# *System Impact Study*
# *PID 266*
# *40MW Plant*

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# Contents

# 1. Introduction

This Energy Resource Interconnection Service (ERIS) is based on the Customer's request for a 40MW interconnection on Entergy's transmission system between Tallulah and Delhi substations located at the PID 266 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 conducted to determine if the new unit 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 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 Tallulah – Delhi 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 266 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 266 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 266 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 266 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 266 plant **with and without priors**. Priors included are: 221, 231, 238, 240, 244, 247, 250, 251, 252, 253, 255, 256, 257, 260, and 261.

### 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 40MW 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 the requesting generator as the source and adjacent control areas as the 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

It was determined there are no Entergy Transmission System upgrades required for this ERIS request. A summary of the analysis results are documented in Table 3.3.1 for each scenario. Detailed results for each of the thirteen (13) studied interfaces for Scenarios 1, 2, 3, and 4 are included in Tables 3.3.2 – 3.3.5.

**Table 3.1: Summary of Results for PID 266 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 | -376 | -206 | -506 | -298 |
| AEPW | American Electric Power - West | 2014 | -811 | -2580 | -932 | -2312 |
| AMRN | Ameren Transmission | 2014 | -373 | -192 | -499 | -294 |
| CLEC | CLECO | 2014 | -454 | -1594 | -191 | -93 |
| EES | Entergy | 2014 | -400 | -1578 | -521 | -1364 |
| EMDE | Empire District Electric Co | 2014 | -384 | -219 | -525 | -309 |

| 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 |
|---|---|---|---|---|---|---|
| LAFA | Lafayette Utilities System | 2014 | -461 | -542 | -233 | -78 |
| LAGN | Louisiana Generating, LLC | 2014 | -464 | -239 | -283 | -79 |
| LEPA | Louisiana Energy & Power Authority | 2014 | -824 | -1009 | -292 | -69 |
| OKGE | Oklahoma Gas & Electric Company | 2014 | -1385 | -231 | -1581 | -107 |
| SMEPA | South Mississippi Electric Power Assoc. | 2014 | -899 | -1265 | -348 | -276 |
| SOCO | Southern Company | 2014 | -410 | -193 | -501 | -295 |
| SPA | Southwest Power Administration | 2014 | -384 | -224 | -523 | -308 |
| TVA | Tennessee Valley Authority | 2014 | -372 | -187 | -476 | -281 |

# 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 Tallulah - Delhi 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 | Est. Cost | AECI | AEPW | AMRN | CLECO | EES | EMDE | LAFA | LAGN | LEPA | OKGE | SMEPA | SOCO | SPA | TVA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Baxter Wilson - South East Vicksburg 115kV | 2,520,000 | X | X | X | X | X | X | X | X | X | X | X | X | X | X |
| Baxter Wilson SES - Vicksburg 115kV | 3,360,000 | X | X | X | X | X | X | X | X | X | X | X | X | X | X |
| Carroll 230/138kV transformer (CLECO) | Other Ownership | | 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 |
| French Settlement - Sorrento 230kV | 7,200,000 | | | | | | | | | | | X | | | |
| Gerald Andrus SES 230/115kV transformer 1 | 9,350,000 | X | X | X | | X | X | | | | X | X | X | X | X |
| Habetz - Richard 138kV | Included in 2011 ICT Base Plan | | | | X | | | X | | X | | | | | |
| International Paper - Mansfield 138kV (CLECO) | Other Ownership | | X | | | | | | | | X | | | | |
| International Paper - Wallake 138kV (CLECO) | Other Ownership | | X | | | | | | | | X | | | | |
| Jackson Miami - Jackson Monument Street 115kV | 2,520,000 | | | | | | | | | | | X | | | |
| Lake Village Bagby - Macon Lake 115kV | 3,360,000 | | X | | | | X | | | | X | | | X | |
| North Crowley - Scott1 138kV | 14,280,000 | | | | | | | X | | X | | | | | |
| Ray Braswell - Baxter Wilson 500kV - Supplemental Upgrade | TBD | 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 | | | |
| 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 | | | | | | | |
| Semere - Scott2 138kV | 13,440,000 | | | | | | | X | | | | | | | |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | TBD | X | X | X | X | X | X | X | X | | X | | X | X | X |

| Limiting Element | Est. Cost | AECI | AEPW | AMRN | CLECO | EES | EMDE | LAFA | LAGN | LEPA | OKGE | SMEPA | SOCO | SPA | TVA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 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 | Est. Cost | AECI | AEPW | AMRN | CLECO | EES | EMDE | LAFA | LAGN | LEPA | OKGE | SMEPA | SOCO | SPA | TVA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Baxter Wilson - South East Vicksburg 115kV | 2,520,000 | X | X | X | X | X | X | X | X | X | X | X | X | X | X |
| Brookhaven - Mallalieu (MEPA) 115kV | Included in 2011 ICT Base Plan | | | | | | | | | | | X | | | |
| Champagne - Plaisance (CLECO) 138kV | 10,920,00 | | | | | | | X | | X | | | | | |
| Coughlin - Plaisance 138kV (CLECO) | Other Ownership | | | | | | | X | | X | | | | | |
| Cypress 500/138kV transformer 1 | 18,770,000 | | X | | X | X | | | | | | | | | |
| Cypress 500/230kV transformer | 19,110,000 | | X | | | X | | | | | | | | | |
| Florence - South Jackson 115kV - Supplemental Upgrade | Committed to by others | | | | | | | | | | | X | | | |
| French Settlement - Sorrento 230kV | 7,200,000 | | | | | | | | | | | X | | | |
| Habetz - Richard 138kV | Included in 2011 ICT Base Plan | | | | X | | | X | | X | | | | | |
| Hartburg - Inland Orange 230kV | TBD | | X | | | X | | | | | | | | | |
| Helbig - McLewis 230kV | TBD | | X | | | X | | | | | | | | | |
| Inland - McLewis 230kV - Supplemental Upgrade | TBD | | X | | | 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 | | | | | |
| North Crowley - Scott1 138kV | 14,280,000 | | | | | | | X | | X | | | | | |

| Limiting Elements | Est. Cost | AECI | AEPW | AMRN | CLECO | EES | EMDE | LAFA | LAGN | LEPA | OKGE | SMEPA | SOCO | SPA | TVA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Rapidies (CLECO) - Rodemacher (CLECO) 230kV | Other Ownership | | | | | | | X | | 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 | | | |
| Richard - Scott1 138kV | 23,520,000 | | | | | | | X | | X | | | | | |
| Scott1 - Bonin 138kV | 4,200,000 | | | | | | | X | | X | | | | | |
| Semere - Scott2 138kV | 13,444,000 | | | | | | | 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 | Est. Cost | AECI | AEPW | AMRN | CLECO | EES | EMDE | LAFA | LAGN | LEPA | OKGE | SMEPA | SOCO | SPA | TVA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Baxter Wilson - South East Vicksburg 115kV | 2,520,000 | X | | X | | X | X | | | | | | X | X | X |
| Baxter Wilson SES - Vicksburg 115kV | 3,360,000 | X | X | X | X | X | X | X | X | X | X | X | X | X | X |
| Carroll 230/138kV transformer (CLECO) | Other Ownership | | X | | | | | | | | | | | | |
| Downsville - Ruston East 115kV | 7,560,000 | X | X | X | X | X | X | X | X | X | X | X | X | X | X |
| Edwards - Vicksburg East 115kV | 9,240,000 | X | | X | | X | X | | | X | | X | X | X | X |
| International Paper - Mansfield 138kV (CLECO) | Other Ownership | | X | | | | | | | | X | | | | |
| International Paper - Wallake 138kV (CLECO) | Other Ownership | | X | | | | | | | | X | | | | |
| Lake Village Bagby - Macon Lake 115kV | 3,360,000 | | | | | | | | | | | | | X | |
| Ray Braswell - Baxter Wilson 500kV - Supplemental Upgrade | TBD | 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 | | | |
| Ruston East - Vienna 115kV | 2,520,000 | X | X | X | X | X | X | X | X | X | X | X | X | X | X |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | TBD | 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 | Est. Cost | AECI | AEPW | AMRN | CLECO | EES | EMDE | LAFA | LAGN | LEPA | OKGE | SMEPA | SOCO | SPA | TVA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Baxter Wilson - South East Vicksburg 115kV | 3,360,000 | X | | X | | X | X | | | | | | X | 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 | | | |
| Hartburg - Inland Orange 230kV - Supplemental Upgrade | TBD | | X | | | X | | | | | | | | | |
| Helbig - McLewis 230kV | TBD | | X | | | X | | | | | | | | | |
| Inland - McLewis 230kV- Supplemental Upgrade | TBD | | X | | | X | | | | | | | | | |
| International Paper - Mansfield 138kV (CLECO) | Other Ownership | | X | | | | | | | | | | | | |
| Rapidies (CLECO) - Rodemacher (CLECO) 230kV | Other Ownership | | | | | | | X | | 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 | | | |

# 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.

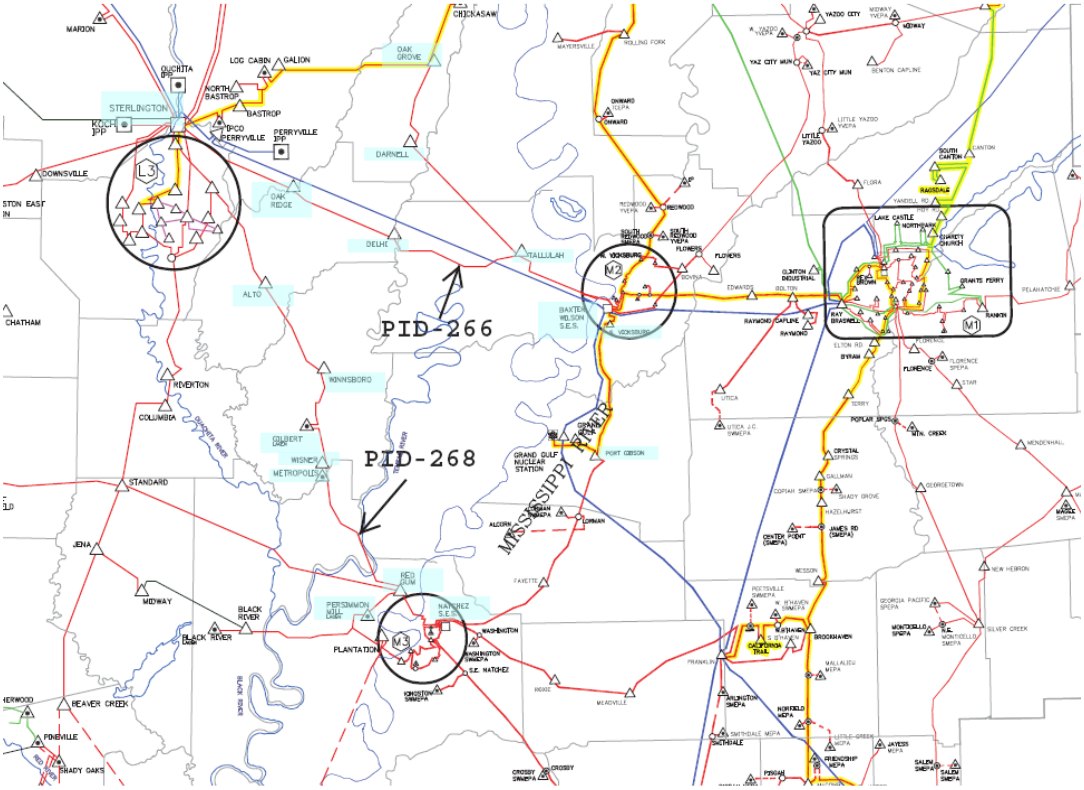


**Figure 5.1: Tallulah-Delhi and Wisner-Red Gum 155kV Vicinity**

## 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.

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- [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 <u>without</u> PID 266 and 268 projects**

