voltage dip as follows:

- 3-phase fault or single-line-ground fault with normal clearing resulting in the loss of a single component (generator, transmission circuit or transformer) or a loss of a single component without fault:
  Not to exceed 20% for more than 20 cycles at any bus
  Not to exceed 25% at any load bus
  Not to exceed 30% at any non-load bus

- 3-phase faults with normal clearing resulting in the loss of two or more components (generator, transmission circuit or transformer), and SLG fault with delayed clearing resulting in the loss of one or more components:

Not to exceed 20% for more than 40 cycles at any bus
Not to exceed 30% at any bus

The duration of the transient voltage dip excludes the duration of the fault. The transient voltage dip criteria will not be applied to three-phase faults followed by stuck breaker conditions unless the determined impact is extremely widespread.

The voltages at all local buses (above 115 kV) were monitored during each of the fault cases as appropriate.

As there is no specific voltage dip criteria for three-phase stuck breaker faults, the results of these faults were compared with the most stringent voltage dip criteria of - not to exceed 20 % for more than 20 cycles.

Critical Clearing Time (CCT) Analysis

An evaluation of the critical clearing times was carried out for faults on lines and transformers in the G. Gulf 500 kV substation

Critical Clearing Time assessment was performed on 2012 summer peak system conditions.

Critical Clearing Time (CCT) was calculated for a three-phase stuck-breaker fault on each branch connected to G. Gulf 500 kV substation. CCT is defined as the longest fault clearing time for which stability is maintained.

Independent pole operation (IPO) was assumed for breakers in both switchyards, with breaker failure occurring on only a single phase. This results in a three-phase fault becoming a single-phase fault at the normal clearing time. The single phase fault is then cleared by backup protection.

The Normal Clearing Time was kept equal to the normal value (5 cycles on 500 kV and 6 cycles on 230 kV) and the backup clearing time was varied to find the CCT. All machines in the Entergy system were monitored for stability.

2.2 STUDY MODEL DEVELOPMENT

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

Power Flow Case

A Powerflow case "EN12S08_Final_U2_With Upgrades_unconv.sav" representing the 2012 Summer Peak conditions was provided by SPP/ Entergy.

Two prior-queued projects, PID-223 and PID-224, were added to the base case. Thus a pre-project powerflow case was established and named as 'PRE-PID-226.sav'.

The proposed PID-226 project is a 206 MW uprate at G. Gulf Unit. The additional 206 MW was dispatched against the White Bluff Unit #1. Table 2-1 summarizes the dispatch. Thus a post-project power flow case with PID-226 was established and named as 'POST-PID-226.sav'.

Table 2-1 PID-226 project details

System condition	MW	Point of Interconnection	Sink
2012 Summer Peak	206	G. Gulf (#336821)	White Bluff Unit 1 (#337652)

Figure 2-1 shows the PSS/E one-line diagram for the local area WITH the PID-226 project, for 2012 Summer Peak system conditions.

Stability Database

A base case stability database was provided by SPP/Entergy in a PSSE *.dyr file format ('red11S_newnum.dyr').

To create a dynamic database (a snapshot file) for PRE-PID-226 powerflow case, stability data for PID-223 and PID-224 and the dynamic data in 'dystop.dyr' was appended to the base case stability database.

After the proposed uprate of the G. Gulf unit the total MW output of the plant will be 1544 MW, higher than the existing maximum limit (0.90 p.u. on 1600 MVA) on the Governor. For the stability analysis purpose, to avoid the initial condition errors, the limit was changed from 0.90 p.u to 0.97 p.u. on 1600 MVA base. Given the large system under consideration impact of such assumption will not be significant. The pre-project stability database was updated to create dynamic database for Post-PID-226 powerflow case.

The data provided at the Interconnection Request for PID-226 is included in Appendix A. The PSS/E power flow and stability data for PID-226, used for this study, are included in Appendix B.

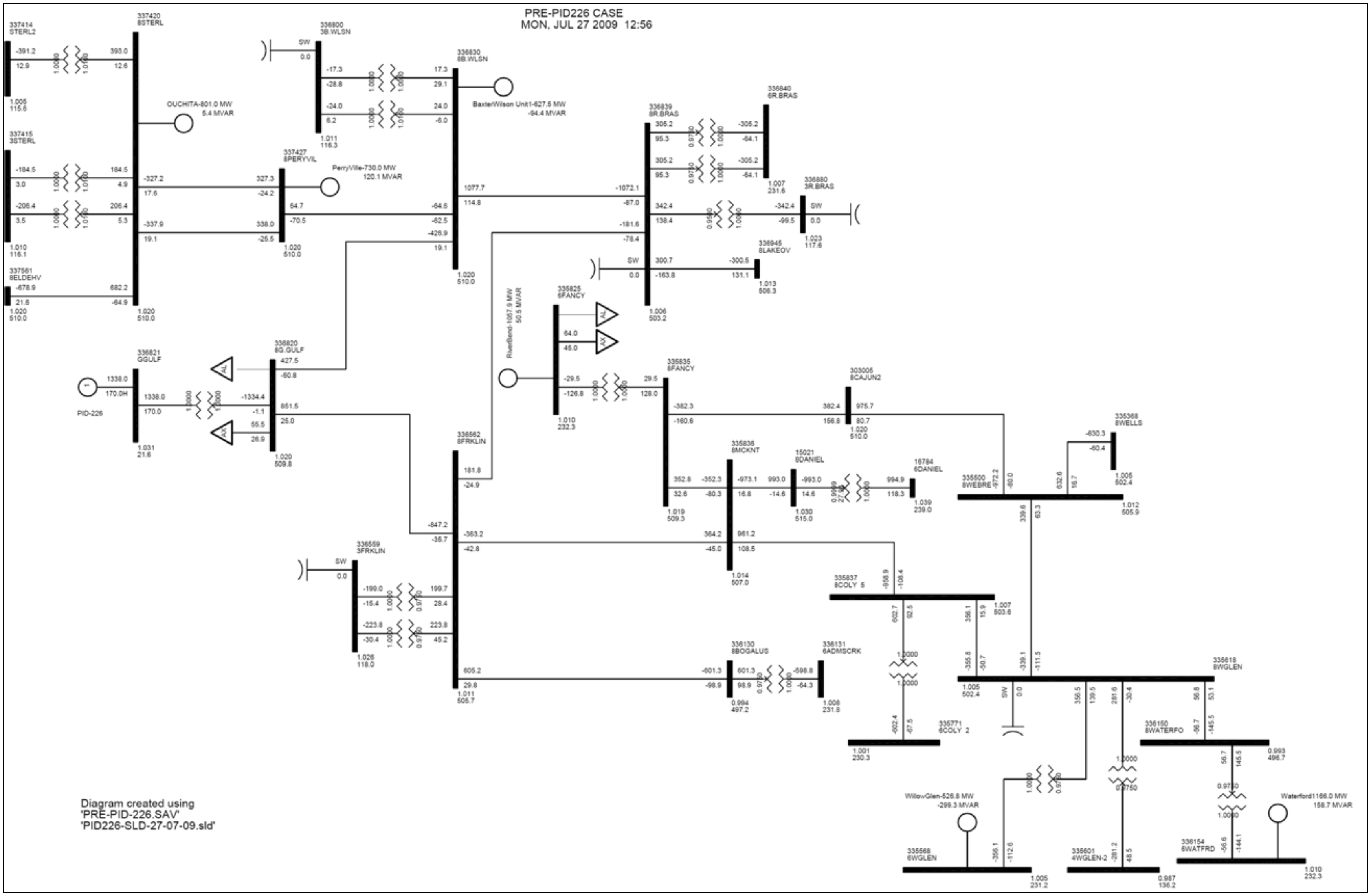


Figure 2-1 One-line Diagram of the local area <u>without</u> PID-226 (2012 Summer Peak)

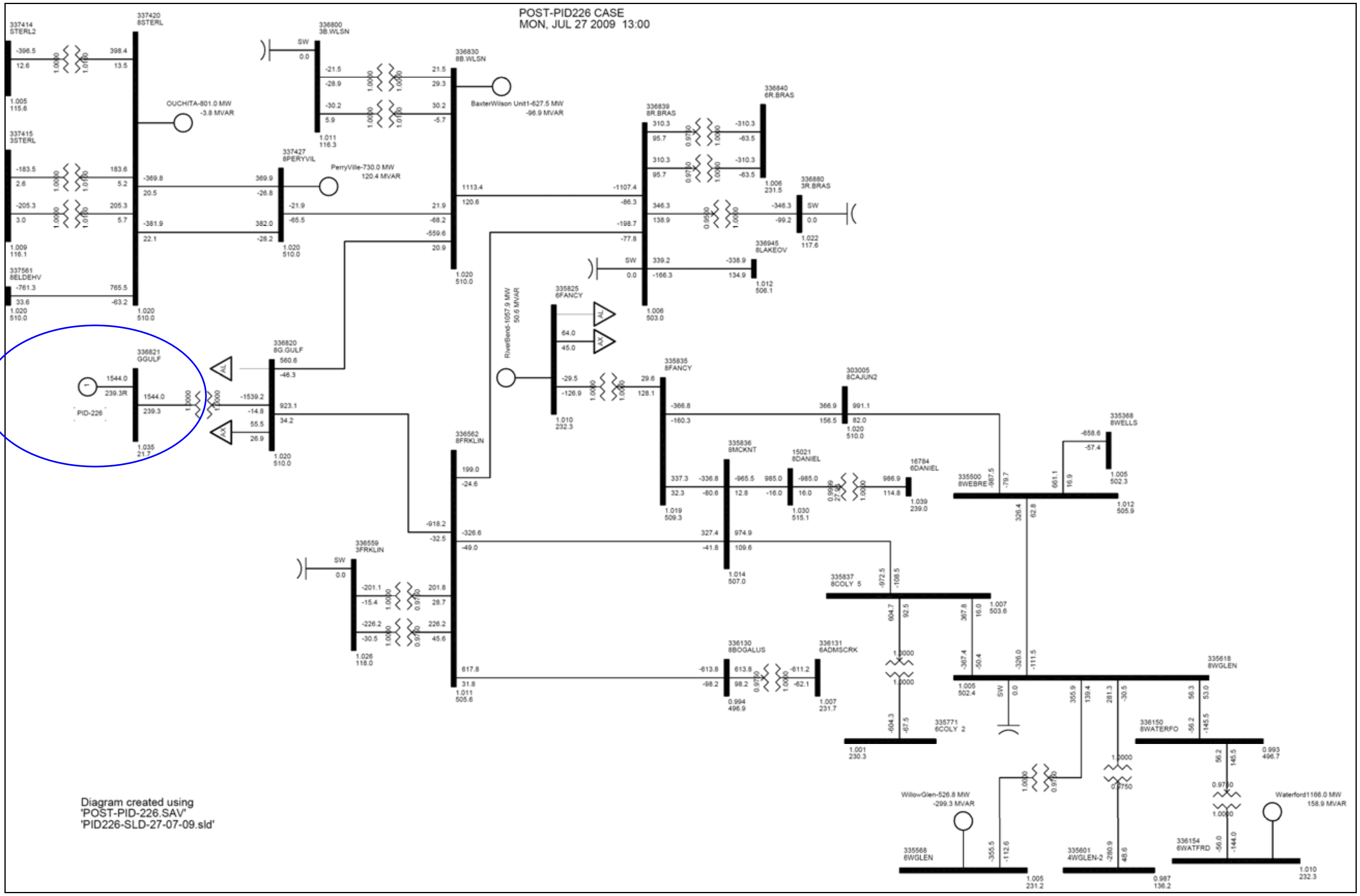


Figure 2-2 One-line Diagram of the local area <u>with</u> PID-226 (2012 Summer Peak)

2.3 TRANSIENT STABILITY ANALYSIS

Stability simulations were run to examine the transient behavior of the G. Gulf Unit and impact of the proposed uprate on the Entergy system. Stability analysis was performed using the following procedure. First, three-phase faults with normal clearing were simulated. Next, the three-phase stuck breaker (IPO: 3PH-1PH) faults were simulated. The fault clearing times used for the simulations are given inTable 2-2.

Table 2-2: Fault Clearing Times

Contingency at kV level	Normal Clearing	Delayed Clearing
500	5 cycles	5+9 cycles

The breaker failure scenario was simulated with the following sequence of events:

1) At the normal clearing time for the primary breakers, the faulted line is tripped at the far end from the fault by normal breaker opening.

2) The fault remains in place for Three-phase stuck-breaker (IPO: 3PH-1PH) faults. The fault admittances is changed to Thevenin equivalent admittance of single phase faults.

3) The fault is then cleared by back-up clearing. If the system was found to be unstable, then the fault was repeated without the proposed PID-226 project.

All line trips are assumed to be permanent (i.e. no high speed re-closure).

Table 2-3 and Table 2-4 list all the fault cases that were simulated in this study.

Fifteen (15) three phase normally cleared and twenty seven (27) three-phase stuck breaker converted into single-line-to-ground fault (following Independent Pole Operation of breakers) were simulated.

For all cases analyzed, the initial disturbance was applied at t = 0.1 seconds. The breaker clearing was applied at the appropriate time following this fault inception.

