System Impact Study
PID 268
60MW Plant

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Rev	Issue Date	Description of Revision	Revised By	Project Manager
0	7/8/11	Posting System Impact Study	EC	BR

Contents

1. Introduction

This Energy Resource Interconnection Service (ERIS) is based on the Customer's request for interconnection on Entergy's transmission system between the Red Gum and Wisner 115kV substations located at the PID 268 115kV substation. The proposed commercial operation date of the project is December 31, 2013. The objective of this study is to assess the reliability impact of the new facility on the Entergy transmission system with respect to the steady state and transient stability performance of the system as well as its effects on the system's existing short circuit current capability. It is also intended to determine whether the transmission system meets standards established by NERC Reliability Standards and Entergy's planning guidelines when the plant is connected to Entergy's transmission system. If not, transmission improvements will be identified.

The System Impact Study process required a load flow analysis to determine if the existing transmission lines were adequate to handle the full output from the plant for simulated transfers to adjacent control areas. A short circuit analysis was performed to determine if the generation would cause the available fault current to surpass the fault duty of existing equipment within the Entergy transmission system. A transient stability analysis was also conducted to determine if the project would cause a stability problem on the Entergy system. The load flow results from the ERIS study are for information only. ERIS does not in and of itself convey any transmission service.

This ERIS System Impact Study was based on information provided by the Customer and assumptions made by Entergy's Independent Coordinator of Transmission (ICT) planning group and Entergy's Transmission Technical System Planning group. All supplied information and assumptions are documented in this report. If the actual equipment installed is different from the supplied information or the assumptions made, the results outlined in this report are subject to change.

It was determined that there are no Entergy Transmission System upgrades required for this ERIS request. The estimated cost of interconnection facilities is $7,500,000; which covers the cost of the construction of a new 115kV 3-element ring bus substation cut-in at the Customer's point of interconnection on Entergy's Wisner – Red Gum 115kV transmission line.

2. Short circuit Analysis/Breaker Rating Analysis

2.1 Model Information

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

2.2 Short Circuit Analysis

The method used to determine if any short circuit problems would be caused by the addition of the PID 268 generation is as follows:

Three-phase and single-phase to ground faults were simulated on the Entergy base case short circuit model and the worst case short circuit level was determined at each station. The PID 268 generator was then modeled in the base case to generate a revised short circuit model. The base case short circuit results were then compared with the results from the revised model to identify any breakers that were under-rated as a result of additional short circuit contribution from PID 268 generation. Any breakers identified to be upgraded through this comparison are mandatory upgrades.

2.3 Analysis Results

The results of the short circuit analysis indicated that the additional generation due to PID 268 generation caused no increase in short circuit current such that they exceeded the fault interrupting capability of the high voltage circuit breakers within the vicinity of the PID 268 plant **with and without priors**. Priors included are: 221, 231, 238, 240, 244, 247, 250, 251, 252, 253, 255, 256, 257, 260, 261, and 266.

2.4 Problem Resolution

As a result of the short circuit analysis findings, no resolution was required.

3. Load Flow Analysis

3.1 Model Information

The load flow analysis was performed based on the projected 2014 summer peak load flow model. Approved future transmission projects in the 2011-2013 ICT Base Plan were used in the models for scenarios three and four. These upgrades can be found on Entergy's OASIS web page at http://www.oatioasis.com/EES/EESDocs/Disclaimer.html

The loads were scaled based on the forecasted loads for the year. All firm power transactions between Entergy and its neighboring control areas were modeled for the year 2014 excluding short-term firm transactions on the same transmission interface. An economic dispatch was carried out on Entergy generating units after the scaling of load and modeling of transactions. The proposed 60MW generation and the associated facilities were then modeled in the case to build a revised case for the load flow analysis. Transfers were simulated between thirteen (13) control areas and Entergy using requesting generator as the source and adjacent control area as sink. The generator step-up transformers, generators, and interconnecting lines were modeled according to the information provided by the customer.

This study considered the following four scenarios:

Scenario No.	Approved Future Transmission Projects	Pending Transmission Service & Study Requests
1	Not Included	Not Included
2	Not Included	Included
3	Included	Not Included
4	Included	Included

3.2 Load Flow Analyses

3.2.1 Load Flow Analysis:

The load flow analysis was performed as a DC analysis using PSS/E and PSS/MUST software by Power Technologies Incorporated (PTI). A Transmission Reliability Margin (TRM) value that effectively reduced line ratings by 5% was used in the model. With the above assumptions implemented, the First

Contingency Incremental Transfer Capability (FCITC) values are calculated. The FCITC depends on various factors – the system load, generation dispatch, scheduled maintenance of equipment, and the configuration of the interconnected system and the power flows in effect among the interconnected systems. The FCITC is also dependent on previously confirmed firm reservations on the interface. The details of each scenario list each limiting element, the contingency for the limiting element, and the Available Transfer Capacity (ATC). The ATC is equal to the FCITC.

3.2.2 Performance Criteria

The criteria for overload violations are as follows:

A) With All Lines in Service
- The MVA flow in any branch should not exceed Rate A (normal rating).
- Voltage greater than 0.95pu.

B) Under Contingencies
- The MVA flow through any facility should not exceed Rate A.
- Voltage greater than 0.92pu.

3.2.3 Power Factor Consideration / Criteria

FERC Order 661A describes the power factor design requirements for wind and solar generation plants. A wind or solar generation facility's reactive power requirements are based on the aggregate of all units that feed into a single point on the transmission system. The Transmission Provider's System Impact Study is needed to demonstrate that a specific power factor requirement is necessary to ensure safety or reliability.

Contingencies were taken in North Louisiana, South Arkansas and Northwest Mississippi. All of the bus voltages were monitored in those regions.

There were no voltage limitations if the study plant is operated at unity power factor.

3.3 Analysis Results

Summary of the analysis results are documented in following table for each scenario.

Table 3.1: Summary of Results for PID 268 – ERIS Load Flow Study

Interface		Summer Peak Case Used	FCITC Available for Scenario 1	FCITC Available for Scenario 2	FCITC Available for Scenario 3	FCITC Available for Scenario 4
AECI	Associated Electric Cooperative, Inc.	2014	-1302	-709	-1445	-343
AEPW	American Electric Power - West	2014	-634	-1491	-720	-1455
AMRN	Ameren Transmission	2014	-1406	-568	-1559	-284
CLEC	CLECO	2014	-362	-595	-236	-290
EES	Entergy	2014	-502	-1696	-341	-1462
EMDE	Empire District Electric Co	2014	-1103	-889	-1232	-413
LAFA	Lafayette Utilities	2014	-451	-447	-304	-179

Interface		Summer Peak Case Used	FCITC Available for Scenario 1	FCITC Available for Scenario 2	FCITC Available for Scenario 3	FCITC Available for Scenario 4
	System					
LAGN	Louisiana Generating, LLC	2014	-592	-360	-394	-188
LEPA	Louisiana Energy & Power Authority	2014	-827	-1014	-412	-139
OKGE	Oklahoma Gas & Electric Company	2014	-939	-1122	-1055	-496
SMEPA	South Mississippi Electric Power Assoc.	2014	-1275	-1410	-364	-221
SOCO	Southern Company	2014	-517	-319	-354	-169
SPA	Southwest Power Administration	2014	-1182	-976	-1315	-444
TVA	Tennessee Valley Authority	2014	-458	-393	-310	-205

4. Interconnection Facilities

The interconnection customer's designated Point of Interconnection (POI) is a new 115kV substation that will be constructed and cut-in on Entergy's Wisner – Red Gum 115kV transmission line. The interconnection customer is responsible for constructing all facilities needed to deliver generation to the POI. The estimated cost for a 115kV, 3-element ring bus configuration substation is $7.5 Million. The cost is based on parametric estimating techniques for a "typical" site. The cost may change significantly based on specific project parameters that are not known at this time. Costs specific to this interconnection will be developed during the Facilities Study.

TABLE 3.2: DETAILS OF SCENARIO 1 RESULTS: (WITHOUT FUTURE PROJECTS AND WITHOUT PENDING TRANSMISSION SERVICE & STUDY REQUEST)

Limiting Element	Cost Est.	AECI	AEPW	AMRN	CLECO	EES	EMDE	LAFA	LAGN	LEPA	OKGE	SMEPA	SOCO	SPA	TVA
Baxter Wilson SES - Vicksburg 115kV	2,520,000											X	X		X
Bonin - Cecelia 138kV	11,760,000									X					
Brookhaven - Brookhaven South 115kV	3,360,000											X			
Brookhaven South - Franklin 115kV	10,920,000											X			
CALIFRN - Vaughn 115kV	5,040,000											X			
Carroll 230/138kV transformer (CLECO)	Other Ownership	X	X				X				X			X	
Champagne - Plaisance (CLECO) 138kV	10,920,000							X		X					
Coughlin - Plaisance 138kV (CLECO)	Other Ownership							X		X					
Downsville - Ruston East 115kV	7,560,000	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Franklin - Vaughn 115kV	5,880,000											X			
French Settlement - Sorrento 230kV	7,200,000											X			
Habetz - Richard 138kV	Included in 2011 ICT Base Plan							X		X					
International Paper - Mansfield 138kV (CLECO)	Other Ownership	X	X	X			X				X			X	
International Paper - Wallake 138kV (CLECO)	Other Ownership	X	X	X			X				X			X	
Jackson Miami - Jackson Monument Street 115kV	2,520,000											X			
North Crowley - Scott1 138kV	14,280,000							X		X					
Pleasant Hill 500/161kV transformer	Included in 2011 ICT Base Plan													X	
Ray Braswell - Baxter Wilson 500kV - Supplemental Upgrade	TBD	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Ray Braswell - West Jackson 115kV	5,040,000											X			
Ray Braswell 500/230kV transformer ckt2 - Supplemental Upgrade	TBD											X			

Limiting Element	Cost Est.	AECI	AEPW	AMRN	CLECO	EES	EMDE	LAFA	LAGN	LEPA	OKGE	SMEPA	SOCO	SPA	TVA
Ruston East - Vienna 115kV	2,520,000	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Scott1 - Bonin 138kV	4,200,000							X		X					
Semere - Scott2 138kV	13,440,000							X							
Toledo - VP Tap 138kV	Included in 2011 ICT Base Plan		X												
Willow Glen - Evergreen 230kV ckt 2	3,600,000									X					

TABLE 3.3: DETAILS OF SCENARIO 2 RESULTS: (WITHOUT FUTURE PROJECTS AND WITH PENDING TRANSMISSION SERVICE & STUDY REQUEST)

Limiting Elements	Cost Est.	AECI	AEPW	AMRN	CLECO	EES	EMDE	LAFA	LAGN	LEPA	OKGE	SMEPA	SOCO	SPA	TVA
Bonin - Cecelia 138kV	11,760,000									X					
Brookhaven - Brookhaven South 115kV	3,360,000											X			
Brookhaven - Mallalieu (MEPA) 115kV	Included in 2011 ICT Base Plan											X			
Brookhaven South - Franklin 115kV	10,920,000											X			
Champagne - Plaisance (CLECO) 138kV	10,920,000							X		X					
Coughlin - Plaisance 138kV (CLECO)	Other Ownership							X		X					
Cypress 500/138kV transformer 1	18,770,000		X			X									
Cypress 500/230kV transformer	19,110,000		X			X									
Florence - South Jackson 115kV - Supplemental Upgrade	TBD											X			
Franklin - Vaughn 115kV	5,880,000											X			
French Settlement - Sorrento 230kV	7,200,000											X			
Habetz - Richard 138kV	Included in 2011 ICT Base Plan							X		X					
Hartburg - Inland Orange 230kV - Supplemental Upgrade	TBD					X									
Helbig - McLewis 230kV	TBD					X									
Jackson Miami - Jackson Monument Street 115kV	2,520,000											X			
Jackson Miami - Rex Brown 115kV	1,680,000											X			
Judice - Scott1 138kV	6,720,000									X					
Natchez SES - Red Gum 115kV		X	X	X	X	X	X	X	X	X	X	X	X	X	X
North Crowley - Scott1 138kV	14,280,000							X		X					
Rapidies (CLECO) - Rodemacher (CLECO) 230kV	Other Ownership							X							
Ray Braswell - Baxter Wilson 500kV - Supplemental Upgrade	TBD	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Ray Braswell - West Jackson 115kV	5,040,000											X			
Ray Braswell 500/230kV transformer ckt2 - Supplemental Upgrade	TBD											X			

Limiting Elements	Cost Est.	AECI	AEPW	AMRN	CLECO	EES	EMDE	LAFA	LAGN	LEPA	OKGE	SMEPA	SOCO	SPA	TVA
Richard - Scott1 138kV	23,520,000							X		X					
Scott1 - Bonin 138kV	4,200,000							X		X					
Semere - Scott2 138kV	13,440,000							X							
Willow Glen - Evergreen 230kV ckt 2	3,600,000									X					

TABLE 3.4: DETAILS OF SCENARIO 3 RESULTS: (WITH FUTURE PROJECTS AND WITHOUT PENDING TRANSMISSION SERVICE & STUDY REQUEST)

Limiting Element	Cost Est.	AECI	AEPW	AMRN	CLECO	EES	EMDE	LAFA	LAGN	LEPA	OKGE	SMEPA	SOCO	SPA	TVA
Brookhaven - Brookhaven South 115kV	3,360,000											X			
Brookhaven South - Franklin 115kV	10,920,000											X			
Carroll 230/138kV transformer (CLECO)	Other Ownership	X	X				X				X			X	
Downsville - Ruston East 115kV	7,560,000	X	X	X	X	X	X	X	X	X	X		X	X	X
International Paper - Mansfield 138kV (CLECO)	Other Ownership	X	X	X			X				X			X	
International Paper - Wallake 138kV (CLECO)	Other Ownership	X	X	X			X				X			X	
Ray Braswell - Baxter Wilson 500kV - Supplemental Upgrade	TBD									X		X			
Ray Braswell 500/230kV transformer ckt2 - Supplemental Upgrade	TBD											X			
Rilla - Frostkraft Supplemental Upgrade	TBD	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Ruston East - Vienna 115kV	2,520,000	X	X	X	X	X	X	X	X	X	X		X	X	X

TABLE 3.5: DETAILS OF SCENARIO 4 RESULTS: (WITH FUTURE PROJECTS AND WITH PENDING TRANSMISSION SERVICE & STUDY REQUEST)

Limiting Element	Cost Est.	AECI	AEPW	AMRN	CLECO	EES	EMDE	LAFA	LAGN	LEPA	OKGE	SMEPA	SOCO	SPA	TVA
Brookhaven South - Franklin 115kV	10,920,000											X			
Coughlin - Plaisance 138kV (CLECO)	Other Ownership							X		X					
Cypress 500/138kV transformer 1	18,770,000		X			X									
Cypress 500/230kV transformer	19,110,000		X			X									
Florence - South Jackson 115kV - Supplemental Upgrade	TBD											X			
Hartburg - Inland Orange 230kV - Supplemental Upgrade	TBD					X									
Helbig - McLewis 230kV	TBD					X									
Inland - McLewis 230kV - Supplemental Upgrade	TBD					X									
International Paper - Mansfield 138kV (CLECO)	Other Ownership	X	X	X			X				X			X	
Natchez SES - Red Gum 115kV	10,080,000					X			X	X		X	X		X
Rapidies (CLECO) - Rodemacher (CLECO) 230kV	Other Ownership							X							
Ray Braswell - Baxter Wilson 500kV - Supplemental Upgrade	TBD	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Rilla - Frostkraft Supplemental Upgrade	TBD	X	X	X		X	X	X	X	X	X	X	X	X	X

Stability Study

5. Executive Summary

Southwest Power Pool (SPP) commissioned ABB Inc. to perform a stability study for the interconnection of two projects PID 266 and PID 268. The proposed projects are 40 MW and 60 MW Photovoltaic (PV) based generation. PID 266 has a proposed Point of Interconnection on the Tallulah-Delhi 115kV transmission line (approximately 0.65 miles from Tallulah and 20 miles from Delhi substations) and PID 268, on the Wisner-Red Gum 115kV transmission line (approximately 13 miles from Wisner and 12 miles from Red Gum substations) in the Entergy service territory.

The objective of this study is to evaluate the combined impact of proposed PID 266 and PID 268 projects on the stability of the Entergy transmission system and nearby generating stations. The study was performed on a 2014 Summer Peak case, provided by SPP-ICT/Entergy.

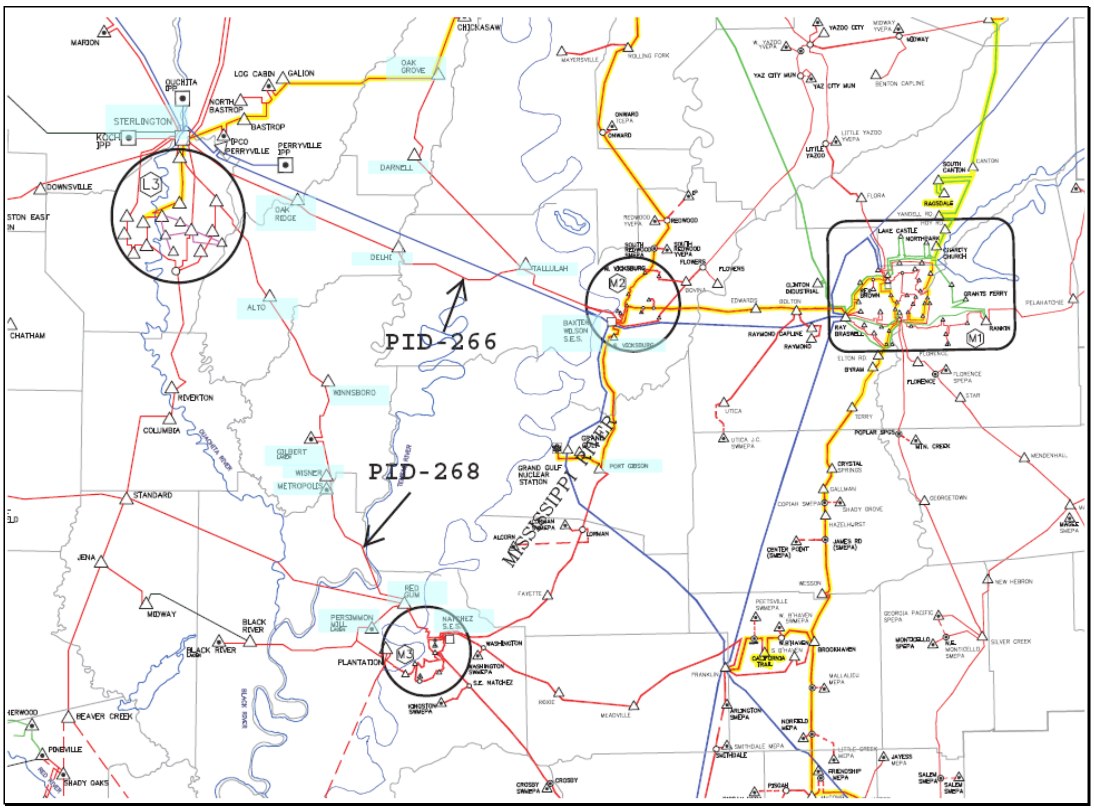


Figure 5.1: Tallulah-Delhi and Wisner-Red Gum 155kV Vicinity

6. Final conclusions

Based on the results of stability analysis, it can be concluded that interconnection of the proposed PID 266 (40 MW) generation at Tallulah-Delhi 115kV transmission line and PID 268 (60MW) generation at Wisner-Red Gum 115kV transmission line in the Entergy service territory does not adversely impact the stability of the Entergy System. Results indicated that the system is stable following all simulated three-phase normally cleared and three-phase stuck-breaker faults with adequate voltage recovery and damping. Also, no transient voltage criteria violations were observed.