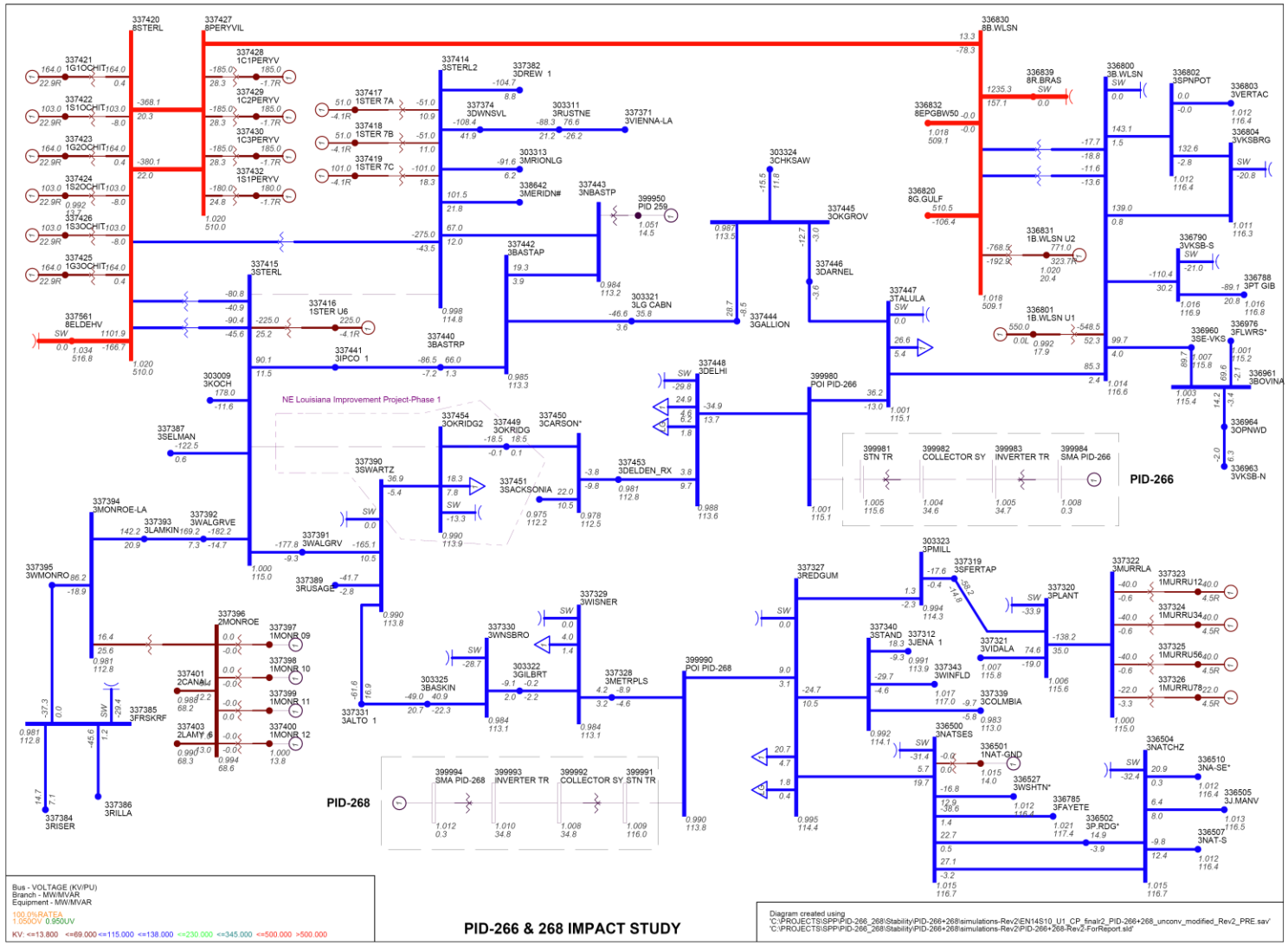
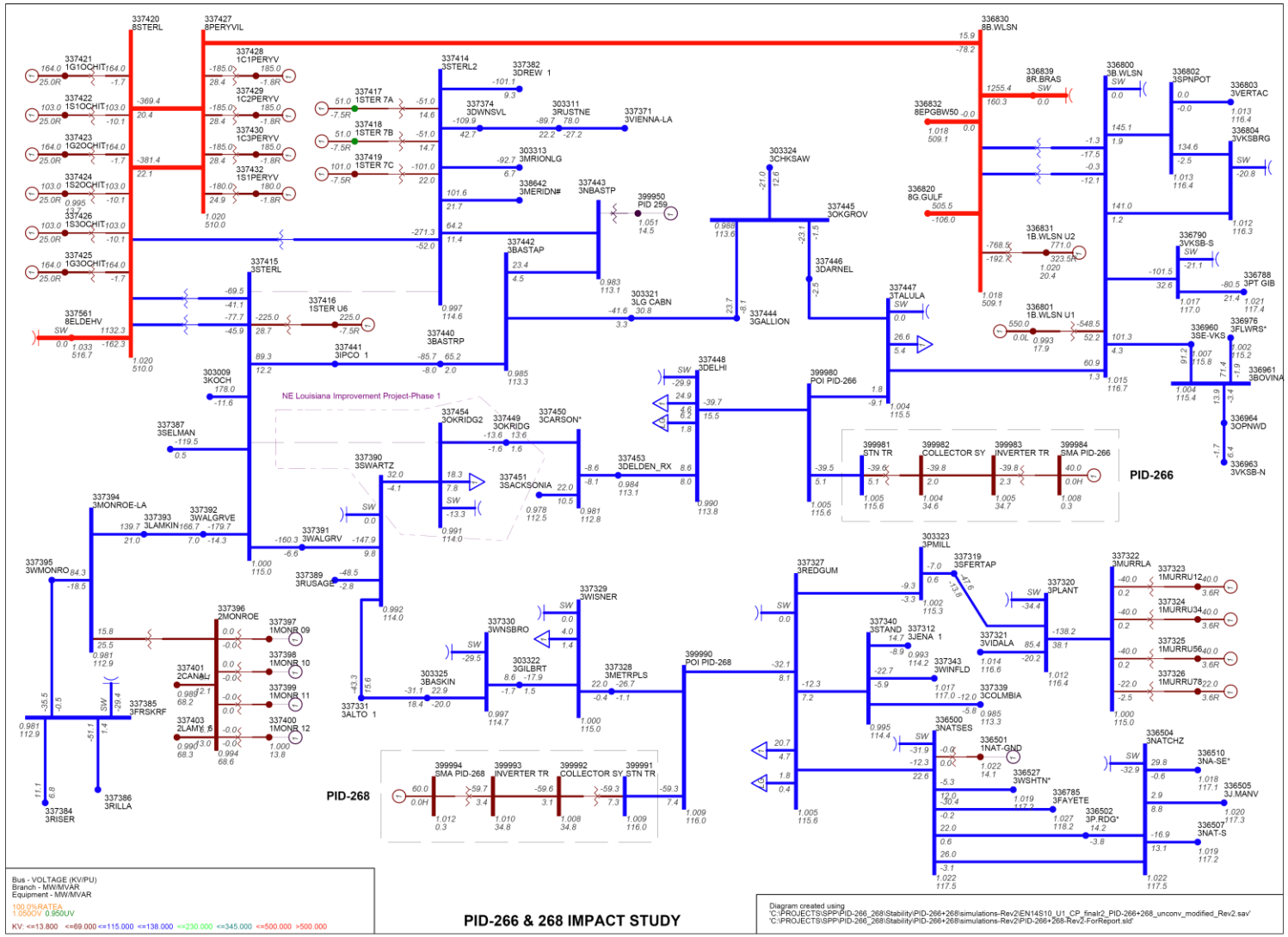