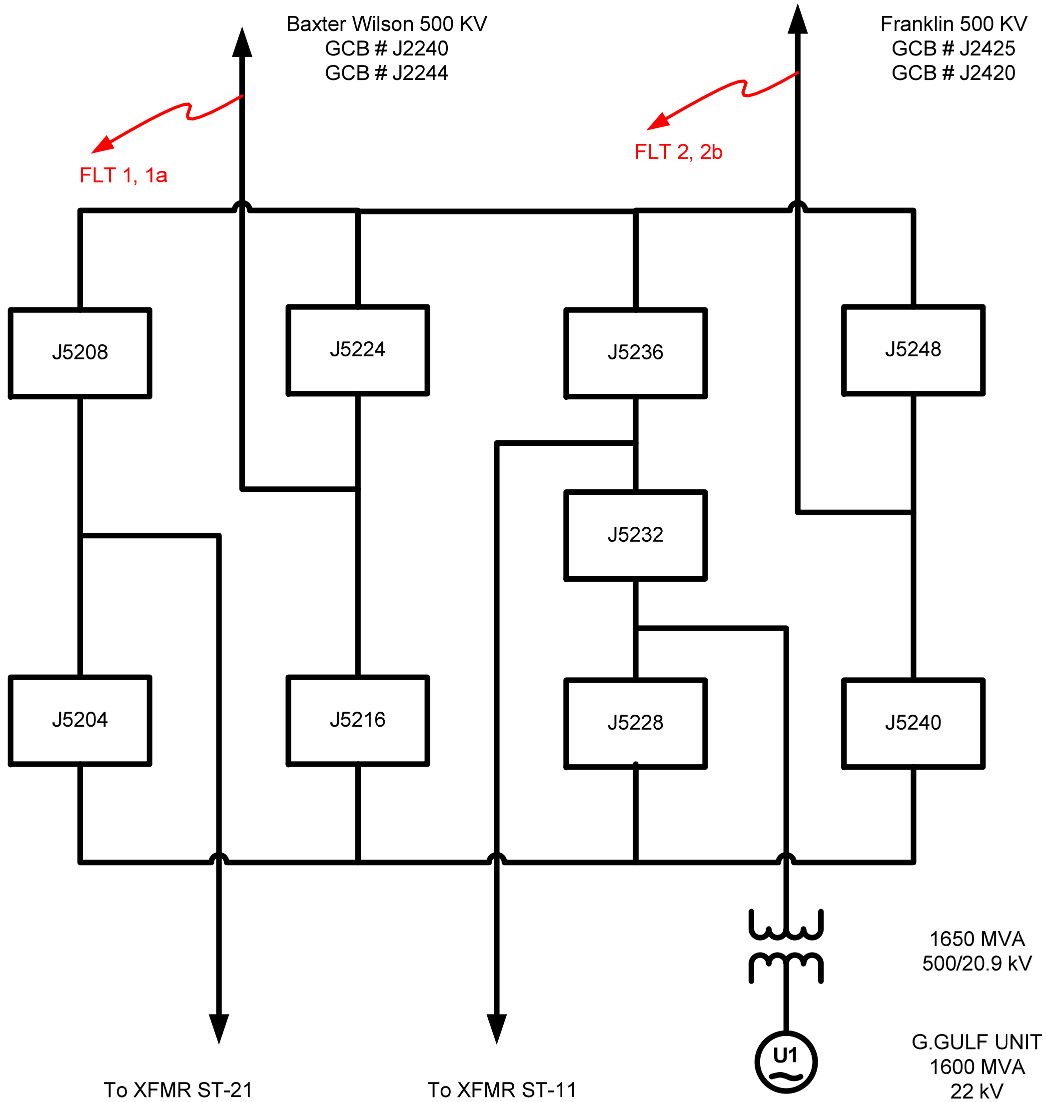
Table 2-3 List of 3 Phase faults simulated for stability analysis

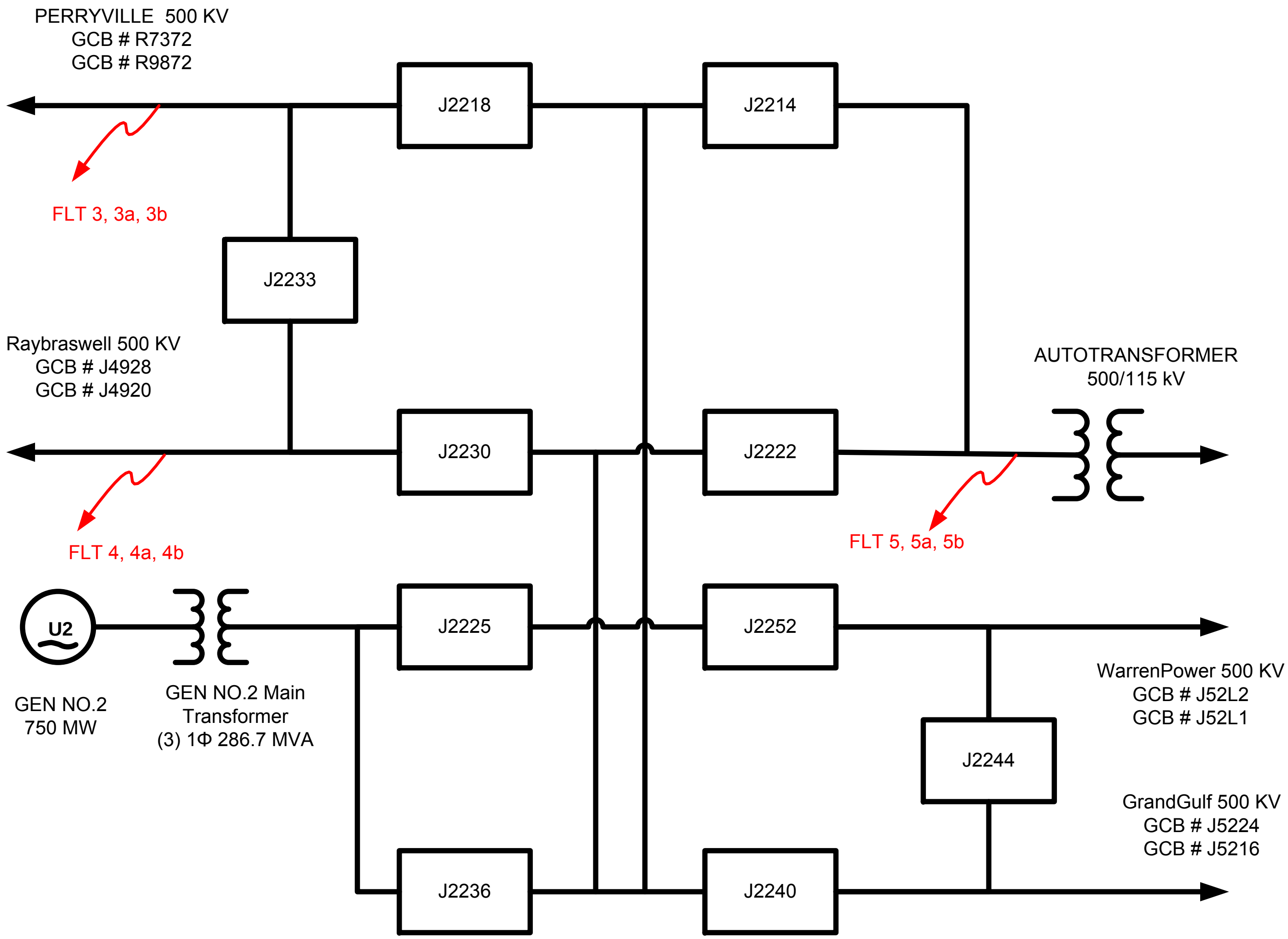
CASE	LOCATION	TYPE	CLEARING TIME (cycles)	BREAKER TRIP #	TRIPPED FACILITIES
FAULT-1	G. Gulf - B. Wilson 500 kV	3 PH	5	J5224, J5216, J2240, J2244	G. Gulf - B. Wilson 500 kV
FAULT-2	G. Gulf - Franklin 500 kV	3 PH	5	J2425, J2420, J5248, J5240	G. Gulf - Franklin 500 kV
FAULT-3	B. Wilson - Perryville 500 kV	3 PH	5	R7372,R9872, J2233, J2218	B. Wilson - Perryville 500 kV
FAULT-4	B. Wilson - Ray Braswell 500 kV	3 PH	5	J4928, J4920, J2230, J2233	B. Wilson - Ray Braswell 500 kV
FAULT-5	B. Wilson 500/115 kV transformer #1	3 PH	5	J2214, J2222,	B. Wilson 500/115 kV transformer #1
FAULT-6	Ray Braswell - Franklin 500 kV	3 PH	5	J2404, J2408, J4908, J4904	Ray Braswell - Franklin 500 kV
FAULT-7	Ray Braswell - Lakeover 500 kV	3 PH	5	J4928,J4908, J9218, J9234	Ray Braswell - Lakeover 500 kV
FAULT-8	Ray Braswell - B. Wilson 500 kV	3 PH	5	J4928, J4920, J2230, J2233	Ray Braswell - B. Wilson 500 kV
FAULT-9	Ray Braswell 500/ 115 kV Transformer #1	3 PH	5	J4904, J4917	Ray Braswell 500/ 115 kV Transformer #1
FAULT-10	Ray Braswell 500/ 230 kV Transformer #1	3 PH	5	J4917, J4920	Ray Braswell 500/ 230 kV Transformer #1
FAULT-11	Franklin - McKinight 500 kV	3 PH	5	BRK#21105, BRK#21110, J2416,2412	Franklin - McKinight 500 kV
FAULT-12	Franklin - Bogal USA - Adams Creek 500 kV	3 PH	5	S4402, S4405, J2416, J2420	Franklin - Bogal USA - Adams Creek 500 kV
FAULT-13	Franklin - Ray Braswell 500 kV	3 PH	5	J2404, J2408, J4908, J4904	Franklin - Ray Braswell 500 kV
FAULT-14	Franklin - G. Gulf 500 kv	3 PH	5	J2425, J2420, J5248, J5240	Franklin - G. Gulf 500 kv
FAULT-15	Franklin 500/115 kV transformer #1	3 PH	5	J2425, J2404	Franklin 500/115 kV transformer #1

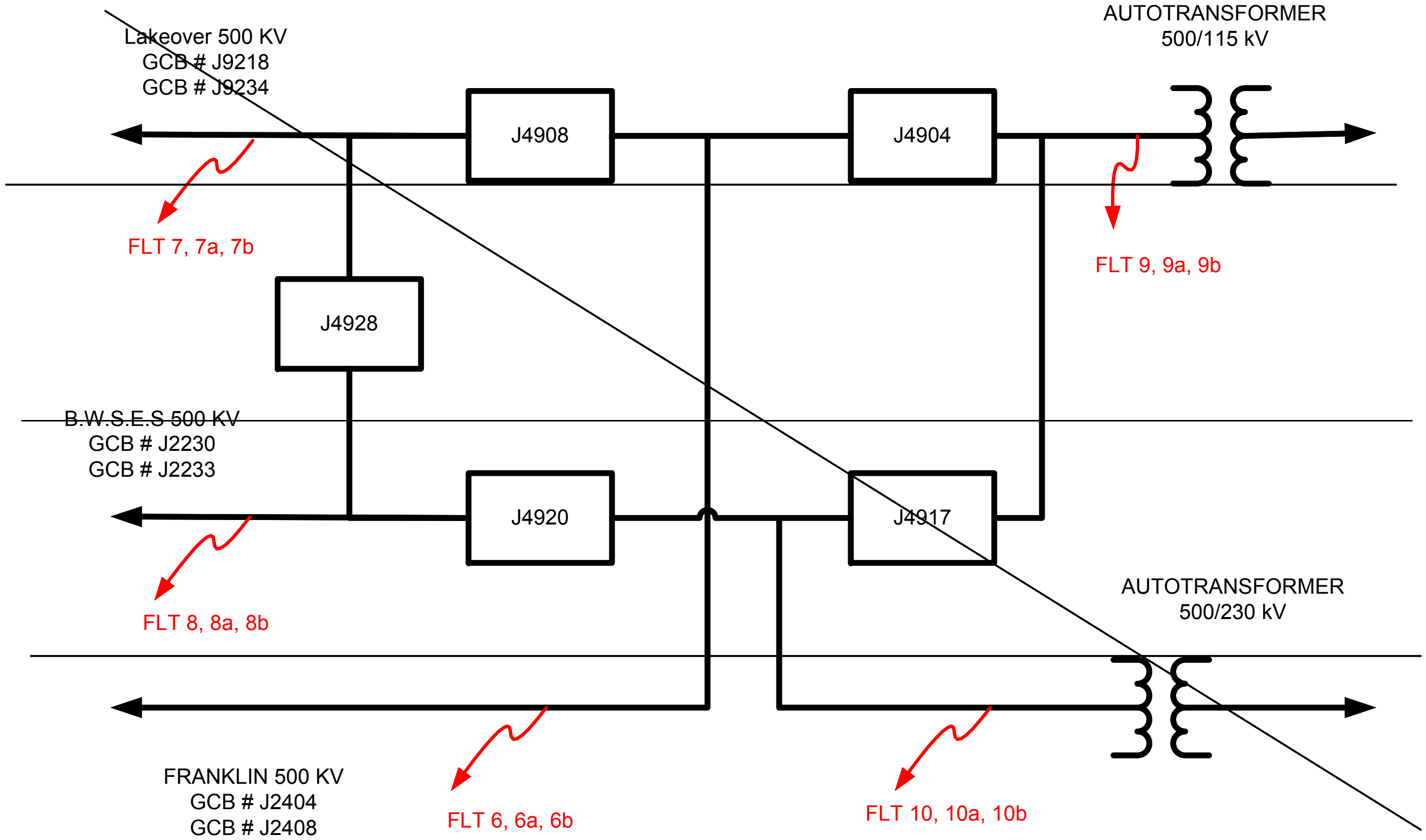
Table 2-4 List of 3 PhaseStuck Brekaer (IPO: 3PH-1PH) faults simulated for stability analysis