7. Stability Analysis

7.1 Stability Analysis Methodology

The goal of stability analysis is to verify that the response to dynamic events (e.g. faults) is acceptable (i.e. no out-of-step condition, acceptable voltage recovery, post-disturbance, damped oscillations) with the proposed PID 266 and PID 268 in service.

Three-phase faults with normal clearing and delayed clearing were simulated. If system is unstable following a three-phase stuck breaker fault, it will be repeated assuming a single-phase stuck breaker fault. Three-phase and single-phase line faults were simulated for the specified duration and synchronous machine rotor angles were monitored to make sure they maintained synchronism following fault removal. Bus voltages were monitored to check any voltage recovery issues. The fault clearing times used for the simulations are given in Table 7.1.

Table 7.1: Fault Clearing Times

Contingency at kV level	Normal Clearing	Delayed Clearing
500 and 115	6 cycles	6+9 cycles

System quantities like machine angles and bus voltages were plotted over the entire simulation duration. For PV applications, the electrical power output, reactive power outpu, and inverter terminal voltage were monitored.

The following transient voltage criteria were used:

- Three-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
- Three-phase faults with normal clearing resulting in the loss of two (2) 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

For the proposed PV interconnections, the voltage and frequency relay settings were provided by the manufacturer (as shown in Table 7.2). The voltage and frequency is measured at the PV inverter terminals. The trip times shown in Table 7.2 include relay pickup and breaker times.

Table 7.2: Voltage and Frequency Relay Settings for PV

Voltage Range (p.u)	Trip Time (sec.)
V < 0.45	0.16
0.45 < V < 0.85	2
1.1 < V < 1.2	1

Voltage Range (p.u)	**Trip Time (sec.)**
V > 1.2	0.16
Frequency (Hz)	**Trip Time (sec.)**
F > 62	0.16
F < 57	0.16

Stability analysis was performed using the PSS/E™ dynamics program V30.3.3 CVF build. PSS/E™ is a positive sequence program. Balanced faults such as three-phase faults can be simulated by applying a fault admittance of –j2E9 (essentially infinite admittance or zero impedance).

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.

7.2 Study Model Development

The PID 266 and PID 268 projects are respectively, 40 MW and 60 MW PV based generation, which comprises of PV modules (Trina Solar TSM-PC14) and inverters (SMA SC500HE). These inverters are typically integrated with an array of PV modules, step-up transformers and other balance-of-system components necessary to convert solar irradiance to AC power for delivery at transmission or distribution voltage.

The SMA PV inverter and PV modules are modeled as an equivalent generator, which are scaled to the capacity rating of proposed plants (40MW and 60MW). The voltage at the inverter terminals is 270V and is stepped up to feed a 34.5kV collector system through inverter step-up transformer, which is connected to the respective point of interconnection of PID 266 and 268 projects via 34.5/115kV station transformer.

Based on the provided data, the PV inverter is capable of supplying/drawing reactive power to/from the grid thus contributing to grid voltage support. The reactive power capability corresponds to a power factor range from 0.95 lagging to 0.95 leading. No block diagram or documentation was available at the time of study.

For the purposes of this study, PV inverters were modeled at unity power factor based on developer's information. We also performed a sensitivity analysis with the proposed PV generation operating at 0.95 PF lead (i.e. absorbing reactive power), which is most conservative.

The study models consisted of a power flow and a dynamic representation of the PV as described below.

7.2.1 Power Flow Case

A pre-project power flow case representing 2014 Summer Peak conditions, 'EN14S10_U1_CP_finalr2_PID266_unconv.sav' was provided by SPP/ Entergy.

SPP/Entergy also provided the following system data - electrical network model (power flow) for the renewable (PV) generation projects (PID 266 and PID 268):

- One-line diagram of single machine representation for the solar plant with number of inverters and individual inverter ratings (Power and Voltage)
- Type and make of the PV inverter
- Collector system equivalent
- Transformers (main and inverter) impedances and ratings

For representation in the power flow, the PV inverters were modeled as equivalent generators connected to a type 2 (generator) bus, with a nominal voltage of 0.27kV. The inverter type being supplied for this project is of SMA SC500HE make; modeled at unity power factor – i.e. the Qmax and Qmin of the equivalent generator are set at zero. Also, a total of 80 inverters for PID 266 and 120 inverters for PID 268 (each inverter is rated at 500 kW; 40MW ÷ 0.5 = 80 inverters and 60MW ÷ 0.5 = 120) were represented by single equivalent generators (one (1) each for 40 MW and 60 MW plants). An equivalent inverter step-up transformer representation was used to model the 0.27/34.5kV with 5.75% impedance and X/R ratio of 13. The main (station) transformers were modeled with 8% impedance and X/R ratio of 13 on a respective MVA base for each project. Collector system equivalents and POI interconnection were modeled as per data provided.

A post-project case was developed by adding the PID 266 and PID 268 projects. The representation of PID 266 and PID 268 were updated to reflect data for 40 MW and 60MW equivalent generators (PV Inverter). Both projects were modeled as shown in Figure 7.2 and dispatched against Lewis Creek generators in the Entergy footprint area. The local area generation at Sterlington, Perryville, Ouachita, and Baxter Wilson were turned on at their Pmax. The power flow case was updated with Sterlington and Baxter Wilson substation changes as well as the NE Louisiana Improvement Phase1 Project[1] as per Entergy suggestions.

Figure 7.1 and Figure 7.2 show the PSS/E one-line diagram for the local area without and with PID 266 and PID 268 projects respectively, for the 2014 Summer Peak system conditions.

7.2.2 Stability Database

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

SPP also provided the dynamic data for PV inverter model (‘SMASCIC0_V303_CVF66B’ user written model) for representation of the proposed solar projects (PID 266 and PID 268) in the dynamic regime. Manufacturer provided settings were used for the PV inverter. A “dyre” file was created with the given parameters and read into the dynamic data to append the base stability database. The SMA SC500HE inverter model was compiled and linked with the standard PSSE library to create a new dynamics set up for performing the post-project simulations.

- [1] Split Oak Ridge bus and create Oak Ridge 2 (3OKRIDG2).
- Construct Swartz to 3OKRIDG2 230kV line operated at 115kV (13 miles) ACSR 1272 Bittern equipment limited to 239 MVA while 115kV.
- Move load and capacitor from Oak Ridge to new 3OKRIDG2.
- Open original Sterlington-Oak Ridge line in order to serve load from new line.

Figure 7.1: One-line diagram for the local area without PID 266 and 268 projects

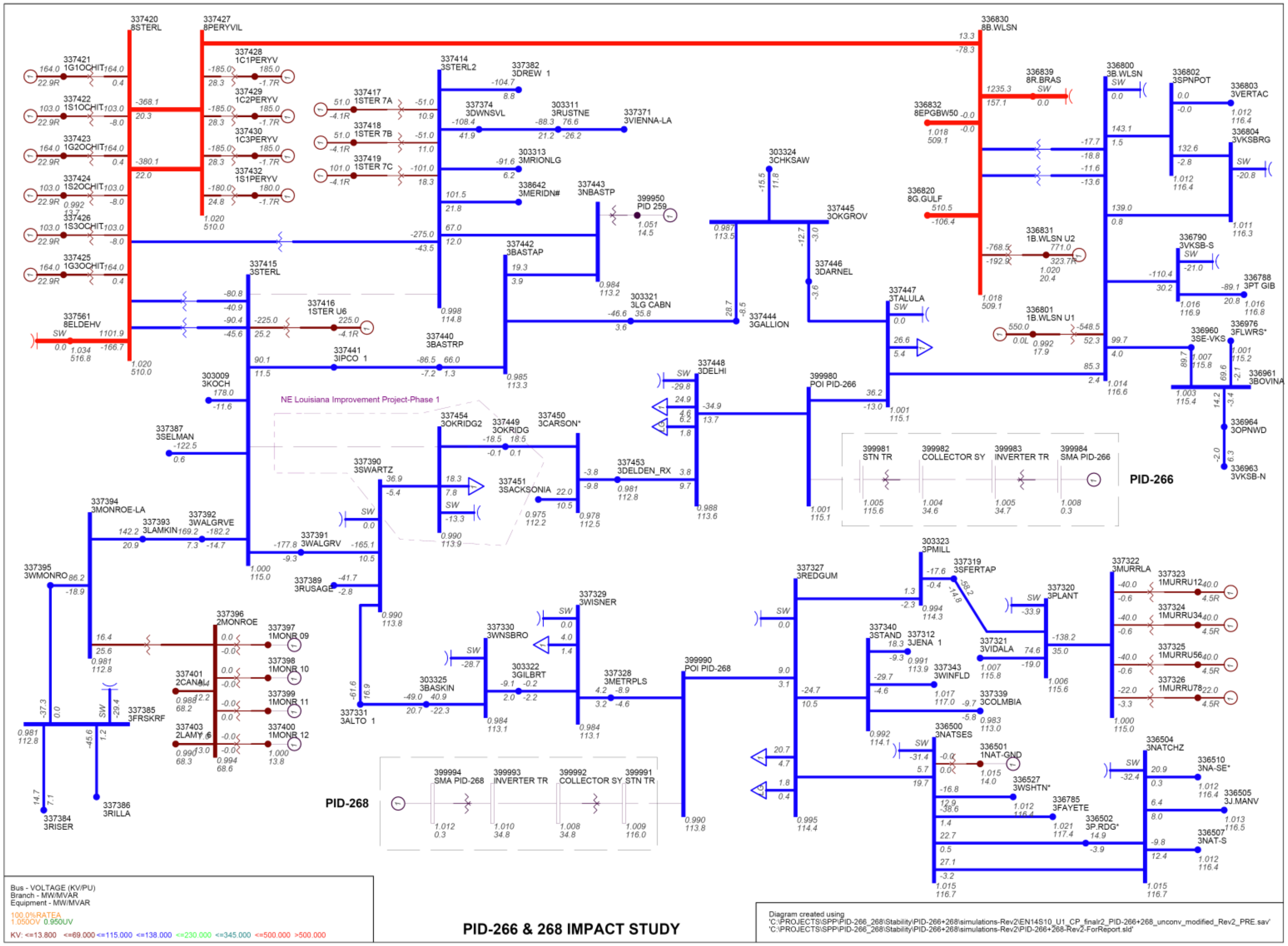
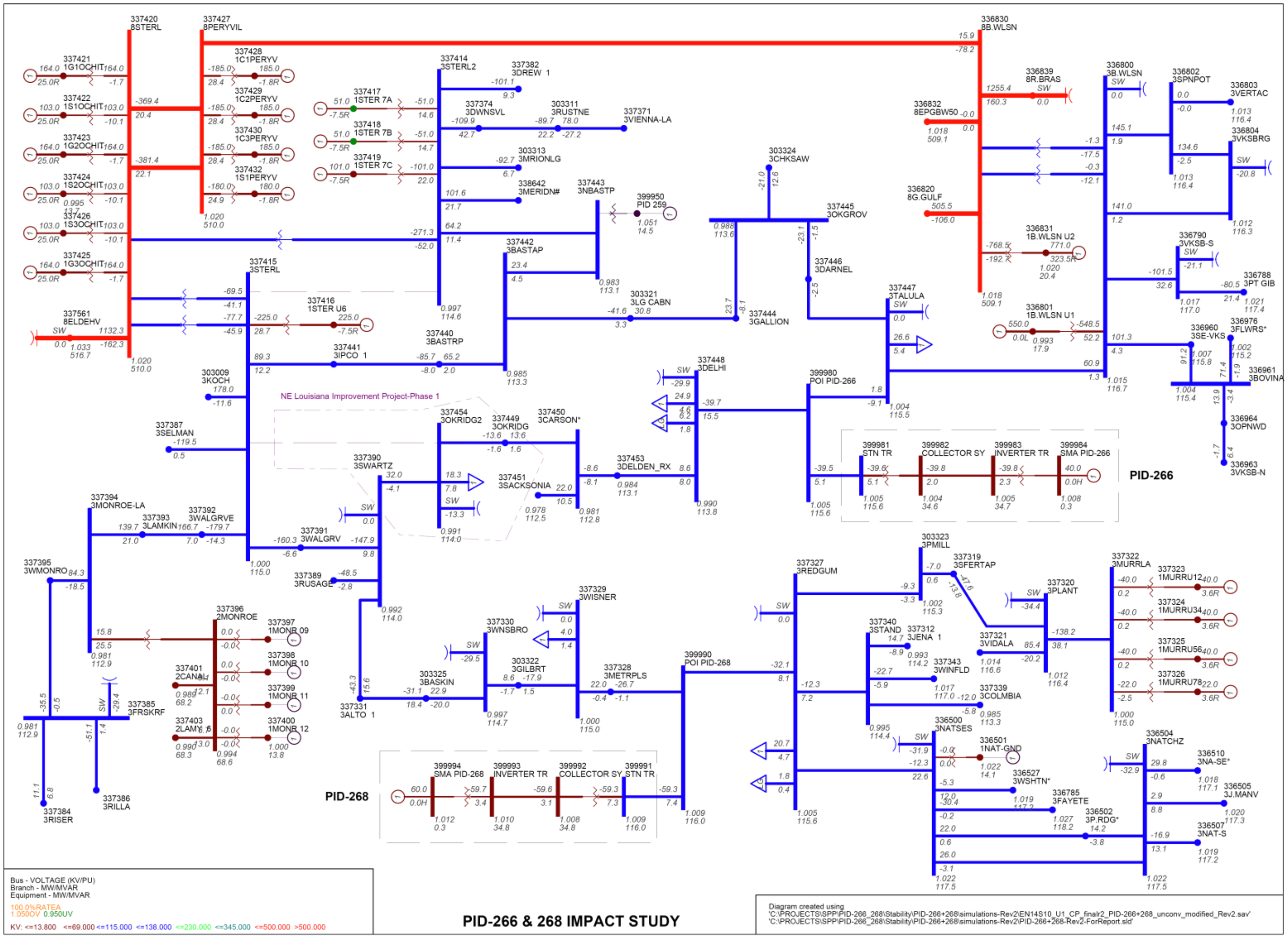


Figure 7.2: One-line diagram for the local area with PID 266 and 268 projects



7.3 Transient Stability Analysis

Stability simulations were run to examine the transient behavior of the PID 266 and PID 268 projects and its combined impact on the Entergy system.

Three-phase faults were chosen in the vicinity of PID 266 and PID 268 and simulated as either normally clearing or with stuck-breaker conditions.

Breaker configuration at the point of interconnections of PID 266 and PID 268 were unavailable and therefore we assumed a three-breaker ring bus configuration at the 115kV POI.

First, three-phase faults with normal clearing were simulated. Next, three-phase stuck breaker faults were simulated. If a three-phase stuck breaker fault was found to be unstable, then a single-line-to-ground (SLG) fault followed by breaker failure was studied.

Breaker failure scenarios were simulated with the following sequence of events:

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

2) The fault is then cleared by back-up clearing.

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

Table 7.3 lists all the fault cases that were simulated in this study, including normally cleared three-phase faults and three-phase stuck breaker faults. Figure 7.3 to Figure 7.9 show the layout diagrams of the nearby 500kV and 115kV substations where faults were simulated, as well as fault locations.

7.3.1 Low Voltage Ride Through (LVRT)

One of the interconnection requirements for renewable generation is the ability to stay online during and after a normally cleared three-phase fault. For the proposed interconnections, FERC-661A methodology, which is being applied for wind installation was adopted to test the fault ride-through performance.

Table 7.3 shows the faults simulated to test LVRT capability of the proposed PV generation.

For all cases analyzed, the initial disturbance was applied at t = 1 seconds.