**Figure 7.2: One-line diagram for the local area with PID 266 and 268 projects**



## 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**

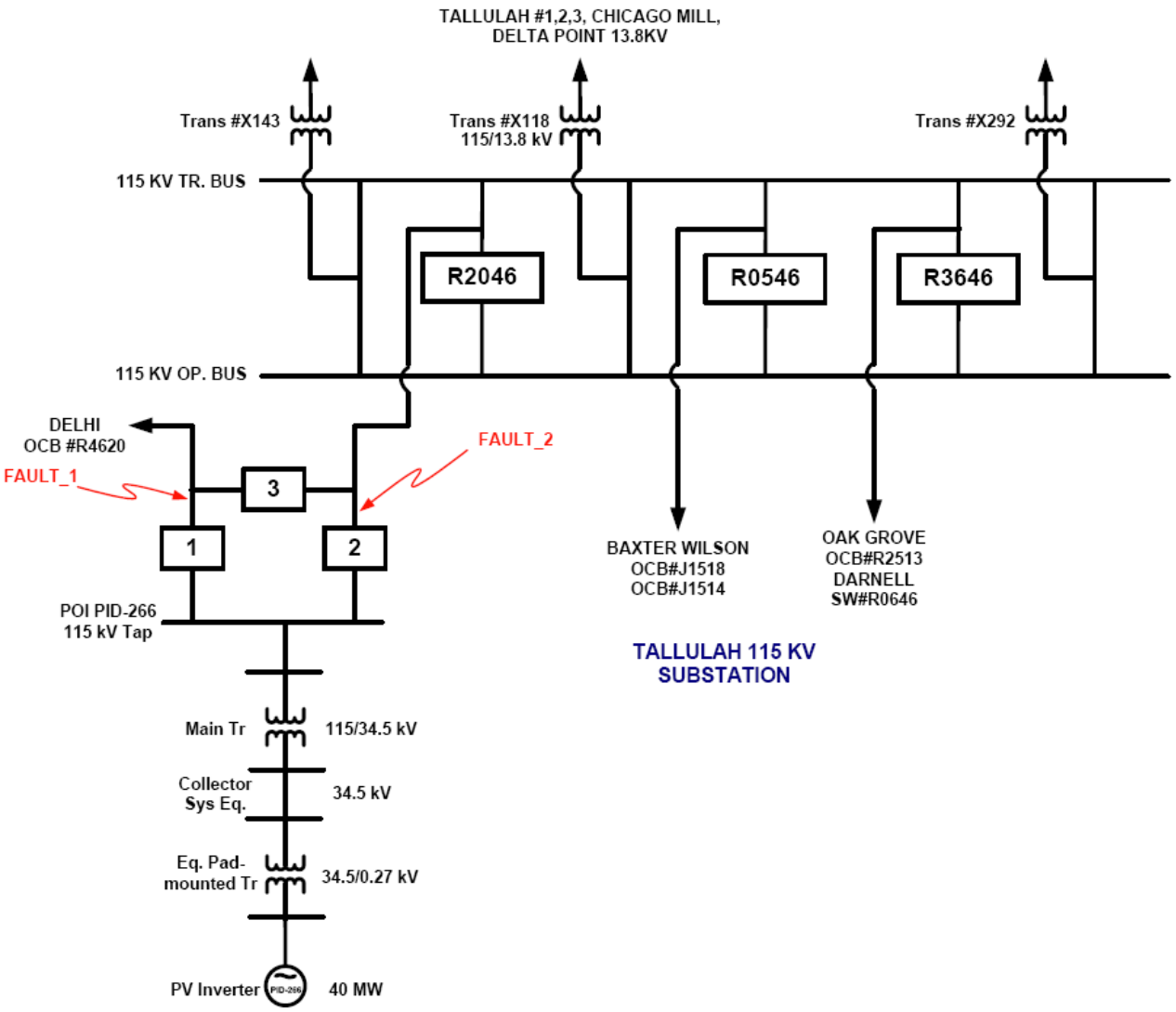


**Figure 7.4: One-line diagram for Red Gum 115kV substation**

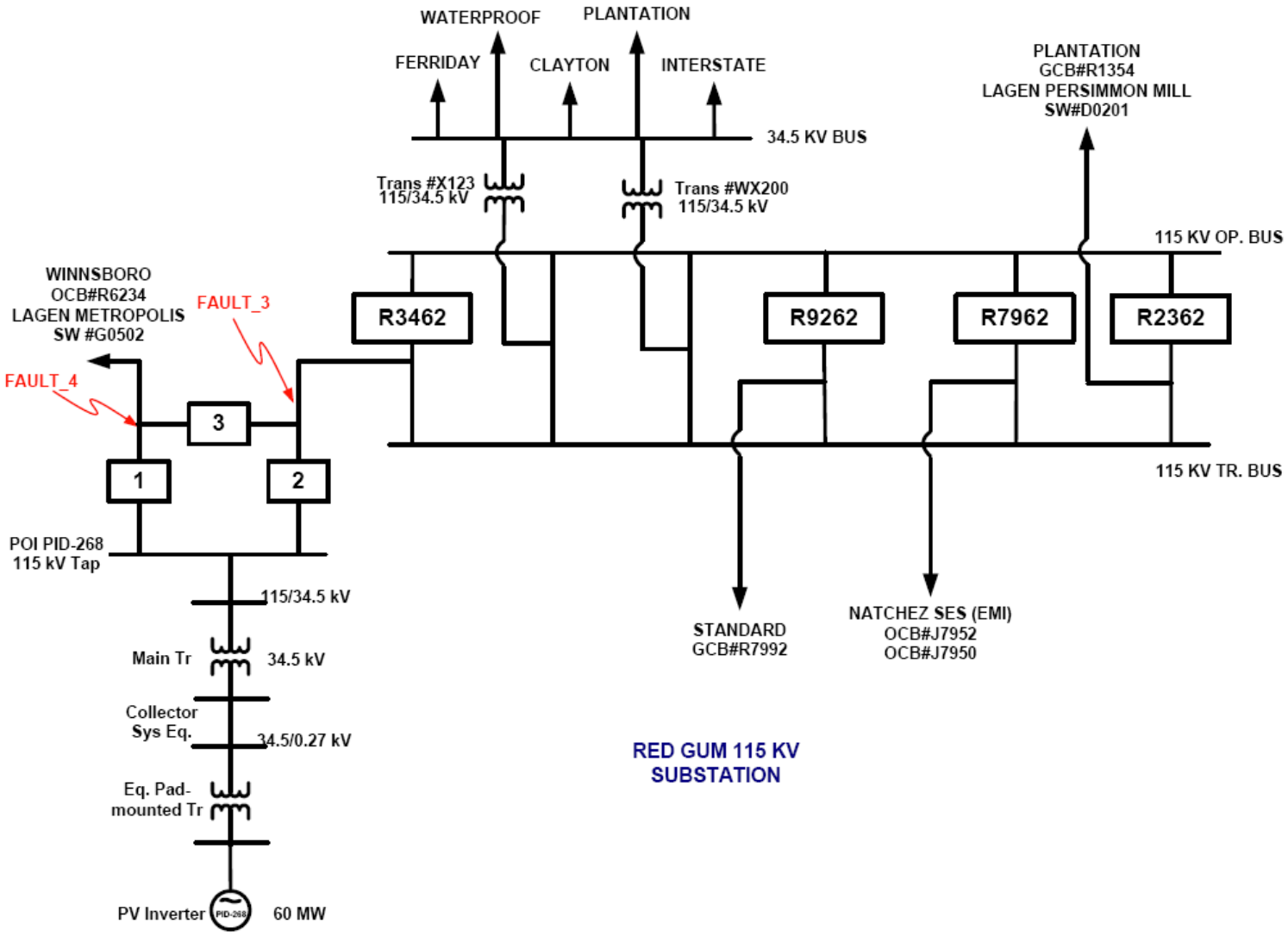


**Figure 7.5: One-line diagram for Baxter Wilson 500kV substation**

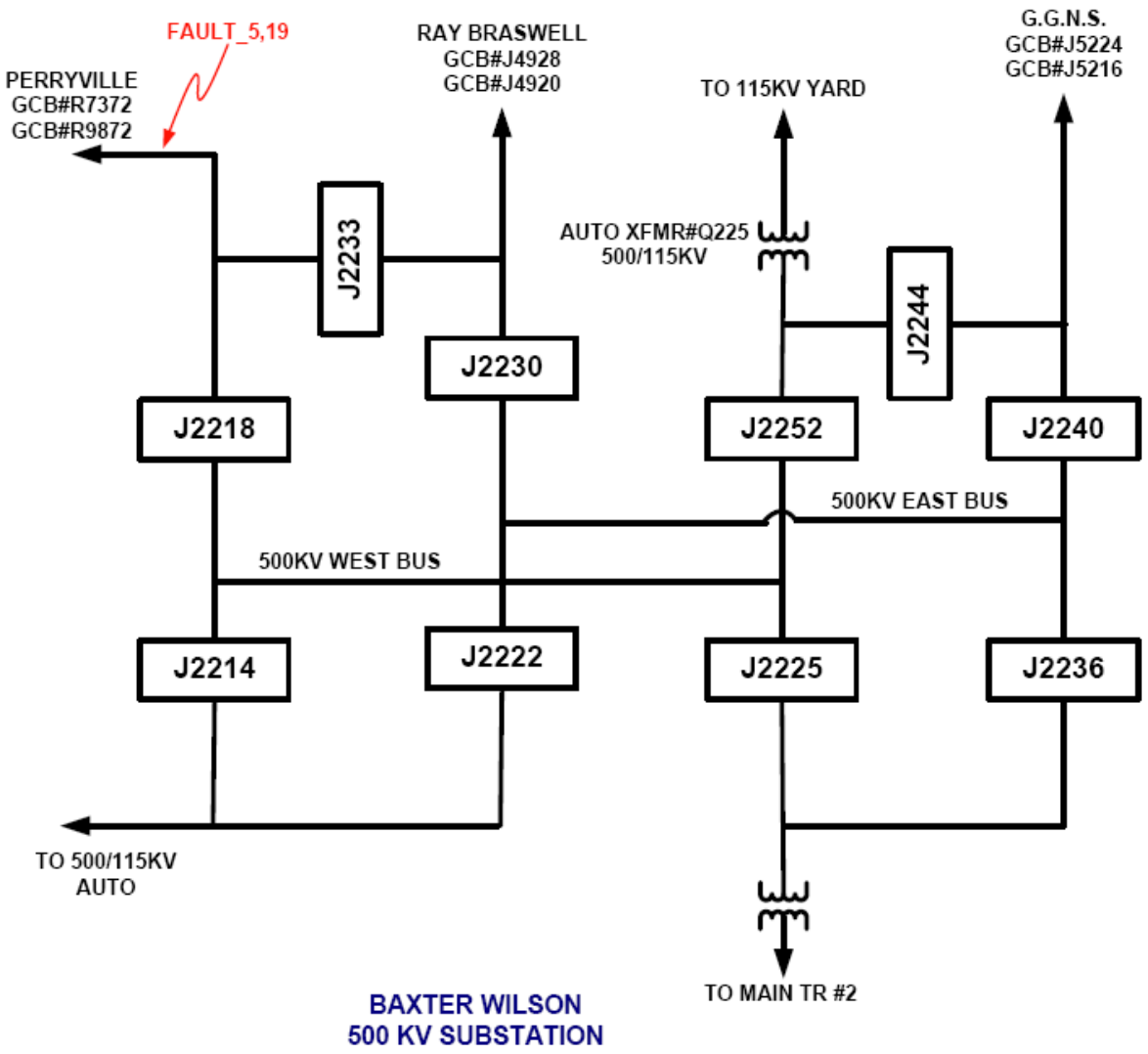


**Figure 7.6: One-line diagram for Baxter Wilson 115kV substation**

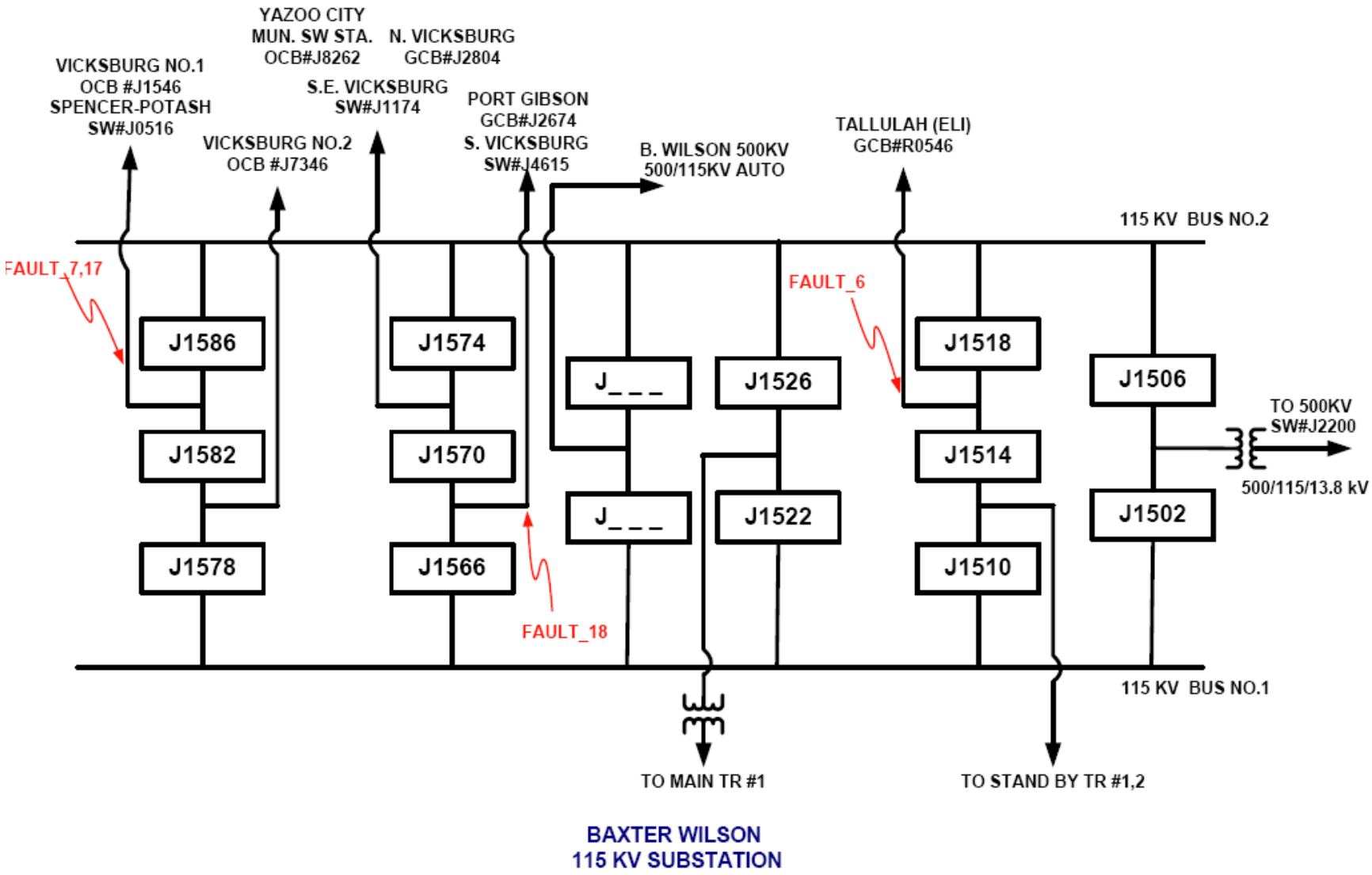


**Figure 7.7: One-line diagram for Sterlington 115kV substation**

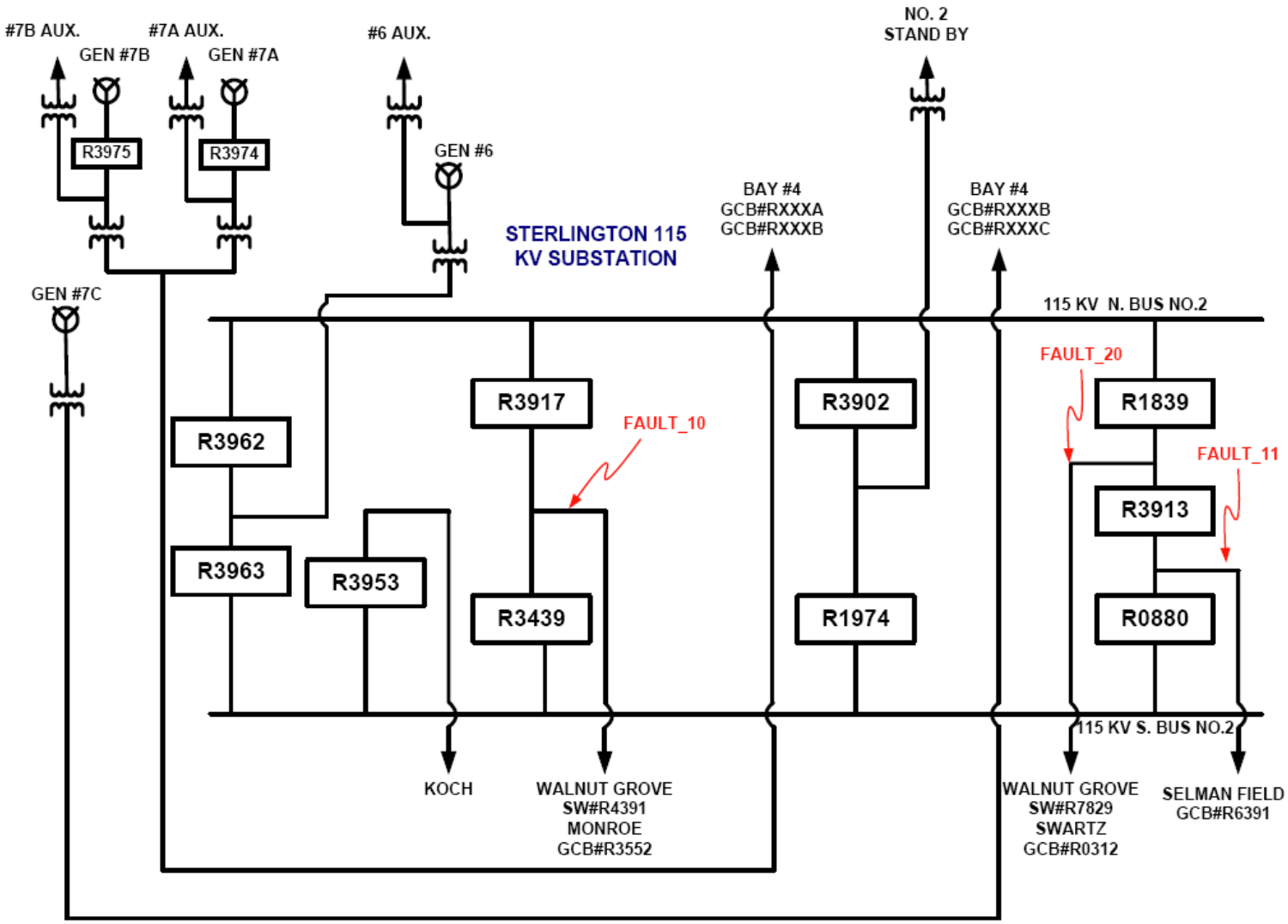


**Figure 7.8: One-line diagram for Sterlington 115kV substation**

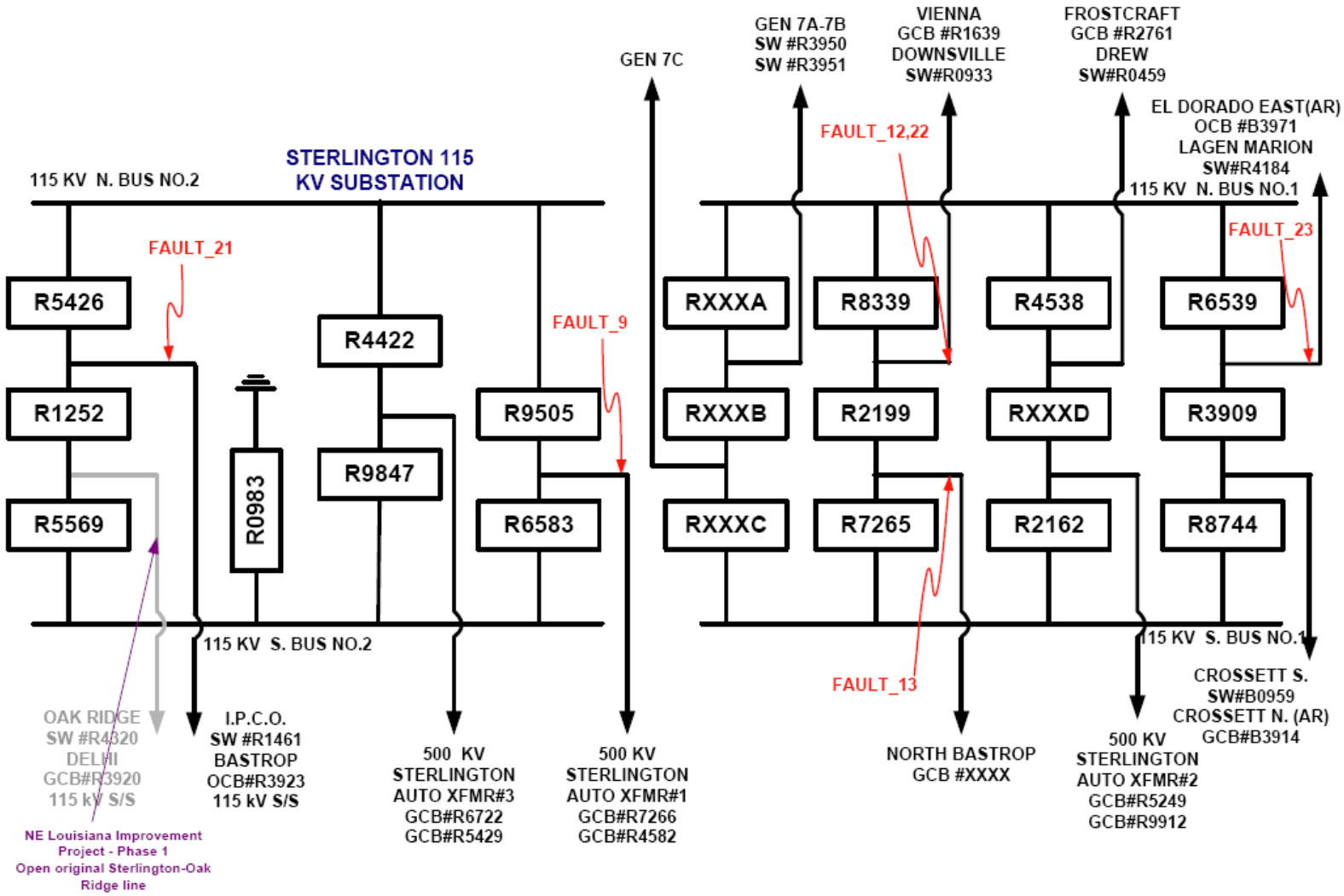
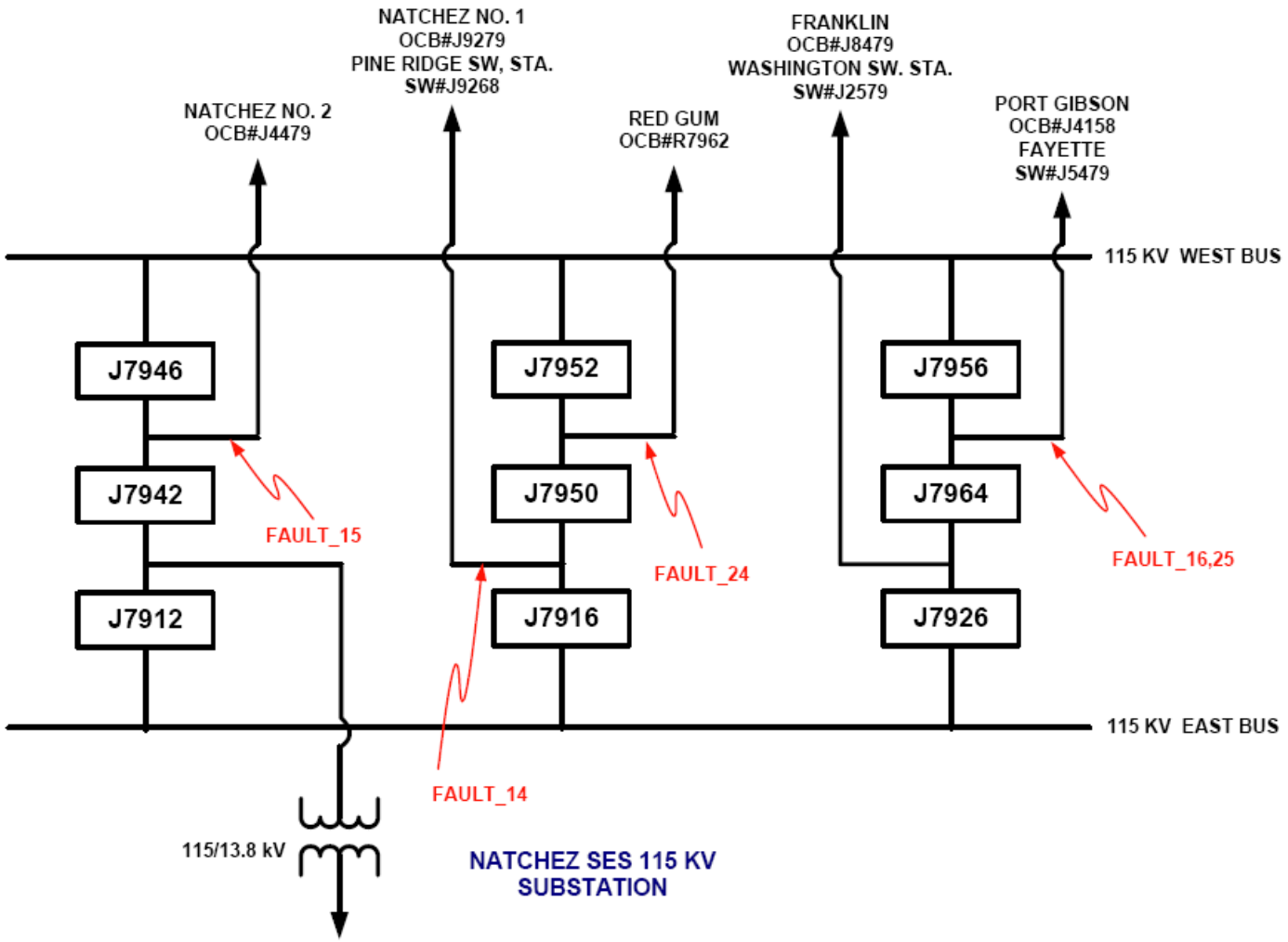