CASE	LOCATION	TYPE	CLEARING TIME (cycles)		SLG FAULT IMPEDANCE (MVA)	STUCK BREAKER #	PRIMARY BREAKER TRIP #	SECONDARY BREAKER TRIP	TRIPPED FACILITIES
			PRIMARY	Back-up					
FAULT-1a	G. Gulf - B. Wilson 500 kV	3 PH/SLG	5	9	640.02-j8505.34	J5224	J5216, J2240, J2244	J5208, J5236, J5248	G. Gulf - B. Wilson 500 kV
FAULT-2b	G. Gulf - Franklin 500 kV	3 PH/SLG	5	9	640.02-j8505.34	J5248	J2425, J2420, J5240	J5208, J5236, J5224	G. Gulf - Franklin 500 kV
FAULT-3a	B. Wilson - Perryville 500 kV	3 PH/SLG	5	9	779.96-j8641.41	J2233	R7372,R9872, J2218	J2230, J4928, J4920	B. Wilson - Perryville 500 kV; B. wilson Ray Braswell 500 kV
FAULT-3b	B. Wilson - Perryville 500 kV	3 PH/SLG	5	9	779.96-j8641.41	J2218	R7372,R9872, J2233	J2214, J2252, J2225	B. Wilson - Perryville 500 kV; B. Wilson 500/115 kV transformer#1
FAULT-4a	B. Wilson - Ray Braswell 500 kV	3 PH/SLG	5	9	779.96-j8641.41	J2233	J4928, J4920, J2230	R7372,R9872, J2218	B. Wilson - Ray Braswell 500 kV; B. Wilson - Perryville 500 kV
FAULT-4b	B. Wilson - Ray Braswell 500 kV	3 PH/SLG	5	9	779.96-j8641.41	J2230	J4928, J4920, J2233	J2240, J2236, J2222	B. Wilson - Ray Braswell 500 kV
FAULT-5a	B. Wilson 500/115 kV transformer #1	3 PH/SLG	5	9	779.96-j8641.41	J2214	J2222	J2218, J2252, J2225	B. Wilson 500/115 kV transformer #1
~~FAULT-6a~~	~~Ray Braswell - Franklin 500 kV~~	~~3 PH/SLG~~	~~5~~	~~9~~	~~765.3-j6686.74~~	~~J4908~~	~~J2404, J2408, J4904~~	~~J4928, J9218, J9234~~	~~Ray Braswell - Franklin 500 kV; Ray Braswell - Lakeover 500 kV~~
~~FAULT-6b~~	~~Ray Braswell - Franklin 500 kV~~	~~3 PH/SLG~~	~~5~~	~~9~~	~~765.3-j6686.74~~	~~J4904~~	~~J2404, J2408, J4908~~	~~J4917~~	~~Ray Braswell - Franklin 500 Kv; Ray Braswell 500/115 kV transformer #1~~
~~FAULT-7a~~	~~Ray Braswell - Lakeover 500 kV~~	~~3 PH/SLG~~	~~5~~	~~9~~	~~765.3-j6686.74~~	~~J4928~~	~~J4908, J9218, J9234~~	~~J2230, J2233, J4920~~	~~Ray Braswell - Lakeover 500 kV; Ray Braswell - B. Wilson 500 kV~~
~~FAULT-7b~~	~~Ray Braswell - Lakeover 500 kV~~	~~3 PH/SLG~~	~~5~~	~~9~~	~~765.3-j6686.74~~	~~J4908~~	~~J4928, J9218, J9234~~	~~J4904, J2404, J2408~~	~~Ray Braswell - Lakeover 500 kV, Ray Braswell - Franklin 500 kV~~
~~FAULT-8a~~	~~Ray Braswell - B. Wilson 500 kV~~	~~3 PH/SLG~~	~~5~~	~~9~~	~~765.3-j6686.74~~	~~J4928~~	~~J4920, J2230, J2233~~	~~J4908, J9218, J9234~~	~~Ray Braswell - B. Wilson 500 kV; Ray Braaswell - Lakeover 500 kV~~
~~FAULT-8b~~	~~Ray Braswell - B. Wilson 500 kV~~	~~3 PH/SLG~~	~~5~~	~~9~~	~~765.3-j6686.74~~	~~J4920~~	~~J4928, J2230, J2233~~	~~J4917~~	~~Ray Braswell - B. Wilson 500 kV; Ray Braswell 500/230 kV transformer #1~~
~~FAULT-9a~~	~~Ray Braswell 500/ 115 kV Transformer #1~~	~~3 PH/SLG~~	~~5~~	~~9~~	~~765.3-j6686.74~~	~~J4904~~	~~J4917~~	~~J2404, J2408, J4908~~	~~Ray Braswell 500/ 115 kV Transformer #1; Ray Braswell - Franklin 500 kV~~

CASE	LOCATION	TYPE	CLEARING TIME (cycles)		SLG FAULT IMPEDANCE (MVA)	STUCK BREAKER #	PRIMARY BREAKER TRIP #	SECONDARY BREAKER TRIP	TRIPPED FACILITIES
			PRIMARY	Back-up					
~~FAULT-9b~~	~~Ray Braswell 500/ 115 kV Transformer #1~~	~~3 PH/SLG~~	~~5~~	~~9~~	~~765.3-j6686.74~~	~~J4917~~	~~J4904~~	~~J4920~~	~~Ray Braswell 500/ 115 kV Transformer #1; Ray Braswell 500/230 kV transformer #1~~
~~FAULT-10a~~	~~Ray Braswell 500/ 230 kV Transformer #1~~	~~3 PH/SLG~~	~~5~~	~~9~~	~~765.3-j6686.74~~	~~J4920~~	~~J4917~~	~~J4928, J2230, J2233~~	~~Ray Braswell 500/ 230 kV Transformer #1; Ray Braswell - B. Wilson 500 kV~~
~~FAULT-10b~~	~~Ray Braswell 500/ 230 kV Transformer #1~~	~~3 PH/SLG~~	~~5~~	~~9~~	~~765.3-j6686.74~~	~~J4917~~	~~J4920~~	~~J4904~~	~~Ray Braswell 500/ 115 kV Transformer #1; Ray Braswell 500/230 kV transformer #1~~
FAULT-11a	Franklin - McKinight 500 kV	3 PH/SLG	5	9	823.73-j5887.89	J2416	BRK#21105, BRK#21110, J2412	J2420, S4402, S4405	Franklin - McKinight 500 kV; Franklin - Bogal USA - Adams Creek 500 kV
FAULT-11b	Franklin - McKinight 500 kV	3 PH/SLG	5	9	823.73-j5887.89	J2412	BRK#21105, BRK#21110, J2416	J2408	Franklin - McKinight 500 kV; Franklin 500/115 kV transformer #1
FAULT-12a	Franklin - Bogal USA - Adams Creek 500 kV	3 PH/SLG	5	9	823.73-j5887.89	J2416	S4402, S4405, J2420	BRK #21105, BRK#21110, J2412	Franklin - Bogal USA - Adams Creek 500 kV; Franklin - McKnight 500 kV
FAULT-12b	Franklin - Bogal USA - Adams Creek 500 kV	3 PH/SLG	5	9	823.73-j5887.89	J2420	S4402, S4405, J2416	J2420	Franklin - Bogal USA - Adams Creek 500 Kv; Franklin - G. Gulf 500 kV
FAULT-13a	Franklin - Ray Braswell 500 kV	3 PH/SLG	5	9	823.73-j5887.89	J2404	J2408, J4904, J4908	J2425	Franklin - Ray Braswell 500 Kv, Franklin 500/115 kV transformer #1
FAULT-13b	Franklin - Ray Braswell 500 kV	3 PH/SLG	5	9	823.73-j5887.89	J2408	J2404, J4908, J4904	J2412	Franklin - Ray Braswell 500 kV; Franklin 500/115 kV transformer #2
FAULT-14a	Franklin - G. Gulf 500 kv	3 PH/SLG	5	9	823.73-j5887.89	J2425	J2420, J5248, J5240	J2404	Franklin - G. Gulf 500 kV; Franklin 500/115 kV transformer #1
FAULT-14b	Franklin - G. Gulf 500 kv	3 PH/SLG	5	9	823.73-j5887.89	J2420	J5248, J5240, J2425	J2416, S4402, S4405	Franklin - G. Gulf 500 kV; Franklin - Bogal USA - Adams Creek 500 kV
FAULT-15a	Franklin 500/115 kV transformer #1	3 PH/SLG	5	9	823.73-j5887.89	J2404	J2425	J2408, J4904, J4908	Franklin 500/115 kV transformer #1; Franklin - Ray Braswell 500 kV
FAULT-15b	Franklin 500/115 kV transformer #1	3 PH/SLG	5	9	823.73-j5887.89	J2425	J2404	J2420, J5248, J5240	Franklin 500/115 kV transformer #1; Franklin - G. Gulf 500 kV


Baxter Wilson 500 KV
GCB # J2240
GCB # J2244
Franklin 500 KV
GCB # J2425
GCB # J2420
FLT 1, 1a
FLT 2, 2b
J5208
J5224
J5236
J5248
J5232
J5204
J5216
J5228
J5240
1650 MVA
500/20.9 kV
U1
G.GULF UNIT
1600 MVA
22 kV
To XFMR ST-21
To XFMR ST-11


PERRYVILLE 500 KV
GCB # R7372
GCB # R9872
J2218
J2214
FLT 3, 3a, 3b
J2233
Raybraswell 500 KV
GCB # J4928
GCB # J4920
AUTOTRANSFORMER
500/115 kV
J2230
J2222
FLT 4, 4a, 4b
FLT 5, 5a, 5b
U2
J2225
J2252
GEN NO.2
750 MW
GEN NO.2 Main
Transformer
(3) 1Φ 286.7 MVA
WarrenPower 500 KV
GCB # J52L2
GCB # J52L1
J2244
GrandGulf 500 KV
GCB # J5224
GCB # J5216
J2236
J2240



Lakeover 500 KV
GCB # J9218
GCB # J9234
AUTOTRANSFORMER
500/115 kV
J4908
J4904
FLT 7, 7a, 7b
FLT 9, 9a, 9b
J4928
B.W.S.E.S 500 KV
GCB # J2230
GCB # J2233
J4920
J4917
FLT 8, 8a, 8b
AUTOTRANSFORMER
500/230 kV
FRANKLIN 500 KV
GCB # J2404
GCB # J2408
FLT 6, 6a, 6b
FLT 10, 10a, 10b

