System Impact Study Report
PID 225
13MW Uprate

Prepared by:

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Rev	Issue Date	Description of Revision	Revised By	Project Manager
0	2/3/09	Posted	HDE	JDH

Executive Summary:

This System Impact Study is the second step of the interconnection process and is based on the PID-225 request for interconnection on Entergy's transmission system at Big Cajun 2 500 kV substation. This report is organized into two sections, namely, Section – A, Energy Resource Interconnection Service (ERIS) and Section – B, Network Resource Interconnection Service (NRIS – Section B).

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

Requestor for PID-225 did request NRIS, but did not request ERIS, therefore, under Section - A (ERIS) a load flow analysis was not performed. PID 225 is an up-rate to an existing facility. The study evaluates connection of 13 MW to the Entergy Transmission System. An NRIS load flow study was performed on the latest available 2012 Summer Peak case, using PSS/E and MUST software by Siemens Power Technologies International (Siemens-PTI). The proposed in-service date for NRIS is August 1, 2009.

Results of the System Impact Study contend that under NRIS, the estimated upgrade cost with priors is $0 and without priors is $229,336,645.

Estimated Project Planning Upgrades for PID 225

Study	Estimated cost With Priors ($)	Estimated cost Without Priors ($)
NRIS	$0	$229,336,645

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

Section – A

Energy Resource Interconnection Service

TABLE OF CONTENTS FOR SECTION –A (ERIS)

I. Introduction

This Energy Resource Interconnection Service (ERIS) is based on a request for interconnection onto Entergy’s transmission system. Since PID 225 did not request ERIS, a load flow study was not required. The objective of this study is to assess the reliability impact of the new facility on the Entergy transmission system with respect to the steady state and transient stability performance of the system as well as its effects on the system’s existing short circuit current capability. It is also intended to determine whether the transmission system meets standards established by NERC Reliability Standards and Entergy’s planning guidelines when the plant is connected to Entergy’s transmission system. If not, transmission improvements will be identified.

The System Impact Study process required a load flow analysis to determine if the existing transmission lines are adequate to handle the full output from the plant for simulated transfers to adjacent control areas. A short circuit analysis would be 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 units would cause a stability problem on the Entergy system.

II. Short Circuit Analysis / Breaker Rating Analysis

No Short Circuit analysis was performed due to generator having a signed IA and the generator characteristics remain unchanged.

III. Load Flow Analysis

No load flow analysis performed due to generator not requesting ERIS.

IV. Stability Analysis

1.0 Stability Summary

Southwest Power Pool (SPP) has performed a stability study for PID-225, which is a request for 13 MW Uprate of existing Big Cajun 2, Unit #3 in the Entergy transmission system. At customer's request the feasibility (power flow) study was not performed as a part of this study.

The objective of the impact study is to evaluate the impact of the proposed 13 MW Uprate (PID-225) on system stability and nearby transmission system. The study is performed on 2012 Summer Peak case, provided by Entergy. Figure 0-1 shows the location of the Big Cajun 2, Unit #3 with proposed 13 MW increase of generation (see figure 1-1 below for location).

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

Based on the results of stability analysis it can be concluded that proposed 13 MW Uprate of the Big Cajun 2,Unit #3 **does not** adversely impact the stability of the Entergy System in the local area.

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

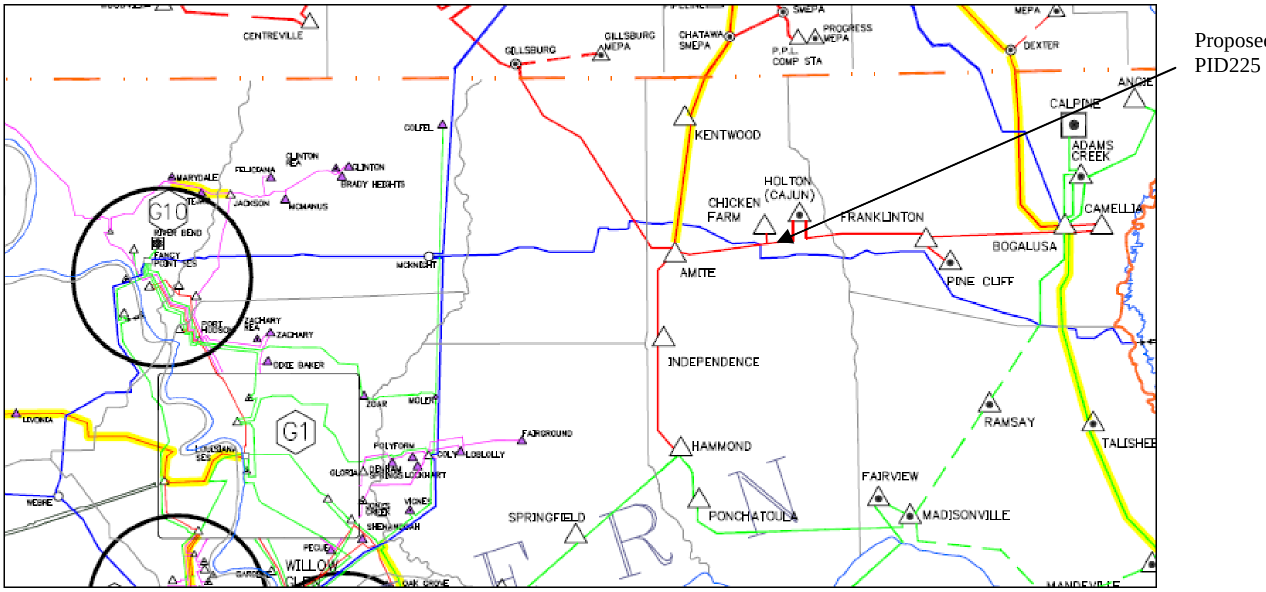

Figure 0-1 PID 225 Project location

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2.1 Stability Analysis Methodology

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

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

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

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

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

For three-phase faults, a fault admittance of –j2E9 is used (essentially infinite admittance or zero impedance). For the single phase stuck breaker faults, the fault admittances considered are mentioned in Table 0-3.

Transient Voltage Criteria

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

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

- 3-phase faults with normal clearing resulting in the loss of two or more components (generator, transmission circuit or transformer), and SLG fault with delayed clearing resulting in the loss of one or more components:
  Not to exceed 20% for more than 40 cycles at any bus
  Not to exceed 30% at any bus

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

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

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

2.2 STUDY MODEL DEVELOPMENT

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

Power Flow Case

A Power Flow case "EN12S07_final u3_r4+PID224+PriorGIs-uncov.sav" representing the 2012 Summer Peak conditions was provided by SPP/ Entergy.