**Figure 7.9: One-line diagram for Natchez 115kV substation**



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**

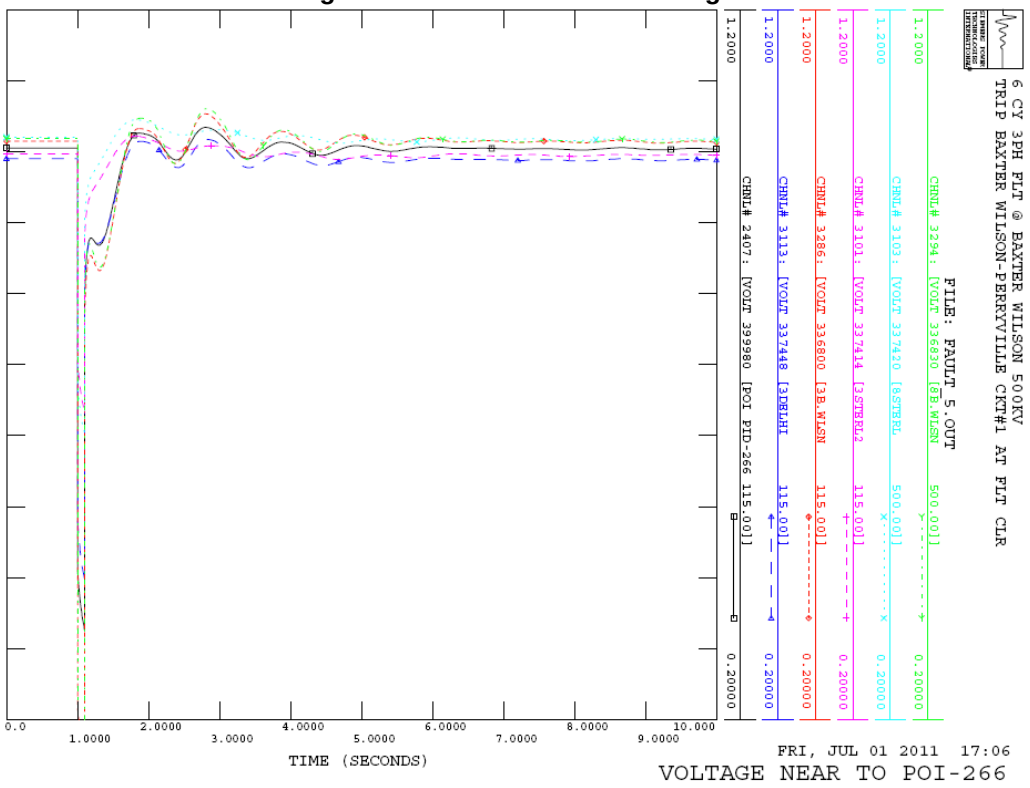



**Figure 7.10B: Plots for machine angle**

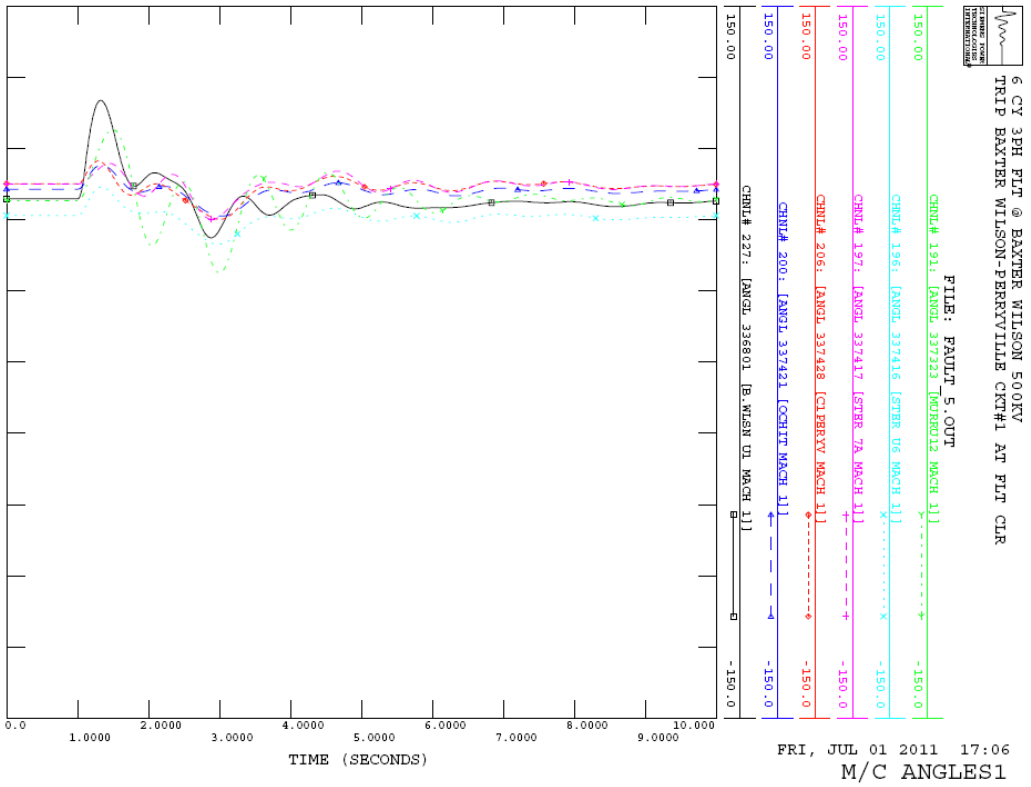


**Figure 7.11: Plots for PV (SMA SC500HE) Inverter Variables**

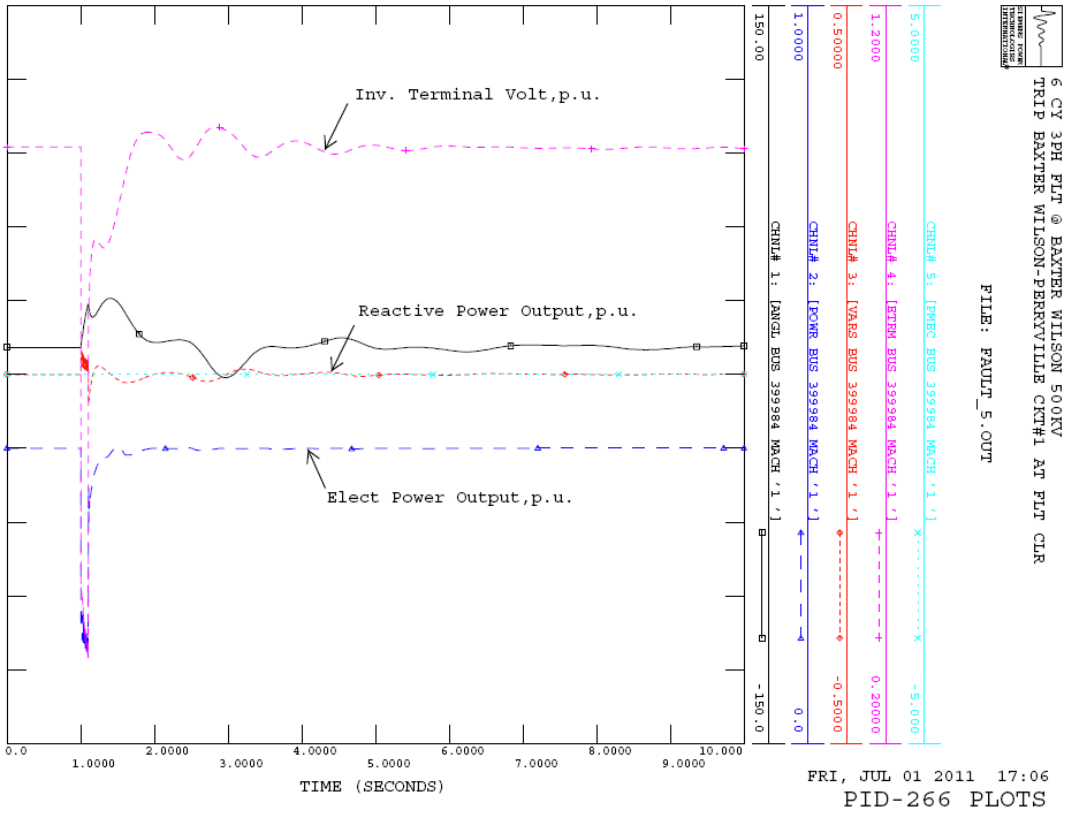


**Table 7.4: Three-Phase Normally Cleared and Stuck Breaker Faults Simulation Results**

| 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

Entergy Services, Inc.
FERC Electric Tariff
Third Revised Volume No. 3

Original Sheet No. 382

**Attachment A to Appendix 1**
**Interconnection Request**

## LARGE GENERATING FACILITY DATA

### UNIT RATINGS

kVA 40,000.00 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 | | |

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Vice President, Transmission

Effective: July 13, 2007

Issued on: July 13, 2007

## 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)
25,000.00/33,000.00 / 41,000.00 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

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Vice President, Transmission

Issued on: July 13, 2007

Effective: July 13, 2007

## 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:
80 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.

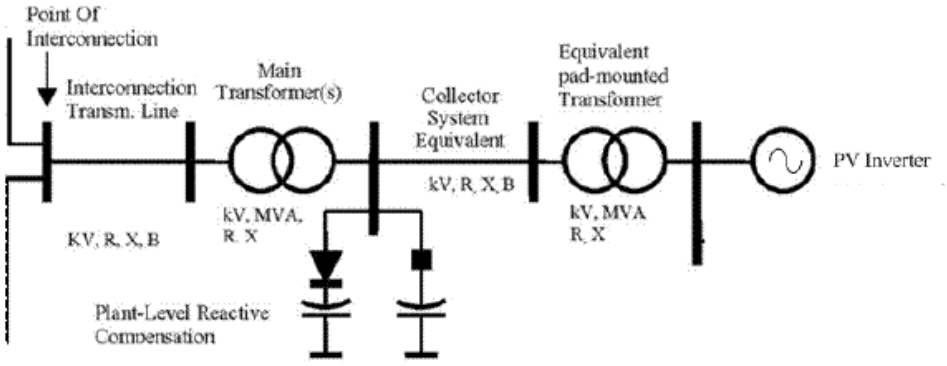


*Figure A-1. Single-machine representation one-line diagram*

2. **Interconnection Transmission Line.**
   - Point of Interconnection (substation or transmission line name): Tallulah-Delhi 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): 25 / 33 / 41 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 .00249_ pu on 100 MVA and collector kV base (positive sequence)
- X = _____ ohm or .0013415 pu on 100 MVA and collector kV base (positive sequence)
- B = _____ µF or .002543_ 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: 80
- 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.