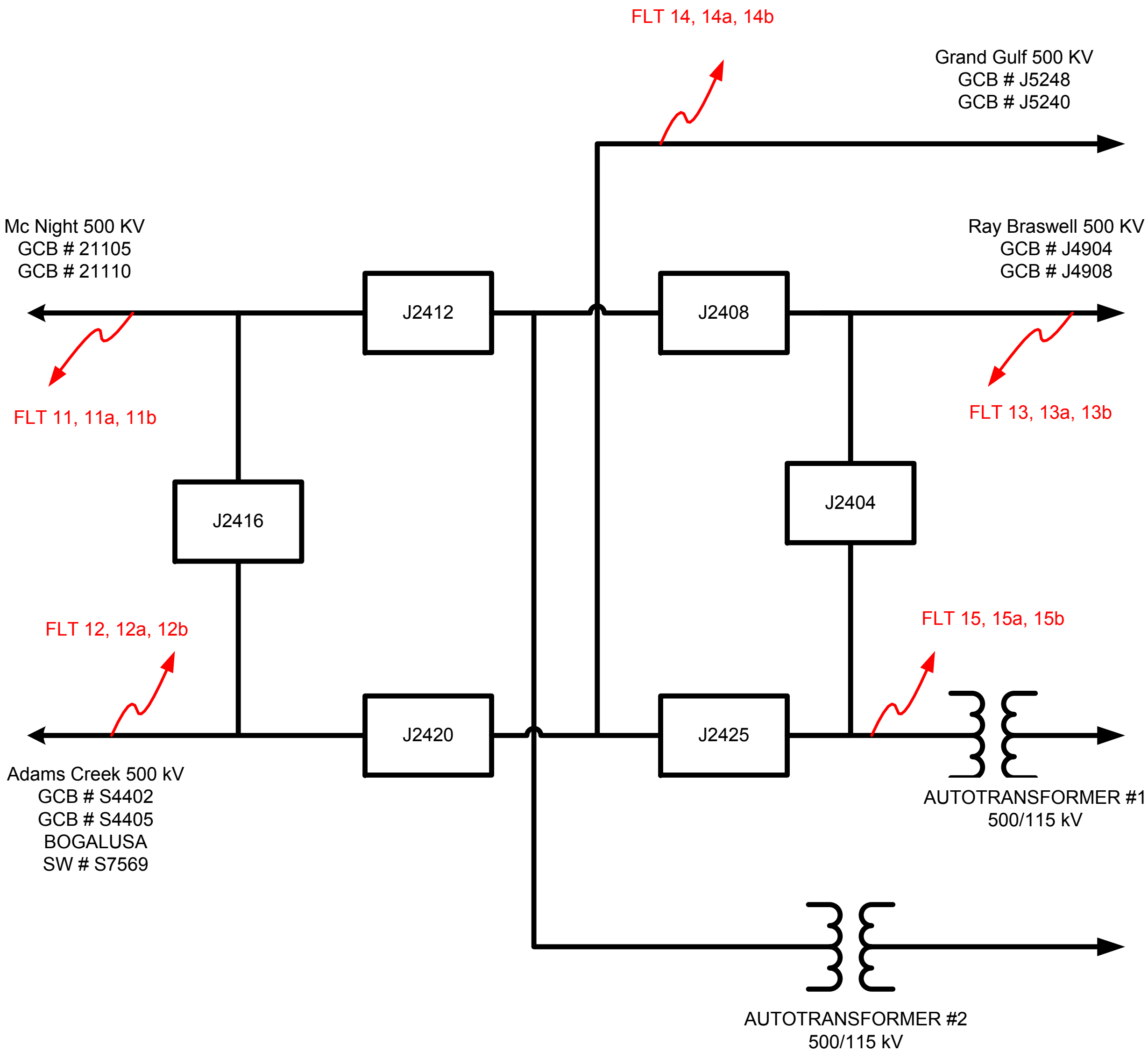

FLT 14, 14a, 14b
Grand Gulf 500 KV
GCB # J5248
GCB # J5240
Mc Night 500 KV
GCB # 21105
GCB # 21110
Ray Braswell 500 KV
GCB # J4904
GCB # J4908
J2412
J2408
FLT 11, 11a, 11b
FLT 13, 13a, 13b
J2416
J2404
FLT 12, 12a, 12b
FLT 15, 15a, 15b
J2420
J2425
Adams Creek 500 kV
GCB # S4402
GCB # S4405
BOGALUSA
SW # S7569
AUTOTRANSFORMER #1
500/115 kV
AUTOTRANSFORMER #2
500/115 kV

Table 2-5 Results of faults simulated for stability analysis

CASE	PRE-PID226		POST-PID226	
	Stable	Acceptable Voltages	Stable	Acceptable Voltages
	?	?	?	?
FAULT-1	Not tested		Y	Y
FAULT-2	Not tested		Y	Y
FAULT-3	Not tested		Y	Y
FAULT-4	Not tested		Y	Y
FAULT-5	Not tested		Y	Y
FAULT-6	Not tested		Y	Y
FAULT-7	Not tested		Y	Y
FAULT-8	Not tested		Y	Y
FAULT-9	Not tested		Y	Y
FAULT-10	Not tested		Y	Y
FAULT-11	Not tested		Y	Y
FAULT-12	Not tested		Y	Y
FAULT-13	Not tested		Y	Y
FAULT-14	Not tested		Y	Y
FAULT-15	Not tested		Y	Y
FAULT-1a	Not tested		Y	Y
FAULT-2b	Not tested		Y	Y
FAULT-3a	Not tested		Y	Y
FAULT-3b	Not tested		Y	Y
FAULT-4a	Not tested		Y	Y
FAULT-4b	Not tested		Y	Y
FAULT-5a	Not tested		Y	Y
~~FAULT-6a~~	~~Not tested~~		~~Y~~	~~Y~~
~~FAULT-6b~~	~~Not tested~~		~~Y~~	~~Y~~
~~FAULT-7a~~	~~Not tested~~		~~Y~~	~~Y~~
~~FAULT-7b~~	~~Not tested~~		~~Y~~	~~Y~~
~~FAULT-8a~~	~~Not tested~~		~~Y~~	~~Y~~
~~FAULT-8b~~	~~Not tested~~		~~Y~~	~~Y~~
~~FAULT-9a~~	~~Not tested~~		~~Y~~	~~Y~~
~~FAULT-9b~~	~~Not tested~~		~~Y~~	~~Y~~
~~FAULT-10a~~	~~Not tested~~		~~Y~~	~~Y~~
~~FAULT-10b~~	~~Not tested~~		~~Y~~	~~Y~~
FAULT-11a	Not tested		Y	Y
FAULT-11b	Not tested		Y	Y
FAULT-12a	Not tested		Y	Y
FAULT-12b	Not tested		Y	Y
FAULT-13a	Not tested		Y	Y
FAULT-13b	Not tested		Y	Y
FAULT-14a	Not tested		Y	Y
FAULT-14b	Not tested		Y	Y
FAULT-15a	Not tested		Y	Y
FAULT-15b	Not tested		Y	Y

The system was found to be STABLE following all the simulated faults.

Figure 2-3 and Figure 2-4 show plots for the G. Gulf unit response and the voltage recovery at POI following two selected faults.

Transient Voltage Recovery

The voltages at all buses in the Entergy system (above 115 kV) were monitored during each of the fault cases as appropriate. No Voltage criteria violation was observed following a normally cleared three-phase fault.

As there are no specific voltage dip criteria for three-phase fault converted into single-phase stuck breaker faults, the results of these faults were compared with the most stringent voltage dip criteria - not to exceed 20 % for more than 20 cycles. After comparison against the voltage-criteria, no voltage criteria violation was observed with the proposed uprate of G. Gulf unit (PID-226) case.

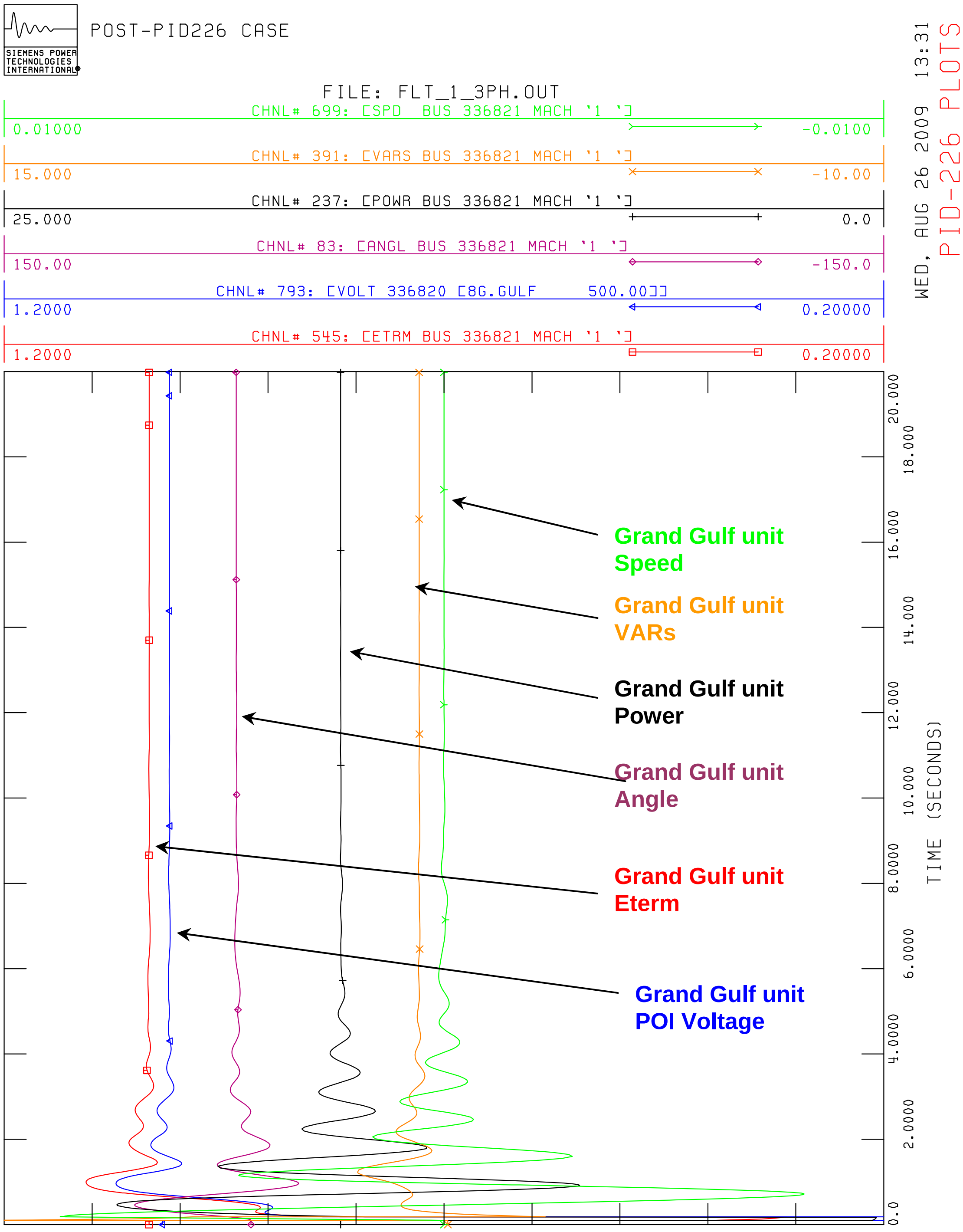


Figure 2-3 PID-226 Machine parameters for FLT_1_3PH

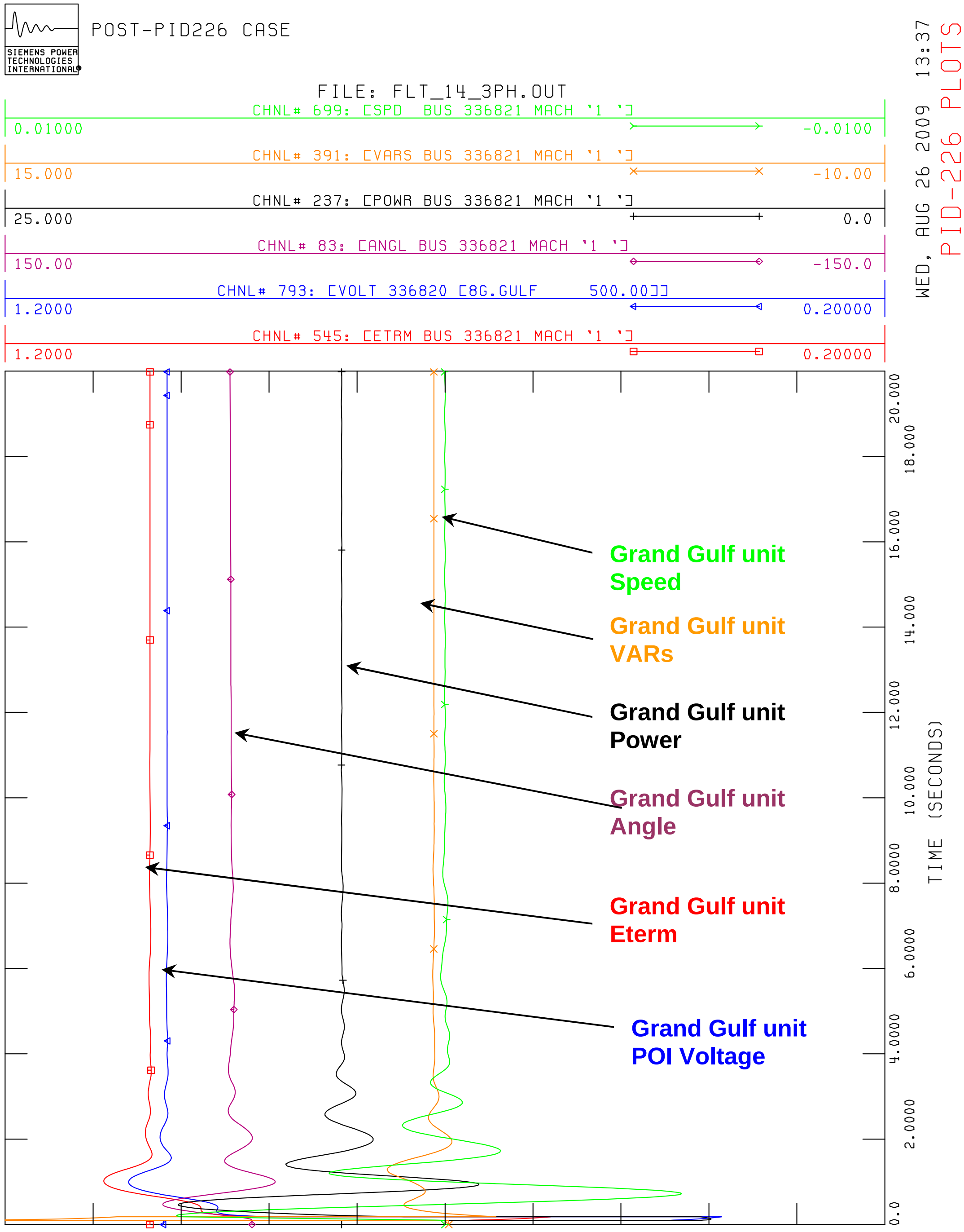


Figure 2-4 PID-226 Machine parameters for Fault _14_3PH

2.4 CRITICAL CLEARING TIME ANALYSIS

Evaluation of Critical Clearing Time (CCT) was carried out for faults at G. Gulf 500 kV substation. Two 3 phase stuck breaker (IPO operation) faults - Fault 1a and Fault 2b - at G. Gulf 500 kV substation were considered.