Table 7.3: List of Simulated Faults

Fault #	Line on which Fault occurs	Fault Location (For Simulation)	Fault Type	Fault Clearing (CY)		Stuck Breaker	Breaker Clearing		Tripped Facilities
				Primary	Back-up		Primary	Back-up	
FAULT_1	POI PID 266 - Delhi; 115kV	POI PID 266 115kV	3PH	6	None	None	1 & 3 (POI PID 266), R4620(Delhi)	None	POI PID 266-Delhi; 115kV line
FAULT_2	POI PID 266 - Tallulah; 115kV	POI PID 266 115kV	3PH	6	None	None	2 & 3 (POI PID 266), R2046(Tallulah)	None	PID-250 POI-Tallulah; 115kV line
FAULT_3	POI PID 268 - Red Gum; 115kV	POI PID 268 115kV	3PH	6	None	None	2 & 3 (POI PID 268), R3462 (Red Gum)	None	PID-250 POI-Red Gum; 115kV line
FAULT_4	POI PID 268 - Metropolis; 115kV	POI PID 268 115kV	3PH	6	None	None	1 & 3 (POI PID 268), R6234 at Winnsboro (Metropolis)	None	POI PID 268-Metropolis-Wisner-Gilbert-Winnsboro; All are 115kV facilities
FAULT_5	Baxter Wilson - Perryville; 500kV	Baxter Wilson 500kV	3PH	6	None	None	J2218,J2233 (Baxter Wilson 500kV), R7372,R9872 (Perryville 500kV)	None	Baxter Wilson - Perryville; 500kV lines
FAULT_6	Baxter Wilson - Tallulah; 115kV	Baxter Wilson 115kV	3PH	6	None	None	J1514,J1518 (Baxter Wilson), R0546 (Tallulah)	None	Baxter Wilson-Tallulah; 115kV lines
FAULT_7	Baxter Wilson - Spencer Potash; 115kV	Baxter Wilson 115kV	3PH	6	None	None	J1582, J1586 (Baxter Wilson), R1546 at Vicksburg #1 (Spencer Potash)	None	Baxter Wilson-Spencer Potash-Vicksburg #1; 115kV lines
FAULT_8	Sterlington-Perryville #1; 500kV	Sterlington 500kV	3PH	6	None	None	Breaker at Sterlington and Perryville	None	Sterlington-Perryville #1; 500kV line
FAULT_9	Sterlington 500/115kV Autotransformer#1	Sterlington 115kV	3PH	6	None	None	R9505, R6583 (Sterlington 115kV), R7266, R4582 (Sterlington 500kV)	None	Sterlington 500/115kV Autotransformer#1 tripped
FAULT_10	Sterlington-Walnut Grove-Monroe; 115kV	Sterlington 115kV	3PH	6	None	None	R3917, R3439 (Sterlington), R3552 at Monroe (Walnut Grove)	None	Sterlington-Walnut Grove - Lamkin - Monroe; All are 115kV facilities
FAULT_11	Sterlington-Selman Field; 115kV	Sterlington 115kV	3PH	6	None	None	R0880, R3913 (Sterlington), R6391 at Selman Field	None	Sterlington-Selman Field; 115kV lines
FAULT_12	Sterlington-Downsville-Vienna; 115kV	Sterlington 115kV	3PH	6	None	None	R2199, R8339 (Sterlington), R1639 at Vienna (Downsville)	None	Sterlington-Downsville-Vienna ; 115kV lines
FAULT_13	Sterlington-North Bastrop; 115kV	Sterlington 115kV	3PH	6	None	None	R1299, R7265 (Sterlington), XXXX (North Bastrop)	None	Sterlington-North Bastrop; 115kV line
FAULT_14	Natchez SES - Pine Ridge; 115kV	Natchez SES 115kV	3PH	6	None	None	J7916 ,J7950 (Natchez SES), J9279 (Natchez)	None	Natchez SES-Pine Ridge-Natchez; All are 115kV facilities

Fault #	Line on which Fault occurs	Fault Location (For Simulation)	Fault Type	Fault Clearing (CY)		Stuck Breaker	Breaker Clearing		Tripped Facilities
				Primary	Back-up		Primary	Back-up	
FAULT_15	Natchez SES - Natchez ; 115kV	Natchez SES 115kV	3PH	6	None	None	J7942 ,J7946 (Natchez SES), J4479 Natchez)	None	Natchez SES-Natchez; 115kV line
FAULT_16	Natchez SES - Fayette; 115kV	Natchez SES 115kV	3PH	6	None	None	J7956 ,J7964 (Natchez SES), J4158 at Port Gibson (Fayette)	None	Natchez SES-Fayette-Port Gibson; All are 115kV facilities
FAULT_17	Baxter Wilson - Spencer Potash; 115kV	Baxter Wilson 115kV	3PHSB	6	9	J1582 (Baxter Wilson)	J1586 (Baxter Wilson), R1546 at Vicksburg (Spencer Potash)	J1578 (Baxter Wilson)	Baxter Wilson-Spencer Potash-Vicksburg ,Baxter Wilson-Vicksburg ; 115kV lines
FAULT_18	Baxter Wilson - S.Vicksburg; 115kV	Baxter Wilson 115kV	3PHSB	6	9	J1570 (Baxter Wilson)	J1566 (Baxter Wilson), J2674 at Port Gibson (S. Vicksburg)	J1574 (Baxter Wilson)	Baxter Wilson-S. Vicksburg-Port Gibson, Baxter Wilson-SE Vicksburg-N Vicksburg ; 115kV lines
FAULT_19	Baxter Wilson - Perryville; 500kV	Baxter Wilson 500kV	3PHSB	6	9	J2233 (Baxter Wilson)	J2218 (Baxter Wilson 500kV), R7372,R9872 (Perryville 500kV)	J2230 (Baxter Wilson)	Baxter Wilson - Perryville, Baxter Wilson - Ray Braswell, All are 500kV lines
FAULT_20	Sterlington-Walnut Grove-Swartz; 115kV	Sterlington 115kV	3PHSB	6	9	R3913 (Sterlington)	R1839 (Sterlington), R0312 at Swartz (Walnut Grove)	R0880 (Sterlington)	Sterlington-Walnut Grove - Swartz, Sterlington-Selman Field; All are 115kV facilities
FAULT_21	Sterlington-IPCO-Bastrop 115kV	Sterlington 115kV	3PHSB	6	9	R1252 (Sterlington)	R5426 (Sterlington), R3923 at Bastrop (IPCO)	R5569 (Sterlington)	Sterlington-IPCO-Bastrop; All are 115kV facilities
FAULT_22	Sterlington-Downsville-Vienna; 115kV	Sterlington 115kV	3PHSB	6	9	R2199 (Sterlington)	R8339(Sterlington), R1639 at Vienna (Downsville)	R7265 (Sterlington)	Sterlington-Downsville-Vienna, Sterlington-North Bastrop ; All are 115kV facilities
FAULT_23	Sterlington-Lagen Marion-ElDorado; 115kV	Sterlington 115kV	3PHSB	6	9	R3909 (Sterlington)	R6539 Sterlington, B3971 at El Dorado East (Marion)	R8744 (Sterlington)	Sterlington-Marion-El Dorado East, Sterlington-Crossett S.-Crossett N. ; All are 115kV facilities
FAULT_24	Natchez SES - Red Gum; 115kV	Natchez SES 115kV	3PHSB	6	9	J7950 (Natchez SES)	J7952 (Natchez SES), J9262 (Red Gum)	J7916 (Natchez SES)	Natchez SES-Red Gum;, Natchez SES-Pine Ridge-Natchez; All are 115kV facilities
FAULT_25	Natchez SES - Fayette; 115kV	Natchez SES 115kV	3PHSB	6	9	J7964 (Natchez SES)	J7956 (Natchez SES), J4158 at Port Gibson (Fayette)	J7926 (Natchez SES)	Natchez SES-Fayette-Port Gibson, Natchez SES-Washington-Franklin; All are 115kV facilities