# APPENDIX B: POWER FLOW AND STABILITY DATA

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

**Power flow Data**

***PID 266***

```
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 |
|---|---|---|
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Eldorado EHV - Sheridan 500kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Gerald Andrus - Bagby 230kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Bagby 230/115kV transformer 1 | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Chicot AECC - Lake Village Bagby 115kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Chicot (AECC) - Eudora 115kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Chicksaw - Eudora 115kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Chicksaw - Oakgrove 115kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Independence SES - Keo 500kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Etta - McNeil 500kv | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Etta - Hot Springs EHV 500kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Base Case | * |
| Baxter Wilson - South East Vicksburg 115kV | Vicksburg - West Vicksburg 115kV | -376 |
| Downsville - Ruston East 115kV | Eldorado EHV - Sterlington 500kV | -313 |
| Ruston East - Vienna 115kV | Eldorado EHV - Sterlington 500kV | -165 |
| Gerald Andrus SES 230/115kV transformer 1 | Gerald Andrus SES - Indianola 230kV | -97 |
| Baxter Wilson - South East Vicksburg 115kV | Vicksburg West - Hain Road 115kV | -69 |
| Baxter Wilson SES - Vicksburg 115kV | Baxter Wilson SES - Spencer Potash 115kV | -35 |
| Ray Braswell - Baxter Wilson 500kV - Supplemental Upgrade | Franklin - Grand Gulf 500kV | -16 |

**AEP-W**

| Limiting Element | Contingency Element | ATC |
|---|---|---|
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Gerald Andrus - Bagby 230kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Bagby 230/115kV transformer 1 | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Sarepta - Longwood (AEPW) 345kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Sarepta - El Dorado EHV 345kV ckt 1 | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | El Dorado 500/345kV Transformer | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Eldorado EHV - Sheridan 500kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Chicot AECC - Lake Village Bagby 115kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Chicot (AECC) - Eudora 115kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Chicksaw - Eudora 115kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental | Chicksaw - Oakgrove 115kV | * |

| Limiting Element | Contingency Element | ATC |
|---|---|---|
| Upgrade | | |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Base Case | * |
| International Paper - Mansfield 138kV (CLECO) | Dolet Hills - S.W. Shreveport 345kV (CLECO) | -811 |
| Carroll 230/138kV transformer (CLECO) | Dolet Hills - S.W. Shreveport 345kV (CLECO) | -664 |
| Toledo - VP Tap 138kV | Colfax - Rodemacher 230kV | -439 |
| Baxter Wilson - South East Vicksburg 115kV | Vicksburg - West Vicksburg 115kV | -403 |
| International Paper - Wallake 138kV (CLECO) | Dolet Hills - S.W. Shreveport 345kV (CLECO) | -384 |
| Downsville - Ruston East 115kV | Eldorado EHV - Sterlington 500kV | -275 |
| Toledo - VP Tap 138kV | Colfax - Montgomery 230kV | -202 |
| Lake Village Bagby - Macon Lake 115kV | Eldorado EHV - Sterlington 500kV | -176 |
| Ruston East - Vienna 115kV | Eldorado EHV - Sterlington 500kV | -145 |
| Gerald Andrus SES 230/115kV transformer 1 | Gerald Andrus SES - Indianola 230kV | -116 |
| Baxter Wilson - South East Vicksburg 115kV | Vicksburg West - Hain Road 115kV | -74 |
| Baxter Wilson SES - Vicksburg 115kV | Baxter Wilson SES - Spencer Potash 115kV | -36 |
| Ray Braswell - Baxter Wilson 500kV - Supplemental Upgrade | Franklin - Grand Gulf 500kV | -19 |

**AMRN**

| Limiting Element | Contingency Element | ATC |
|---|---|---|
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Chicot AECC - Lake Village Bagby 115kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Chicot (AECC) - Eudora 115kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Chicksaw - Eudora 115kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Chicksaw - Oakgrove 115kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Independence SES - Keo 500kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Etta - Hot Springs EHV 500kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Etta - McNeil 500kv | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Sheridan - White Bluff 500kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Eldorado EHV - McNeil 500kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Freeport TN (TVA) - Birmingham Steel(TVA) 500kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Base Case | * |
| Baxter Wilson - South East Vicksburg 115kV | Vicksburg - West Vicksburg 115kV | -373 |
| Downsville - Ruston East 115kV | Eldorado EHV - Sterlington 500kV | -329 |
| Ruston East - Vienna 115kV | Eldorado EHV - Sterlington 500kV | -173 |
| Gerald Andrus SES 230/115kV transformer 1 | Gerald Andrus SES - Indianola 230kV | -95 |
| Baxter Wilson - South East Vicksburg 115kV | Vicksburg West - Hain Road 115kV | -68 |
| Baxter Wilson SES - Vicksburg 115kV | Baxter Wilson SES - Spencer Potash 115kV | -34 |
| Ray Braswell - Baxter Wilson 500kV - Supplemental Upgrade | Franklin - Grand Gulf 500kV | -15 |

**CLECO**

| Limiting Element | Contingency Element | ATC |
|---|---|---|
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Roy S. Nelson - Richard 500kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Columbia - Standard 115kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Columbia - Riverton 115kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Rilla - Riverton 115kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Montgomery - Winnfield 230kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Winnfield 230/115kV transformer | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Carroll - Messick 230kV (CLECO) | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Winnfield - Jeldwen (CLECO) 115kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Base Case | * |
| Baxter Wilson - South East Vicksburg 115kV | Vicksburg - West Vicksburg 115kV | -454 |
| Downsville - Ruston East 115kV | Eldorado EHV - Sterlington 500kV | -306 |
| Habetz - Richard 138kV | Wells 500/230kV transformer | -164 |
| Ruston East - Vienna 115kV | Eldorado EHV - Sterlington 500kV | -161 |
| Baxter Wilson - South East Vicksburg 115kV | Vicksburg West - Hain Road 115kV | -83 |
| Baxter Wilson SES - Vicksburg 115kV | Baxter Wilson SES - Spencer Potash 115kV | -38 |
| Ray Braswell - Baxter Wilson 500kV - Supplemental Upgrade | Franklin - Grand Gulf 500kV | -15 |

**EES**

| Limiting Element | Contingency Element | ATC |
|---|---|---|
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Gallion - Oakgrove 115kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Log Cabin - Gallion 115kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Log Cabin - Bastrop Tap 115kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Darnelle - Tallulah 115kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Darnelle - Oak Grove 115kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Franklin - Mcknight 500kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Delhi - PID 266 115kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Carson* - Delden_RX 115kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Delhi - Delden_RX 115kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Oak Ridge - Carson* 115kV | * |
| Downsville - Ruston East 115kV | Eldorado EHV - Sterlington 500kV | -400 |
| Baxter Wilson - South East Vicksburg 115kV | Vicksburg - West Vicksburg 115kV | -382 |
| Ruston East - Vienna 115kV | Eldorado EHV - Sterlington 500kV | -210 |
| Gerald Andrus SES 230/115kV transformer 1 | Gerald Andrus SES - Indianola 230kV | -113 |

| Limiting Element | Contingency Element | ATC |
|---|---|---|
| Baxter Wilson - South East Vicksburg 115kV | Vicksburg West - Hain Road 115kV | -71 |
| Baxter Wilson SES - Vicksburg 115kV | Baxter Wilson SES - Spencer Potash 115kV | -34 |
| Ray Braswell - Baxter Wilson 500kV - Supplemental Upgrade | Franklin - Grand Gulf 500kV | -13 |

**EMDE**

| Limiting Element | Contingency Element | ATC |
|---|---|---|
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Eldorado EHV - Sheridan 500kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Gerald Andrus - Bagby 230kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Bagby 230/115kV transformer 1 | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Chicot AECC - Lake Village Bagby 115kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Chicot (AECC) - Eudora 115kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Chicksaw - Eudora 115kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Chicksaw - Oakgrove 115kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Etta - McNeil 500kv | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Etta - Hot Springs EHV 500kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Independence SES - Keo 500kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Base Case | * |
| Baxter Wilson - South East Vicksburg 115kV | Vicksburg - West Vicksburg 115kV | -384 |
| Downsville - Ruston East 115kV | Eldorado EHV - Sterlington 500kV | -299 |
| Lake Village Bagby - Macon Lake 115kV | Eldorado EHV - Sterlington 500kV | -175 |
| Ruston East - Vienna 115kV | Eldorado EHV - Sterlington 500kV | -157 |
| Gerald Andrus SES 230/115kV transformer 1 | Gerald Andrus SES - Indianola 230kV | -103 |
| Baxter Wilson - South East Vicksburg 115kV | Vicksburg West - Hain Road 115kV | -70 |
| Baxter Wilson SES - Vicksburg 115kV | Baxter Wilson SES - Spencer Potash 115kV | -35 |
| Ray Braswell - Baxter Wilson 500kV - Supplemental Upgrade | Franklin - Grand Gulf 500kV | -17 |

**LAFA**

| Limiting Element | Contingency Element | ATC |
|---|---|---|
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Darnelle - Tallulah 115kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Darnelle - Oak Grove 115kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Delhi - PID 266 115kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Delhi - Delden_RX 115kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Carson* - Delden_RX 115kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Oak Ridge - Carson* 115kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Sterlington - Oak Ridge 115kV | * |

| Limiting Element | Contingency Element | ATC |
|---|---|---|
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Franklin - Mcknight 500kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Webre - Wells 500kV | * |
| Baxter Wilson - South East Vicksburg 115kV | Vicksburg - West Vicksburg 115kV | -461 |
| Downsville - Ruston East 115kV | Eldorado EHV - Sterlington 500kV | -367 |
| Semere - Scott2 138kV | Cocodrie (CLECO) - Vil Plat (CLECO) 230kV | -317 |
| Coughlin - Plaisance 138kV (CLECO) | Cocodrie (CLECO) - Vil Plat (CLECO) 230kV | -289 |
| Semere - Scott2 138kV | Vil Plat (CLECO) - West Fork (CLECO) 230kV | -280 |
| Habetz - Richard 138kV | Cocodrie (CLECO) - Vil Plat (CLECO) 230kV | -224 |
| Champagne - Plaisance (CLECO) 138kV | Cocodrie (CLECO) - Vil Plat (CLECO) 230kV | -223 |
| Ruston East - Vienna 115kV | Eldorado EHV - Sterlington 500kV | -193 |
| Habetz - Richard 138kV | Vil Plat (CLECO) - West Fork (CLECO) 230kV | -185 |
| Coughlin - Plaisance 138kV (CLECO) | Vil Plat (CLECO) - West Fork (CLECO) 230kV | -147 |
| Semere - Scott2 138kV | Wells 500/230kV transformer | -147 |
| North Crowley - Scott1 138kV | Cocodrie (CLECO) - Vil Plat (CLECO) 230kV | -137 |
| North Crowley - Scott1 138kV | Vil Plat (CLECO) - West Fork (CLECO) 230kV | -106 |
| Baxter Wilson - South East Vicksburg 115kV | Vicksburg West - Hain Road 115kV | -84 |
| Champagne - Plaisance (CLECO) 138kV | Vil Plat (CLECO) - West Fork (CLECO) 230kV | -81 |
| North Crowley - Scott1 138kV | Richard - Scott1 138kV | -59 |
| Baxter Wilson SES - Vicksburg 115kV | Baxter Wilson SES - Spencer Potash 115kV | -38 |
| Habetz - Richard 138kV | Wells 500/230kV transformer | -33 |
| North Crowley - Scott1 138kV | Wells 500/230kV transformer | -23 |
| Ray Braswell - Baxter Wilson 500kV - Supplemental Upgrade | Franklin - Grand Gulf 500kV | -12 |
| Habetz - Richard 138kV | Acadian - Bonin 230kV (LAFA) | -1 |
| Scott1 - Bonin 138kV | Cocodrie (CLECO) - Vil Plat (CLECO) 230kV | 3 |

**LAGN**

| Limiting Element | Contingency Element | ATC |
|---|---|---|
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Gallion - Oakgrove 115kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Log Cabin - Gallion 115kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Log Cabin - Bastrop Tap 115kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Darnelle - Tallulah 115kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Darnelle - Oak Grove 115kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Delhi - PID 266 115kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Delhi - Delden_RX 115kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Carson* - Delden_RX 115kV | * |

| Limiting Element | Contingency Element | ATC |
|---|---|---|
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Oak Ridge - Carson* 115kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Sterlington - Oak Ridge 115kV | * |
| Baxter Wilson - South East Vicksburg 115kV | Vicksburg - West Vicksburg 115kV | -464 |
| Downsville - Ruston East 115kV | Eldorado EHV - Sterlington 500kV | -455 |
| Ruston East - Vienna 115kV | Eldorado EHV - Sterlington 500kV | -239 |
| Baxter Wilson - South East Vicksburg 115kV | Vicksburg West - Hain Road 115kV | -85 |
| Baxter Wilson SES - Vicksburg 115kV | Baxter Wilson SES - Spencer Potash 115kV | -38 |
| Ray Braswell - Baxter Wilson 500kV - Supplemental Upgrade | Franklin - Grand Gulf 500kV | -12 |

**LEPA**

| Limiting Element | Contingency Element | ATC |
|---|---|---|
| Habetz - Richard 138kV | Cocodrie (CLECO) - Vil Plat (CLECO) 230kV | -824 |
| Habetz - Richard 138kV | Vil Plat (CLECO) - West Fork (CLECO) 230kV | -681 |
| North Crowley - Scott1 138kV | Cocodrie (CLECO) - Vil Plat (CLECO) 230kV | -510 |
| Baxter Wilson - South East Vicksburg 115kV | Vicksburg - West Vicksburg 115kV | -464 |
| Downsville - Ruston East 115kV | Eldorado EHV - Sterlington 500kV | -459 |
| Coughlin - Plaisance 138kV (CLECO) | Cocodrie (CLECO) - Vil Plat (CLECO) 230kV | -455 |
| North Crowley - Scott1 138kV | Vil Plat (CLECO) - West Fork (CLECO) 230kV | -395 |