Two prior-queued projects, PID-223 and PID-224, were added to the Base Case. Thus a pre-project Power Flow case was established and named as 'PRE-PID-225.sav'

The proposed PID-225 project will be a 13 MW Uprate at Big Cajun 2, Unit 3 . Per Entergy's request 31 MW of the auxiliary load at the B. Cajun 2 Unit #3 was added at the machine terminal. The generation at B. Cajun 2 unit #3 was increased by 44 MW (= 13 MW Uprate + 31 MW auxiliary load). The gross output of the B. Cajun 2 Unit #3 was modeled at 619 MW level, resulting net 13 MW generation increase. The additional 13 MW was dispatched against the White Bluff Unit #2. Table 2-1 summarizes the dispatch. Thus a post-project power flow case with PID-225 was established and named as 'POST-PID-225.sav'.

Table 0-1: PID-225 project details

System condition	MW	Point of Interconnection	Sink
2012 Summer Peak	13	Big Cajun 2 (#303008)	White Bluff Unit 2 (#337653)

Figure 0-2 and Figure 0-3 show the PSS/E one-line diagrams for the local area WITHOUT and WITH the PID-225 project, respectively, for 2012 Summer Peak system conditions.

Stability Database

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

To create a dynamic database (a snapshot file) for Pre-PID-225 Power Flow case, stability data for PID-223 and PID-224 was appended to the Base Case stability database.

Then, the stability data for PID-225 was appended to the pre-project stability database to create dynamic database for Post-PID-225 Power Flow case.

The data provided at the Interconnection Request for PID-225 is included in Appendix A. The PSS/E power flow and stability data for PID-225, used for this study, are included in Appendix B.