3PH = Three-phase faults

3PHSB = Three-phase stuck breaker faults

Assumed a three-breaker (#1,2,3) ring bus at the POI

Figure 7.3: One-line diagram for Tallulah 115kV substation

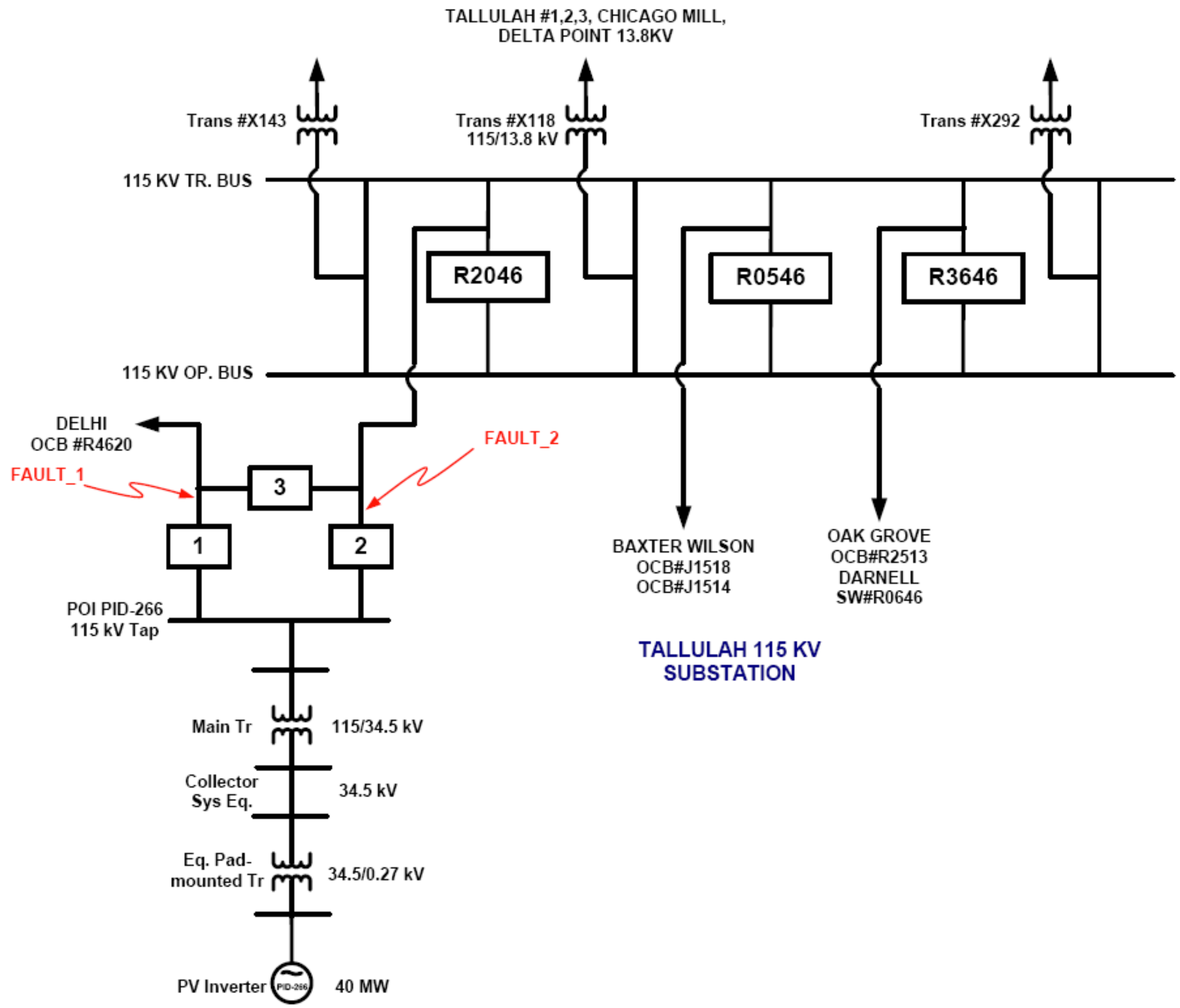


Figure 7.4: One-line diagram for Red Gum 115kV substation

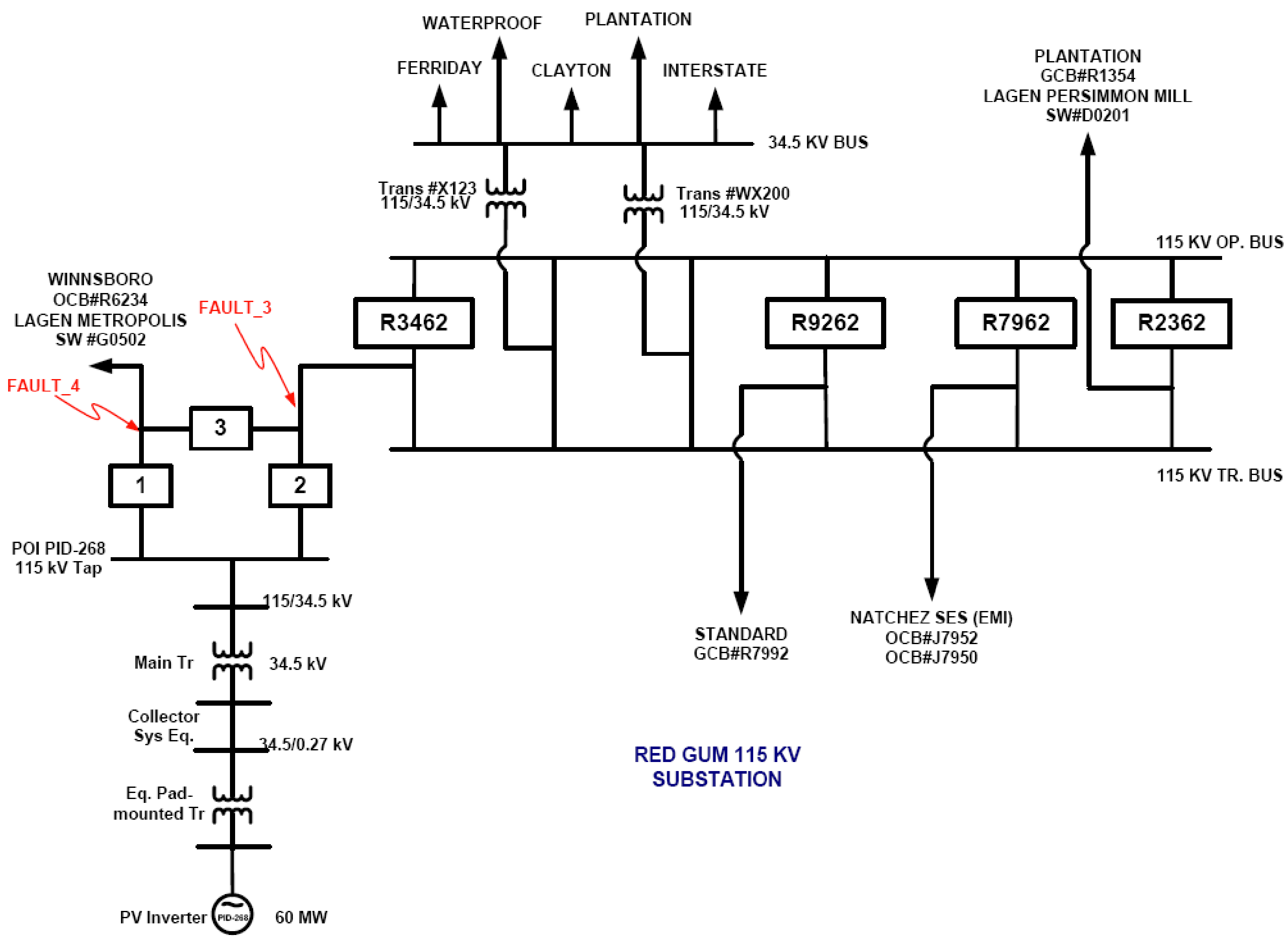


Figure 7.5: One-line diagram for Baxter Wilson 500kV substation

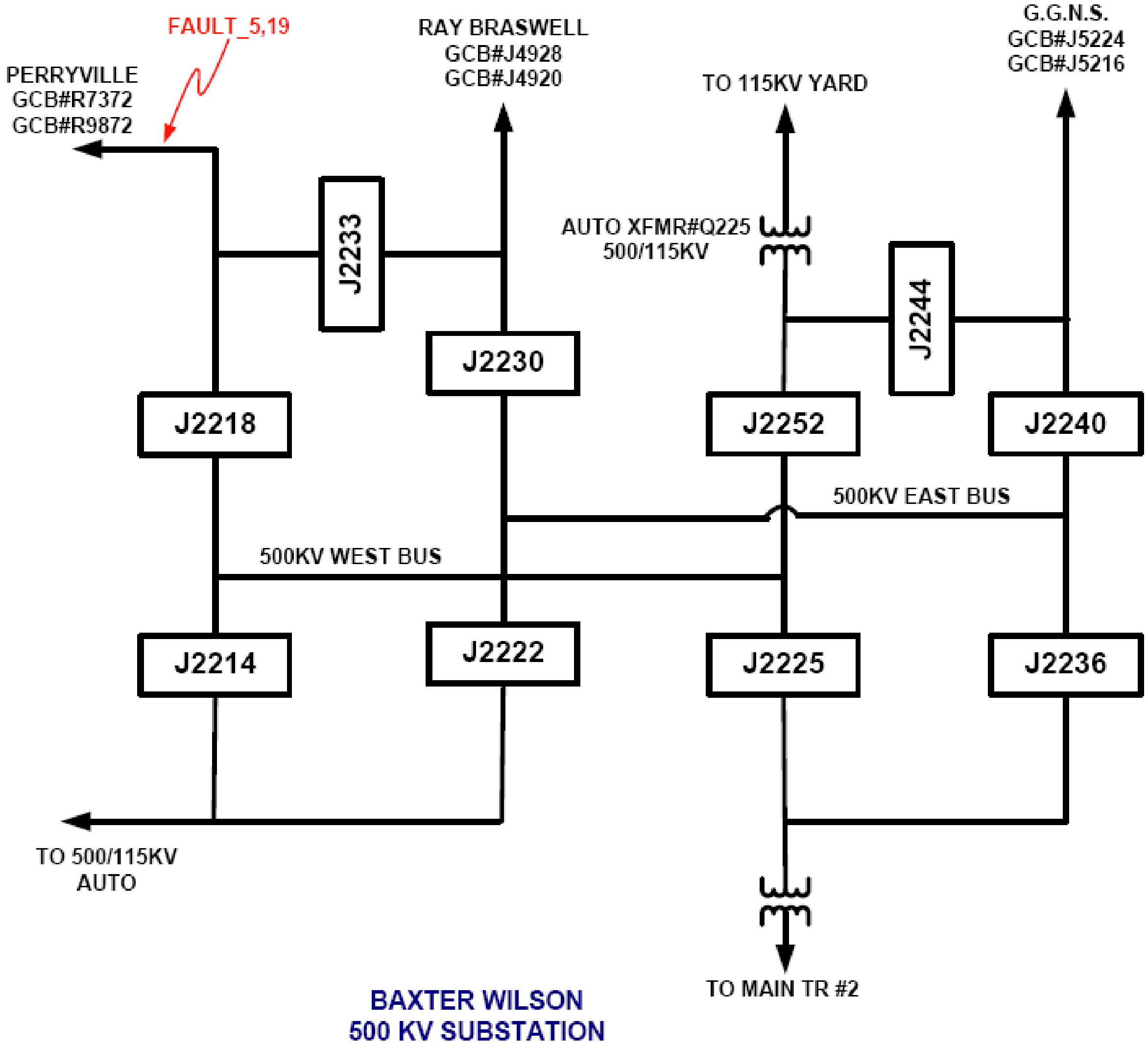


Figure 7.6: One-line diagram for Baxter Wilson 115kV substation

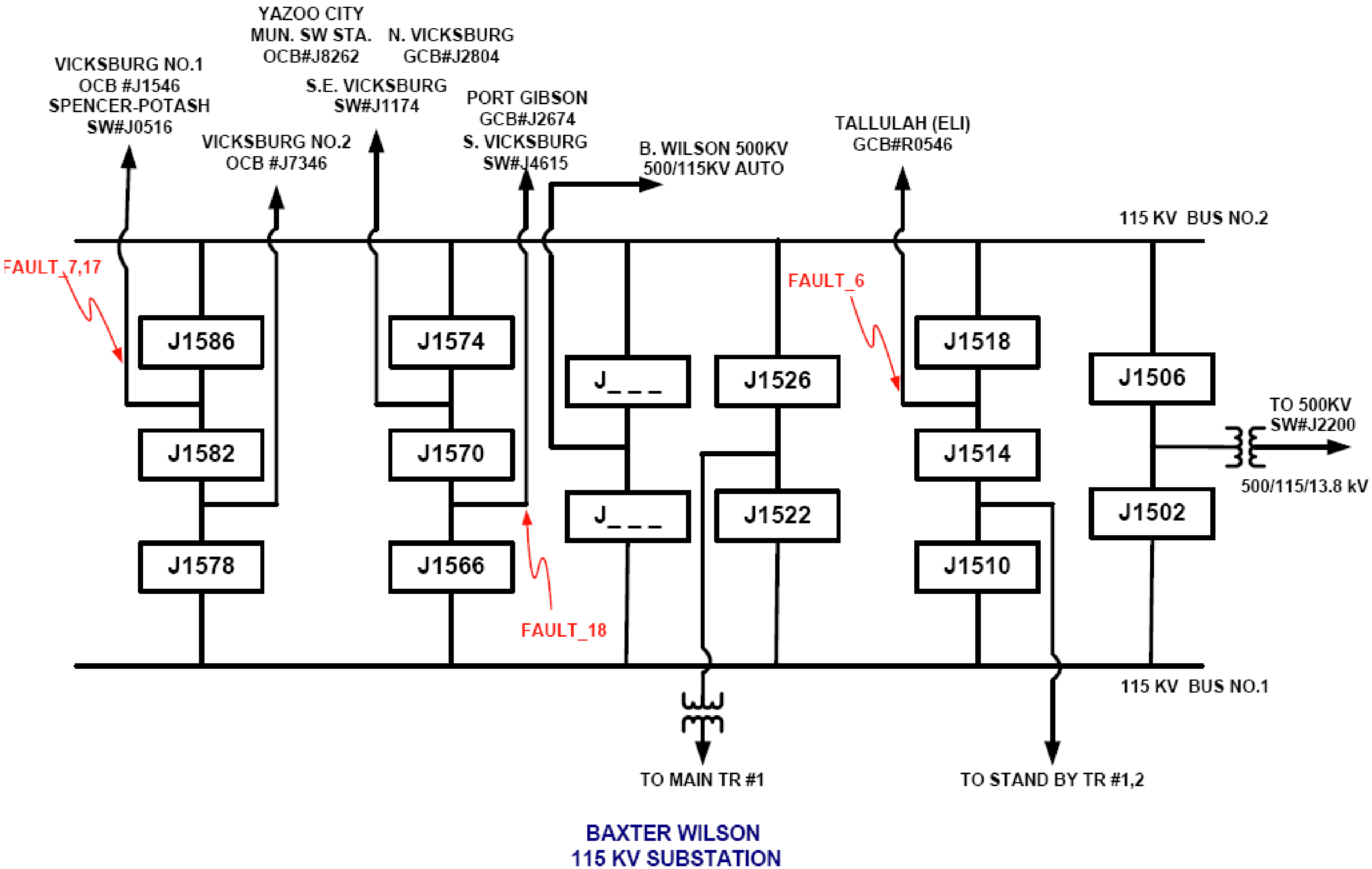


Figure 7.7: One-line diagram for Sterlington 115kV substation

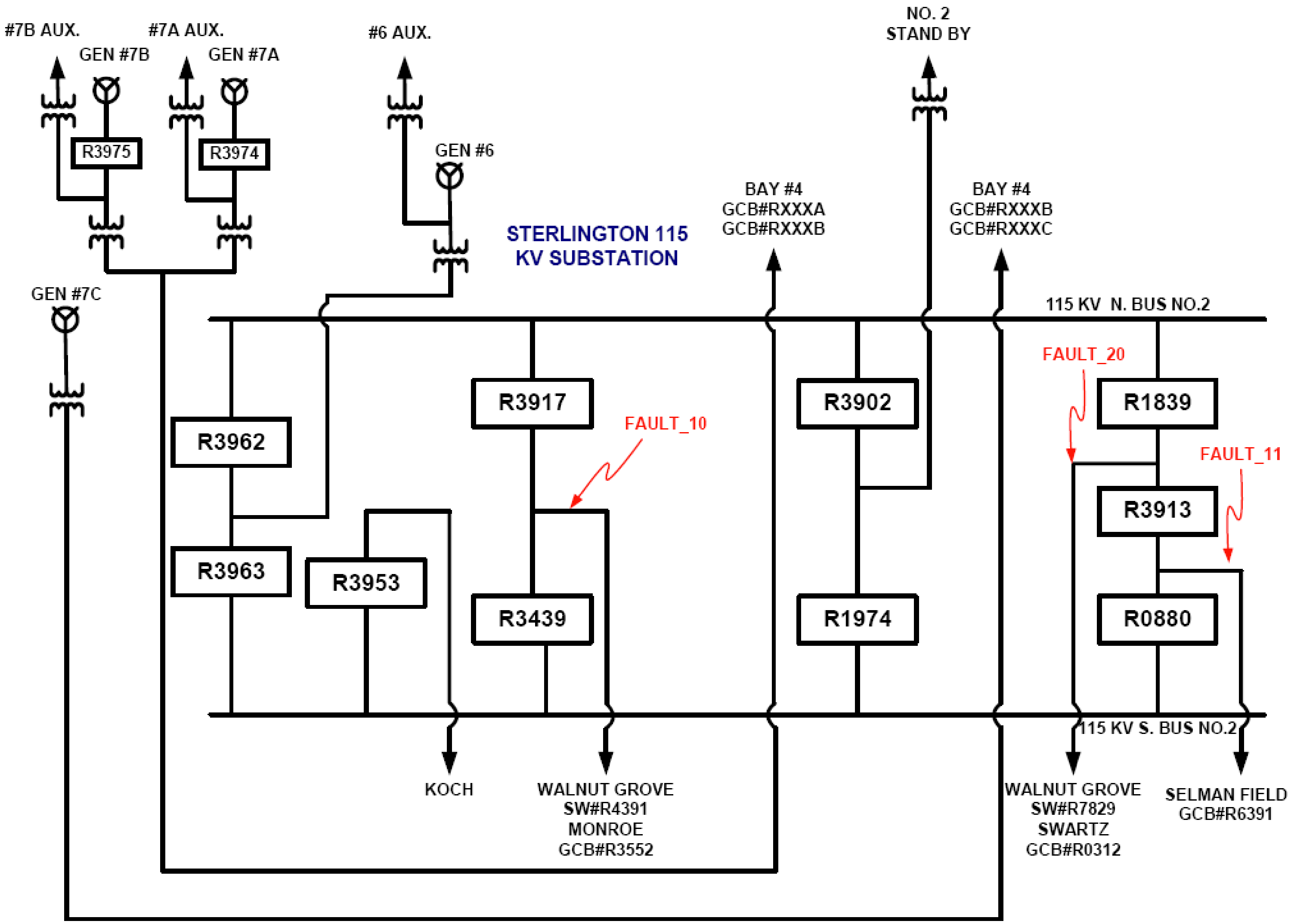


Figure 7.8: One-line diagram for Sterlington 115kV substation

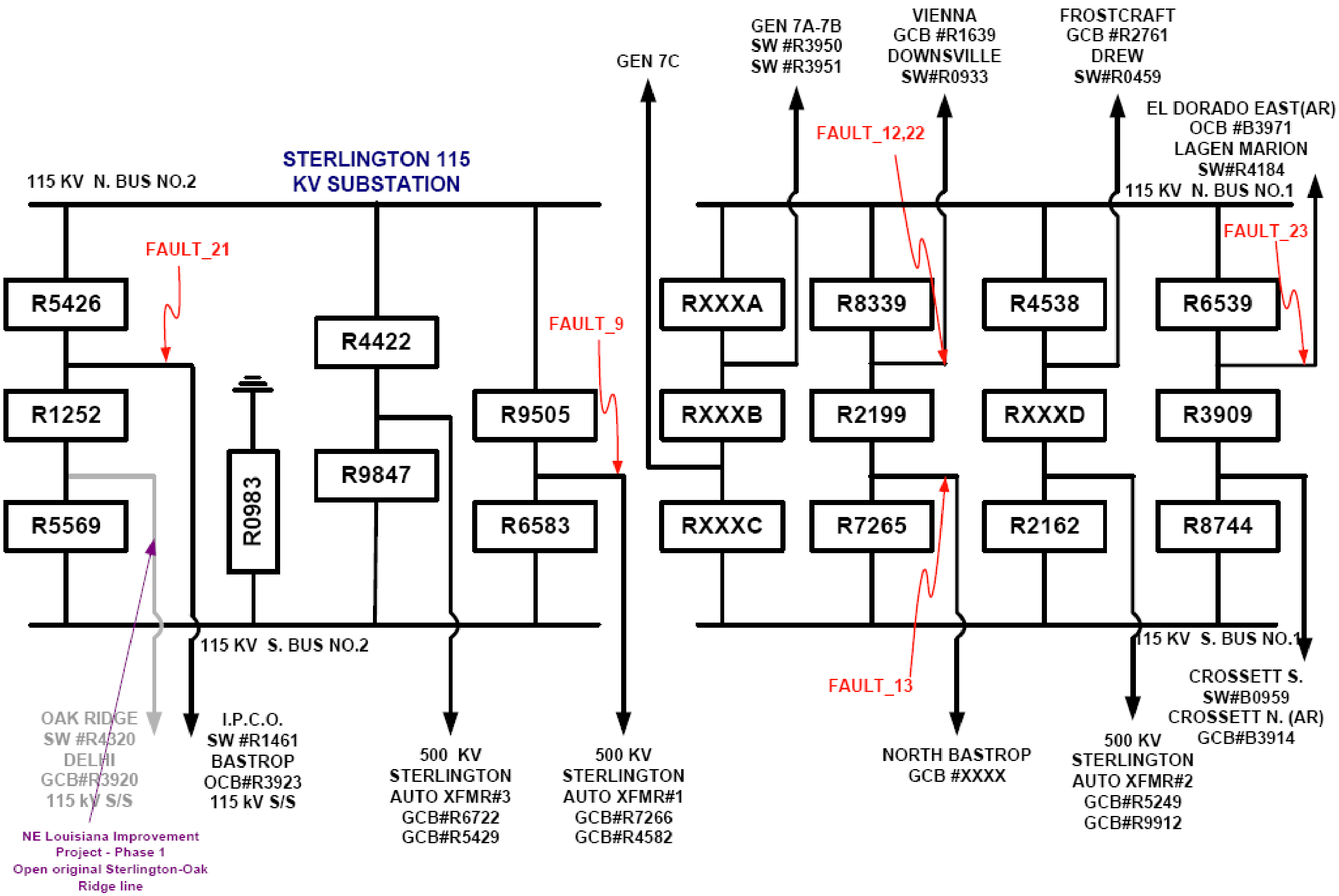
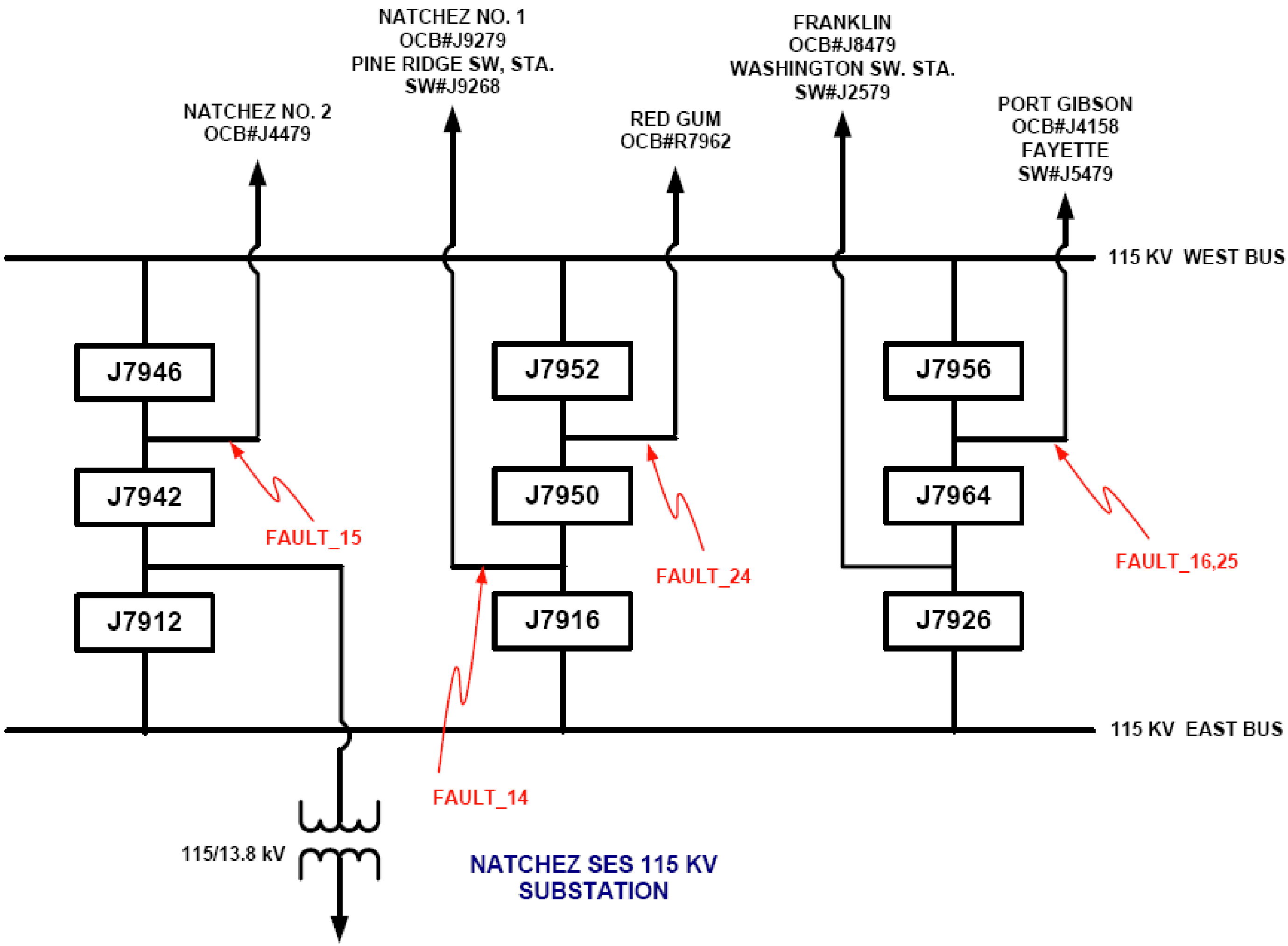


Figure 7.9: One-line diagram for Natchez 115kV substation



A “no-disturbance” simulation was run to ensure the models initialized correctly. The “no-disturbance” simulation showed no drifts in the model response(s), implying that the models initialized correctly.

Analyses on the post-project case showed the system to be stable following all three-phase normally cleared and stuck breaker faults. Table 7.4 shows the simulation results for the three-phase normally cleared and stuck breaker faults and the plots from simulations are shown in Appendix C.

The voltages at all buses were monitored during each of the fault cases as appropriate. No transient voltage criteria violations were observed following normally cleared three-phase faults. 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 i.e., not to exceed 20% for more than 20 cycles. No voltage criteria violations were observed.

Figure 7.10A and Figure 7.10B show the network quantities and Figure 7.11 shows the PV quantities for fault_5, which is a three-phase fault at the Baxter Wilson 500kV line.

To demonstrate the low voltage ride-through capability of the proposed projects, we simulated nine (9) cycles, three-phase faults at the POI. Table 7.5 shows the simulation results for tested LVRT faults. No voltage related trips were indicated. The plots from LVRT simulations are shown in Appendix C.

7.3.2 Sensitivity analysis with 0.95 (leading) power factor

The stability analysis documented in section 2.3 assumed unity power factor for the PV inverters. Sensitivity analyses were run to check the operation of machine (PV Inverter) with the capability of 0.95 pf (absorbing Mvars). We simulated all the fault cases listed in Table 7.3. The simulations results for sensitivity analysis are shown in Table 7.4 and Table 7.5. The PID 268 tripped for the fault at POI (FAULT_3 in the Table) with the manufacturer specified default voltage relay settings. A possible mitigation of this tripping may be achieved through a review and due revision of the voltage relay settings. The practical feasibility of such mitigation would require consultations with the Inverter manufacturer. The voltage recovery was found to be acceptable for rest of the simulated faults. The plots from sensitivity analyses simulations for tested LVRT faults and the three-phase normally cleared and stuck breaker faults are shown in Appendix C.