| Champagne - Plaisance (CLECO) 138kV | Cocodrie (CLECO) - Vil Plat (CLECO) 230kV | -350 |
| Ruston East - Vienna 115kV | Eldorado EHV - Sterlington 500kV | -241 |
| Coughlin - Plaisance 138kV (CLECO) | Vil Plat (CLECO) - West Fork (CLECO) 230kV | -231 |
| North Crowley - Scott1 138kV | Richard - Scott1 138kV | -196 |
| Habetz - Richard 138kV | Wells 500/230kV transformer | -137 |
| Champagne - Plaisance (CLECO) 138kV | Vil Plat (CLECO) - West Fork (CLECO) 230kV | -127 |
| North Crowley - Scott1 138kV | Wells 500/230kV transformer | -93 |
| Baxter Wilson - South East Vicksburg 115kV | Vicksburg West - Hain Road 115kV | -85 |
| Willow Glen - Evergreen 230kV ckt 2 | Willow Glen - Evergreen 230kV ckt 1 | -41 |
| Baxter Wilson SES - Vicksburg 115kV | Baxter Wilson SES - Spencer Potash 115kV | -37 |
| Ray Braswell - Baxter Wilson 500kV - Supplemental Upgrade | Franklin - Grand Gulf 500kV | -11 |
| Habetz - Richard 138kV | Acadian - Bonin 230kV (LAFA) | -4 |

**OKGE**

| Limiting Element | Contingency Element | ATC |
|---|---|---|
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Eldorado EHV - Sheridan 500kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Gerald Andrus - Bagby 230kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Bagby 230/115kV transformer 1 | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Chicot AECC - Lake Village Bagby 115kV | * |

| Limiting Element | Contingency Element | ATC |
|---|---|---|
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Chicot (AECC) - Eudora 115kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Chicksaw - Eudora 115kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Chicksaw - Oakgrove 115kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Sarepta - Longwood (AEPW) 345kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Sarepta - El Dorado EHV 345kV ckt 1 | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | El Dorado 500/345kV Transformer | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Base Case | * |
| International Paper - Mansfield 138kV (CLECO) | Dolet Hills - S.W. Shreveport 345kV (CLECO) | -1385 |
| International Paper - Wallake 138kV (CLECO) | Dolet Hills - S.W. Shreveport 345kV (CLECO) | -657 |
| Baxter Wilson - South East Vicksburg 115kV | Vicksburg - West Vicksburg 115kV | -391 |
| Downsville - Ruston East 115kV | Eldorado EHV - Sterlington 500kV | -288 |
| Lake Village Bagby - Macon Lake 115kV | Eldorado EHV - Sterlington 500kV | -173 |
| Ruston East - Vienna 115kV | Eldorado EHV - Sterlington 500kV | -151 |
| Gerald Andrus SES 230/115kV transformer 1 | Gerald Andrus SES - Indianola 230kV | -108 |
| Baxter Wilson - South East Vicksburg 115kV | Vicksburg West - Hain Road 115kV | -72 |
| Baxter Wilson SES - Vicksburg 115kV | Baxter Wilson SES - Spencer Potash 115kV | -35 |
| Ray Braswell - Baxter Wilson 500kV - Supplemental Upgrade | Franklin - Grand Gulf 500kV | -18 |

**SMEPA**

| Limiting Element | Contingency Element | ATC |
|---|---|---|
| Ray Braswell 500/230kV transformer ckt2 - Supplemental Upgrade | Lakeover - Ray Braswell 500kV | * |
| French Settlement - Sorrento 230kV | Bogalusa - Franklin 500kV | -899 |
| French Settlement - Sorrento 230kV | Bogalusa - Adams Creek 500/230kV transformer | -899 |
| Jackson Miami - Jackson Monument Street 115kV | South Jackson 230/115kV transformer 1 | -836 |
| Ray Braswell - West Jackson 115kV | Jackson Forrest Hill - Ray Braswell 115kV | -585 |
| Ray Braswell - West Jackson 115kV | South Jackson 230/115kV transformer 1 | -554 |
| Downsville - Ruston East 115kV | Eldorado EHV - Sterlington 500kV | -540 |
| Baxter Wilson - South East Vicksburg 115kV | Vicksburg - West Vicksburg 115kV | -409 |
| French Settlement - Sorrento 230kV | Fairview - Gypsy 230kV | -406 |
| Ray Braswell - West Jackson 115kV | Jackson Forrest Hill - Southwest Jackson 115kV | -394 |
| French Settlement - Sorrento 230kV | Fairview - Madisonville 230kV | -366 |
| Ray Braswell - West Jackson 115kV | Jackson Miami - Rex Brown 115kV | -319 |
| Ruston East - Vienna 115kV | Eldorado EHV - Sterlington 500kV | -284 |
| Ray Braswell - West Jackson 115kV | Jackson Miami - Jackson Monument Street 115kV | -252 |
| Jackson Miami - Jackson Monument Street 115kV | Ray Braswell 500/230kV transformer ckt1 and ckt2 Test Contingency | -249 |
| Jackson Miami - Jackson Monument Street 115kV | Jackson Forrest Hill - Ray Braswell 115kV | -214 |
| Jackson Miami - Jackson Monument Street 115kV | Jackson HICO - Rex Brown E 115kV | -202 |

| Limiting Element | Contingency Element | ATC |
|---|---|---|
| Jackson Miami - Jackson Monument Street 115kV | Jackson HICO - North Jackson 115kV | -202 |
| Gerald Andrus SES 230/115kV transformer 1 | Gerald Andrus SES - Indianola 230kV | -126 |
| Jackson Miami - Jackson Monument Street 115kV | Jackson Forrest Hill - Southwest Jackson 115kV | -79 |
| Baxter Wilson - South East Vicksburg 115kV | Vicksburg West - Hain Road 115kV | -75 |
| Jackson Miami - Jackson Monument Street 115kV | Klean - Jackson Northeast 115kV | -43 |
| Baxter Wilson SES - Vicksburg 115kV | Baxter Wilson SES - Spencer Potash 115kV | -33 |
| Jackson Miami - Jackson Monument Street 115kV | Ray Braswell - West Jackson 115kV | -14 |
| Jackson Miami - Jackson Monument Street 115kV | Klean - Flowood 115kV | 15 |

**SOCO**

| Limiting Element | Contingency Element | ATC |
|---|---|---|
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Choctaw MS (TVA) - Clay (TVA) 500kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Darnelle - Tallulah 115kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Darnelle - Oak Grove 115kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Delhi - PID 266 115kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | McAdams - Wolf Creek 500kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | French Camp (TVA) - Choctaw (TVA) 500kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Carson* - Delden_RX 115kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Delhi - Delden_RX 115kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Oak Ridge - Carson* 115kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Sterlington - Oak Ridge 115kV | * |
| Downsville - Ruston East 115kV | Eldorado EHV - Sterlington 500kV | -410 |
| Baxter Wilson - South East Vicksburg 115kV | Vicksburg - West Vicksburg 115kV | -375 |
| Ruston East - Vienna 115kV | Eldorado EHV - Sterlington 500kV | -215 |
| Gerald Andrus SES 230/115kV transformer 1 | Gerald Andrus SES - Indianola 230kV | -97 |
| Baxter Wilson - South East Vicksburg 115kV | Vicksburg West - Hain Road 115kV | -69 |
| Baxter Wilson SES - Vicksburg 115kV | Baxter Wilson SES - Spencer Potash 115kV | -34 |
| Ray Braswell - Baxter Wilson 500kV - Supplemental Upgrade | Franklin - Grand Gulf 500kV | -12 |

**SPA**

| Limiting Element | Contingency Element | ATC |
|---|---|---|
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Eldorado EHV - Sheridan 500kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Gerald Andrus - Bagby 230kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Bagby 230/115kV transformer 1 | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Chicot AECC - Lake Village Bagby 115kV | * |

| Limiting Element | Contingency Element | ATC |
|---|---|---|
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Chicot (AECC) - Eudora 115kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Chicksaw - Eudora 115kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Chicksaw - Oakgrove 115kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Etta - Hot Springs EHV 500kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Etta - McNeil 500kv | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Independence SES - Keo 500kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Base Case | * |
| Baxter Wilson - South East Vicksburg 115kV | Vicksburg - West Vicksburg 115kV | -384 |
| Downsville - Ruston East 115kV | Eldorado EHV - Sterlington 500kV | -296 |
| Lake Village Bagby - Macon Lake 115kV | Eldorado EHV - Sterlington 500kV | -171 |
| Ruston East - Vienna 115kV | Eldorado EHV - Sterlington 500kV | -156 |
| Gerald Andrus SES 230/115kV transformer 1 | Gerald Andrus SES - Indianola 230kV | -103 |
| Baxter Wilson - South East Vicksburg 115kV | Vicksburg West - Hain Road 115kV | -70 |
| Baxter Wilson SES - Vicksburg 115kV | Baxter Wilson SES - Spencer Potash 115kV | -35 |
| Ray Braswell - Baxter Wilson 500kV - Supplemental Upgrade | Franklin - Grand Gulf 500kV | -17 |

**TVA**

| Limiting Element | Contingency Element | ATC |
|---|---|---|
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Perryville - Sterlington 500kV ckt 1 | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Franklin - Grand Gulf 500kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | West Point (TVA) - Clay (TVA) 500kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Franklin - Mcknight 500kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Lakeover - Ray Braswell 500kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Baxter Wilson - Grand Gulf 500kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Baxter Wilson - Ray Braswell 500kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Gallion - Oakgrove 115kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Log Cabin - Gallion 115kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Log Cabin - Bastrop Tap 115kV | * |
| Downsville - Ruston East 115kV | Eldorado EHV - Sterlington 500kV | -372 |
| Baxter Wilson - South East Vicksburg 115kV | Vicksburg - West Vicksburg 115kV | -363 |
| Ruston East - Vienna 115kV | Eldorado EHV - Sterlington 500kV | -195 |
| Gerald Andrus SES 230/115kV transformer 1 | Gerald Andrus SES - Indianola 230kV | -90 |
| Baxter Wilson - South East Vicksburg 115kV | Vicksburg West - Hain Road 115kV | -67 |
| Baxter Wilson SES - Vicksburg 115kV | Baxter Wilson SES - Spencer Potash 115kV | -33 |
| Ray Braswell - Baxter Wilson 500kV - Supplemental Upgrade | Franklin - Grand Gulf 500kV | -13 |

# APPENDIX F: Details of Scenario 2 – 2014

**AECI**

| Limiting Element | Contingency Element | ATC |
|---|---|---|
| Ray Braswell - Baxter Wilson 500kV - Supplemental Upgrade | Franklin - Grand Gulf 500kV | -206 |
| Baxter Wilson - South East Vicksburg 115kV | Vicksburg - West Vicksburg 115kV | -194 |

**AEP-W**

| Limiting Element | Contingency Element | ATC |
|---|---|---|
| Hartburg - Inland Orange 230kV - Supplemental Upgrade | Cypress - Hartburg 500kV | -2580 |
| Helbig - McLewis 230kV | Cypress - Hartburg 500kV | -2547 |
| Hartburg - Inland Orange 230kV | Cypress - Hartburg 500kV | -2467 |
| Inland - McLewis 230kV - Supplemental Upgrade | Cypress - Hartburg 500kV | -1853 |
| Cypress 500/138kV transformer 1 | Cypress 500/230kV transformer | -1303 |
| Ray Braswell - Baxter Wilson 500kV - Supplemental Upgrade | Franklin - Grand Gulf 500kV | -243 |
| Baxter Wilson - South East Vicksburg 115kV | Vicksburg - West Vicksburg 115kV | -208 |
| Cypress 500/230kV transformer | Cypress 500/138kV transformer 1 | -188 |

**AMRN**

| Limiting Element | Contingency Element | ATC |
|---|---|---|
| Baxter Wilson - South East Vicksburg 115kV | Vicksburg - West Vicksburg 115kV | -192 |
| Ray Braswell - Baxter Wilson 500kV - Supplemental Upgrade | Franklin - Grand Gulf 500kV | -192 |

**CLECO**

| Limiting Element | Contingency Element | ATC |
|---|---|---|
| Cypress 500/138kV transformer 1 | Cypress 500/230kV transformer | -1594 |
| Habetz - Richard 138kV | Wells 500/230kV transformer | -313 |
| Baxter Wilson - South East Vicksburg 115kV | Vicksburg - West Vicksburg 115kV | -234 |
| Ray Braswell - Baxter Wilson 500kV - Supplemental Upgrade | Franklin - Grand Gulf 500kV | -195 |

**EES**

| Limiting Element | Contingency Element | ATC |
|---|---|---|
| Helbig - McLewis 230kV | Cypress - Hartburg 500kV | -1578 |
| Hartburg - Inland Orange 230kV - Supplemental Upgrade | Cypress - Hartburg 500kV | -1556 |
| Hartburg - Inland Orange 230kV | Cypress - Hartburg 500kV | -1488 |
| Inland - McLewis 230kV - Supplemental Upgrade | Cypress - Hartburg 500kV | -1135 |
| Cypress 500/138kV transformer 1 | Cypress 500/230kV transformer | -919 |
| Baxter Wilson - South East Vicksburg 115kV | Vicksburg - West Vicksburg 115kV | -197 |
| Ray Braswell - Baxter Wilson 500kV - Supplemental Upgrade | Franklin - Grand Gulf 500kV | -168 |
| Cypress 500/230kV transformer | Cypress 500/138kV transformer 1 | -129 |

**EMDE**

| Limiting Element | Contingency Element | ATC |
|---|---|---|
| Ray Braswell - Baxter Wilson 500kV - Supplemental Upgrade | Franklin - Grand Gulf 500kV | -219 |
| Baxter Wilson - South East Vicksburg 115kV | Vicksburg - West Vicksburg 115kV | -198 |

**LAFA**

| Limiting Element | Contingency Element | ATC |
|---|---|---|
| Coughlin - Plaisance 138kV (CLECO) | Cocodrie (CLECO) - Vil Plat (CLECO) 230kV | -542 |
| Champagne - Plaisance (CLECO) 138kV | Cocodrie (CLECO) - Vil Plat (CLECO) 230kV | -476 |
| Coughlin - Plaisance 138kV (CLECO) | Vil Plat (CLECO) - West Fork (CLECO) 230kV | -400 |
| Semere - Scott2 138kV | Cocodrie (CLECO) - Vil Plat (CLECO) 230kV | -377 |
| Semere - Scott2 138kV | Vil Plat (CLECO) - West Fork (CLECO) 230kV | -341 |
| Champagne - Plaisance (CLECO) 138kV | Vil Plat (CLECO) - West Fork (CLECO) 230kV | -334 |
| Habetz - Richard 138kV | Cocodrie (CLECO) - Vil Plat (CLECO) 230kV | -274 |
| Baxter Wilson - South East Vicksburg 115kV | Vicksburg - West Vicksburg 115kV | -238 |
| Habetz - Richard 138kV | Vil Plat (CLECO) - West Fork (CLECO) 230kV | -235 |
| Rapidies (CLECO) - Rodemacher (CLECO) 230kV | Rodemacher (CLECO) - Sherwood (CLECO) 230kV | -202 |
| North Crowley - Scott1 138kV | Cocodrie (CLECO) - Vil Plat (CLECO) 230kV | -198 |
| Semere - Scott2 138kV | Wells 500/230kV transformer | -188 |
| North Crowley - Scott1 138kV | Vil Plat (CLECO) - West Fork (CLECO) 230kV | -167 |
| Ray Braswell - Baxter Wilson 500kV - Supplemental Upgrade | Franklin - Grand Gulf 500kV | -159 |
| North Crowley - Scott1 138kV | Richard - Scott1 138kV | -145 |
| Semere - Scott2 138kV | Bonin - Cecelia 138kV | -109 |
| North Crowley - Scott1 138kV | Wells 500/230kV transformer | -65 |
| Habetz - Richard 138kV | Wells 500/230kV transformer | -64 |
| Semere - Scott2 138kV | Habetz - Richard 138kV | -64 |
| Habetz - Richard 138kV | Acadian - Bonin 230kV (LAFA) | -48 |
| 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 | 32 |
| Scott1 - Bonin 138kV | Vil Plat (CLECO) - West Fork (CLECO) 230kV | 33 |

**LAGN**

| Limiting Element | Contingency Element | ATC |
|---|---|---|
| Baxter Wilson - South East Vicksburg 115kV | Vicksburg - West Vicksburg 115kV | -239 |