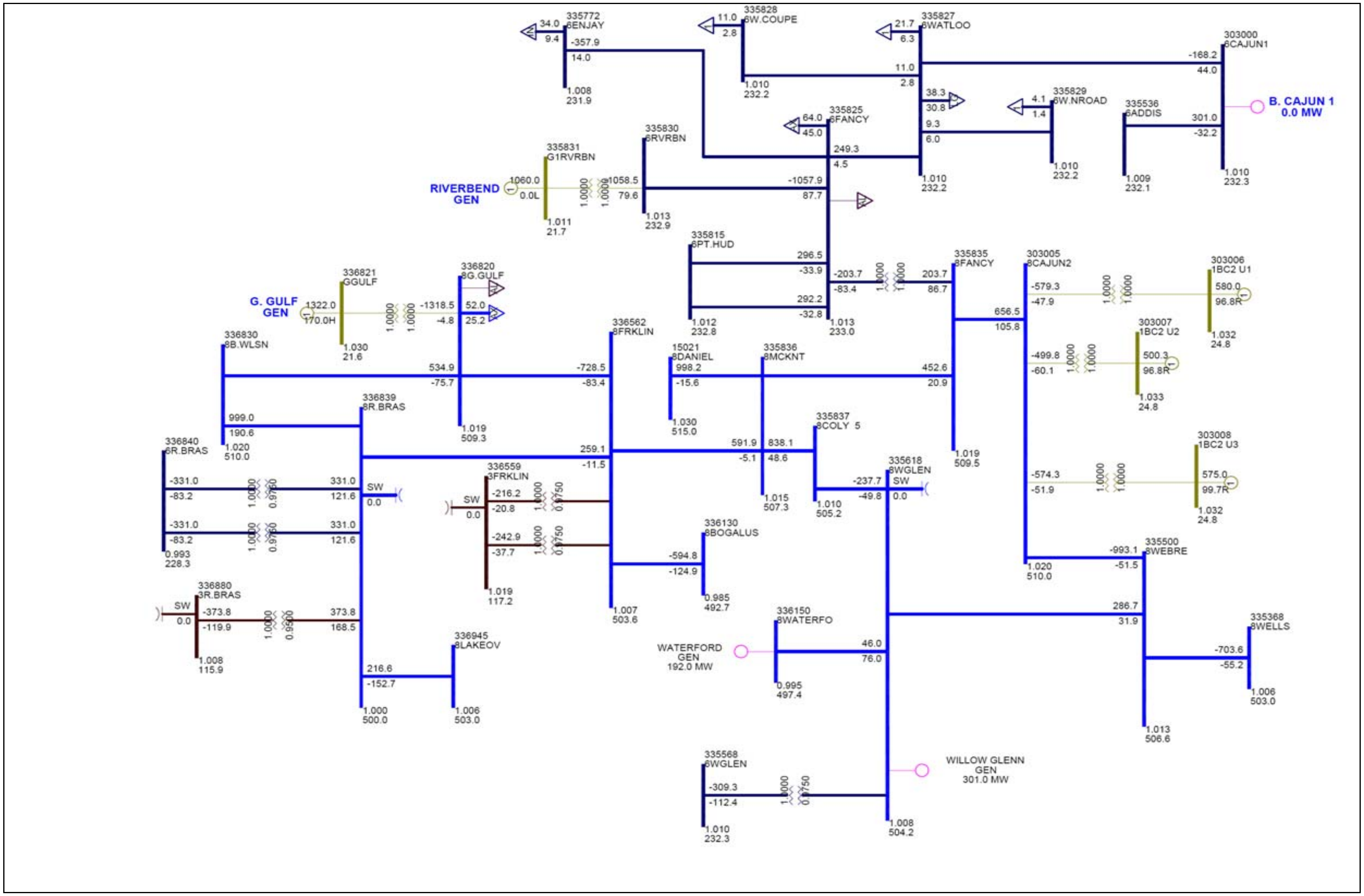


Figure 0-2 2012 Summer Peak Flows and Voltages without PID-225

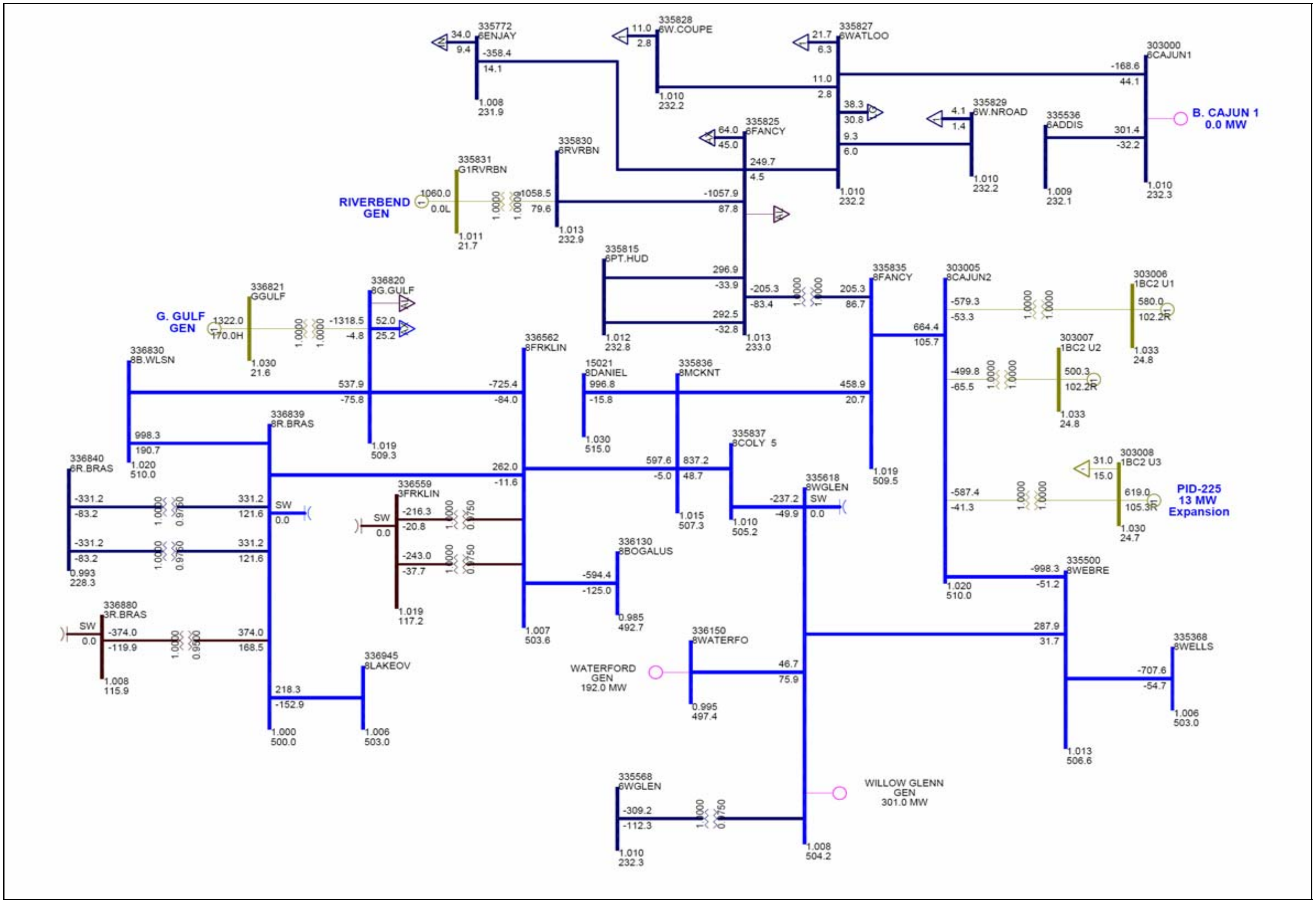


Figure 0-3 2012 Summer Peak Flows and Voltages with PID-225

2.3 *TRANSIENT STABILITY ANALYSIS*

Stability simulations were run to examine the transient behavior of the PID-225 generator and its impact on the Entergy system. Stability analysis was performed using the following procedure. First, three-phase faults with normal clearing were simulated. Next, the stuck breaker single phase fault conditions were simulated. The fault clearing times used for the simulations are given inTable 0-2.

Table 0-2: Fault Clearing Times

Contingency at kV level	Normal Clearing	Delayed Clearing
230	6 cycles	6+9 cycles
500	5 cycles	6+9 cycles

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

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

2) The fault remains in place for single-phase stuck-breakers. The fault admittances is changed to Thevenin equivalent admittance of single phase faults.

3) The fault is then cleared by back-up clearing. If the system was found to be unstable, then the fault was repeated without the proposed PID-225 project.

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

Table 0-3 lists all the fault cases that were simulated in this study.

Twelve (12) three phase normally cleared and nine (9) three-phase stuck breaker converted into single-line-to-ground fault (following Independent Pole Operation of breakers) were simulated.

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

Table 0-3 List of faults simulated for stability analysis

Fault No	Fault Location	Fault Type	Clearing Time (in cycles)		Stuck Breaker	Tripping Breaker		Tripping Facilities	Stable ?	Acceptable Voltages ?	Fault Admittance in MVA
			Primary Fault clearing time	Backup Fault clearing time		Primary Trip Breaker	Secondary Trip Breaker				
Fault-1	Big Cajun 2 500kV	3 Phase	5.0	---	---	20580, 20565, 20555, 20550	---	B. Cajun 2- Webre 500kV line	YES	YES	
Fault-1a	Big Cajun 2 500kV	3 Phase /SLG	5.0	9.0	20550	20580, 20565, 20555	20570, 20535	B. Cajun 2- Webre 500kV line	YES	YES	885.59 -j 13361.1
Fault-2	Big Cajun 2 500kV	3 Phase	5.0	---	---	20770, 20775, 20535, 20540	---	B. Cajun 2- Fancy Point 500kV line	YES	YES	
Fault-2a	Big Cajun 2 500kV	3 Phase /SLG	5.0	9.0	20535	20770, 20775, 20540	20550, 20570	B. Cajun 2- Fancy Point 500kV line	YES	YES	885.59 -j 13361.1
Fault-3	Fancy Point 500kV	3 Phase	5.0	---	---	20765, 20770, 20740, 20735	---	Fancy Point 500/230kV Auto-transformer	YES	YES	
Fault-4	Fancy Point 500kV	3 Phase	5.0	---	---	20765, 20775	---	Fancy Point - McKnight 500kV line	YES	YES	
Fault-5	Fancy Point 500kV	3 Phase	5.0	---	---	20770, 20775	---	Fancy Point- B. Cajun 2 500kV line	YES	YES	
Fault-6	Webre 500kV	3 Phase	5.0	---	---	20580, 20565	---	Webre- B Cajun 2 500kV line	YES	YES	
Fault-7	Webre 500kV	3 Phase	5.0	---	---	20580, 20585	---	Webre- Richard 500kV line	YES	YES	
Fault-8	Webre 500kV	3 Phase	5.0	---	---	20585, 20565	---	Webre- Willow Glenn 500kV line	YES	YES	
Fault-9	Fancy Point 230kV	3 Phase	6.0	---	---	20740, 20745	---	Fancy Point- Waterloo (B Cajun 1) 230kV line	YES	YES	
Fault-9a	Fancy Point 230kV	3 Phase /SLG	6.0	9.0	20745	20740	20695, 20670, 20650, 20640, 20620	Fancy Point- Waterloo (B Cajun 1) 230kV line and Fancy PT - PT. Hudson 230 kV line	YES	YES	753.86 -j 10222.88
Fault-9b	Fancy Point 230kV	3 Phase /SLG	6.0	9.0	20740	20745	20735, 20770, 20765	Fancy Point- Waterloo (B Cajun 1) 230kV line and Fancy Point 500/230kV Auto-transformer	YES	YES	753.86 -j 10222.88
Fault-10	Fancy Point 230kV	3 Phase	6.0	---	---	20695, 20690	---	Fancy Point- Port Hudson ckt 1 230kV	YES	YES	
Fault-10a	Fancy Point 230kV	3 Phase /SLG	6.0	9.0	20690	20695	20735, 20660, 20635, 20610,	Fancy Point- Port Hudson ckt 1 230kV	YES	YES	753.86 -j 10222.88