The primary Clearing Time was kept equal to the normal value (5 cycles on 500 kV and 6 cycles on 230 kV) and the backup clearing time was varied to find the CCT.

Table 2-6 shows the Critical Clearing Times calculated for the simulated faults with PID-222. Figure 2-5 and Figure 2-6 shows the excursions in the speed of G. Gulf unit following the two faults for both, WITH and WITHOUT PID-226 project.

Table 2-6: CCT Results

CASE	LOCATION	CCT (in cycles)		
		Primary clearing	Back-up Clearing	
			WITHOUT PID-226	WITH PID-226
FAULT_1a	G. Gulf - B. Wilson 500 kV	5	41	15
FAULT_2b	G. Gulf - Franklin 500 kV	5	46	18

It can be seen from the results that the smallest CCT at G. Gulf 500 kV substation was 5 + 15 cycles for a fault involving loss of G. Gulf – B. Wilson 500 kV line. The lowest critical clearing time 20 cycles (=5 + 15 cycles) is still larger than Entergy's standard clearing time of14 cycles (= 5 + 9 cycles) for 500 kV breakers.

Based on the results of critical clearing time analysis it can be concluded that proposed PID-226 project (206 MW uprate of G. Gulf Unit#1) does not adversely impact the critical clearing at G. gulf 500 kV substation.

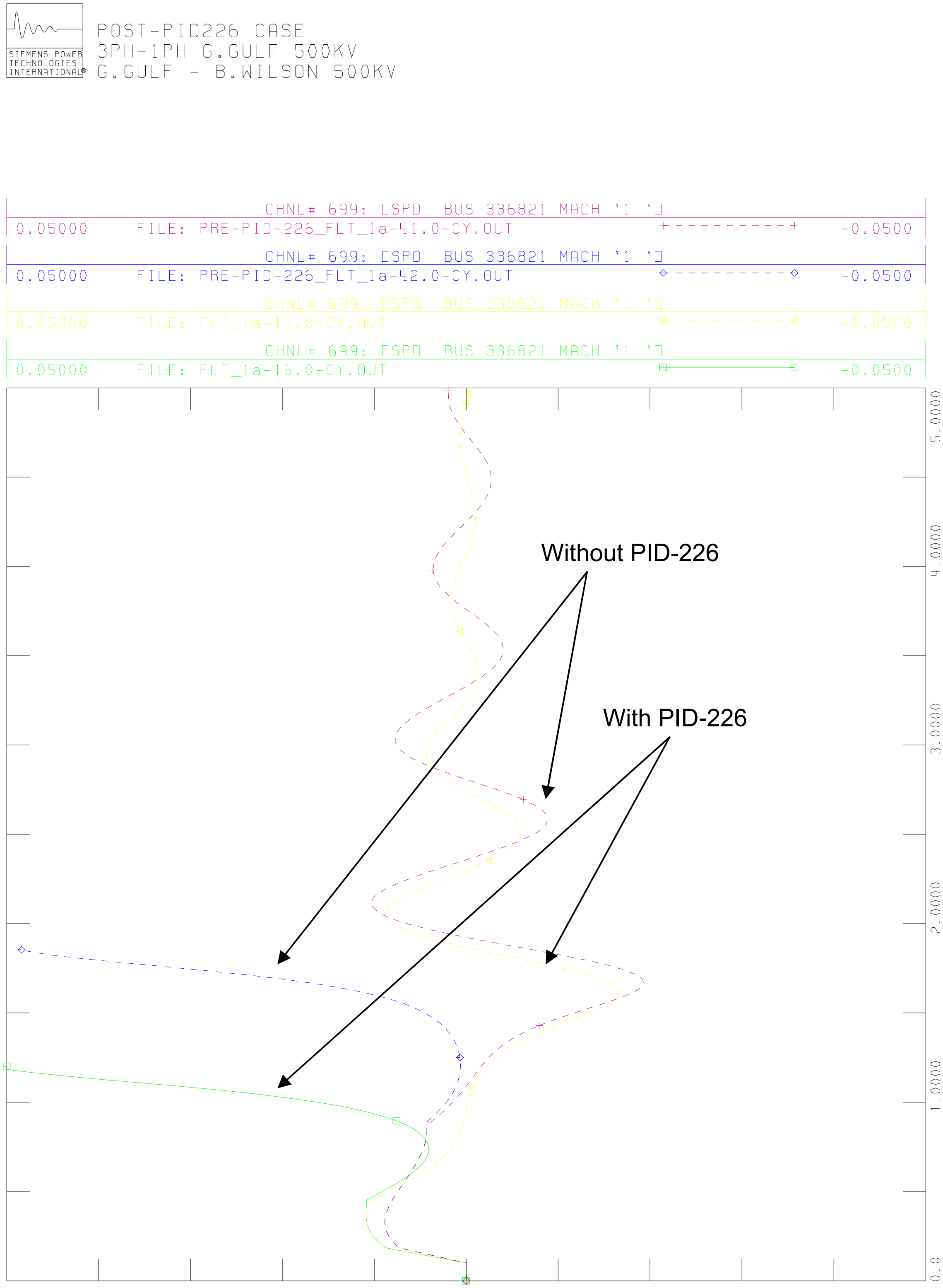


Figure 2-5 Critical Clearing Time comparison following Fault 1a

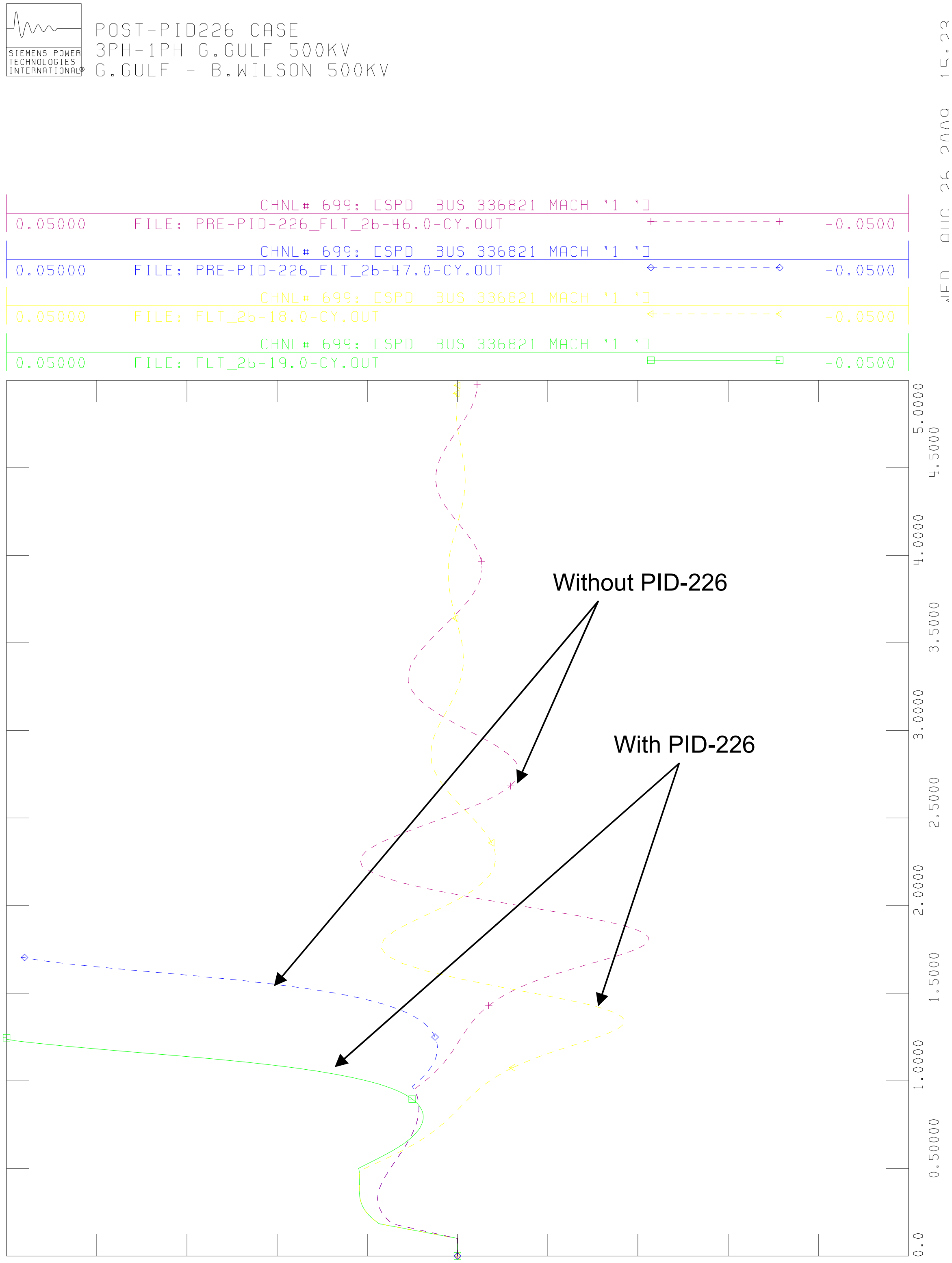


Figure 2-6 Critical Clearing Time comparison following Fault 2b

3 CONCLUSIONS

Southwest Power Pool, Inc (SPP) at the request of Entergy Services Inc. has commissioned ABB Inc. to perform a stability analysis for Facility study of PID-226, which is a request for 206 MW uprate of existing G. Gulf Unit #1 in the Entergy transmission system.

A system impact study for the PID-226 has previously been completed. The objective of this study was to supplement the stability analysis performed in the system impact study for PID-226 Project. To that end, selected faults at G. Gulf 500 kV substation were simulated and a Critical Clearing Time Analysis was performed at G. Gulf 500 kV substation. The study was performed on 2012 Summer Peak case, provided by SPP/Entergy.

The system was stable following all simulated normally cleared and stuck-breaker faults. No voltage criteria violation was observed following simulated faults.

The Critical Clearing times at G. Gulf 500 kV substations are within the capabilities of the existing protection systems. The smallest CCT at G. Gulf 500 kV substation was 5 + 15 cycles for a fault involving loss of G. Gulf – B. Wilson 500 kV.

Based on the results of stability analysis it can be concluded that proposed PID-226 project does not adversely impact the stability of the Entergy System in the local area. Also, PID-226 does not adversely impact the Critical Clearing time at G. Gulf 500 kV substations. Hence, no transmission reinforcements and/ or upgrades were identified for the interconnection of the PID-226 project.

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

APPENDIX A DATA PROVIDED BY CUSTOMER

Attachment A to Appendix 1
Interconnection Request

LARGE GENERATING FACILITY DATA

UNIT RATINGS

kVA 1600000 °F 95 Voltage 22000
Power Factor 0.9 lag
Speed (RPM) 1800 Connection (e.g. Wye) Wye
Short Circuit Ratio 0.75 Frequency, Hertz 60
Stator Amperes at Rated kVA 41989 Field Volts ______
Max Turbine MW 1525 °F 95

COMBINED TURBINE-GENERATOR-EXCITER INERTIA DATA

Inertia Constant, H = 4.5112 kW sec/kVA
Moment-of-Inertia, WR^2 = 9644006 lb. ft.^{2}

REACTANCE DATA (PER UNIT-RATED KVA)

	DIRECT AXIS		QUADRATURE AXIS	
Synchronous – saturated	X_{dv}	1.292	X_{qv}	1.258
Synchronous – unsaturated	X_{di}	1.551	X_{qi}	1.473
Transient – saturated	X'_{dv}	0.380	X'_{qv}	0.751
Transient – unsaturated	X'_{di}	0.417	X'_{qi}	0.832
Subtransient – saturated	X''_{dv}	0.243	X''_{qv}	0.255
Subtransient – unsaturated	X''_{di}	0.288	X''_{qi}	0.302
Negative Sequence – saturated	$X2_v$	0.249		
Negative Sequence – unsaturated	$X2_i$	0.295		
Zero Sequence – saturated	$X0_v$	0.181		
Zero Sequence – unsaturated	$X0_i$	0.151		
Leakage Reactance	Xl_m	0.245		

FIELD TIME CONSTANT DATA (SEC)

Open Circuit	T'_{do}	6.286	T'_{qo}	0.382
Three-Phase Short Circuit Transient	T'_{d3}	1.446	T'_{q}	0.501
Line to Line Short Circuit Transient	T'_{d2}	2.062		
Line to Neutral Short Circuit Transient	T'_{d1}	2.211		
Short Circuit Subtransient	T''_{d}	0.030	T''_{q}	0.043
Open Circuit Subtransient	T''_{do}	0.047	T''_{qo}	0.123

ARMATURE TIME CONSTANT DATA (SEC)

Three Phase Short Circuit	T_{a3}	0.361
Line to Line Short Circuit	T_{a2}	0.361
Line to Neutral Short Circuit	T_{a1}	0.314

NOTE: If requested information is not applicable, indicate by marking "N/A."