| Ray Braswell - Baxter Wilson 500kV - Supplemental Upgrade | Franklin - Grand Gulf 500kV | -161 |

**LEPA**

| Limiting Element | Contingency Element | ATC |
|---|---|---|
| Habetz - Richard 138kV | Cocodrie (CLECO) - Vil Plat (CLECO) 230kV | -1009 |
| Habetz - Richard 138kV | Vil Plat (CLECO) - West Fork (CLECO) 230kV | -867 |
| Coughlin - Plaisance 138kV (CLECO) | Cocodrie (CLECO) - Vil Plat (CLECO) 230kV | -852 |
| Champagne - Plaisance (CLECO) 138kV | Cocodrie (CLECO) - Vil Plat (CLECO) 230kV | -748 |
| North Crowley - Scott1 138kV | Cocodrie (CLECO) - Vil Plat (CLECO) 230kV | -738 |
| Willow Glen - Evergreen 230kV ckt 2 | Willow Glen - Evergreen 230kV ckt 1 | -653 |

| Limiting Element | Contingency Element | ATC |
|---|---|---|
| Coughlin - Plaisance 138kV (CLECO) | Vil Plat (CLECO) - West Fork (CLECO) 230kV | -629 |
| North Crowley - Scott1 138kV | Vil Plat (CLECO) - West Fork (CLECO) 230kV | -623 |
| Champagne - Plaisance (CLECO) 138kV | Vil Plat (CLECO) - West Fork (CLECO) 230kV | -525 |
| North Crowley - Scott1 138kV | Richard - Scott1 138kV | -484 |
| Rapidies (CLECO) - Rodemacher (CLECO) 230kV | Rodemacher (CLECO) - Sherwood (CLECO) 230kV | -355 |
| North Crowley - Scott1 138kV | Wells 500/230kV transformer | -268 |
| Habetz - Richard 138kV | Wells 500/230kV transformer | -260 |
| Baxter Wilson - South East Vicksburg 115kV | Vicksburg - West Vicksburg 115kV | -239 |
| Habetz - Richard 138kV | Acadian - Bonin 230kV (LAFA) | -189 |
| Ray Braswell - Baxter Wilson 500kV - Supplemental Upgrade | Franklin - Grand Gulf 500kV | -137 |
| Scott1 - Bonin 138kV | Cocodrie (CLECO) - Vil Plat (CLECO) 230kV | -83 |
| Richard - Scott1 138kV | Cocodrie (CLECO) - Vil Plat (CLECO) 230kV | 6 |
| Judice - Scott1 138kV | Sellers Road (CLECO) - Labbe (LAFA) 230kV | 34 |
| Judice - Scott1 138kV | Sellers Road (CLECO) - Segura (CLECO) 230kV | 38 |

**OKGE**

| Limiting Element | Contingency Element | ATC |
|---|---|---|
| Ray Braswell - Baxter Wilson 500kV - Supplemental Upgrade | Franklin - Grand Gulf 500kV | -231 |
| Baxter Wilson - South East Vicksburg 115kV | Vicksburg - West Vicksburg 115kV | -202 |

**SMEPA**

| Limiting Element | Contingency Element | ATC |
|---|---|---|
| Ray Braswell 500/230kV transformer ckt2 - Supplemental Upgrade | Lakeover - Ray Braswell 500kV | * |
| Jackson Miami - Jackson Monument Street 115kV | South Jackson 230/115kV transformer 1 | -1265 |
| French Settlement - Sorrento 230kV | Bogalusa - Adams Creek 500/230kV transformer | -975 |
| French Settlement - Sorrento 230kV | Bogalusa - Franklin 500kV | -975 |
| Jackson Miami - Jackson Monument Street 115kV | Jackson HICO - North Jackson 115kV | -568 |
| Jackson Miami - Jackson Monument Street 115kV | Jackson HICO - Rex Brown E 115kV | -568 |
| Ray Braswell - West Jackson 115kV | South Jackson 230/115kV transformer 1 | -552 |
| Jackson Miami - Jackson Monument Street 115kV | Jackson Forrest Hill - Ray Braswell 115kV | -531 |
| Ray Braswell - West Jackson 115kV | Jackson Forrest Hill - Ray Braswell 115kV | -422 |
| Jackson Miami - Jackson Monument Street 115kV | Jackson Forrest Hill - Southwest Jackson 115kV | -396 |
| Jackson Miami - Jackson Monument Street 115kV | Klean - Jackson Northeast 115kV | -380 |
| Jackson Miami - Jackson Monument Street 115kV | Klean - Flowood 115kV | -322 |
| Jackson Miami - Jackson Monument Street 115kV | North Jackson - Jackson Canton Road 115kV | -315 |
| Brookhaven - Mallalieu (MEPA) 115kV | Bogalusa - Adams Creek 500/230kV transformer | -297 |
| Brookhaven - Mallalieu (MEPA) 115kV | Bogalusa - Franklin 500kV | -297 |
| Jackson Miami - Jackson Monument Street 115kV | Ray Braswell - West Jackson 115kV | -285 |
| Ray Braswell - West Jackson 115kV | Jackson Forrest Hill - Southwest Jackson 115kV | -231 |
| Baxter Wilson - South East Vicksburg 115kV | Vicksburg - West Vicksburg 115kV | -211 |
| Ray Braswell - West Jackson 115kV | Jackson Miami - Rex Brown 115kV | -195 |
| Ray Braswell - West Jackson 115kV | Jackson Miami - Jackson Monument Street | -129 |

| Limiting Element | Contingency Element | ATC |
|---|---|---|
| | 115kV | |
| Ray Braswell - Baxter Wilson 500kV - Supplemental Upgrade | Franklin - Grand Gulf 500kV | -127 |
| Jackson Miami - Rex Brown 115kV | South Jackson 230/115kV transformer 1 | -120 |
| Florence - South Jackson 115kV - Supplemental Upgrade | Bogalusa - Franklin 500kV | -54 |
| Florence - South Jackson 115kV - Supplemental Upgrade | Bogalusa - Adams Creek 500/230kV transformer | -54 |
| Florence - South Jackson 115kV - Supplemental Upgrade | Choctaw MS (TVA) - Clay (TVA) 500kV | 22 |

**SOCO**

| Limiting Element | Contingency Element | ATC |
|---|---|---|
| Baxter Wilson - South East Vicksburg 115kV | Vicksburg - West Vicksburg 115kV | -193 |
| Ray Braswell - Baxter Wilson 500kV - Supplemental Upgrade | Franklin - Grand Gulf 500kV | -152 |

**SPA**

| Limiting Element | Contingency Element | ATC |
|---|---|---|
| Ray Braswell - Baxter Wilson 500kV - Supplemental Upgrade | Franklin - Grand Gulf 500kV | -224 |
| Baxter Wilson - South East Vicksburg 115kV | Vicksburg - West Vicksburg 115kV | -198 |

**TVA**

| Limiting Element | Contingency Element | ATC |
|---|---|---|
| Baxter Wilson - South East Vicksburg 115kV | Vicksburg - West Vicksburg 115kV | -187 |
| Ray Braswell - Baxter Wilson 500kV - Supplemental Upgrade | Franklin - Grand Gulf 500kV | -167 |

# APPENDIX G: Details of Scenario 3 – 2014

**AECI**

| Limiting Element | Contingency Element | ATC |
|---|---|---|
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Eldorado EHV - Sheridan 500kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Gerald Andrus - Bagby 230kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Bagby 230/115kV transformer 1 | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Baxter Wilson 500/115kV transformer 2 | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Chicot AECC - Lake Village Bagby 115kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Chicot (AECC) - Eudora 115kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Chicksaw - Eudora 115kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Chicksaw - Oakgrove 115kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Holland Bottoms - ISES 500kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Etta - McNeil 500kv | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Base Case | * |
| Baxter Wilson - South East Vicksburg 115kV | Vicksburg - West Vicksburg 115kV | -506 |
| Downsville - Ruston East 115kV | Eldorado EHV - Sterlington 500kV | -197 |
| Baxter Wilson SES - Vicksburg 115kV | Baxter Wilson SES - Spencer Potash 115kV | -108 |
| Ruston East - Vienna 115kV | Eldorado EHV - Sterlington 500kV | -39 |
| Baxter Wilson - South East Vicksburg 115kV | Vicksburg West - Hain Road 115kV | -25 |
| Ray Braswell - Baxter Wilson 500kV - Supplemental Upgrade | Franklin - Grand Gulf 500kV | 38 |
| Edwards - Vicksburg East 115kV | Baxter Wilson - Ray Braswell 500kV | 38 |

**AEPW**

| Limiting Element | Contingency Element | ATC |
|---|---|---|
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Gerald Andrus - Bagby 230kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Bagby 230/115kV transformer 1 | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Sarepta - Longwood (AEPW) 345kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Eldorado EHV - Sheridan 500kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Baxter Wilson 500/115kV transformer 2 | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Chicot AECC - Lake Village Bagby 115kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Chicot (AECC) - Eudora 115kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Chicksaw - Eudora 115kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Chicksaw - Oakgrove 115kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Sarepta - El Dorado EHV 345kV ckt 1 | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Base Case | * |
| International Paper - Mansfield 138kV (CLECO) | Dolet Hills - S.W. Shreveport 345kV (CLECO) | -932 |
| Carroll 230/138kV transformer (CLECO) | Dolet Hills - S.W. Shreveport 345kV (CLECO) | -705 |
| International Paper - Wallake 138kV (CLECO) | Dolet Hills - S.W. Shreveport 345kV (CLECO) | -470 |
| Downsville - Ruston East 115kV | Eldorado EHV - Sterlington 500kV | -170 |
| Baxter Wilson SES - Vicksburg 115kV | Baxter Wilson SES - Spencer Potash 115kV | -117 |

| Limiting Element | Contingency Element | ATC |
|---|---|---|
| Ruston East - Vienna 115kV | Eldorado EHV - Sterlington 500kV | -33 |

**AMRN**

| Limiting Element | Contingency Element | ATC |
|---|---|---|
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Eldorado EHV - Sheridan 500kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Gerald Andrus - Bagby 230kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Bagby 230/115kV transformer 1 | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Baxter Wilson 500/115kV transformer 2 | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Chicot AECC - Lake Village Bagby 115kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Chicot (AECC) - Eudora 115kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Chicksaw - Eudora 115kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Chicksaw - Oakgrove 115kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Hollands Bottom - ISES 500kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Baxter Wilson 500/115kV transformer 1 | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Base Case | * |
| Baxter Wilson - South East Vicksburg 115kV | Vicksburg - West Vicksburg 115kV | -499 |
| Downsville - Ruston East 115kV | Eldorado EHV - Sterlington 500kV | -208 |
| Baxter Wilson SES - Vicksburg 115kV | Baxter Wilson SES - Spencer Potash 115kV | -106 |
| Ruston East - Vienna 115kV | Eldorado EHV - Sterlington 500kV | -41 |
| Baxter Wilson - South East Vicksburg 115kV | Vicksburg West - Hain Road 115kV | -25 |
| Ray Braswell - Baxter Wilson 500kV - Supplemental Upgrade | Franklin - Grand Gulf 500kV | 35 |
| Edwards - Vicksburg East 115kV | Baxter Wilson - Ray Braswell 500kV | 37 |

**CLECO**

| Limiting Element | Contingency Element | ATC |
|---|---|---|
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Colfax - Rodemacher 230kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Colfax - Montgomery 230kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Gerald Andrus - Bagby 230kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Bagby 230/115kV transformer 1 | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Hartburg - Roy S. Nelson 500kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Baxter Wilson 500/115kV transformer 2 | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Dolet Hills - S.W. Shreveport 345kV (CLECO) | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Chicot AECC - Lake Village Bagby 115kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Sarepta - Longwood (AEPW) 345kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Base Case | * |
| Downsville - Ruston East 115kV | Eldorado EHV - Sterlington 500kV | -191 |
| Baxter Wilson SES - Vicksburg 115kV | Baxter Wilson SES - Spencer Potash 115kV | -128 |
| Ruston East - Vienna 115kV | Eldorado EHV - Sterlington 500kV | -37 |
| Ray Braswell - Baxter Wilson 500kV - Supplemental Upgrade | Franklin - Grand Gulf 500kV | 36 |

**EES**

| Limiting Element | Contingency Element | ATC |
|---|---|---|
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Perryville - Sterlington 500kV ckt 1 | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Franklin - Grand Gulf 500kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Baxter Wilson - Ray Braswell 500kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Baxter Wilson - Grand Gulf 500kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Gallion - Oakgrove 115kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Log Cabin - Gallion 115kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Log Cabin - Bastrop Tap 115kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Franklin - Mcknight 500kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Darnelle - Tallulah 115kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Darnelle - Oak Grove 115kV | * |
| Baxter Wilson - South East Vicksburg 115kV | Vicksburg - West Vicksburg 115kV | -521 |
| Downsville - Ruston East 115kV | Eldorado EHV - Sterlington 500kV | -254 |
| Baxter Wilson SES - Vicksburg 115kV | Baxter Wilson SES - Spencer Potash 115kV | -104 |
| Ruston East - Vienna 115kV | Eldorado EHV - Sterlington 500kV | -50 |
| Ray Braswell - Baxter Wilson 500kV - Supplemental Upgrade | Franklin - Grand Gulf 500kV | 32 |
| Edwards - Vicksburg East 115kV | Baxter Wilson - Ray Braswell 500kV | 38 |

**EMDE**

| Limiting Element | Contingency Element | ATC |
|---|---|---|
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Eldorado EHV - Sheridan 500kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Gerald Andrus - Bagby 230kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Bagby 230/115kV transformer 1 | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Baxter Wilson 500/115kV transformer 2 | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Chicot AECC - Lake Village Bagby 115kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Chicot (AECC) - Eudora 115kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Chicksaw - Eudora 115kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Chicksaw - Oakgrove 115kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Baxter Wilson 500/115kV transformer 1 | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Etta - McNeil 500kv | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Base Case | * |
| Baxter Wilson - South East Vicksburg 115kV | Vicksburg - West Vicksburg 115kV | -525 |
| Downsville - Ruston East 115kV | Eldorado EHV - Sterlington 500kV | -188 |
| Baxter Wilson SES - Vicksburg 115kV | Baxter Wilson SES - Spencer Potash 115kV | -111 |
| Ruston East - Vienna 115kV | Eldorado EHV - Sterlington 500kV | -37 |
| Baxter Wilson - South East Vicksburg 115kV | Vicksburg West - Hain Road 115kV | -26 |
| Edwards - Vicksburg East 115kV | Baxter Wilson - Ray Braswell 500kV | 40 |
| Ray Braswell - Baxter Wilson 500kV - Supplemental Upgrade | Franklin - Grand Gulf 500kV | 40 |

**LAFA**

| Limiting Element | Contingency Element | ATC |
|---|---|---|