Fault No	Fault Location	Fault Type	Clearing Time (in cycles)		Stuck Breaker	Tripping Breaker		Tripping Facilities	Stable ?	Acceptable Voltages ?	Fault Admittance in MVA
			Primary Fault clearing time	Backup Fault clearing time		Primary Trip Breaker	Secondary Trip Breaker				
Fault-10b	Fancy Point 230kV	3 Phase /SLG	6.0	9.0	20695	20690	20745, 20670, 20650, 20640, 20620	Fancy Point- Port Hudson ckt 1 & 2 230kV	YES	YES	753.86 -j 10222.88
Fault-11	Fancy Point 230kV	3 Phase	6.0	---	---	20665, 20660	---	Fancy Point- Enjay 230kV line	YES	YES	
Fault-11a	Fancy Point 230kV	3 Phase /SLG	6.0	9.0	20660	20665	20690, 20735, 20635, 20610	Fancy Point -Enjay 230kV line	YES	YES	753.86 -j 10222.88
Fault-12	Fancy Point 230kV	3 Phase	6.0	---	---	20765, 20770, 20740, 20735	---	Fancy Point 500/230kV Auto-transformer	YES	YES	
Fault-12a	Fancy Point 230kV	3 Phase /SLG	6.0	9.0	20740	20765, 20770, 20735	20745	Fancy Point 500/230kV Auto-transformer and Fancy Point-Waterloo (B Cajun 1) 230kV line	YES	YES	753.86 -j 10222.88
Fault-12b	Fancy Point 230kV	3 Phase /SLG	6.0	9.0	20735	20765, 20770, 20740	20690, 20660, 20635, 20610	Fancy Point 500/230kV Auto-transformer	YES	YES	753.86 -j 10222.88

Note:-
* Fancy Point and Webre 500kV substations have Ring bus configurations. Breaker failure at either substation would trip the complete substation on backup clearing time

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

The stability plots showed undamped oscillations of small magnitude in the angle of18 MW machine at 3HODGE 115 kV (#337347) for all the faults. On further investigation it was found that the subject generator is represented by using a classical generator model (‘*GENCLS*’) in the dynamic database. Fault-1a was repeated on Pre-PID-225 case. The undamped oscillations were observed in the pre-project case also (see Figure 0-4). Hence, the undamped oscillations in the Hodge unit are not attributable to the proposed PID-225 project.

Transient Voltage Recovery

No voltage criteria violation was observed following simulated faults.

The voltages at all buses in the Entergy system (69 kV and above) were monitored during each of the fault cases as appropriate. No Voltage criteria violation was observed following a normally cleared three-phase fault.

As there are no specific voltage dip criteria for three-phase fault converted into single-phase stuck breaker faults, the results of these faults were compared with the most stringent voltage dip criteria of - not to exceed 20 % for more than 20 cycles. After comparison against the voltage-criteria, no faults were found to be in violation WITH PID-225 case.

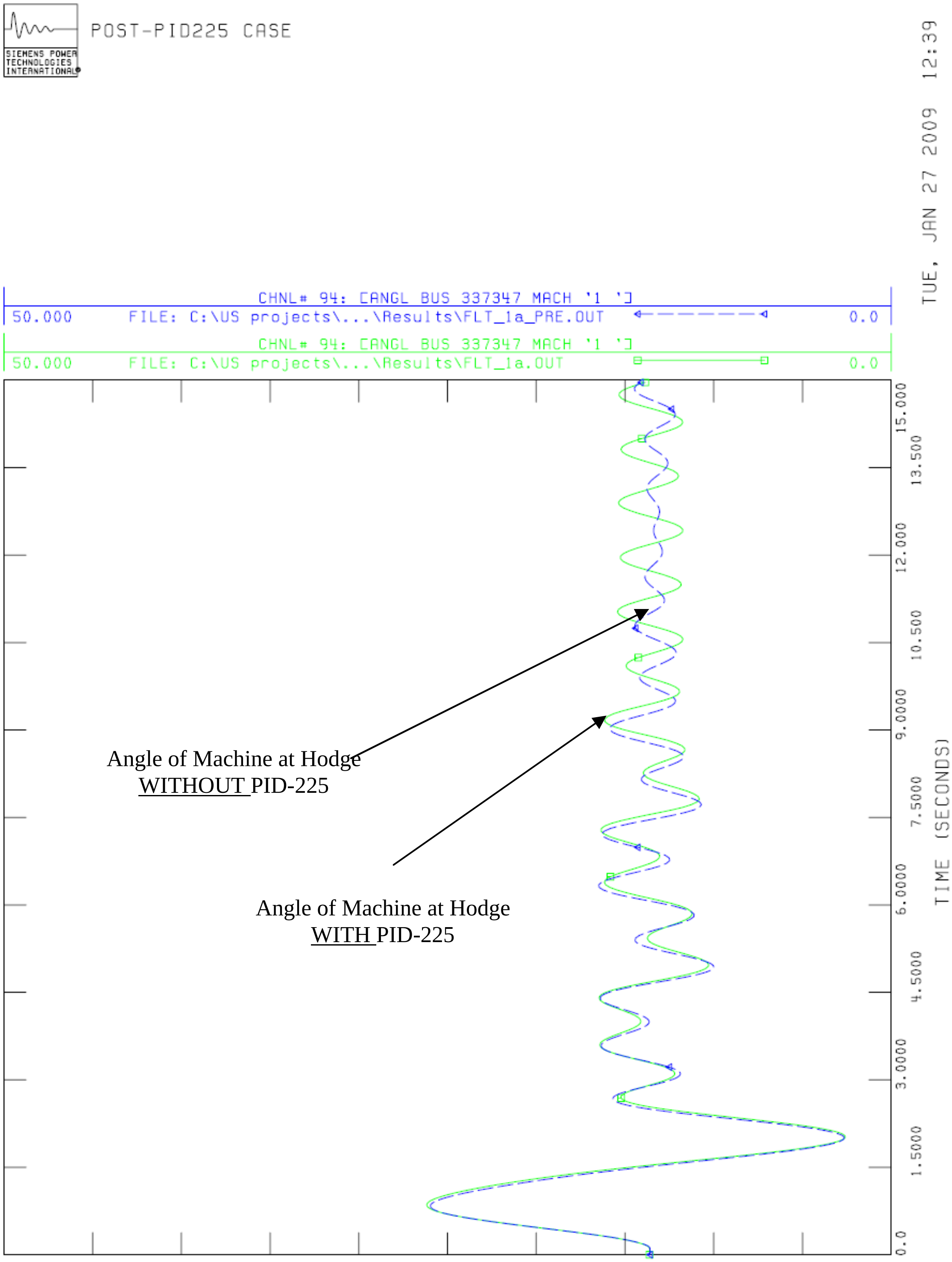


Figure 0-4 Angle of machine at Hodge following Fault_1a **without and with** PID-225

CONCLUSIONS

The objective of this study was to evaluate the impact of proposed PID-225 (13 MW) Uprate of existing Big Cajun 2 Unit #3 on system stability and the nearby transmission system and generating stations. The study was performed on 2012 Summer Peak case, provided by SPP/Entergy.