MW CAPABILITY AND PLANT CONFIGURATION LARGE GENERATING FACILITY DATA

ARMATURE WINDING RESISTANCE DATA (PER UNIT)

Positive	R_1	0.003656
Negative	R_2	0.04775
Zero	R_0	0.00253

Rotor Short Time Thermal Capacity I_2^2t = 5.47
Field Current at Rated kVA, Armature Voltage and PF = 8580 amps
Field Current at Rated kVA and Armature Voltage, 0 PF = 11400 amps
Three Phase Armature Winding Capacitance = 1.464 microfarad
Field Winding Resistance = 0.0405 ohms 20 °C
Armature Winding Resistance (Per Phase) = 0.0004794 ohms 20 °C

CURVES

Provide Saturation, Vee, Reactive Capability, Capacity Temperature Correction curves. Designate normal and emergency Hydrogen Pressure operating range for multiple curves.

Please refer to Attachment 1.

GENERATOR STEP-UP TRANSFORMER DATA RATINGS

Capacity Self-cooled/Maximum Nameplate
___1650000__________/_____1650000______kVA

Voltage Ratio(Generator Side/System side/Tertiary)
__20.9__________/____500__________/_____none_________kV

Winding Connections (Low V/High V/Tertiary V (Delta or Wye))
__Delta_________/_____Wye___ ____/____none_______

Fixed Taps Available
__+7.5% / +5% / +2.5% / 0 / -2.5%____________________

Present Tap Setting
__Nominal____

IMPEDANCE

Positive Z_1 (on self-cooled kVA rating)__0.1627_______ % _46.41___ X/R

Zero Z_0 (on self-cooled kVA rating)__0.1627_______ % __46.41___ X/R

EXCITATION SYSTEM DATA

Identify appropriate IEEE model block diagram of excitation system and power system stabilizer (PSS) for computer representation in power system stability simulations and the corresponding excitation system and PSS constants for use in the model.

Please refer to attachment 2.

GOVERNOR SYSTEM DATA

Identify appropriate IEEE model block diagram of governor system for computer representation in power system stability simulations and the corresponding governor system constants for use in the model.

Please refer to attachment 3.

WIND GENERATORS

Number of generators to be interconnected pursuant to this Interconnection Request:

____

Elevation: ______________ _____ Single Phase _____ Three Phase

Inverter manufacturer, model name, number, and version:

____

List of adjustable setpoints for the protective equipment or software:

____

Note: A completed General Electric Company Power Systems Load Flow (PSLF) data sheet or other compatible formats, such as IEEE and PTI power flow models, must be supplied with the Interconnection Request. If other data sheets are more appropriate to the proposed device, then they shall be provided and discussed at Scoping Meeting.

INDUCTION GENERATORS

(*) Field Volts: ________________
(*) Field Amperes: ______________
(*) Motoring Power (kW): ________
(*) Neutral Grounding Resistor (If Applicable): ____________
(*) I_2^2t or K (Heating Time Constant): ____________
(*) Rotor Resistance: ____________
(*) Stator Resistance: ____________
(*) Stator Reactance: _____________
(*) Rotor Reactance: _____________
(*) Magnetizing Reactance: ___________
(*) Short Circuit Reactance: ___________
(*) Exciting Current: ________________
(*) Temperature Rise: ________________
(*) Frame Size: _______________
(*) Design Letter: _____________
(*) Reactive Power Required In Vars (No Load): ________
(*) Reactive Power Required In Vars (Full Load): ________
(*) Total Rotating Inertia, H: ________Per Unit on KVA Base

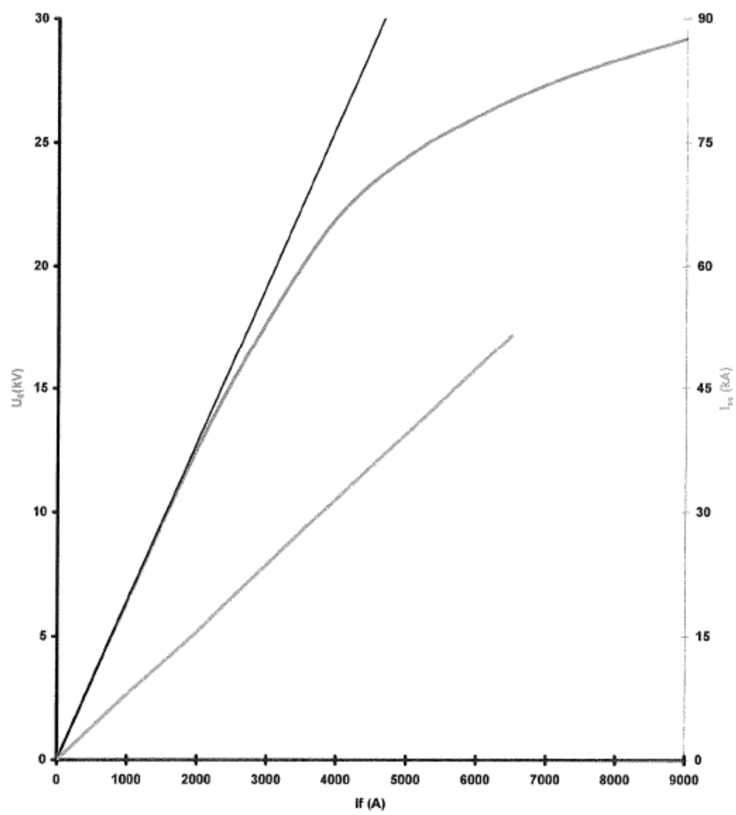
Note: Please consult Transmission Provider prior to submitting the Interconnection Request to determine if the information designated by (*) is required.

GENERATOR **Grand Gulf 1 - Uprate**

Open Circuit Voltage and Short Circuit Current

Generator - Typ: THFF 180/76-18

S_N =	1600	MVA	PF =	0.90		I_{f0} =	4000	A
U_N =	22.00	kV	f_N =	60	Hz	I_{fN} =	8580	A
I_N =	41.989	kA	$T_{Cold\ Gas}$ =	40.0	°C			



SIEMENS Dr. Klocke Rev. 000

Energy Sector E F PR GN EN PL 42 2009-06-11

ATTACHMENT 1

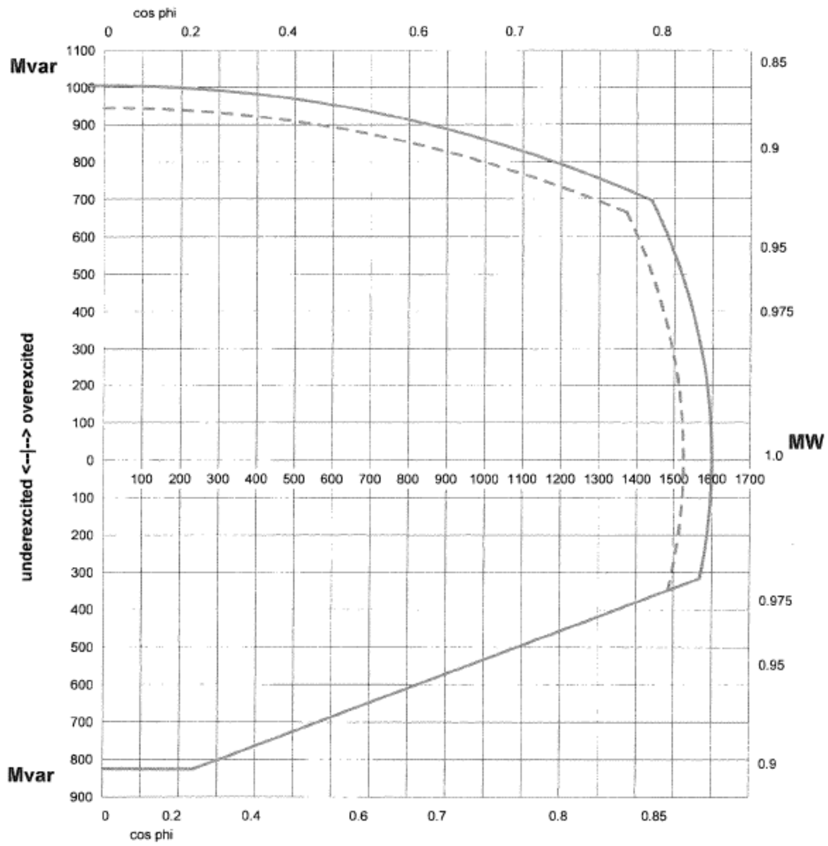
Sheet 1 of 3

Turbogenerators

Grand Gulf 1 - Uprate to 1600 MVA
Reactive Capability Curve

Generator Type **THFF 180/76-18**

		uprate (———)	prev. (— — —)
Apparent Power	S	1600.00 MVA	1525.00 MVA
Armature Voltage	U	22.00 kV	
Armature Current	I	41.989 kA	40.021 kA
Frequency	f	60.0 Hz	
Power Factor	P.F.	0.900	0.900
H2-Pressure (gauge)	pe	5.170 bar	4.140 bar
Cold Gas Temperature	Tk	40.0 °C	40.0 °C



Siemens AG
Power Generation

GN EN PL42 / Jun 10, 2009
Generator Systems Engineering Mlh

ATTACHMENT 1
Sheet 2 of 3

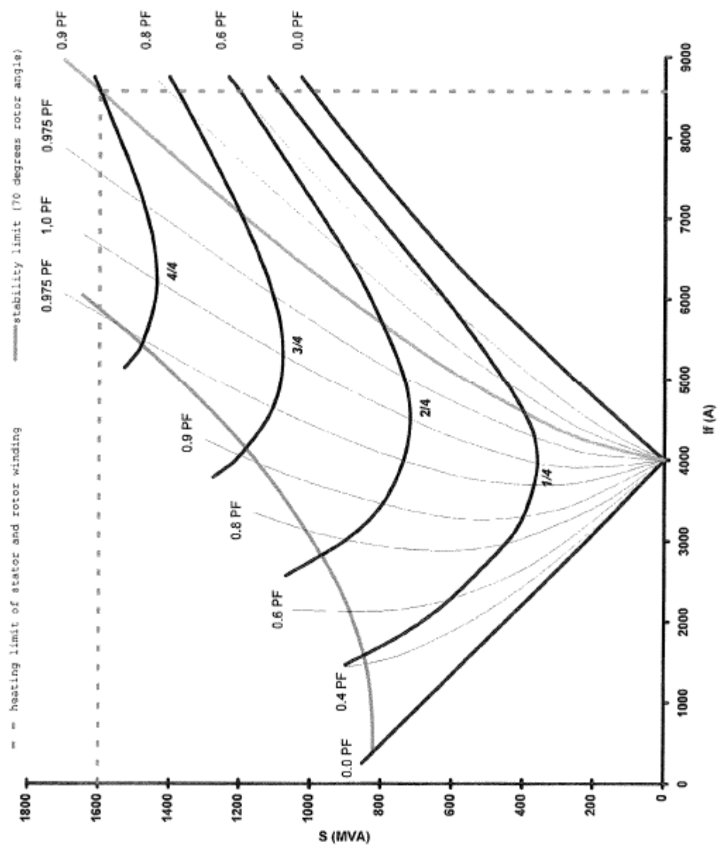
GENERATOR

Grand Gulf 1 - Uprate

V-Curves at Rated Voltage

Generator - Typ: THFF 180/76-18

S_N =	1600	MVA	PF =	0.90		I_{f0} =	4000	A
U_N =	22.00	kV	f_N =	60	Hz	I_{fN} =	8580	A
I_N =	41.989	kA	$T_{Cold\ Gas}$ =	40.0	°C			



V-Curves Refer to Apparent Power

SIEMENS
Energy Sector

Dr. Klocke
E F PR GN EN PL 42

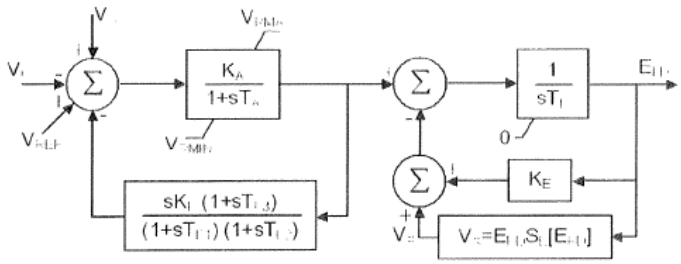
Rev. 000
2009-06-10

ATTACHMENT 1
Sheet 3 of 3

GRAND GULF

IEEE TYPE AC5A EXCITATION SYSTEM MODEL DATA

K_A = 600 p.u.	T_A = 0.10 sec.
K_F = 0.02 p.u.	T_{F1} = 1.0 sec.
T_{F2} = 0.13 sec.	T_{F3} = 0
T_E = 0.22 sec.	T_R = 0.2 sec.
S_{E1} = 0.73	EFD_1 = 3.7 p.u.
S_{E2} = 0.73	EFD_2 = 2.8 p.u.
K_E = 1.0 p.u.	
V_{Rmax} = 6.4 p.u.	V_{Rmin} = -6.4 p.u.