Figure 7.10A: Plots for bus voltage

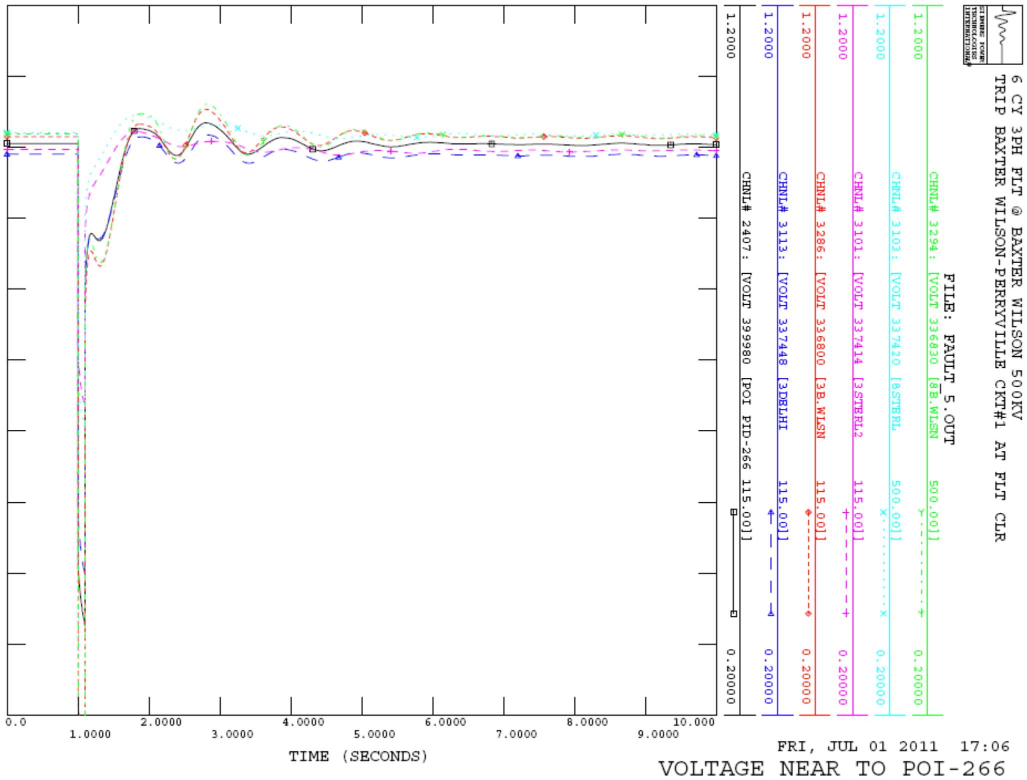


Figure 7.10B: Plots for machine angle

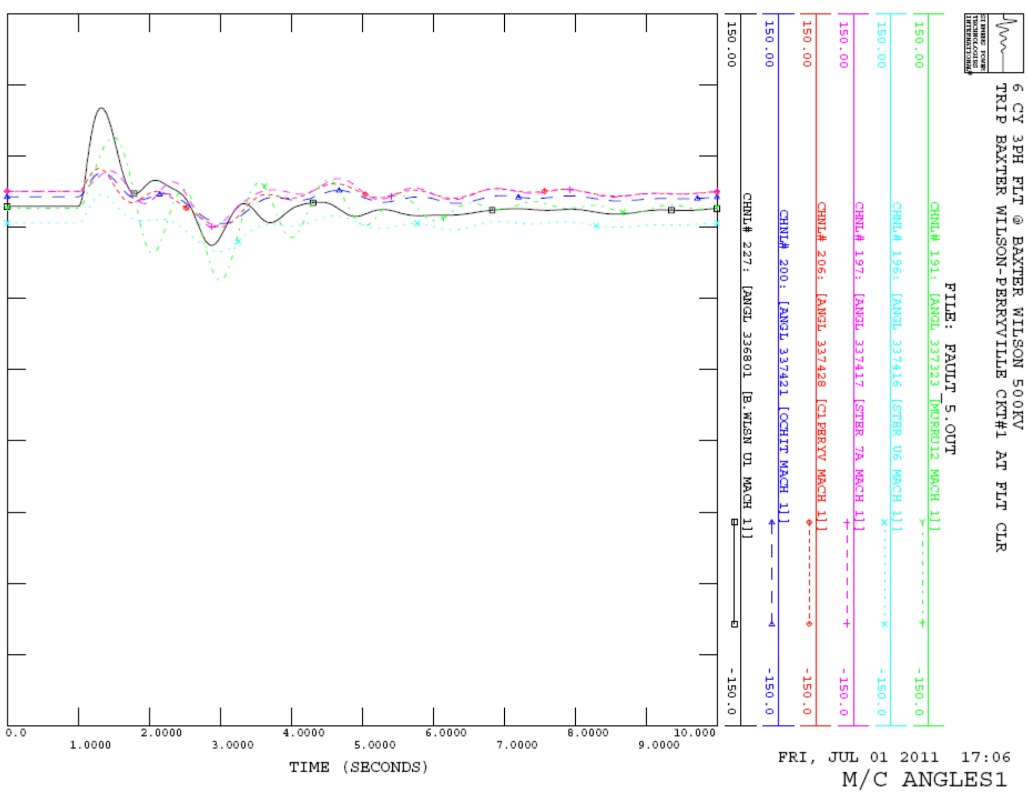


Figure 7.11: Plots for PV (SMA SC500HE) Inverter Variables

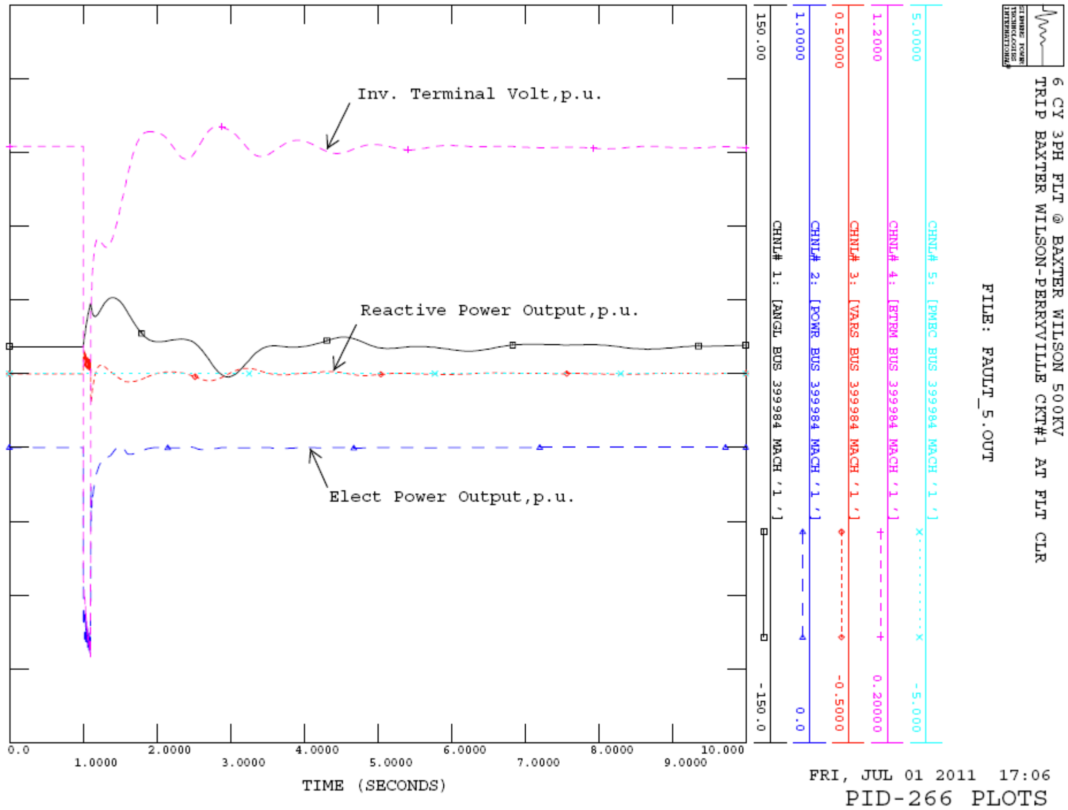


Table 7.4: Three-Phase Normally Cleared and Stuck Breaker Faults Simulation Results

Fault #	Unity PF	0.95 (leading) PF
FAULT_1	STABLE	STABLE
FAULT_2	STABLE	STABLE
FAULT_3	STABLE	PID 268 TRIPPED
FAULT_4	STABLE	STABLE
FAULT_5	STABLE	STABLE
FAULT_6	STABLE	STABLE
FAULT_7	STABLE	STABLE
FAULT_8	STABLE	STABLE
FAULT_9	STABLE	STABLE
FAULT_10	STABLE	STABLE
FAULT_11	STABLE	STABLE
FAULT_12	STABLE	STABLE
FAULT_13	STABLE	STABLE
FAULT_14	STABLE	STABLE
FAULT_15	STABLE	STABLE
FAULT_16	STABLE	STABLE
FAULT_17	STABLE	STABLE
FAULT_18	STABLE	STABLE
FAULT_19	STABLE	STABLE
FAULT_20	STABLE	STABLE
FAULT_21	STABLE	STABLE
FAULT_22	STABLE	STABLE
FAULT_23	STABLE	STABLE
FAULT_24	STABLE	STABLE
FAULT_25	STABLE	STABLE

Table 7.5: LVRT Capability Faults Simulation Results

Fault #	Unity PF	0.95 (leading) PF
FAULT_1	STABLE	STABLE
FAULT_2	STABLE	STABLE
FAULT_3	STABLE	PID 268 TRIPPED
FAULT_4	STABLE	STABLE

APPENDIX A: DATA PROVIDED BY CUSTOMER

Attachment A to Appendix 1
Interconnection Request

LARGE GENERATING FACILITY DATA

UNIT RATINGS

kVA 60,000.00 AC °F NA Voltage 138,000.00 VOLTS
Power Factor ± 0.95
Speed (RPM) NA
Connection (e.g. Wye) DELTA CONNECTION TO GRID
Short Circuit Ratio NA
Frequency, Hertz 60
Stator Amperes at Rated kVA NA
Field Volts NA
Max Turbine MW NA °F ______

COMBINED TURBINE-GENERATOR-EXCITER INERTIA DATA

Inertia Constant, H = NA kW sec/kVA
Moment-of-Inertia, WR^2 = NA lb. $ft.^2$

REACTANCE DATA (PER UNIT-RATED KVA)

	DIRECT AXIS		QUADRATURE AXIS	
Synchronous – saturated	X_{dv}	NA	X_{qv}	NA
Synchronous – unsaturated	X_{di}	NA	X_{qi}	NA
Transient – saturated	X'_{dv}	NA	X'_{qv}	NA
Transient – unsaturated	X'_{di}	NA	X'_{qi}	NA
Subtransient – saturated	X''_{dv}	NA	X''_{qv}	NA
Subtransient – unsaturated	X''_{di}	NA	X''_{qi}	NA
Negative Sequence – saturated	$X2_v$	NA		
Negative Sequence – unsaturated	$X2_i$	NA		
Zero Sequence – saturated	$X0_v$	NA		
Zero Sequence – unsaturated	$X0_i$	NA		
Leakage Reactance	Xl_m	NA		

FIELD TIME CONSTANT DATA (SEC)

Open Circuit	T'_{do}	NA	T'_{qo}	NA
Three-Phase Short Circuit Transient	T'_{d3}	NA	T'_{q}	NA
Line to Line Short Circuit Transient	T'_{d2}	NA		
Line to Neutral Short Circuit Transient	T'_{d1}	NA		
Short Circuit Subtransient	T''_{d}	NA	T''_{q}	NA
Open Circuit Subtransient	T''_{do}	NA	T''_{qo}	NA

ARMATURE TIME CONSTANT DATA (SEC)

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

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	NA
Negative	R_2	NA
Zero	R_0	NA

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

CURVES

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

GENERATOR STEP-UP TRANSFORMER DATA RATINGS

Capacity — Self-cooled/ Maximum Nameplate
40,000.00/53,000.00 / 66,000.00 kVA

Voltage Ratio(Generator Side/System side/Tertiary)
34.5 / 138 / NA kV

Winding Connections (Low V/High V/Tertiary V (Delta or Wye))
WYE GND / DELTA / NA

Fixed Taps Available ±2.5

Present Tap Setting NA

IMPEDANCE

Positive — Z_1 (on self-cooled kVA rating) 8 % 13 X/R

Zero — Z_0 (on self-cooled kVA rating) 8 % 13 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.

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.

WIND GENERATORS

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

Elevation: NA ______ Single Phase 3 Three Phase

Inverter manufacturer, model name, number, and version:
SMA,SMA-SC-500HE

List of adjustable setpoints for the protective equipment or software:
AC current limit, AC power limit, Autostart state, PV current limit, PV turn-on voltage, Re-connection delay, MPPT tracking, Turn off timer

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: NA
(*) Field Amperes: NA
(*) Motoring Power (kW): NA
(*) Neutral Grounding Resistor (If Applicable): NA
(*) I_2^2t or K (Heating Time Constant): NA
(*) Rotor Resistance: NA
(*) Stator Resistance: NA
(*) Stator Reactance: NA
(*) Rotor Reactance: NA
(*) Magnetizing Reactance: NA
(*) Short Circuit Reactance: NA
(*) Exciting Current: NA
(*) Temperature Rise: NA
(*) Frame Size: NA
(*) Design Letter: NA
(*) Reactive Power Required In Vars (No Load): NA
(*) Reactive Power Required In Vars (Full Load): NA
(*) Total Rotating Inertia, H: NA 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

APPENDIX A
SAMPLE PV POWER PLANT DATA REQUEST

Note: This document has been adapted to PV applications from the WECC Wind Power Plant Power Flow Modeling Guidelines[10] dated May 2008. The data provider should refer to this document for background related to the specifics of this data request:

1. **One-Line Diagram.** This should be similar to Figure 1 below.

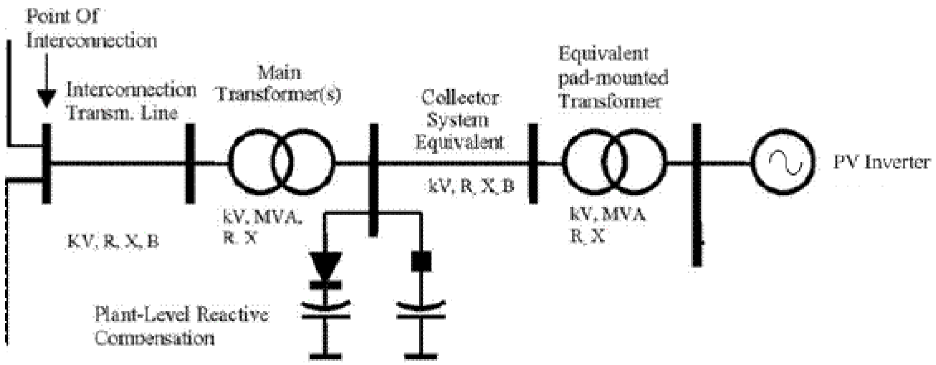


Figure A-1. Single-machine representation one-line diagram

2. **Interconnection Transmission Line.**
   - Point of Interconnection (substation or transmission line name): Wisner-Red Gum 115 kV Line
   - Line voltage = 115 kV
   - R = ________ ohm or .000478 pu on 100 MVA and line kV base (positive sequence)
   - X = ________ ohm or .001792 pu on 100 MVA and line kV base (positive sequence)
   - B = ________ µF or .000019 pu on 100 MVA and line kV base (positive sequence)

3. **Station Transformer.** (Note: If there are multiple transformers, data for each transformer should be provided)
   - Rating (ONAN/ONAF/ONAF): 40 / 53 / 66 MVA
   - Nominal Voltage for each winding (Low /High /Tertiary): 34.5 / 115 / N/A kV
   - Available taps: Fixed, +/- 2.5% (indicate fixed or with LTC), Operating Tap: 0
   - Positive sequence Z_{HL}: 8 %, 13 X/R on transformer self-cooled (ONAN) MVA

[10] http://www.wecc.biz/library/WECC Documents/Documents for Generators/Generator Testing Program/Wind Generator Power Flow Modeling Guide.pdf

4. **Collector System Equivalent Model**. This can be found by applying the equivalencing methodology described in Section 3.4; otherwise, typical values can be used.

- Collector system voltage = _34.5_____ kV
- R = _________ ohm or .002988_ pu on 100 MVA and collector kV base (positive sequence)
- X = _________ ohm or _.0016098 pu on 100 MVA and collector kV base (positive sequence)
- B = _________ µF or .003051_ pu on 100 MVA and collector kV base (positive sequence)

5. **Inverter Step-Up Transformer.** Note: These are typically two-winding air-cooled transformers. If the proposed project contains different types or sizes of step-up transformers, please provide data for each type.

- Rating: _2_____ MVA
- Nominal voltage for each winding (Low /High): _0.270__/ 34.5___kV
- Available taps: _Fixed, +/- 2.5% (indicate fixed or with LTC), Operating Tap:_0___
- Positive sequence impedance (Z1) _5.75_%, _13_X/R on transformer self-cooled MVA

6. **Inverter and PV Module Data.**

- Number of Inverters: _120____
- Nameplate Rating (each Inverter): _500___/500___kW/kVA
- Describe reactive capability as a function of voltage: _90% to 110% of rated terminal voltage___
- Inverter Manufacturer and Model #: _SMA SC500HE_
- PV Module Manufacturer and Model #: _Trina Solar TSM-PC14_
- [Note: This section would also request completed PSLF or PSS/E data sheets for the generic PV library model(s) once they are available.]

7. **Plant Reactive Power Compensation.** Provide the following information for plant-level reactive compensation, if applicable:

- Individual shunt capacitor and size of each: _N/A__X_______MVA
- Dynamic reactive control device, (SVC, STATCOM): _N/A____________________
- Control range _N/A_______________________ MVAr (lead and lag)
- Control mode (e.g., voltage, power factor, reactive power): _N/A_______________
- Regulation point _N/A___________________
- Describe the overall reactive power control strategy: _Power factor control by plant-level controller. Planned operation is at unity power factor, with capability up to .90 leading or .90 lagging._

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APPENDIX B: Power flow and Stability Data

Following data is presented in PSS/E Version 30.3.3 format.