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

Based on the results of stability analysis it can be concluded that proposed 13 MW Uprate of the Big Cajun 2, Unit #3 does not adversely impact the stability of the Entergy System in the local area.

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

APPENDIX A - DATA PROVIDED BY CUSTOMER

Attachment A to Appendix 1
Interconnection Request

LARGE GENERATING FACILITY DATA

UNIT RATINGS

kVA **688,000** °F **95** _Voltage **24,000**
Power Factor **0.916**
Speed (RPM) **3600**
Short Circuit Ratio **0.5**
Stator Amperes at Rated kVA **16,551**
Max Turbine MW **588 net** °F **95**
619 MW gross

Connection (e.g. Wye) **Wye**
Frequency, Hertz **60**
Field Volts **499.2 VDC**

COMBINED TURBINE-GENERATOR-EXCITER INERTIA DATA

Inertia Constant, H = **2.6**kW sec/kVA
Moment-of-Inertia, WR_2 = **6.31x 10^5** lb. ft.^{2}

REACTANCE DATA (PER UNIT-RATED KVA)

	DIRECT AXIS		QUADRATURE AXIS	
Synchronous – saturated	Xdv	**1.77**	Xqv	**1.69**
Synchronous – unsaturated	Xdi	**1.77**	Xqi	**1.69**
Transient – saturated	X'dv	**0.225**	X'qv	**N/A**
Transient – unsaturated	X'di	**0.250**	X'qi	**0.44**
Subtransient – saturated	X"dv	**0.160**	X"qv	**0.160**
Subtransient – unsaturated	X"di	**0.195**	X"qi	**0.195**
Negative Sequence – saturated	X2v	**0.160**		
Negative Sequence – unsaturated	X2i	**0.195**		
Zero Sequence – saturated	X0v	**0.125**		
Zero Sequence – unsaturated	X0i	**0.125**		
Leakage Reactance	Xlm	**0.12 sat** **0.14 unsat**		

FIELD TIME CONSTANT DATA (SEC)

Open Circuit	T'_{do}	**4.00**	T'_{qo}	**0.53**
Three-Phase Short Circuit Transient	T'_{d3}	**0.52**	T'_{q}	____
Line to Line Short Circuit Transient	T'_{d2}	**0.81**		
Line to Neutral Short Circuit Transient	T'_{d1}	**1.0**		
Short Circuit Subtransient	T''_{d}	**0.023**	T''_{q}	**0.023**
Open Circuit Subtransient	T''_{do}	**0.032**	T''_{qo}	**0.062**

ARMATURE TIME CONSTANT DATA (SEC)

Three Phase Short Circuit	T_{a3}	**0.15**
Line to Line Short Circuit	T_{a2}	**0.15**
Line to Neutral Short Circuit	T_{a1}	**0.14**

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

MW CAPABILITY AND PLANT CONFIGURATION
LARGE GENERATING FACILITY DATA

ARMATURE WINDING RESISTANCE DATA (PER UNIT)

Positive	R_1	**0.0037**
Negative	R_2	**0.021**
Zero	R_0	**0.011**

Rotor Short Time Thermal Capacity I_2^2t = **8.89**

Field Current at Rated kVA, Armature Voltage and PF = **4295** amps

Field Current at Rated kVA and Armature Voltage, 0 PF = **5386** amps

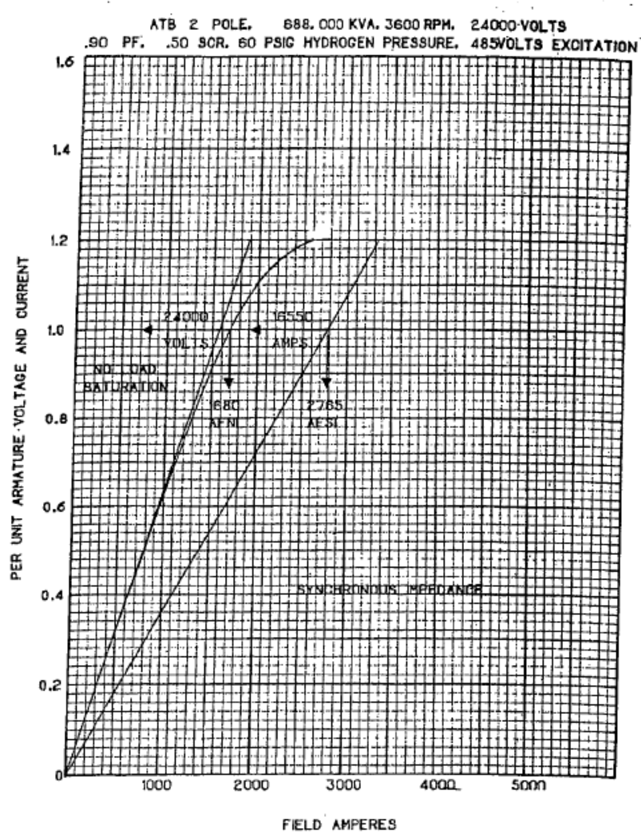
Three Phase Armature Winding Capacitance = **0.5592** microfarad