IEEE Type AC5A Excitation System Model

Reference: IEEE Standard 421.5-2005, "IEEE Recommended Practice for Excitation System Models for Power System Stability Studies"

Excitation system model data 061120. By J.D. Hurley. 12-7153. 12-7154.doc
Printed: 12/7/2006 2:02:21 PM

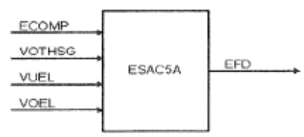
Siemens Westinghouse Confidential

ESAC5A

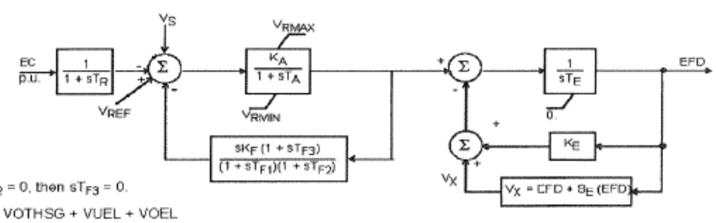
IEEE Type AC5A Excitation System

This model is located at system bus	# _________ IBUS,
machine	# _________ I.
This model uses CONs starting with	# _________ J,

CONs	#	Value	Description
J		0.2	T_R (Seconds)
J+1		600	K_A
J+2		0.1	T_A (Seconds)
J+3		6.4	V_{RMAX} Or Zero
J+4		-6.4	V_{RMIN}
J+5		1	K_E Or Zero
J+6		0.22	$T_E > 0$ (Seconds)
J+7		0.02	K_F
J+8		1.0	$T_{F1} > 0$ (Seconds)
J+9		0.13	T_{F2} (Seconds)
J+10		0	T_{F3} (Seconds)
J+11		3.7	E_1
J+12		0.73	$S_E(E_1)$
J+13		2.8	E_2
J+14		0.73	$S_E(E_2)$



IBUS, 'ESAC5A', I, T_R, K_A, T_A, V_{RMAX}, V_{RMIN}, K_E, T_E, K_F, T_{F1}, T_{F2}, T_{F3}, E_1, $S_E(E_1)$, E_2, $S_E(E_2)$/

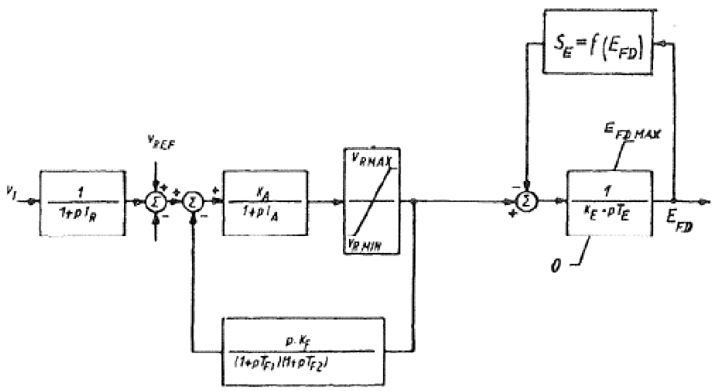


If $T_{F2} = 0$, then $sT_{F3} = 0$.

V_S = VOTHSG + VUEL + VOEL

SIEMENS

Excitation System
Thyrisiem
Computer Representation 1)



$T_R = 0.20$ s
$T_A = 0.10$ s
$T_{F1} = 1.0$ s
$T_{F2} = 0.13$ s
$T_E = 0.22$ s

$K_A = 600$
$K_F = 0.02$
$K_E = 1.0$

$E_{FDMAX} = 3.7$
S_{EMAX}, $S_{E0.75MAX}$ } 0.73

$V_{RMAX} = 6.4$
$V_{RMIN} = -6.4$

1) According to IEEE

E111 / Ro
17-03-82

Fig.2.1.

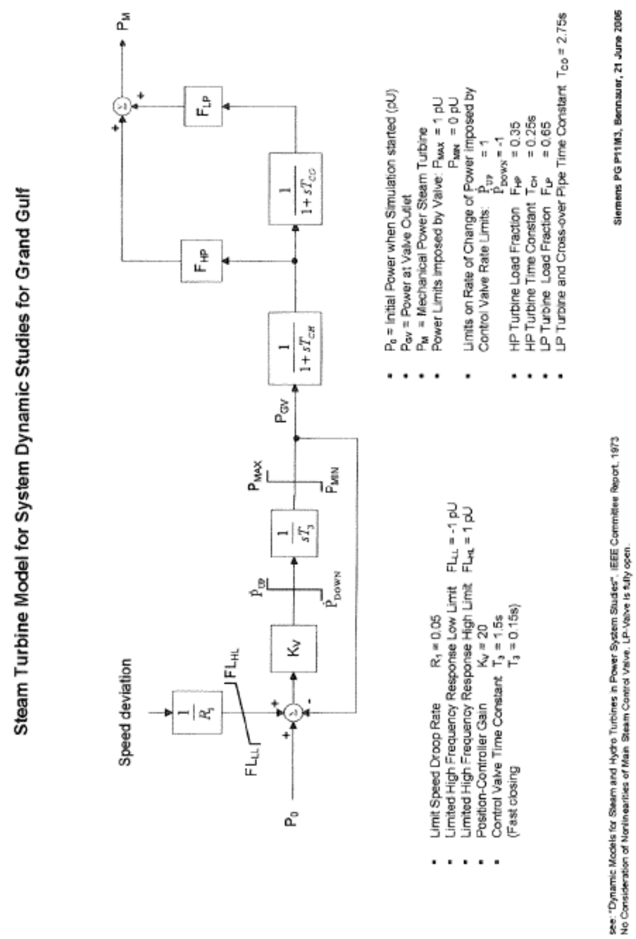
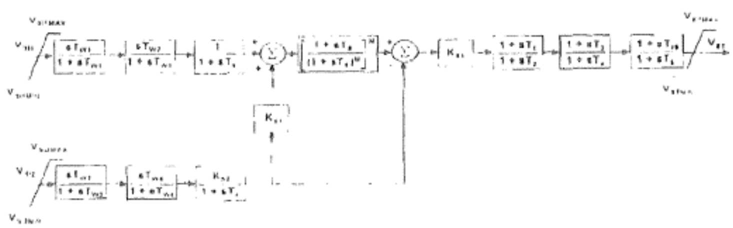

Steam Turbine Model for System Dynamic Studies for Grand Gulf
Speed deviation
P0
FLLL
FLHL
Kv
PUP
PDOWN
PMAX
PMIN
PGV
FHP
FLP
PM
Limit Speed Droop Rate R1 = 0.05
Limited High Frequency Response Low Limit FLLL = -1 pU
Limited High Frequency Response High Limit FLHL = 1 pU
Position-Controller Gain Kv = 20
Control Valve Time Constant T3 = 1.5s
(Fast closing T3 = 0.15s)
P0 = Initial Power when Simulation started (pU)
PGV = Power at Valve Outlet
PM = Mechanical Power Steam Turbine
Power Limits imposed by Valve: PMAX = 1 pU
PMIN = 0 pU
Limits on Rate of Change of Power imposed by
Control Valve Rate Limits: PUP = 1
PDOWN = -1
HP Turbine Load Fraction FHP = 0.35
HP Turbine Time Constant TCH = 0.25s
LP Turbine Load Fraction FLP = 0.65
LP Turbine and Cross-over Pipe Time Constant TCO = 2.75s
see: "Dynamic Models for Steam and Hydro Turbines in Power System Studies", IEEE Committee Report, 1973
No Consideration of Nonlinearities of Main Steam Control Valve. LP-Valve is fully open.
Siemens PG P11M3, Bennauer, 21 June 2006

Fig.3.1.

TYPICAL EX2000 Power System Stabilizer (PSS)
IPS90995GD
TYPICAL DATA, NOT FOR DESIGN PURPOSES



Ref. IEEE 421.5-1992 Type PSS2A

Note: Parameters shown with ranges give the typical or useful ranges
actual setting ranges are usually much wider.

VSI1 = speed input VSI2 = electrical power input
VSI1max, VSI1min - input #1 limits +/- 0.08 pu (fixed)
VSI2max, VSI2min - input #2 limits +/- 1 25 pu (fixed)
*T1 = lead #1 0.15 (range 0.1 - 2.0 sec) *T2 = lag #1 0.03 (range 0.01 - 1 0 sec)
*T3 = lead #2 0.15 (range 0.1 2.0 sec) *T4 = lag #2 0.03 (range 0.01 - 1.0 sec)
T5 = lag #3 0.0 (fixed not used in GE design) can be used if there are three lead lags or for equivalent torsional filter time constant which may be required for some units (determined by studies)
T6 = 0.0 (fixed) T7 = TW 2.0 sec (range 2 - 15 sec)
T8 = 0.5 sec (fixed) T9 = 0.1 sec (fixed)
T10 = Lag #3 = 0.0 (fixed not used in GE design)
N = 1 (fixed) M = 6 (fixed)
*KS1 = PSS gain = 8 - (range 3 - 20 typical)
KS2 = 0 202 = TW/(2H) - where H = combined turbine-gen. inertia constant
KS3 = 1.0
VSTmax = (range 0.05 to 0.1) VSTmin = (range -0.05 to -0.1)
TW1 = TW see note on T7 above TW2 = TW see note on T7 above
TW3 = TW see note on T7 above TW4 = 0.0 (fixed)
* Note:Lead/Lags and Gain must be Determined by Studies

HCS 3-19-2002

IEEEG1

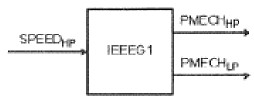
IEEE Type 1 Speed-Governing Model

This model is located at system bus	# ________ IBUS,
machine	# ________ I.
This Mmodel may be located at system bus	# ________ 0 JBUS,
machine	# ________ 0 M.
This model uses CONs starting with	# ________ J,

NOTE: JBUS and JM are set to zero for non-cross compound.

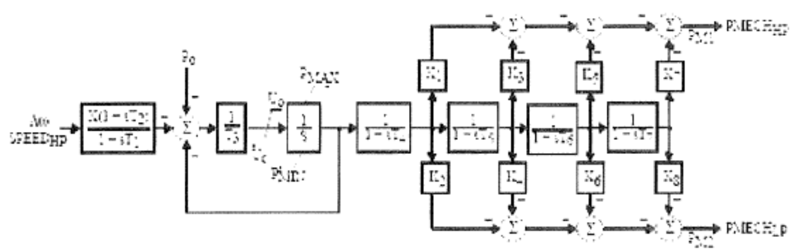
(Note: this is a non-cross compound unit)

CONs	#	Value	Description
J		12	K
J+1		0	T_1 (Seconds)
J+2		0	T_2 (Seconds)
J+3		0.075	T_3 (>0)(Seconds)
J+4		0.60	U_O (p.u./Seconds)
J+5		-0.60	U_C (<0.)(p.u./Seconds)
J+6		0.9	P_{MAX}(p.u. on Machine MVA Rating)
J+7		0	P_{MIN}(p.u. on Machine MVA Rating)
J+8		0.25	T_4(Seconds)
J+9		0.35	K_1
J+10		0	K_2
J+11		2.75	T_5 (Seconds)
J+12		0.65	K_3
J+13		0	K_4
J+14		0	T_6(Seconds)
J+15		0	K_5
J+16		0	K_6
J+17		0	T_7(Seconds)
J+18		0	K_7
J+19		0	K_8



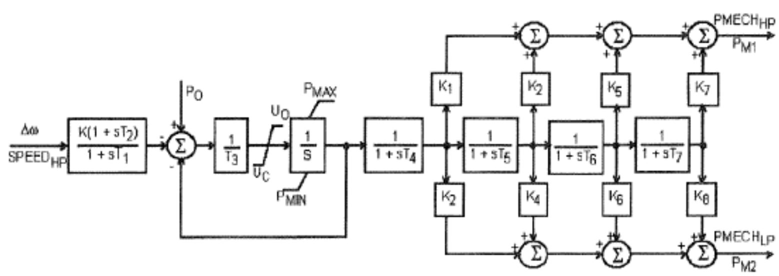
Correct Model: Note that K3 is properly represented.

GOVERNOR MODEL DATA SHEETS
IEEEG1 Power Technologies, Inc.



Incorrect Model: Note that there are two blocks with K2 and no block with K3.