<u>Power flow Data</u>

<u>PID 266</u>

```
0,   100.00          / PSS/E-30.3

399980,'POI PID 266 ', 115.0000,1,     0.000,     0.000, 351, 140,1.00482,  16.4790,   1
399981,'STN TR      ', 115.0000,1,     0.000,     0.000, 351, 140,1.00492,  16.5206,   1
399982,'COLLECTOR SY',  34.5000,1,     0.000,     0.000, 351, 140,1.00396,  20.9344,   1
399983,'INVERTER TR ',  34.5000,1,     0.000,     0.000, 351, 140,1.00492,  20.9678,   1
399984,'SMA PID 266 ',   0.2700,2,     0.000,     0.000, 351, 140,1.00768,  24.2116,   1
0 / END OF BUS DATA, BEGIN LOAD DATA
0 / END OF LOAD DATA, BEGIN GENERATOR DATA
399984,'1 ',    40.000,     0.000,     0.000,     0.000,1.00000,     0,    40.000,
0.00000,9999.00000,   0.00000,   0.00000,1.00000,1,    1.0,    40.000,     0.000,
1,1.0000
0 / END OF GENERATOR DATA, BEGIN BRANCH DATA
337447, 399980,'1 ',   0.00286,   0.00449,   0.00043,   80.00,   80.00,    0.00,
0.00000,  0.00000,  0.00000,  0.00000,1,   0.66,   1,1.0000
337448,-399980,'1 ',   0.08654,   0.13591,   0.01307,   80.00,   80.00,    0.00,
0.00000,  0.00000,  0.00000,  0.00000,1,  19.99,   1,1.0000
399980, 399981,'1 ',   0.00048,   0.00179,   0.00002,    0.00,    0.00,    0.00,
0.00000,  0.00000,  0.00000,  0.00000,1,   0.00,   1,1.0000
399982, 399983,'1 ',   0.00249,   0.00134,   0.00254,    0.00,    0.00,    0.00,
0.00000,  0.00000,  0.00000,  0.00000,1,   0.00,   1,1.0000
0 / END OF BRANCH DATA, BEGIN TRANSFORMER DATA
399981,399982,     0,'1 ',1,2,1,   0.00000,   0.00000,2,'            ',1,   1,1.0000
   0.00614,   0.07970,    41.00
1.00000, 115.000,   0.000,    41.00,    41.00,    41.00, 0,      0, 1.10000, 0.90000,
1.10000, 0.90000,   5, 0, 0.00000, 0.00000
1.00000,  34.500
399983,399984,     0,'1 ',1,2,1,   0.00000,   0.00000,2,'            ',1,   1,1.0000
   0.00441,   0.05730,    40.00
1.00000,  34.500,   0.000,    40.00,    40.00,    40.00, 0,      0, 1.10000, 0.90000,
1.10000, 0.90000,   5, 0, 0.00000, 0.00000
1.00000,   0.270
0 / END OF TRANSFORMER DATA, BEGIN AREA DATA
 351,337653,    -6.400,    10.000,'EES         '
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
 140,'ELINTH      '
0 / END OF ZONE DATA, BEGIN INTER-AREA TRANSFER DATA
0 / END OF INTER-AREA TRANSFER DATA, BEGIN OWNER DATA
   1,'DEFAULT     '
0 / END OF OWNER DATA, BEGIN FACTS DEVICE DATA
0 / END OF FACTS DEVICE DATA
```

PID 268

```
0,   100.00          / PSS/E-30.3

399990,'POI PID 268 ', 115.0000,1,     0.000,     0.000, 351, 140,1.00859,  11.2082,   1
399991,'STN TR      ', 115.0000,1,     0.000,     0.000, 351, 140,1.00874,  11.2701,   1
399992,'COLLECTOR SY',  34.5000,1,     0.000,     0.000, 351, 140,1.00798,  15.3478,   1
399993,'INVERTER TR ',  34.5000,1,     0.000,     0.000, 351, 140,1.00970,  15.4074,   1
399994,'SMA PID 268 ',   0.2700,2,     0.000,     0.000, 351, 140,1.01247,  18.6205,   1
0 / END OF BUS DATA, BEGIN LOAD DATA
0 / END OF LOAD DATA, BEGIN GENERATOR DATA
399994,'1 ',    60.000,     0.000,     0.000,     0.000,1.00000,     0,    60.000,
0.00000,9999.00000,   0.00000,   0.00000,1.00000,1,    1.0,    60.000,     0.000,
1,1.0000
0 / END OF GENERATOR DATA, BEGIN BRANCH DATA
337327, 399990,'1 ',   0.02963,   0.07336,   0.00861,  115.00,  115.00,    0.00,
0.00000,  0.00000,  0.00000,  0.00000,1,  11.94,   1,1.0000
337328,-399990,'1 ',   0.02747,   0.06798,   0.00798,  115.00,  115.00,    0.00,
0.00000,  0.00000,  0.00000,  0.00000,1,  11.07,   1,1.0000
399990, 399991,'1 ',   0.00048,   0.00179,   0.00002,    0.00,    0.00,    0.00,
0.00000,  0.00000,  0.00000,  0.00000,1,   0.00,   1,1.0000
399992, 399993,'1 ',   0.00299,   0.00161,   0.00305,    0.00,    0.00,    0.00,
0.00000,  0.00000,  0.00000,  0.00000,1,   0.00,   1,1.0000
0 / END OF BRANCH DATA, BEGIN TRANSFORMER DATA
399991,399992,     0,'1 ',1,2,1,   0.00000,   0.00000,2,'            ',1,   1,1.0000
   0.00614,   0.07970,    66.00
1.00000, 115.000,   0.000,    66.00,    66.00,    66.00, 0,      0, 1.10000, 0.90000,
1.10000, 0.90000,   5, 0, 0.00000, 0.00000
1.00000,  34.500
399993,399994,     0,'1 ',1,2,1,   0.00000,   0.00000,2,'            ',1,   1,1.0000
   0.00441,   0.05730,    60.00
1.00000,  34.500,   0.000,    60.00,    60.00,    60.00, 0,      0, 1.10000, 0.90000,
1.10000, 0.90000,   5, 0, 0.00000, 0.00000
1.00000,   0.270
0 / END OF TRANSFORMER DATA, BEGIN AREA DATA
 351,337653,    -6.400,    10.000,'EES         '
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
 140,'ELINTH      '
0 / END OF ZONE DATA, BEGIN INTER-AREA TRANSFER DATA
0 / END OF INTER-AREA TRANSFER DATA, BEGIN OWNER DATA
   1,'DEFAULT     '
0 / END OF OWNER DATA, BEGIN FACTS DEVICE DATA
0 / END OF FACTS DEVICE DATA
```

Dynamics Data

PID 266

```
 PLANT MODELS

 REPORT FOR ALL MODELS                    BUS 399984 [SMA PID 266 0.2700] MODELS


     ** SMASCI **  BUS  MACH       C O N S      S T A T E S     V A R S
                399984   1  130343-130374  51006- 51009   8294-  8316

   VRATIO  IRATIO   TDC     KPDC    KIDC     KPQ     KIQ    ILIM
   1.200   1.100   0.002   2.000  20.000   0.100  10.000   1.110

    PFC     PPS     RPS     PFS     FSP     FRV     QREG   RMOD
   0.000  -0.250  -5.170  -0.400 999.990  60.050   0.000   0.000

    OV1L    OV1T    OV2L    OV2T    UV1L    UV1T    UV2L   UV2T
   1.200   0.160   1.100   1.000   0.450   0.160   0.850   2.000

    OFL     OFT     UFL     UFT     LVL     VSP     VRP    KPLL
  62.000   0.160  57.000   0.160   1.000   0.200   0.250  30.000
```

PID 268

```
PLANT MODELS

 REPORT FOR ALL MODELS                    BUS 399994 [SMA PID 268 0.2700] MODELS


     ** SMASCI **  BUS  MACH       C O N S      S T A T E S     V A R S
                399994   1  130375-130406  51010- 51013   8318-  8340

   VRATIO  IRATIO   TDC     KPDC    KIDC     KPQ     KIQ    ILIM
   1.200   1.100   0.002   2.000  20.000   0.100  10.000   1.110

    PFC     PPS     RPS     PFS     FSP     FRV     QREG   RMOD
   0.000  -0.250  -5.170  -0.400 999.990  60.050   0.000   0.000

    OV1L    OV1T    OV2L    OV2T    UV1L    UV1T    UV2L   UV2T
   1.200   0.160   1.100   1.000   0.450   0.160   0.850   2.000

    OFL     OFT     UFL     UFT     LVL     VSP     VRP    KPLL
  62.000   0.160  57.000   0.160   1.000   0.200   0.250  30.000
```

APPENDIX C: Plots for Stability Simulations

Plots will be posted in a separate posting titled *System Impact Study Report Stability Plots*.

The plots can be viewed at the following link:

http://www.oatioasis.com/EES/EESDocs/interconnection_studies_ICT.htm

APPENDIX D: Prior Generation Interconnection and Transmission Service Requests in Study Models

Prior Generation Interconnection NRIS requests that were included in this study:

PID	Substation	MW	In Service Date
	NONE		

Prior transmission service requests that were included in this study:

OASIS #		PSE	MW	Begin	End
74597193		NRG Power Marketing	300	1/1/2013	1/1/2018
74597198		NRG Power Marketing	300	1/1/2013	1/1/2018
74799834		Cargill Power Markets	101	7/1/2012	7/1/2017
74799836		Cargill Power Markets	101	7/1/2012	7/1/2017
74799837		Cargill Power Markets	101	7/1/2012	7/1/2017
74799848		Cargill Power Markets	101	7/1/2013	7/1/2018
74799851		Cargill Power Markets	101	7/1/2013	7/1/2018
74799853		Cargill Power Markets	101	7/1/2013	7/1/2018
74846159		AEPM	65	1/1/2015	1/1/2020
74899933		Entergy Services (SPO)	322	2/1/2011	2/1/2041
74899968		Entergy Services (SPO)	65	1/1/2013	1/1/2015
74899972		Entergy Services (SPO)	1	1/1/2015	1/1/2045
74899974		Entergy Services (SPO)	1	1/1/2015	1/1/2045
74899976		Entergy Services (SPO)	1	1/1/2015	1/1/2045
74899980		Entergy Services (SPO)	584	1/1/2015	1/1/2045
74899988		Entergy Services (SPO)	1	6/1/2012	6/1/2042
74899989		Entergy Services (SPO)	485	6/1/2012	6/1/2042
74899996		Entergy Services (SPO)	450	6/1/2012	6/1/2042
74900000		Entergy Services (SPO)	620	6/1/2012	6/1/2042
74900014		Entergy Services (SPO)	35	6/1/2012	6/1/2042
74900016		Entergy Services (SPO)	20	6/1/2012	6/1/2042
74901827		Entergy Services (SPO)	1	2/1/2011	2/1/2041
75009400		Entergy Services (SPO)	1	1/1/2012	1/1/2042
75206836		ETEC	125	1/1/2015	2/1/2020

APPENDIX E: Details of Scenario 1 – 2014

AECI

Limiting Element	Contingency Element	ATC
International Paper - Mansfield 138kV (CLECO)	Dolet Hills - S.W. Shreveport 345kV (CLECO)	-1302
Carroll 230/138kV transformer (CLECO)	Dolet Hills - S.W. Shreveport 345kV (CLECO)	-725
International Paper - Wallake 138kV (CLECO)	Dolet Hills - S.W. Shreveport 345kV (CLECO)	-617
Downsville - Ruston East 115kV	Eldorado EHV - Sterlington 500kV	-372
Ruston East - Vienna 115kV	Eldorado EHV - Sterlington 500kV	-195
Ray Braswell - Baxter Wilson 500kV - Supplemental Upgrade	Franklin - Grand Gulf 500kV	-55

AEPW

Limiting Element	Contingency Element	ATC
International Paper - Mansfield 138kV (CLECO)	Dolet Hills - S.W. Shreveport 345kV (CLECO)	-634
Toledo - VP Tap 138kV	Colfax - Rodemacher 230kV	-525
Carroll 230/138kV transformer (CLECO)	Dolet Hills - S.W. Shreveport 345kV (CLECO)	-438
Downsville - Ruston East 115kV	Eldorado EHV - Sterlington 500kV	-320
International Paper - Wallake 138kV (CLECO)	Dolet Hills - S.W. Shreveport 345kV (CLECO)	-301
Toledo - VP Tap 138kV	Colfax - Montgomery 230kV	-241
Ruston East - Vienna 115kV	Eldorado EHV - Sterlington 500kV	-168
Ray Braswell - Baxter Wilson 500kV - Supplemental Upgrade	Franklin - Grand Gulf 500kV	-115

AMRN

Limiting Element	Contingency Element	ATC
International Paper - Mansfield 138kV (CLECO)	Dolet Hills - S.W. Shreveport 345kV (CLECO)	-1406
International Paper - Wallake 138kV (CLECO)	Dolet Hills - S.W. Shreveport 345kV (CLECO)	-667
Downsville - Ruston East 115kV	Eldorado EHV - Sterlington 500kV	-395
Ruston East - Vienna 115kV	Eldorado EHV - Sterlington 500kV	-207
Ray Braswell - Baxter Wilson 500kV - Supplemental Upgrade	Franklin - Grand Gulf 500kV	-44

CLECO

Limiting Element	Contingency Element	ATC
Downsville - Ruston East 115kV	Eldorado EHV - Sterlington 500kV	-362
Ruston East - Vienna 115kV	Eldorado EHV - Sterlington 500kV	-190
Ray Braswell - Baxter Wilson 500kV - Supplemental Upgrade	Franklin - Grand Gulf 500kV	-46

EES

Limiting Element	Contingency Element	ATC
Downsville - Ruston East 115kV	Eldorado EHV - Sterlington 500kV	-502
Ruston East - Vienna 115kV	Eldorado EHV - Sterlington 500kV	-264
Ray Braswell - Baxter Wilson 500kV - Supplemental Upgrade	Franklin - Grand Gulf 500kV	-31

EMDE

Limiting Element	Contingency Element	ATC
International Paper - Mansfield 138kV (CLECO)	Dolet Hills - S.W. Shreveport 345kV (CLECO)	-1103
Carroll 230/138kV transformer (CLECO)	Dolet Hills - S.W. Shreveport 345kV (CLECO)	-646
International Paper - Wallake 138kV (CLECO)	Dolet Hills - S.W. Shreveport 345kV (CLECO)	-523
Downsville - Ruston East 115kV	Eldorado EHV - Sterlington 500kV	-352
Ruston East - Vienna 115kV	Eldorado EHV - Sterlington 500kV	-185
Ray Braswell - Baxter Wilson 500kV - Supplemental Upgrade	Franklin - Grand Gulf 500kV	-68

LAFA

Limiting Element	Contingency Element	ATC
Downsville - Ruston East 115kV	Eldorado EHV - Sterlington 500kV	-451
Semere - Scott2 138kV	Cocodrie (CLECO) - Vil Plat (CLECO) 230kV	-318
Semere - Scott2 138kV	Vil Plat (CLECO) - West Fork (CLECO) 230kV	-281
Coughlin - Plaisance 138kV (CLECO)	Cocodrie (CLECO) - Vil Plat (CLECO) 230kV	-238
Ruston East - Vienna 115kV	Eldorado EHV - Sterlington 500kV	-237
Habetz - Richard 138kV	Cocodrie (CLECO) - Vil Plat (CLECO) 230kV	-224
Habetz - Richard 138kV	Vil Plat (CLECO) - West Fork (CLECO) 230kV	-185
Champagne - Plaisance (CLECO) 138kV	Cocodrie (CLECO) - Vil Plat (CLECO) 230kV	-184
Semere - Scott2 138kV	Wells 500/230kV transformer	-152
North Crowley - Scott1 138kV	Cocodrie (CLECO) - Vil Plat (CLECO) 230kV	-138
Coughlin - Plaisance 138kV (CLECO)	Vil Plat (CLECO) - West Fork (CLECO) 230kV	-121
North Crowley - Scott1 138kV	Vil Plat (CLECO) - West Fork (CLECO) 230kV	-107
Champagne - Plaisance (CLECO) 138kV	Vil Plat (CLECO) - West Fork (CLECO) 230kV	-67
North Crowley - Scott1 138kV	Richard - Scott1 138kV	-60
Habetz - Richard 138kV	Wells 500/230kV transformer	-35
Ray Braswell - Baxter Wilson 500kV - Supplemental Upgrade	Franklin - Grand Gulf 500kV	-27
North Crowley - Scott1 138kV	Wells 500/230kV transformer	-24
Habetz - Richard 138kV	Acadian - Bonin 230kV (LAFA)	-1
Scott1 - Bonin 138kV	Cocodrie (CLECO) - Vil Plat (CLECO) 230kV	3
Scott1 - Bonin 138kV	Vil Plat (CLECO) - West Fork (CLECO) 230kV	44

LAGN

Limiting Element	Contingency Element	ATC
Downsville - Ruston East 115kV	Eldorado EHV - Sterlington 500kV	-592
Ruston East - Vienna 115kV	Eldorado EHV - Sterlington 500kV	-311
Ray Braswell - Baxter Wilson 500kV - Supplemental Upgrade	Franklin - Grand Gulf 500kV	-28

LEPA

Limiting Element	Contingency Element	ATC
Habetz - Richard 138kV	Cocodrie (CLECO) - Vil Plat (CLECO) 230kV	-827
Habetz - Richard 138kV	Vil Plat (CLECO) - West Fork (CLECO) 230kV	-684
Downsville - Ruston East 115kV	Eldorado EHV - Sterlington 500kV	-598
North Crowley - Scott1 138kV	Cocodrie (CLECO) - Vil Plat (CLECO) 230kV	-533
North Crowley - Scott1 138kV	Vil Plat (CLECO) - West Fork (CLECO) 230kV	-413
Coughlin - Plaisance 138kV (CLECO)	Cocodrie (CLECO) - Vil Plat (CLECO) 230kV	-341
Ruston East - Vienna 115kV	Eldorado EHV - Sterlington 500kV	-314
Champagne - Plaisance (CLECO) 138kV	Cocodrie (CLECO) - Vil Plat (CLECO) 230kV	-263
Bonin - Cecelia 138kV	Colonial Academy - Richard 138kV	-235
Coughlin - Plaisance 138kV (CLECO)	Vil Plat (CLECO) - West Fork (CLECO) 230kV	-173
Habetz - Richard 138kV	Wells 500/230kV transformer	-160
Champagne - Plaisance (CLECO) 138kV	Vil Plat (CLECO) - West Fork (CLECO) 230kV	-95
Bonin - Cecelia 138kV	Acadia GSU - Colonial Academy 138kV	-49
Willow Glen - Evergreen 230kV ckt 2	Willow Glen - Evergreen 230kV ckt 1	-40
Ray Braswell - Baxter Wilson 500kV - Supplemental Upgrade	Franklin - Grand Gulf 500kV	-20
Habetz - Richard 138kV	Acadian - Bonin 230kV (LAFA)	-4
Scott1 - Bonin 138kV	Cocodrie (CLECO) - Vil Plat (CLECO) 230kV	27