Field Winding Resistance= **0.0791** ohms **25**°C

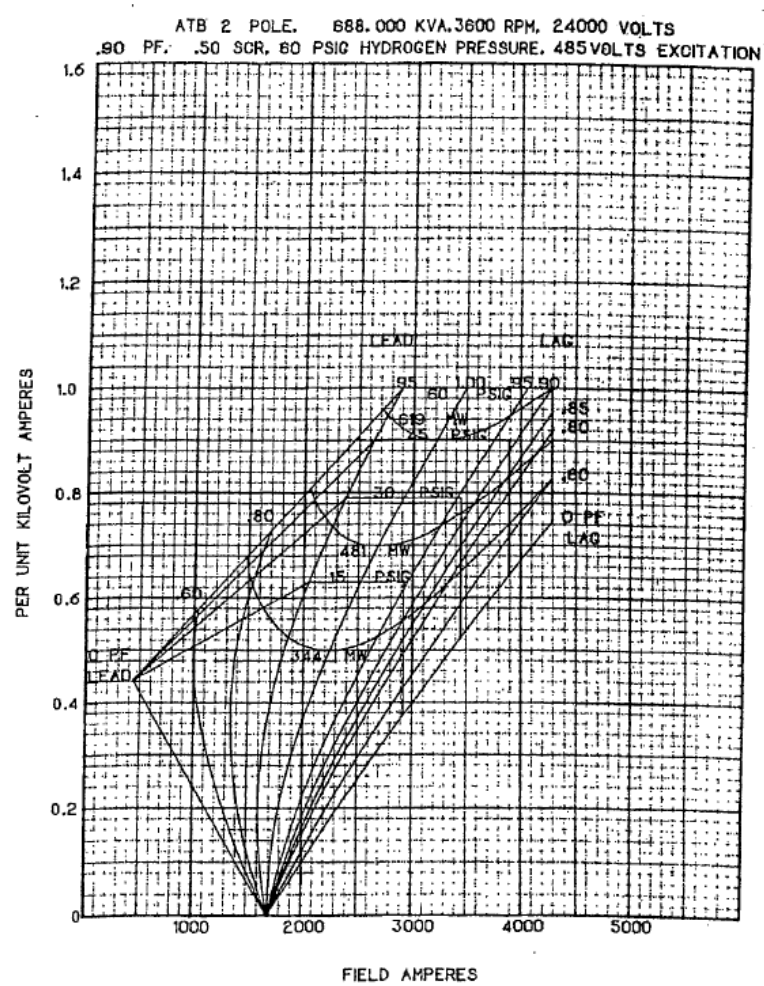
Armature Winding Resistance (Per Phase) = **0.001893** ohms **125°C**

CURVES

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

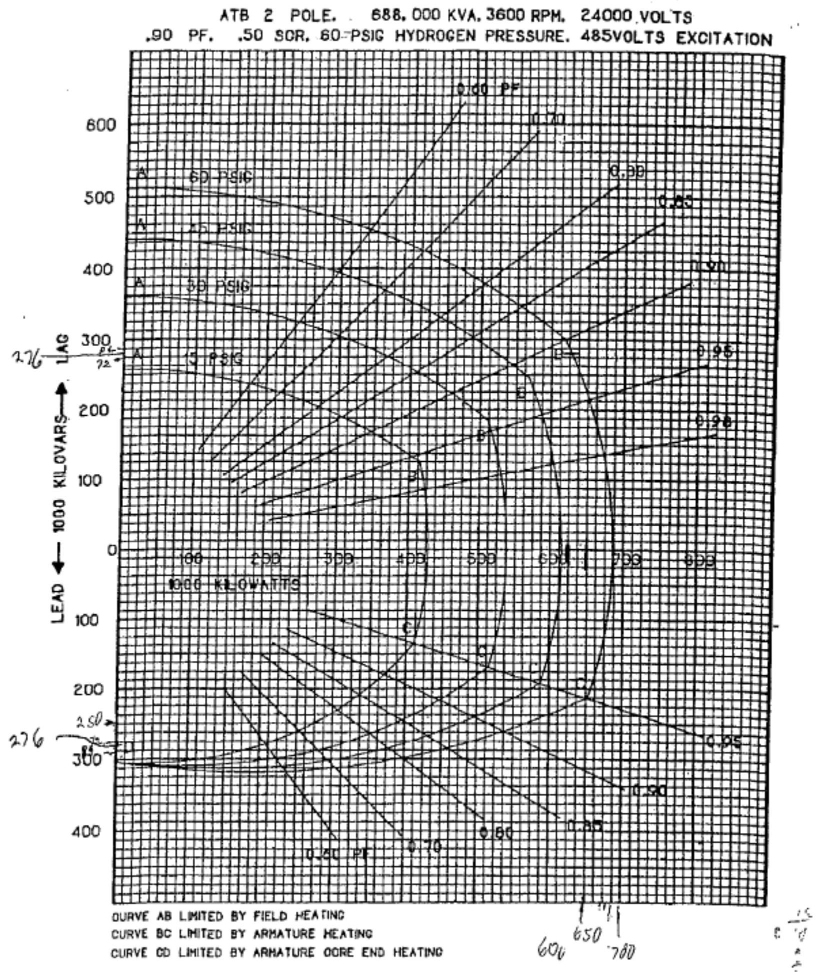


Estimated Saturation Curves Fig. 17-1
Dwg. 448HA760 (rev. 0)



Estimated "V" Curves
Dwg. 448HA761 (rev. 0)

Fig. 17-2



Estimated Capability Curves Fig. 17-3
Dwg. 448HA762 (rev. 0)

GENERATOR STEP-UP TRANSFORMER DATA RATINGS

Capacity Self-cooled/Maximum Nameplate
615 / 689 kVA

Voltage Ratio(Generator Side/System side/Tertiary)
24 / 500 / N/A kV

Winding Connections (Low V/High V/Tertiary V (Delta or Wye))
24,000 / 500,000/ N/A

Fixed Taps Available **2 +/- 2 ½ %**

Present Tap Setting **500 (center tap)**

IMPEDANCE

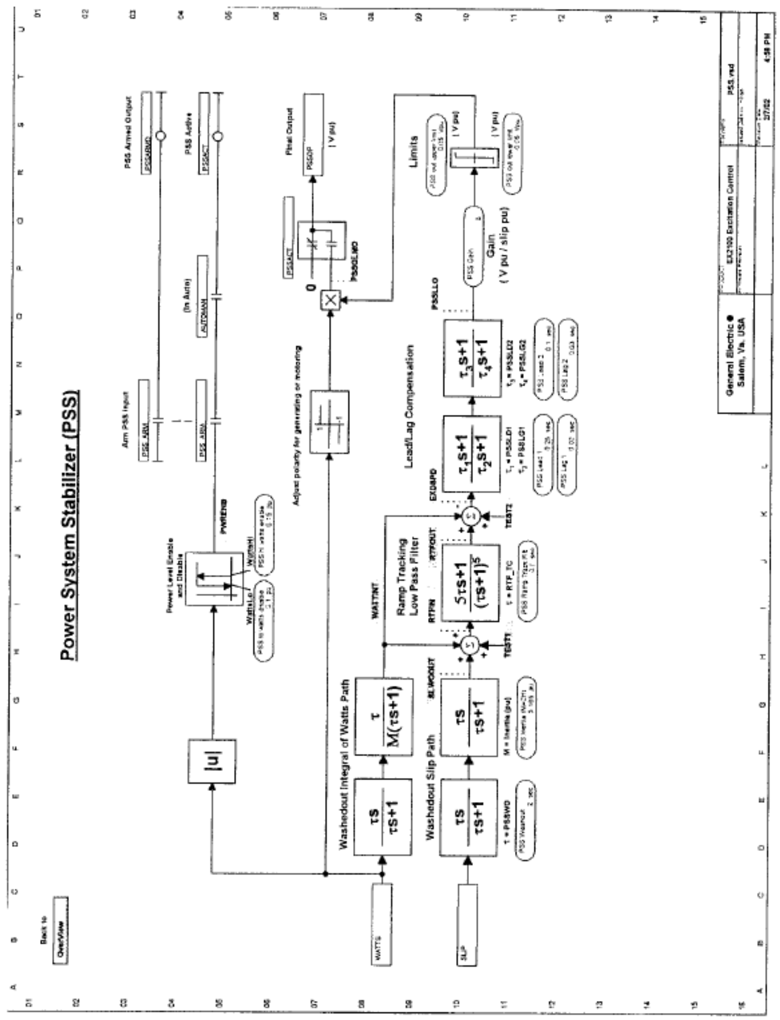
Positive Z_1 (on self-cooled kVA rating) **9.05%** **80** X/R