IBUS, 'IEEEG1', I, JBUS, M, K, T_1, T_2, T_3, U_o, U_c, P_{MAX}, P_{MIN}, T_4, K_1, K_2, T_5, K_3, K_4, T_6, K_5, K_6, T_7, K_7, K_8/



APPENDIX B LOAD FLOW AND STABILITY DATA IN PSSE FORMAT

Loadflow Data

```
336821,'1 ', 1544.000,   0.000,   330.000,  -330.000,1.02000,336820,  1600.000,
0.003656,   0.2880,   0.00000,   0.00000,1.00000,1,  100.0,  1544.000,   150.000,
1,1.0000
0 / END OF GENERATOR DATA, BEGIN BRANCH DATA
0 / END OF BRANCH DATA, BEGIN TRANSFORMER DATA
336820,336821,      0,'1 ',1,2,1,   0.00000,   0.00000,2,'            ',1,   1,1.0000
   0.0035,   0.1627,   1650.00
1.00000,   0.000,   0.000,  1650.00,  1650.00,  1650.00, 0,      0, 1.07500, 0.97500,
1.07500, 0.97500, 5, 0, 0.00000, 0.00000
1.00000,   0.000
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
```

Dynamics Data

```
REPORT FOR ALL MODELS                BUS 336821 [GGULF      21.000] MODELS


 ** GENROU **  BUS X-- NAME --X BASEKV MC    C O N S     S T A T E S
         336821 GGULF       21.000 1  130656-130669  51167-51172

          MBASE     Z S O R C E        X T R A N      GENTAP
         1600.0  0.00366+J 0.28800  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
  6.29 0.047  0.38 0.123   4.51  0.00 1.5510 1.4730 0.4170 0.8320 0.2880 0.2450

                          S(1.0)  S(1.2)
                          0.2000  0.5000


 ** 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
         336821 GGULF       21.000 1  130670-130686  51173-51188    8396-8399    4483-4488

               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    0.202    1.000

     T8       T9      KS1      T1       T2       T3       T4      VSTMAX   VSTMIN
    0.500    0.100    8.000    0.150    0.030    0.150    0.030    0.100   -0.100


 ** ESAC5A **  BUS X-- NAME --X BASEKV MC    C O N S     S T A T E S     VAR
         336821 GGULF       21.000 1  130687-130701  51189-51193    8400

   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
              3.7000  0.7300  2.8000  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
          336821 GGULF       21.000 1  130702-130721  51194-51199    8401-8402

    K      T1      T2      T3     UO      UC    PMAX   PMIN     T4      K1
  12.00   0.000   0.000   0.075  0.600  -0.600 0.9700 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
```

APPENDIX C PLOTS FOR STABILITY SIMULATIONS

F. PSS Sensitivity

GGNS EPU team had submitted typical data for EX2000 type Power System Stabilizer (PSS) represented by IEEE model PSS2A. Submission of PSS model is required by the LGIP, Attachment A to Appendix 1.

It is our understanding that PSS2A represents an accelerating power type PSS, which is standard in the GE EX2000 digital-based excitation systems. The existing excitation system of GGNS generator is type ESAC5A, which is a rotary excitation system with an analog voltage regulator. Installing a digital PSS with analog voltage regulator and rotary excitation system is not prudent, as it may provide very little benefit in controlling power system oscillations.

Installing a stand alone (after market) analog PSS which is not integral to analog excitation voltage regulator may lead to undesirable performance. This defeat the purpose of the PSS, which is a supplementary control system often applied as an integral part of excitation control system. The basic function of the PSS is to apply a signal to the excitation system, thereby creating electrical torques that damp out power oscillations. Additionally, Siemen's engineers were unable to provide operational data for proposed stand alone analog PSS as there are only two generators of the type of GGNS unit in the USA.

GGNS requested approval of the strategy to defer the installation of PSS until implementation of new digital voltage regulator upgrade. This may occur in 18 to 36 months after the implementation of EPU in Refueling Outage RF-18. According to GGNS personnel, new digital voltage regulator upgrade is currently being studied with the inclusion of a digital PSS as a part of the modification.

Based on GGNS's suggestion, ABB (Entergy Transmission's Consultant who had performed Stability Analysis for GGNS – EPU) was requested to perform sensitivity analysis for the proposed uprate with and without originally proposed PSS2A type power system stabilizer. Two of the most limiting faults were simulated without PSS:

1. Fault_1a: 5 + 9 cycles 3 phase stuck breaker fault (IPO breaker operation), cleared by tripping Grand Gulf – Baxter Wilson 500 kV line
2. Fault_2b: 5 + 9 cycles 3 phase stuck breaker fault (IPO breaker operation), cleared by tripping Grand Gulf – Franklin 500 kV line

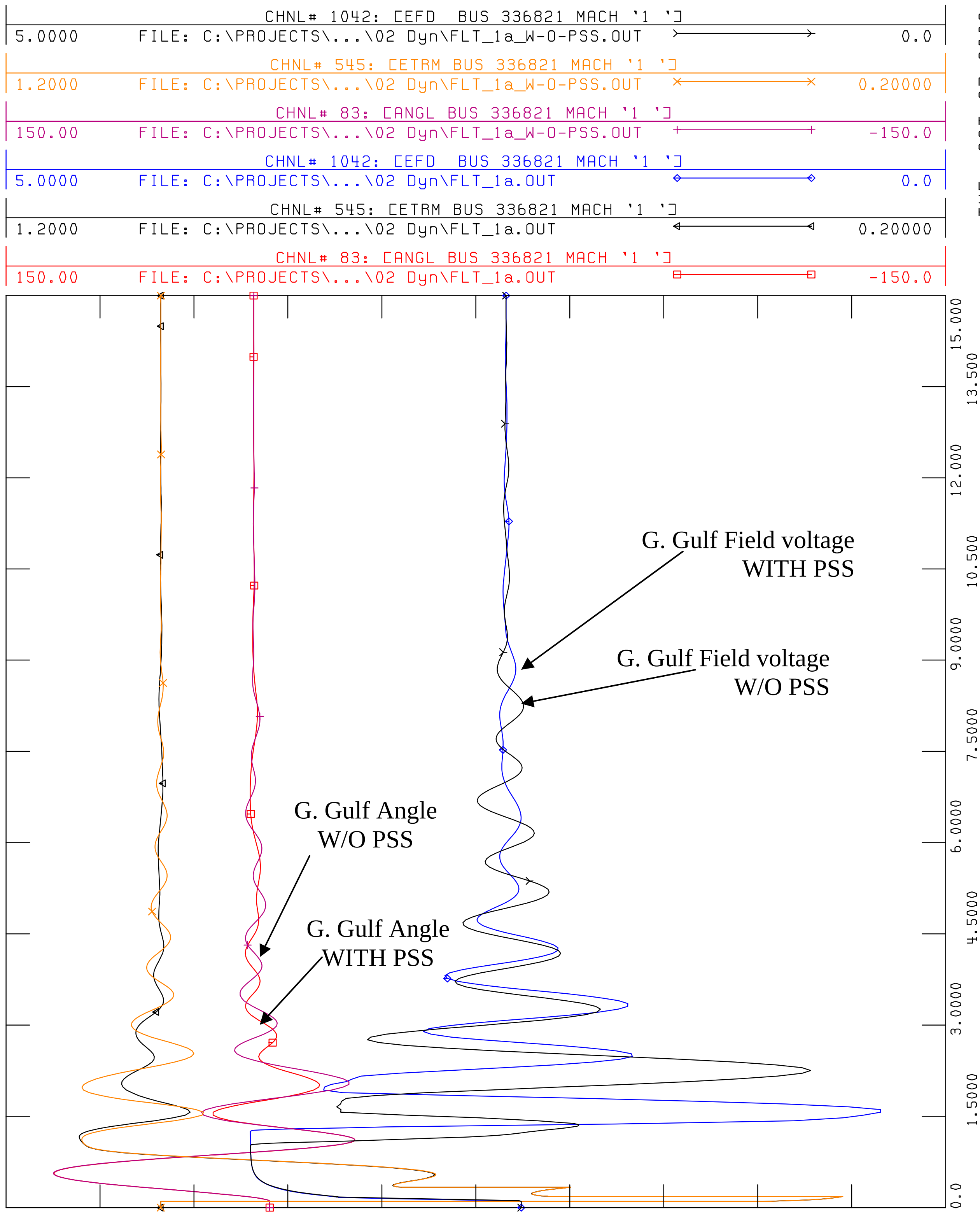
The results indicated that the system would be stable following both faults. As expected, the damping of oscillations in the Grand Gulf unit following both the faults without PSS case was lower than that with the PSS case. However, post-fault performance of the Grand Gulf unit without the PSS was acceptable per Entergy's transmission planning criteria.

Entergy's Technical System Studies Group recommends deferring installation of PSS until implementation of new digital voltage regulator upgrade. The bases for recommendation are listed below:

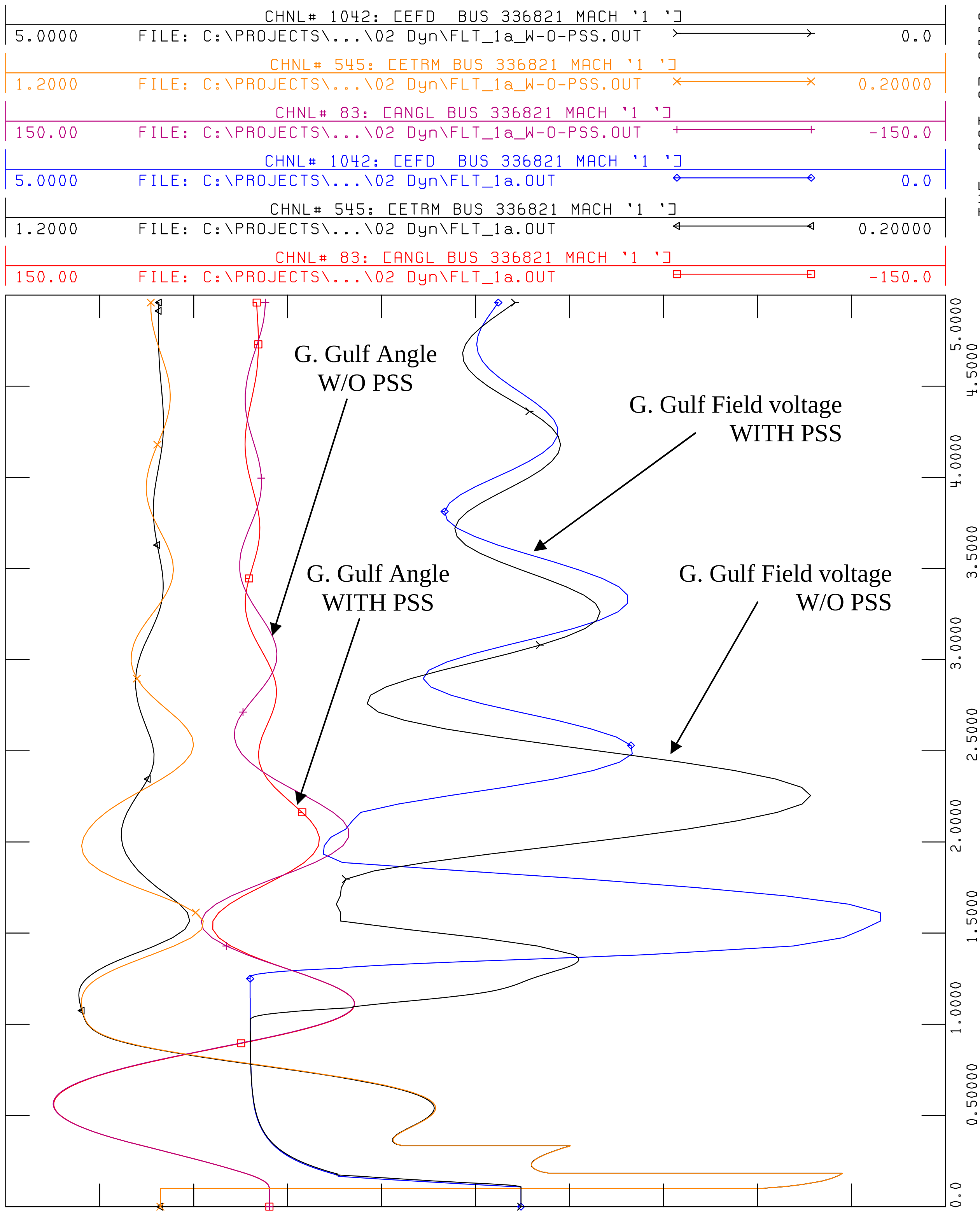
1. After the EPU the GGNS unit will be one of the largest generators in the USA. Alternative to deferral; installation of stand alone analog PSS lacks proven operational history. It is always desirable to use proven technologies with reasonable operational history during upgrades to ensure safe and reliable operation and to ensure required Nuclear Safety.

2. The results of the simulations with and without PSS (sensitivity analysis performed by ABB) indicate satisfactory post-fault performance of the Grand Gulf unit in both scenarios which meets the requirements of transmission planning criteria.

3. Additionally, Policy Statement/Guidelines for Power System Stabilizers on the Entergy System states "In areas where a dynamic stability problem has not been explicitly identified, all synchronous generators (50 MVA and larger) will still be required to install stabilizers. However, in such cases the tuning will not be required and the stabilizer may remain disconnected until further advised by Entergy." Presently, based on the analysis performed by Entergy's consultant (ABB), the area surrounding the Grand Gulf has not exhibited any dynamic stability problem.



G. GULF PARAMETERS WITH and WITHOUT PSS (15 sec time scale)



G. GULF PARAMETERS WITH and WITHOUT PSS (5 sec time scale)