OKGE

Limiting Element	Contingency Element	ATC
International Paper - Mansfield 138kV (CLECO)	Dolet Hills - S.W. Shreveport 345kV (CLECO)	-939
Carroll 230/138kV transformer (CLECO)	Dolet Hills - S.W. Shreveport 345kV (CLECO)	-576
International Paper - Wallake 138kV (CLECO)	Dolet Hills - S.W. Shreveport 345kV (CLECO)	-445
Downsville - Ruston East 115kV	Eldorado EHV - Sterlington 500kV	-337
Ruston East - Vienna 115kV	Eldorado EHV - Sterlington 500kV	-177
Ray Braswell - Baxter Wilson 500kV - Supplemental Upgrade	Franklin - Grand Gulf 500kV	-86

SMEPA

Limiting Element	Contingency Element	ATC
Ray Braswell 500/230kV transformer ckt2 - Supplemental Upgrade	Lakeover 500/115kV transformer	*

Limiting Element	**Contingency Element**	**ATC**
Ray Braswell 500/230kV transformer ckt2 - Supplemental Upgrade	Ray Braswell 500/115kV transformer 1	*
Ray Braswell 500/230kV transformer ckt2 - Supplemental Upgrade	Attala - McAdams 230kV	*
Ray Braswell 500/230kV transformer ckt2 - Supplemental Upgrade	Attala 230/115kV transformer	*
Ray Braswell 500/230kV transformer ckt2 - Supplemental Upgrade	Sansouci - Shelby (TVA) 500kV	*
Ray Braswell 500/230kV transformer ckt2 - Supplemental Upgrade	Livingston Rd. - Lakeover 115kV	*
Ray Braswell 500/230kV transformer ckt2 - Supplemental Upgrade	Dolet Hills - S.W. Shreveport 345kV (CLECO)	*
Ray Braswell 500/230kV transformer ckt2 - Supplemental Upgrade	Ridgeland - Livingston Road 115kV	*
Ray Braswell 500/230kV transformer ckt2 - Supplemental Upgrade	Ray Braswell 500/230kV transformer 1	*
Ray Braswell 500/230kV transformer ckt2 - Supplemental Upgrade	Vicksburg - West Vicksburg 115kV	*
French Settlement - Sorrento 230kV	Bogalusa - Franklin 500kV	-1275
French Settlement - Sorrento 230kV	Bogalusa - Adams Creek 500/230kV transformer	-1275
Brookhaven South - Franklin 115kV	Franklin - Vaughn 115kV	-935
Jackson Miami - Jackson Monument Street 115kV	South Jackson 230/115kV transformer 1	-931
Downsville - Ruston East 115kV	Eldorado EHV - Sterlington 500kV	-744
Brookhaven South - Franklin 115kV	CALIFRN - Vaughn 115kV	-722
Ray Braswell - West Jackson 115kV	South Jackson 230/115kV transformer 1	-655
Brookhaven South - Franklin 115kV	CALIFRN - West Brookhaven 115kV	-603
Brookhaven - Brookhaven South 115kV	Franklin - Vaughn 115kV	-503
Ruston East - Vienna 115kV	Eldorado EHV - Sterlington 500kV	-391
Brookhaven South - Franklin 115kV	Brookhaven - West Brookhaven 115kV	-354
Franklin - Vaughn 115kV	Brookhaven South - Franklin 115kV	-332
Brookhaven - Brookhaven South 115kV	CALIFRN - Vaughn 115kV	-290
Jackson Miami - Jackson Monument Street 115kV	Jackson Forrest Hill - Ray Braswell 115kV	-249
Jackson Miami - Jackson Monument Street 115kV	Jackson HICO - Rex Brown E 115kV	-224
Jackson Miami - Jackson Monument Street 115kV	Jackson HICO - North Jackson 115kV	-224
Brookhaven - Brookhaven South 115kV	CALIFRN - West Brookhaven 115kV	-171
Jackson Miami - Jackson Monument Street 115kV	Jackson Forrest Hill - Southwest Jackson 115kV	-92
Baxter Wilson SES - Vicksburg 115kV	Baxter Wilson SES - Spencer Potash 115kV	-89
Jackson Miami - Jackson Monument Street 115kV	Klean - Jackson Northeast 115kV	-48
Ray Braswell - Baxter Wilson 500kV - Supplemental Upgrade	Franklin - Grand Gulf 500kV	-17
Jackson Miami - Jackson Monument Street 115kV	Ray Braswell - West Jackson 115kV	-16
Jackson Miami - Jackson Monument Street 115kV	Klean - Flowood 115kV	17
CALIFRN - Vaughn 115kV	Brookhaven South - Franklin 115kV	29
Jackson Miami - Jackson Monument Street 115kV	North Jackson - Jackson Canton Road 115kV	57

SOCO

Limiting Element	Contingency Element	ATC
Downsville - Ruston East 115kV	Eldorado EHV - Sterlington 500kV	-517
Ruston East - Vienna 115kV	Eldorado EHV - Sterlington 500kV	-272
Baxter Wilson SES - Vicksburg 115kV	Baxter Wilson SES - Spencer Potash 115kV	-92
Ray Braswell - Baxter Wilson 500kV - Supplemental Upgrade	Franklin - Grand Gulf 500kV	-25

SPA

Limiting Element	Contingency Element	ATC
International Paper - Mansfield 138kV (CLECO)	Dolet Hills - S.W. Shreveport 345kV (CLECO)	-1182
Carroll 230/138kV transformer (CLECO)	Dolet Hills - S.W. Shreveport 345kV (CLECO)	-669
International Paper - Wallake 138kV (CLECO)	Dolet Hills - S.W. Shreveport 345kV (CLECO)	-560
Downsville - Ruston East 115kV	Eldorado EHV - Sterlington 500kV	-348
Ruston East - Vienna 115kV	Eldorado EHV - Sterlington 500kV	-183
Ray Braswell - Baxter Wilson 500kV - Supplemental Upgrade	Franklin - Grand Gulf 500kV	-75
Pleasant Hill 500/161kV transformer	ANO 500/161/22kV 3 Winding Transformer	55

TVA

Limiting Element	Contingency Element	ATC
Downsville - Ruston East 115kV	Eldorado EHV - Sterlington 500kV	-458
Ruston East - Vienna 115kV	Eldorado EHV - Sterlington 500kV	-241
Baxter Wilson SES - Vicksburg 115kV	Baxter Wilson SES - Spencer Potash 115kV	-91
Ray Braswell - Baxter Wilson 500kV - Supplemental Upgrade	Franklin - Grand Gulf 500kV	-30

APPENDIX F: Details of Scenario 2 – 2014

AECI

Limiting Element	Contingency Element	ATC
Ray Braswell - Baxter Wilson 500kV - Supplemental Upgrade	Franklin - Grand Gulf 500kV	-709
Natchez SES - Red Gum 115kV	Plantation - Vidalia 115kV	56

AEPW

Limiting Element	Contingency Element	ATC
Ray Braswell - Baxter Wilson 500kV - Supplemental Upgrade	Franklin - Grand Gulf 500kV	-1491
Cypress 500/138kV transformer 1	Cypress 500/230kV transformer	-1458
Cypress 500/230kV transformer	Cypress 500/138kV transformer 1	-210
Natchez SES - Red Gum 115kV	Plantation - Vidalia 115kV	56

AMRN

Limiting Element	Contingency Element	ATC
Ray Braswell - Baxter Wilson 500kV - Supplemental Upgrade	Franklin - Grand Gulf 500kV	-568
Natchez SES - Red Gum 115kV	Plantation - Vidalia 115kV	56

CLECO

Limiting Element	Contingency Element	ATC
Ray Braswell - Baxter Wilson 500kV - Supplemental Upgrade	Franklin - Grand Gulf 500kV	-595
Natchez SES - Red Gum 115kV	Plantation - Vidalia 115kV	58

EES

Limiting Element	Contingency Element	ATC
Helbig - McLewis 230kV	Cypress - Hartburg 500kV	-1696
Hartburg - Inland Orange 230kV - Supplemental Upgrade	Cypress - Hartburg 500kV	-1669
Hartburg - Inland Orange 230kV	Cypress - Hartburg 500kV	-1596
Inland - McLewis 230kV - Supplemental Upgrade	Cypress - Hartburg 500kV	-1219
Cypress 500/138kV transformer 1	Cypress 500/230kV transformer	-993
Ray Braswell - Baxter Wilson 500kV - Supplemental Upgrade	Franklin - Grand Gulf 500kV	-400
Cypress 500/230kV transformer	Cypress 500/138kV transformer 1	-139
Natchez SES - Red Gum 115kV	Plantation - Vidalia 115kV	55

EMDE

Limiting Element	Contingency Element	ATC
Ray Braswell - Baxter Wilson 500kV - Supplemental Upgrade	Franklin - Grand Gulf 500kV	-889
Natchez SES - Red Gum 115kV	Plantation - Vidalia 115kV	56

LAFA

Limiting Element	Contingency Element	ATC
Coughlin - Plaisance 138kV (CLECO)	Cocodrie (CLECO) - Vil Plat (CLECO) 230kV	-447
Champagne - Plaisance (CLECO) 138kV	Cocodrie (CLECO) - Vil Plat (CLECO) 230kV	-392
Semere - Scott2 138kV	Cocodrie (CLECO) - Vil Plat (CLECO) 230kV	-379

Limiting Element	Contingency Element	ATC
Ray Braswell - Baxter Wilson 500kV - Supplemental Upgrade	Franklin - Grand Gulf 500kV	-349
Semere - Scott2 138kV	Vil Plat (CLECO) - West Fork (CLECO) 230kV	-342
Coughlin - Plaisance 138kV (CLECO)	Vil Plat (CLECO) - West Fork (CLECO) 230kV	-330
Champagne - Plaisance (CLECO) 138kV	Vil Plat (CLECO) - West Fork (CLECO) 230kV	-275
Habetz - Richard 138kV	Cocodrie (CLECO) - Vil Plat (CLECO) 230kV	-275
Habetz - Richard 138kV	Vil Plat (CLECO) - West Fork (CLECO) 230kV	-236
Rapidies (CLECO) - Rodemacher (CLECO) 230kV	Rodemacher (CLECO) - Sherwood (CLECO) 230kV	-228
North Crowley - Scott1 138kV	Cocodrie (CLECO) - Vil Plat (CLECO) 230kV	-200
Semere - Scott2 138kV	Wells 500/230kV transformer	-195
North Crowley - Scott1 138kV	Vil Plat (CLECO) - West Fork (CLECO) 230kV	-169
North Crowley - Scott1 138kV	Richard - Scott1 138kV	-149
Semere - Scott2 138kV	Bonin - Cecelia 138kV	-111
North Crowley - Scott1 138kV	Wells 500/230kV transformer	-68
Habetz - Richard 138kV	Wells 500/230kV transformer	-66
Semere - Scott2 138kV	Habetz - Richard 138kV	-65
Habetz - Richard 138kV	Acadian - Bonin 230kV (LAFA)	-49
Scott1 - Bonin 138kV	Cocodrie (CLECO) - Vil Plat (CLECO) 230kV	-8
Richard - Scott1 138kV	Cocodrie (CLECO) - Vil Plat (CLECO) 230kV	2
Richard - Scott1 138kV	Vil Plat (CLECO) - West Fork (CLECO) 230kV	33
Scott1 - Bonin 138kV	Vil Plat (CLECO) - West Fork (CLECO) 230kV	33
Habetz - Richard 138kV	Flander - Acadian 230kV (LAFA)	45
Natchez SES - Red Gum 115kV	Plantation - Vidalia 115kV	56

LAGN

Limiting Element	Contingency Element	ATC
Ray Braswell - Baxter Wilson 500kV - Supplemental Upgrade	Franklin - Grand Gulf 500kV	-360
Natchez SES - Red Gum 115kV	Plantation - Vidalia 115kV	55

LEPA

Limiting Element	Contingency Element	ATC
Habetz - Richard 138kV	Cocodrie (CLECO) - Vil Plat (CLECO) 230kV	-1014
Habetz - Richard 138kV	Vil Plat (CLECO) - West Fork (CLECO) 230kV	-870
North Crowley - Scott1 138kV	Cocodrie (CLECO) - Vil Plat (CLECO) 230kV	-772
North Crowley - Scott1 138kV	Vil Plat (CLECO) - West Fork (CLECO) 230kV	-652
Willow Glen - Evergreen 230kV ckt 2	Willow Glen - Evergreen 230kV ckt 1	-650
Coughlin - Plaisance 138kV (CLECO)	Cocodrie (CLECO) - Vil Plat (CLECO) 230kV	-639
Champagne - Plaisance (CLECO) 138kV	Cocodrie (CLECO) - Vil Plat (CLECO) 230kV	-561
Coughlin - Plaisance 138kV (CLECO)	Vil Plat (CLECO) - West Fork (CLECO) 230kV	-472
Champagne - Plaisance (CLECO) 138kV	Vil Plat (CLECO) - West Fork (CLECO) 230kV	-394
Bonin - Cecelia 138kV	Colonial Academy - Richard 138kV	-342
Habetz - Richard 138kV	Wells 500/230kV transformer	-305
Ray Braswell - Baxter Wilson 500kV - Supplemental Upgrade	Franklin - Grand Gulf 500kV	-259
Habetz - Richard 138kV	Acadian - Bonin 230kV (LAFA)	-195
Bonin - Cecelia 138kV	Acadia GSU - Colonial Academy 138kV	-157
Scott1 - Bonin 138kV	Cocodrie (CLECO) - Vil Plat (CLECO) 230kV	-73

Limiting Element	Contingency Element	ATC
Bonin - Cecelia 138kV	Acadia GSU - Scanlan 138kV	-36
Richard - Scott1 138kV	Cocodrie (CLECO) - Vil Plat (CLECO) 230kV	7
Judice - Scott1 138kV	Sellers Road (CLECO) - Labbe (LAFA) 230kV	34
Judice - Scott1 138kV	Sellers Road (CLECO) - Segura (CLECO) 230kV	37
Judice - Scott1 138kV	Segura (CLECO) 230/138kV transformer'	43
Natchez SES - Red Gum 115kV	Plantation - Vidalia 115kV	55

OKGE

Limiting Element	Contingency Element	ATC
Ray Braswell - Baxter Wilson 500kV - Supplemental Upgrade	Franklin - Grand Gulf 500kV	-1122
Natchez SES - Red Gum 115kV	Plantation - Vidalia 115kV	56

SMEPA

Limiting Element	Contingency Element	ATC
Ray Braswell 500/230kV transformer ckt2 - Supplemental Upgrade	Lakeover 500/115kV transformer	*
Ray Braswell 500/230kV transformer ckt2 - Supplemental Upgrade	Ray Braswell 500/115kV transformer 1	*
Ray Braswell 500/230kV transformer ckt2 - Supplemental Upgrade	Attala - McAdams 230kV	*
Ray Braswell 500/230kV transformer ckt2 - Supplemental Upgrade	Attala 230/115kV transformer	*
Ray Braswell 500/230kV transformer ckt2 - Supplemental Upgrade	Sansouci - Shelby (TVA) 500kV	*
Ray Braswell 500/230kV transformer ckt2 - Supplemental Upgrade	Keo - West Memphis EHV 500kV	*
Ray Braswell 500/230kV transformer ckt2 - Supplemental Upgrade	Franklin - Grand Gulf 500kV	*
Ray Braswell 500/230kV transformer ckt2 - Supplemental Upgrade	Livingston Rd. - Lakeover 115kV	*
Ray Braswell 500/230kV transformer ckt2 - Supplemental Upgrade	Ridgeland - Livingston Road 115kV	*
Ray Braswell 500/230kV transformer ckt2 - Supplemental Upgrade	Dolet Hills - S.W. Shreveport 345kV (CLECO)	*
Jackson Miami - Jackson Monument Street 115kV	South Jackson 230/115kV transformer 1	-1410
French Settlement - Sorrento 230kV	Bogalusa - Franklin 500kV	-1384
French Settlement - Sorrento 230kV	Bogalusa - Adams Creek 500/230kV transformer	-1384
Brookhaven South - Franklin 115kV	Franklin - Vaughn 115kV	-820
Ray Braswell - West Jackson 115kV	South Jackson 230/115kV transformer 1	-652
Jackson Miami - Jackson Monument Street 115kV	Jackson HICO - North Jackson 115kV	-630
Jackson Miami - Jackson Monument Street 115kV	Jackson HICO - Rex Brown E 115kV	-630
Jackson Miami - Jackson Monument Street 115kV	Jackson Forrest Hill - Ray Braswell 115kV	-618
Brookhaven South - Franklin 115kV	CALIFRN - Vaughn 115kV	-607
Brookhaven South - Franklin 115kV	CALIFRN - West Brookhaven 115kV	-488
Jackson Miami - Jackson Monument Street 115kV	Jackson Forrest Hill - Southwest Jackson 115kV	-460
Jackson Miami - Jackson Monument Street 115kV	Klean - Jackson Northeast 115kV	-421
Brookhaven - Brookhaven South 115kV	Franklin - Vaughn 115kV	-388
Jackson Miami - Jackson Monument Street 115kV	Klean - Flowood 115kV	-356
Jackson Miami - Jackson Monument Street 115kV	North Jackson - Jackson Canton Road 115kV	-349

Limiting Element	Contingency Element	ATC
Jackson Miami - Jackson Monument Street 115kV	Ray Braswell - West Jackson 115kV	-320
Brookhaven - Mallalieu (MEPA) 115kV	Bogalusa - Franklin 500kV	-281
Brookhaven - Mallalieu (MEPA) 115kV	Bogalusa - Adams Creek 500/230kV transformer	-281
Brookhaven South - Franklin 115kV	Brookhaven - West Brookhaven 115kV	-239
Ray Braswell - Baxter Wilson 500kV - Supplemental Upgrade	Franklin - Grand Gulf 500kV	-225
Franklin - Vaughn 115kV	Brookhaven South - Franklin 115kV	-217
Brookhaven - Brookhaven South 115kV	CALIFRN - Vaughn 115kV	-175
Jackson Miami - Rex Brown 115kV	South Jackson 230/115kV transformer 1	-134
Florence - South Jackson 115kV - Supplemental Upgrade	Bogalusa - Franklin 500kV	-58
Florence - South Jackson 115kV - Supplemental Upgrade	Bogalusa - Adams Creek 500/230kV transformer	-58
Brookhaven - Brookhaven South 115kV	CALIFRN - West Brookhaven 115kV	-56
Florence - South Jackson 115kV - Supplemental Upgrade	Choctaw MS (TVA) - Clay (TVA) 500kV	24
Natchez SES - Red Gum 115kV	Plantation - Vidalia 115kV	54