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Franklin - Grand Gulf 500kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Gallion - Oakgrove 115kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Log Cabin - Gallion 115kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Log Cabin - Bastrop Tap 115kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Baxter Wilson - Grand Gulf 500kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Richard - Wells 500kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Darnelle - Tallulah 115kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Darnelle - Oak Grove 115kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Delhi - PID 266 115kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Delhi - Delden_RX 115kV | * |
| Downsville - Ruston East 115kV | Eldorado EHV - Sterlington 500kV | -233 |
| Baxter Wilson SES - Vicksburg 115kV | Baxter Wilson SES - Spencer Potash 115kV | -127 |
| Ruston East - Vienna 115kV | Eldorado EHV - Sterlington 500kV | -46 |
| Ray Braswell - Baxter Wilson 500kV - Supplemental Upgrade | Franklin - Grand Gulf 500kV | 30 |

**LAGN**

| Limiting Element | Contingency Element | ATC |
|---|---|---|
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Baxter Wilson - Ray Braswell 500kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Franklin - Grand Gulf 500kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Gallion - Oakgrove 115kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Log Cabin - Gallion 115kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Log Cabin - Bastrop Tap 115kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Baxter Wilson - Grand Gulf 500kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Darnelle - Tallulah 115kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Darnelle - Oak Grove 115kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Delhi - PID 266 115kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Delhi - Delden_RX 115kV | * |
| Downsville - Ruston East 115kV | Eldorado EHV - Sterlington 500kV | -283 |
| Baxter Wilson SES - Vicksburg 115kV | Baxter Wilson SES - Spencer Potash 115kV | -129 |
| Ruston East - Vienna 115kV | Eldorado EHV - Sterlington 500kV | -55 |
| Ray Braswell - Baxter Wilson 500kV - Supplemental Upgrade | Franklin - Grand Gulf 500kV | 30 |

**LEPA**

| Limiting Element | Contingency Element | ATC |
|---|---|---|
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Franklin - Mcknight 500kV | * |
| Downsville - Ruston East 115kV | Eldorado EHV - Sterlington 500kV | -292 |
| Baxter Wilson SES - Vicksburg 115kV | Baxter Wilson SES - Spencer Potash 115kV | -126 |
| Ruston East - Vienna 115kV | Eldorado EHV - Sterlington 500kV | -57 |
| Ray Braswell - Baxter Wilson 500kV - Supplemental Upgrade | Franklin - Grand Gulf 500kV | 26 |

**OKGE**

| Limiting Element | Contingency Element | ATC |
|---|---|---|
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Eldorado EHV - Sheridan 500kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Gerald Andrus - Bagby 230kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Bagby 230/115kV transformer 1 | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Baxter Wilson 500/115kV transformer 2 | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Chicot AECC - Lake Village Bagby 115kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Chicot (AECC) - Eudora 115kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Chicksaw - Eudora 115kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Chicksaw - Oakgrove 115kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Sarepta - Longwood (AEPW) 345kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Baxter Wilson 500/115kV transformer 1 | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Base Case | * |
| International Paper - Mansfield 138kV (CLECO) | Dolet Hills - S.W. Shreveport 345kV (CLECO) | -1581 |
| International Paper - Wallake 138kV (CLECO) | Dolet Hills - S.W. Shreveport 345kV (CLECO) | -797 |
| Downsville - Ruston East 115kV | Eldorado EHV - Sterlington 500kV | -180 |
| Baxter Wilson SES - Vicksburg 115kV | Baxter Wilson SES - Spencer Potash 115kV | -113 |
| Ruston East - Vienna 115kV | Eldorado EHV - Sterlington 500kV | -35 |

**SMEPA**

| 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 | Ray Braswell 500/230kV transformer 1 | * |
| Ray Braswell 500/230kV transformer ckt2 - Supplemental Upgrade | Bogalusa - Adams Creek 500/230kV transformer | * |
| Ray Braswell 500/230kV transformer ckt2 - Supplemental Upgrade | Bogalusa - Franklin 500kV | * |
| Ray Braswell 500/230kV transformer ckt2 - Supplemental Upgrade | Vicksburg - Waterways 115kV | * |
| Ray Braswell 500/230kV transformer ckt2 - Supplemental Upgrade | East Vicksburg - Waterways 115kV | * |
| Ray Braswell 500/230kV transformer ckt2 - Supplemental Upgrade | Edwards - Vicksburg East 115kV | * |
| Ray Braswell 500/230kV transformer ckt2 - Supplemental Upgrade | Bolton - Edwards 115kV | * |
| Ray Braswell 500/230kV transformer ckt2 - Supplemental Upgrade | Andrus - Holy Bluff 230kV | * |
| Ray Braswell 500/230kV transformer ckt2 - Supplemental Upgrade | Clinton Industrial - Holy Bluff 230kV | * |
| Downsville - Ruston East 115kV | Eldorado EHV - Sterlington 500kV | -348 |
| Ray Braswell - West Jackson 115kV | South Jackson 230/115kV transformer 1 | -294 |
| Baxter Wilson SES - Vicksburg 115kV | Baxter Wilson SES - Spencer Potash 115kV | -102 |
| Ruston East - Vienna 115kV | Eldorado EHV - Sterlington 500kV | -68 |
| Ray Braswell - Baxter Wilson 500kV - Supplemental Upgrade | Franklin - Grand Gulf 500kV | 25 |

| Limiting Element | Contingency Element | ATC |
|---|---|---|
| Edwards - Vicksburg East 115kV | Baxter Wilson - Ray Braswell 500kV | 31 |

**SOCO**

| Limiting Element | Contingency Element | ATC |
|---|---|---|
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Baxter Wilson - Ray Braswell 500kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Gallion - Oakgrove 115kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Log Cabin - Gallion 115kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Lakeover - McAdams 500kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Log Cabin - Bastrop Tap 115kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Choctaw MS (TVA) - Clay (TVA) 500kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Darnelle - Tallulah 115kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Darnelle - Oak Grove 115kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Delhi - PID 266 115kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | McAdams - Wolf Creek 500kV | * |
| Baxter Wilson - South East Vicksburg 115kV | Vicksburg - West Vicksburg 115kV | -501 |
| Downsville - Ruston East 115kV | Eldorado EHV - Sterlington 500kV | -262 |
| Baxter Wilson SES - Vicksburg 115kV | Baxter Wilson SES - Spencer Potash 115kV | -103 |
| Ruston East - Vienna 115kV | Eldorado EHV - Sterlington 500kV | -51 |
| Baxter Wilson - South East Vicksburg 115kV | Vicksburg West - Hain Road 115kV | -25 |
| Ray Braswell - Baxter Wilson 500kV - Supplemental Upgrade | Franklin - Grand Gulf 500kV | 29 |
| Edwards - Vicksburg East 115kV | Baxter Wilson - Ray Braswell 500kV | 34 |

**SPA**

| Limiting Element | Contingency Element | ATC |
|---|---|---|
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Eldorado EHV - Sheridan 500kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Gerald Andrus - Bagby 230kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Bagby 230/115kV transformer 1 | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Baxter Wilson 500/115kV transformer 2 | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Chicot AECC - Lake Village Bagby 115kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Chicot (AECC) - Eudora 115kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Chicksaw - Eudora 115kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Chicksaw - Oakgrove 115kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Etta - Hot Springs EHV 500kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Etta - McNeil 500kv | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Base Case | * |
| Baxter Wilson - South East Vicksburg 115kV | Vicksburg - West Vicksburg 115kV | -523 |
| Lake Village Bagby - Macon Lake 115kV | Eldorado EHV - Sterlington 500kV | -225 |
| Downsville - Ruston East 115kV | Eldorado EHV - Sterlington 500kV | -186 |
| Baxter Wilson SES - Vicksburg 115kV | Baxter Wilson SES - Spencer Potash 115kV | -111 |
| Ruston East - Vienna 115kV | Eldorado EHV - Sterlington 500kV | -36 |
| Baxter Wilson - South East Vicksburg 115kV | Vicksburg West - Hain Road 115kV | -26 |
| Edwards - Vicksburg East 115kV | Baxter Wilson - Ray Braswell 500kV | 40 |

**TVA**

| Limiting Element | Contingency Element | ATC |
|---|---|---|
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Webre - Wells 500kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Hartburg - Roy S. Nelson 500kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Roy S. Nelson - Richard 500kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Perryville - Sterlington 500kV ckt 1 | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Richard - Wells 500kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Lake Village Bagby - Macon Lake 115kV | * |
| Sterlington - Perryville 500kV ckt2 - Supplemental Upgrade | Charity Church - Lakeover 230kV | * |
| Baxter Wilson - South East Vicksburg 115kV | Vicksburg - West Vicksburg 115kV | -476 |
| Downsville - Ruston East 115kV | Eldorado EHV - Sterlington 500kV | -237 |
| Baxter Wilson SES - Vicksburg 115kV | Baxter Wilson SES - Spencer Potash 115kV | -102 |
| Ruston East - Vienna 115kV | Eldorado EHV - Sterlington 500kV | -46 |
| Baxter Wilson - South East Vicksburg 115kV | Vicksburg West - Hain Road 115kV | -24 |
| Ray Braswell - Baxter Wilson 500kV - Supplemental Upgrade | Franklin - Grand Gulf 500kV | 32 |
| Edwards - Vicksburg East 115kV | Baxter Wilson - Ray Braswell 500kV | 34 |

# APPENDIX H: Details of Scenario 4 – 2014

**AECI**

| Limiting Element | Contingency Element | ATC |
|---|---|---|
| Baxter Wilson - South East Vicksburg 115kV | Vicksburg - West Vicksburg 115kV | -298 |
| Ray Braswell - Baxter Wilson 500kV - Supplemental Upgrade | Franklin - Grand Gulf 500kV | -98 |

**AEPW**

| Limiting Element | Contingency Element | ATC |
|---|---|---|
| Hartburg - Inland Orange 230kV - Supplemental Upgrade | Cypress - Hartburg 500kV | -2312 |
| Inland - McLewis 230kV - Supplemental Upgrade | Cypress - Hartburg 500kV | -1560 |
| Inland - McLewis 230kV | Cypress - Hartburg 500kV | -1443 |
| Cypress 500/138kV transformer 1 | Cypress 500/230kV transformer | -1299 |
| Helbig - McLewis 230kV | Cypress - Hartburg 500kV | -994 |
| Cypress 500/230kV transformer | Cypress 500/138kV transformer 1 | -162 |
| Ray Braswell - Baxter Wilson 500kV - Supplemental Upgrade | Franklin - Grand Gulf 500kV | -112 |
| International Paper - Mansfield 138kV (CLECO) | Dolet Hills - S.W. Shreveport 345kV (CLECO) | 35 |

**AMRN**

| Limiting Element | Contingency Element | ATC |
|---|---|---|
| Baxter Wilson - South East Vicksburg 115kV | Vicksburg - West Vicksburg 115kV | -294 |
| Ray Braswell - Baxter Wilson 500kV - Supplemental Upgrade | Franklin - Grand Gulf 500kV | -93 |

**CLECO**

| Limiting Element | Contingency Element | ATC |
|---|---|---|
| Ray Braswell - Baxter Wilson 500kV - Supplemental Upgrade | Franklin - Grand Gulf 500kV | -93 |

**EES**

| Limiting Element | Contingency Element | ATC |
|---|---|---|
| Hartburg - Inland Orange 230kV - Supplemental Upgrade | Cypress - Hartburg 500kV | -1364 |
| Inland - McLewis 230kV - Supplemental Upgrade | Cypress - Hartburg 500kV | -935 |
| Cypress 500/138kV transformer 1 | Cypress 500/230kV transformer | -896 |
| Inland - McLewis 230kV | Cypress - Hartburg 500kV | -865 |
| Helbig - McLewis 230kV | Cypress - Hartburg 500kV | -603 |
| Baxter Wilson - South East Vicksburg 115kV | Vicksburg - West Vicksburg 115kV | -307 |
| Cypress 500/230kV transformer | Cypress 500/138kV transformer 1 | -109 |
| Ray Braswell - Baxter Wilson 500kV - Supplemental Upgrade | Franklin - Grand Gulf 500kV | -83 |

**EMDE**

| Limiting Element | Contingency Element | ATC |
|---|---|---|
| Baxter Wilson - South East Vicksburg 115kV | Vicksburg - West Vicksburg 115kV | -309 |
| Ray Braswell - Baxter Wilson 500kV - Supplemental Upgrade | Franklin - Grand Gulf 500kV | -103 |

**LAFA**

| Limiting Element | Contingency Element | ATC |
|---|---|---|
| Ray Braswell - Baxter Wilson 500kV - Supplemental Upgrade | Franklin - Grand Gulf 500kV | -78 |
| Rapidies (CLECO) - Rodemacher (CLECO) 230kV | Rodemacher (CLECO) - Sherwood (CLECO) 230kV | 7 |
| Coughlin - Plaisance 138kV (CLECO) | Cocodrie - Vil Plat 230kV | 20 |

**LAGN**

| Limiting Element | Contingency Element | ATC |
|---|---|---|
| Ray Braswell - Baxter Wilson 500kV - Supplemental Upgrade | Franklin - Grand Gulf 500kV | -79 |

**LEPA**

| Limiting Element | Contingency Element | ATC |
|---|---|---|
| Ray Braswell - Baxter Wilson 500kV - Supplemental Upgrade | Franklin - Grand Gulf 500kV | -69 |
| Rapidies (CLECO) - Rodemacher (CLECO) 230kV | Rodemacher (CLECO) - Sherwood (CLECO) 230kV | 11 |
| Coughlin - Plaisance 138kV (CLECO) | Cocodrie - Vil Plat 230kV | 23 |

**OKGE**

| Limiting Element | Contingency Element | ATC |
|---|---|---|
| Ray Braswell - Baxter Wilson 500kV - Supplemental Upgrade | Franklin - Grand Gulf 500kV | -107 |

**SMEPA**

| Limiting Element | Contingency Element | ATC |
|---|---|---|
| Ray Braswell - West Jackson 115kV | South Jackson 230/115kV transformer 1 | -276 |
| Ray Braswell - Baxter Wilson 500kV -Supplemental Upgrade | Franklin - Grand Gulf 500kV | -65 |
| Florence - South Jackson 115kV - Supplemental Upgrade | Bogalusa - Franklin 500kV | -22 |
| Florence - South Jackson 115kV - Supplemental Upgrade | Bogalusa - Adams Creek 500/230kV transformer | -22 |
| Florence - South Jackson 115kV - Supplemental Upgrade | Choctaw MS (TVA) - Clay (TVA) 500kV | 28 |

**SOCO**

| Limiting Element | Contingency Element | ATC |
|---|---|---|
| Baxter Wilson - South East Vicksburg 115kV | Vicksburg - West Vicksburg 115kV | -295 |
| Ray Braswell - Baxter Wilson 500kV - Supplemental Upgrade | Franklin - Grand Gulf 500kV | -76 |

**SPA**

| Limiting Element | Contingency Element | ATC |
|---|---|---|
| Baxter Wilson - South East Vicksburg 115kV | Vicksburg - West Vicksburg 115kV | -308 |
| Ray Braswell - Baxter Wilson 500kV - Supplemental Upgrade | Franklin - Grand Gulf 500kV | -105 |

**TVA**

| Limiting Element | Contingency Element | ATC |
|---|---|---|
| Baxter Wilson - South East Vicksburg 115kV | Vicksburg - West Vicksburg 115kV | -281 |
| Ray Braswell - Baxter Wilson 500kV - Supplemental Upgrade | Franklin - Grand Gulf 500kV | -82 |