SOCO

Limiting Element	Contingency Element	ATC
Ray Braswell - Baxter Wilson 500kV - Supplemental Upgrade	Franklin - Grand Gulf 500kV	-319
Natchez SES - Red Gum 115kV	Plantation - Vidalia 115kV	55

SPA

Limiting Element	Contingency Element	ATC
Ray Braswell - Baxter Wilson 500kV - Supplemental Upgrade	Franklin - Grand Gulf 500kV	-976
Natchez SES - Red Gum 115kV	Plantation - Vidalia 115kV	56

TVA

Limiting Element	Contingency Element	ATC
Ray Braswell - Baxter Wilson 500kV - Supplemental Upgrade	Franklin - Grand Gulf 500kV	-393
Natchez SES - Red Gum 115kV	Plantation - Vidalia 115kV	55

APPENDIX G: Details of Scenario 3 – 2014

AECI

Limiting Element	Contingency Element	ATC
International Paper - Mansfield 138kV (CLECO)	Dolet Hills - S.W. Shreveport 345kV (CLECO)	-1445
Carroll 230/138kV transformer (CLECO)	Dolet Hills - S.W. Shreveport 345kV (CLECO)	-795
International Paper - Wallake 138kV (CLECO)	Dolet Hills - S.W. Shreveport 345kV (CLECO)	-728
Downsville - Ruston East 115kV	Eldorado EHV - Sterlington 500kV	-246
Ruston East - Vienna 115kV	Eldorado EHV - Sterlington 500kV	-48
Rilla - Frostkraft Supplemental Upgrade	Sterlington - Walnut Grove East 115kV	-35
Rilla - Frostkraft Supplemental Upgrade	Lamkin - Walnut Grove East 115kV	45

AEPW

Limiting Element	Contingency Element	ATC
International Paper - Mansfield 138kV (CLECO)	Dolet Hills - S.W. Shreveport 345kV (CLECO)	-720
Carroll 230/138kV transformer (CLECO)	Dolet Hills - S.W. Shreveport 345kV (CLECO)	-473
International Paper - Wallake 138kV (CLECO)	Dolet Hills - S.W. Shreveport 345kV (CLECO)	-363
Downsville - Ruston East 115kV	Eldorado EHV - Sterlington 500kV	-205
Ruston East - Vienna 115kV	Eldorado EHV - Sterlington 500kV	-40
Rilla - Frostkraft Supplemental Upgrade	Sterlington - Walnut Grove East 115kV	-35
Rilla - Frostkraft Supplemental Upgrade	Lamkin - Walnut Grove East 115kV	46

AMRN

Limiting Element	Contingency Element	ATC
International Paper - Mansfield 138kV (CLECO)	Dolet Hills - S.W. Shreveport 345kV (CLECO)	-1559
International Paper - Wallake 138kV (CLECO)	Dolet Hills - S.W. Shreveport 345kV (CLECO)	-786
Downsville - Ruston East 115kV	Eldorado EHV - Sterlington 500kV	-262
Ruston East - Vienna 115kV	Eldorado EHV - Sterlington 500kV	-51
Rilla - Frostkraft Supplemental Upgrade	Sterlington - Walnut Grove East 115kV	-35
Rilla - Frostkraft Supplemental Upgrade	Lamkin - Walnut Grove East 115kV	45

CLECO

Limiting Element	Contingency Element	ATC
Downsville - Ruston East 115kV	Eldorado EHV - Sterlington 500kV	-236
Ruston East - Vienna 115kV	Eldorado EHV - Sterlington 500kV	-46
Rilla - Frostkraft Supplemental Upgrade	Sterlington - Walnut Grove East 115kV	-42
Rilla - Frostkraft Supplemental Upgrade	Lamkin - Walnut Grove East 115kV	55

EES

Limiting Element	Contingency Element	ATC
Downsville - Ruston East 115kV	Eldorado EHV - Sterlington 500kV	-341
Ruston East - Vienna 115kV	Eldorado EHV - Sterlington 500kV	-67
Rilla - Frostkraft Supplemental Upgrade	Sterlington - Walnut Grove East 115kV	-34
Rilla - Frostkraft Supplemental Upgrade	Lamkin - Walnut Grove East 115kV	44

EMDE

Limiting Element	Contingency Element	ATC
International Paper - Mansfield 138kV (CLECO)	Dolet Hills - S.W. Shreveport 345kV (CLECO)	-1232
Carroll 230/138kV transformer (CLECO)	Dolet Hills - S.W. Shreveport 345kV (CLECO)	-706
International Paper - Wallake 138kV (CLECO)	Dolet Hills - S.W. Shreveport 345kV (CLECO)	-621
Downsville - Ruston East 115kV	Eldorado EHV - Sterlington 500kV	-231
Ruston East - Vienna 115kV	Eldorado EHV - Sterlington 500kV	-45
Rilla - Frostkraft Supplemental Upgrade	Sterlington - Walnut Grove East 115kV	-35
Rilla - Frostkraft Supplemental Upgrade	Lamkin - Walnut Grove East 115kV	45

LAFA

Limiting Element	Contingency Element	ATC
Downsville - Ruston East 115kV	Eldorado EHV - Sterlington 500kV	-304
Ruston East - Vienna 115kV	Eldorado EHV - Sterlington 500kV	-59
Rilla - Frostkraft Supplemental Upgrade	Sterlington - Walnut Grove East 115kV	-39
Rilla - Frostkraft Supplemental Upgrade	Lamkin - Walnut Grove East 115kV	50

LAGN

Limiting Element	Contingency Element	ATC
Downsville - Ruston East 115kV	Eldorado EHV - Sterlington 500kV	-394
Ruston East - Vienna 115kV	Eldorado EHV - Sterlington 500kV	-77
Rilla - Frostkraft Supplemental Upgrade	Sterlington - Walnut Grove East 115kV	-38
Rilla - Frostkraft Supplemental Upgrade	Lamkin - Walnut Grove East 115kV	49

LEPA

Limiting Element	Contingency Element	ATC
Downsville - Ruston East 115kV	Eldorado EHV - Sterlington 500kV	-412
Ruston East - Vienna 115kV	Eldorado EHV - Sterlington 500kV	-81
Rilla - Frostkraft Supplemental Upgrade	Sterlington - Walnut Grove East 115kV	-38
Rilla - Frostkraft Supplemental Upgrade	Lamkin - Walnut Grove East 115kV	49
Ray Braswell - Baxter Wilson 500kV - Supplemental Upgrade	Franklin - Grand Gulf 500kV	53

OKGE

Limiting Element	Contingency Element	ATC
International Paper - Mansfield 138kV (CLECO)	Dolet Hills - S.W. Shreveport 345kV (CLECO)	-1055
Carroll 230/138kV transformer (CLECO)	Dolet Hills - S.W. Shreveport 345kV (CLECO)	-628
International Paper - Wallake 138kV (CLECO)	Dolet Hills - S.W. Shreveport 345kV (CLECO)	-532
Downsville - Ruston East 115kV	Eldorado EHV - Sterlington 500kV	-220
Ruston East - Vienna 115kV	Eldorado EHV - Sterlington 500kV	-43
Rilla - Frostkraft Supplemental Upgrade	Sterlington - Walnut Grove East 115kV	-35
Rilla - Frostkraft Supplemental Upgrade	Lamkin - Walnut Grove East 115kV	45

SMEPA

Limiting Element	Contingency Element	ATC
Ray Braswell 500/230kV transformer ckt2 - Supplemental Upgrade	McAdams - Pickens 230kV	*
Ray Braswell 500/230kV transformer ckt2 - Supplemental Upgrade	Canton - Pickens 230kV	*
Ray Braswell 500/230kV transformer ckt2 - Supplemental Upgrade	Canton South - Canton 230kV	*
Ray Braswell 500/230kV transformer ckt2 - Supplemental Upgrade	Lakeover 500/115kV transformer	*
Ray Braswell 500/230kV transformer ckt2 - Supplemental Upgrade	Mosel (SMEPA) - Creek (SMEPA) 161kV	*
Ray Braswell 500/230kV transformer ckt2 - Supplemental Upgrade	Red Gum - PID 268 115kV	*
Ray Braswell 500/230kV transformer ckt2 - Supplemental Upgrade	Baxter Wilson 500/115kV transformer 2	*
Ray Braswell 500/230kV transformer ckt2 - Supplemental Upgrade	Franklin 500/115kV transformer 1	*
Ray Braswell 500/230kV transformer ckt2 - Supplemental Upgrade	Franklin 500/115kV transformer 2	*
Ray Braswell 500/230kV transformer ckt2 - Supplemental Upgrade	Webre - Wells 500kV	*
Ray Braswell 500/230kV transformer ckt2 - Supplemental Upgrade	Base Case	*
Brookhaven South - Franklin 115kV	Franklin - Vaughn 115kV	-364
Brookhaven South - Franklin 115kV	CALIFRN - Vaughn 115kV	-155
Brookhaven South - Franklin 115kV	CALIFRN - West Brookhaven 115kV	-39
Rilla - Frostkraft Supplemental Upgrade	Sterlington - Walnut Grove East 115kV	-36
Rilla - Frostkraft Supplemental Upgrade	Lamkin - Walnut Grove East 115kV	47
Ray Braswell - Baxter Wilson 500kV - Supplemental Upgrade	Franklin - Grand Gulf 500kV	47
Brookhaven - Brookhaven South 115kV	Franklin - Vaughn 115kV	58

SOCO

Limiting Element	Contingency Element	ATC
Downsville - Ruston East 115kV	Eldorado EHV - Sterlington 500kV	-354
Ruston East - Vienna 115kV	Eldorado EHV - Sterlington 500kV	-69
Rilla - Frostkraft Supplemental Upgrade	Sterlington - Walnut Grove East 115kV	-35
Rilla - Frostkraft Supplemental Upgrade	Lamkin - Walnut Grove East 115kV	45

SPA

Limiting Element	Contingency Element	ATC
International Paper - Mansfield 138kV (CLECO)	Dolet Hills - S.W. Shreveport 345kV (CLECO)	-1315
Carroll 230/138kV transformer (CLECO)	Dolet Hills - S.W. Shreveport 345kV (CLECO)	-734
International Paper - Wallake 138kV (CLECO)	Dolet Hills - S.W. Shreveport 345kV (CLECO)	-663
Downsville - Ruston East 115kV	Eldorado EHV - Sterlington 500kV	-229
Ruston East - Vienna 115kV	Eldorado EHV - Sterlington 500kV	-45
Rilla - Frostkraft Supplemental Upgrade	Sterlington - Walnut Grove East 115kV	-35
Rilla - Frostkraft Supplemental Upgrade	Lamkin - Walnut Grove East 115kV	45

TVA

Limiting Element	Contingency Element	ATC
Downsville - Ruston East 115kV	Eldorado EHV - Sterlington 500kV	-310
Ruston East - Vienna 115kV	Eldorado EHV - Sterlington 500kV	-61
Rilla - Frostkraft Supplemental Upgrade	Sterlington - Walnut Grove East 115kV	-35
Rilla - Frostkraft Supplemental Upgrade	Lamkin - Walnut Grove East 115kV	45

APPENDIX H: Details of Scenario 4 – 2014

AECI

Limiting Element	Contingency Element	ATC
Ray Braswell - Baxter Wilson 500kV - Supplemental Upgrade	Franklin - Grand Gulf 500kV	-343
Rilla - Frostkraft Supplemental Upgrade	Sterlington - Walnut Grove East 115kV	54
International Paper - Mansfield 138kV (CLECO)	Dolet Hills - S.W. Shreveport 345kV (CLECO)	55

AEPW

Limiting Element	Contingency Element	ATC
Cypress 500/138kV transformer 1	Cypress 500/230kV transformer	-1455
Ray Braswell - Baxter Wilson 500kV - Supplemental Upgrade	Franklin - Grand Gulf 500kV	-613
Cypress 500/230kV transformer	Cypress 500/138kV transformer 1	-181
International Paper - Mansfield 138kV (CLECO)	Dolet Hills - S.W. Shreveport 345kV (CLECO)	27
Rilla - Frostkraft Supplemental Upgrade	Sterlington - Walnut Grove East 115kV	55

AMRN

Limiting Element	Contingency Element	ATC
Ray Braswell - Baxter Wilson 500kV - Supplemental Upgrade	Franklin - Grand Gulf 500kV	-284
Rilla - Frostkraft Supplemental Upgrade	Sterlington - Walnut Grove East 115kV	54
International Paper - Mansfield 138kV (CLECO)	Dolet Hills - S.W. Shreveport 345kV (CLECO)	59

CLECO

Limiting Element	Contingency Element	ATC
Ray Braswell - Baxter Wilson 500kV - Supplemental Upgrade	Franklin - Grand Gulf 500kV	-290

EES

Limiting Element	Contingency Element	ATC
Hartburg - Inland Orange 230kV - Supplemental Upgrade	Cypress - Hartburg 500kV	-1462
Inland - McLewis 230kV - Supplemental Upgrade	Cypress - Hartburg 500kV	-1003
Cypress 500/138kV transformer 1	Cypress 500/230kV transformer	-968
Inland - McLewis 230kV	Cypress - Hartburg 500kV	-928
Helbig - McLewis 230kV	Cypress - Hartburg 500kV	-647
Ray Braswell - Baxter Wilson 500kV - Supplemental Upgrade	Franklin - Grand Gulf 500kV	-209
Cypress 500/230kV transformer	Cypress 500/138kV transformer 1	-117
Rilla - Frostkraft Supplemental Upgrade	Sterlington - Walnut Grove East 115kV	53

EMDE

Limiting Element	Contingency Element	ATC
Ray Braswell - Baxter Wilson 500kV - Supplemental Upgrade	Franklin - Grand Gulf 500kV	-413
International Paper - Mansfield 138kV (CLECO)	Dolet Hills - S.W. Shreveport 345kV (CLECO)	47
Rilla - Frostkraft Supplemental Upgrade	Sterlington - Walnut Grove East 115kV	54

LAFA

Limiting Element	Contingency Element	ATC
Ray Braswell - Baxter Wilson 500kV - Supplemental Upgrade	Franklin - Grand Gulf 500kV	-179
Rapidies (CLECO) - Rodemacher (CLECO) 230kV	Rodemacher (CLECO) - Sherwood (CLECO) 230kV	8
Coughlin - Plaisance 138kV (CLECO)	Cocodrie - Vil Plat 230kV	15
Rilla - Frostkraft Supplemental Upgrade	Sterlington - Walnut Grove East 115kV	60

LAGN

Limiting Element	Contingency Element	ATC
Ray Braswell - Baxter Wilson 500kV - Supplemental Upgrade	Franklin - Grand Gulf 500kV	-188
Rilla - Frostkraft Supplemental Upgrade	Sterlington - Walnut Grove East 115kV	59
Natchez SES - Red Gum 115kV	Plantation - Vidalia 115kV	60

LEPA

Limiting Element	Contingency Element	ATC
Ray Braswell - Baxter Wilson 500kV - Supplemental Upgrade	Franklin - Grand Gulf 500kV	-139
Coughlin - Plaisance 138kV (CLECO)	Cocodrie - Vil Plat 230kV	16
Rilla - Frostkraft Supplemental Upgrade	Sterlington - Walnut Grove East 115kV	58
Natchez SES - Red Gum 115kV	Plantation - Vidalia 115kV	59

OKGE

Limiting Element	Contingency Element	ATC
Ray Braswell - Baxter Wilson 500kV - Supplemental Upgrade	Franklin - Grand Gulf 500kV	-496
International Paper - Mansfield 138kV (CLECO)	Dolet Hills - S.W. Shreveport 345kV (CLECO)	40
Rilla - Frostkraft Supplemental Upgrade	Sterlington - Walnut Grove East 115kV	54

SMEPA

Limiting Element	Contingency Element	ATC
Brookhaven South - Franklin 115kV	Franklin - Vaughn 115kV	-221
Ray Braswell - Baxter Wilson 500kV - Supplemental Upgrade	Franklin - Grand Gulf 500kV	-122
Florence - South Jackson 115kV - Supplemental Upgrade	Bogalusa - Adams Creek 500/230kV transformer	-24
Florence - South Jackson 115kV - Supplemental Upgrade	Bogalusa - Franklin 500kV	-24
Brookhaven South - Franklin 115kV	CALIFRN - Vaughn 115kV	-13
Florence - South Jackson 115kV - Supplemental Upgrade	Choctaw MS (TVA) - Clay (TVA) 500kV	30
Rilla - Frostkraft Supplemental Upgrade	Sterlington - Walnut Grove East 115kV	56
Natchez SES - Red Gum 115kV	Plantation - Vidalia 115kV	59

SOCO

Limiting Element	Contingency Element	ATC
Ray Braswell - Baxter Wilson 500kV - Supplemental Upgrade	Franklin - Grand Gulf 500kV	-169
Rilla - Frostkraft Supplemental Upgrade	Sterlington - Walnut Grove East 115kV	55
Natchez SES - Red Gum 115kV	Plantation - Vidalia 115kV	60

SPA

Limiting Element	Contingency Element	ATC
Ray Braswell - Baxter Wilson 500kV - Supplemental Upgrade	Franklin - Grand Gulf 500kV	-444
International Paper - Mansfield 138kV (CLECO)	Dolet Hills - S.W. Shreveport 345kV (CLECO)	50
Rilla - Frostkraft Supplemental Upgrade	Sterlington - Walnut Grove East 115kV	54

TVA

Limiting Element	Contingency Element	ATC
Ray Braswell - Baxter Wilson 500kV - Supplemental Upgrade	Franklin - Grand Gulf 500kV	-205
Rilla - Frostkraft Supplemental Upgrade	Sterlington - Walnut Grove East 115kV	54
Natchez SES - Red Gum 115kV	Plantation - Vidalia 115kV	60