Zero Z_0 (on self-cooled kVA rating) N/A % ___X/R
(delta/wye transformer)

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

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.



Issued by: Randall Helmick
Vice President, Transmission

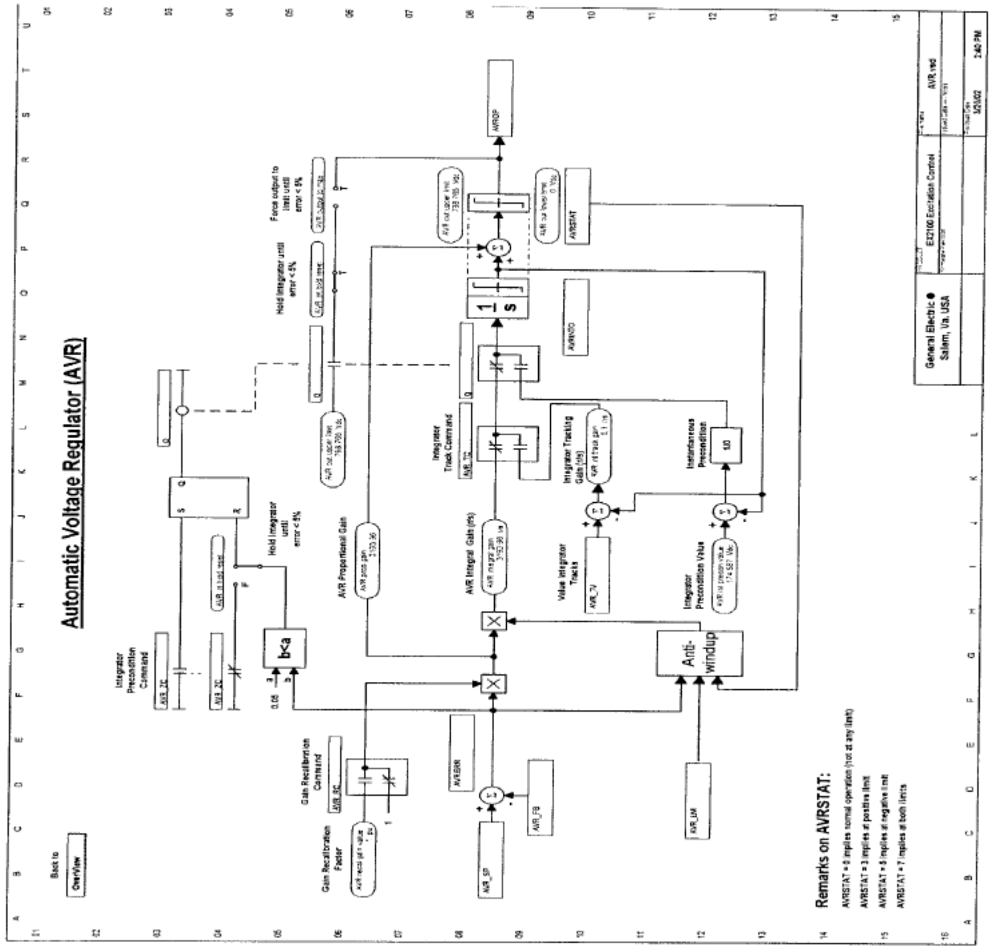
Effective: July 13, 2007

Issued on: July 13, 2007

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

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.



Model – EX2100

Issued by: Randall Helmick
Vice President, Transmission

Effective: July 13, 2007

Issued on: July 13, 2007

WIND GENERATORS

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

Elevation: ____N/A____ Single Phase _N/A_ Three Phase _N/A_

Inverter manufacturer, model name, number, and version:

N/A

List of adjustable set-points for the protective equipment or software:

N/A

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: N/A

(*) Field Amperes: N/A

(*) Motoring Power (kW): N/A

(*) Neutral Grounding Resistor (If Applicable): N/A

(*) I_2^2t or K (Heating Time Constant): N/A

(*) Rotor Resistance: N/A

(*) Stator Resistance: N/A

(*) Stator Reactance: N/A

(*) Rotor Reactance: N/A

(*) Magnetizing Reactance: N/A

(*) Short Circuit Reactance: N/A

(*) Exciting Current: N/A

(*) Temperature Rise: N/A

(*) Frame Size: N/A

(*) Design Letter: N/A

(*) Reactive Power Required In Vars (No Load): N/A

(*) Reactive Power Required In Vars (Full Load): N/A

(*) Total Rotating Inertia, H: N/A Per Unit N/A on KVA Base N/A

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

APPENDIX B - LOAD FLOW AND STABILITY DATA

Load Flow Data

```
   220,'PID220-2    ',  69.0000,1,     0.000,     0.000, 351, 123,1.00123,  12.3992,   1
 99220,'PID220-1    ',  13.8000,2,     0.000,     0.000, 351, 123,1.02100,  15.8483,   1
0 / END OF BUS DATA, BEGIN LOAD DATA
   220,'IN',1, 351, 223,    35.000,    11.800,     0.000,     0.000,     0.000,
0.000,   1
0 / END OF LOAD DATA, BEGIN GENERATOR DATA
 99220,'1 ',    41.000,    14.688,    30.750,     0.000,1.02100,     0,    46.555,
0.00000,   0.16100,   0.00000,   0.00000,1.00000,1,  100.0,    41.000,     0.000,
1,1.0000
0 / END OF GENERATOR DATA, BEGIN BRANCH DATA
0 / END OF BRANCH DATA, BEGIN TRANSFORMER DATA
   220, 99220,     0,'1 ',1,2,1,   0.00000,   0.00000,2,'            ',1,   1,1.0000
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1.00000,   0.000,   0.000,    60.00,     0.00,     0.00, 0,      0, 1.05000, 0.95000,
1.05000, 0.95000,   5, 0, 0.00000, 0.00000
1.00000,   0.000
336213,   220,     0,'1 ',1,2,1,   0.00000,   0.00000,2,'            ',1,   1,1.0000
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1.05000, 0.95000,   5, 0, 0.00000, 0.00000
1.00000,   0.000
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   0.00000,   0.07000,   120.00
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1.05000, 0.95000,   5, 0, 0.00000, 0.00000
1.00000,   0.000
0 / END OF TRANSFORMER DATA, BEGIN AREA DATA
0 / END OF AREA DATA, BEGIN TWO-TERMINAL DC DATA
0 / END OF TWO-TERMINAL DC DATA, BEGIN VSC DC LINE DATA
0 / END OF VSC DC LINE DATA, BEGIN SWITCHED SHUNT DATA
0 / END OF SWITCHED SHUNT DATA, BEGIN IMPEDANCE CORRECTION DATA
0 / END OF IMPEDANCE CORRECTION DATA, BEGIN MULTI-TERMINAL DC DATA
0 / END OF MULTI-TERMINAL DC DATA, BEGIN MULTI-SECTION LINE DATA
0 / END OF MULTI-SECTION LINE DATA, BEGIN ZONE DATA
0 / END OF ZONE DATA, BEGIN INTER-AREA TRANSFER DATA
0 / END OF INTER-AREA TRANSFER DATA, BEGIN OWNER DATA
0 / END OF OWNER DATA, BEGIN FACTS DEVICE DATA
0 / END OF FACTS DEVICE DATA
```

Dynamics Data

```
PRE-PID225 CASE
                               ACTIVE PLANT MODELS

   BUS# X-- NAME --X BASKV ID  MODEL  X----CONS---X  X---STATES--X  X----VARS---X  X---
ICONS---X
 303008 1BC2 U3     24.000 1   GENROU 130102-130115   51080- 51085
                               PSS2A   53669- 53685   27236- 27251    2022-  2025
2681-  2686
                               EXAC3   97785- 97806   40390- 40394

303008 'GENROU' 1     4.0000      0.32000E-01  0.53000      0.62000E-01
          2.6000      0.0000       1.7700       1.6900      0.25000
         0.44000     0.19500      0.14000      0.50000E-01  0.36000    /
 303008 'PSS2A'  1         1            0            3            0
              5            1       2.0000       2.0000       0.0000
          2.0000      0.0000       2.0000      0.38720       1.0000
         0.50000     0.10000       10.000      0.25000      0.20000E-01
         0.10000     0.30000E-01  0.50000E-01 -0.50000E-01/
 303008 'EXAC3'  1     0.0000       0.0000       0.0000       17.070
         0.17000E-01   1.0000     -0.95000       1.8050      0.32000
          6.2200      0.70000E-01   1.0000      0.50000E-01  0.76000
         0.20000     0.83000       1.0000      0.52000       4.6000
         0.18000       6.1300       1.6100    /
```

Section – B

Network Resource Interconnection Service

TABLE OF CONTENTS FOR NRIS

Introduction:

A Network Resource Interconnection Services (NRIS) study was requested by the customer to serve 13 MW of Entergy network load. The expected in service date for this NRIS generator is 8/1/2009. The tests were performed with only confirmed transmission reservations and existing network generators and with transmission service requests in study mode.

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

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

Analysis:

Models

The model used for this analysis is the 2012 summer peak cases developed in 2007.

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

- Non-Firm IPPs within the local region of the study generator were turned off and other non-firm IPPs outside the local area were increased to make up the difference.
- Confirmed firm transmission reservations were modeled for the year 2012.
- Approved transmission reliability upgrades for 2012 were included in the base case. These upgrades can be found at Entergy's OASIS web page, http://www.entergy.com/etroasis/, under approved future projects.

Year	Approved Future Projects
2008 – 2010	2007CP_2009_Approved_ELL-S_Amite_South_Area_Improvements_PhaseII.idv
	2007CP_2009_Approved_ELL-S_EGSI-LA_Amite_South_Area_Improvements_PhaseIII.idv
	2008CP_EAI 2008 Maumelle Approved.idv
	2008CP_EAI 2010 SMEPA Approved.idv

	2011_Approved_ETI_Western_Region_Reliability_Improvement_Phase3_Interim

Year	Proposed Projects for prior generator interconnection requests
2012	Webre – Richard 500kV transmission line (56 miles triple bundled 954)
	Lewis Creek – Conroe 230kV transmission line
	BP08-038 - Loblolly-Hammond Build 230kv Line_R2Corrected.idv Upgraded to 954 DB
	Upgrade Fairview – Gypsy 230kV to 700MVA 34.33 miles Upgrade Madisonville – Mandeville 230kV (CLECO)10 miles Upgrade Front Street – Michoud to 800MVA Upgrade Front Street – Slidell to 800MVA Build Slidell – Michoud 230kV to 600MVA 30 miles Build Nine Mile – Michoud 230kV to 600MVA 22 miles Upgrade LaBarre – South Port 230kV to 700MVA 2.1 miles Add 3rd South Port – Nine Mile river crossing

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

PID	Substation	MW	In Service Date
PID 211	Lewis Creek	570	6/1/2011
PID 216	Wilton 230kV	251	1/1/2010
PID 221	Wolfcreek	875	In Service
PID 222	Nine Mile	570	10/1/2012
PID 223	PID-223 Tap	125	10/1/2010
PID 224	PID-224 Tap	100	12/1/2009

Prior transmission service requests that were included in this study:

OASIS #	PSE	MW	Begin	End
1460900	Louisiana Energy & Power Authority	116	1/1/2009	1/1/2030
1481235	Louisiana Energy & Power Authority	50	2/1/2011	2/1/2016
1481438	NRG Power Marketing	20	2/1/2011	2/1/2021
1483241	NRG Power Marketing	103	1/1/2010	1/1/2020
1483243	NRG Power Marketing	206	1/1/2010	1/1/2020
1483244	NRG Power Marketing	309	1/1/2010	1/1/2020
1520043	Municipal Energy Agency of Miss	20	1/1/2011	1/1/2026
TVA 1	TVA	724	1/1/2009	1/1/2013
ASA-2008-005	SPP	6	1/1/2008	1/1/2019
ASA-2008-009	SPP	100	1/1/2009	1/1/2010
1558911	NRG Power Marketing	100	1/1/2009	1/1/2014
1559579	NRG Power Marketing	500	5/1/2010	5/1/2015
1559580	NRG Power Marketing	500	5/1/2010	5/1/2015
1559581	NRG Power Marketing	150	5/1/2010	5/1/2015
1577156	NRG Power Marketing	200	1/1/2020	1/1/2030
1585221	Constellation Energy Grp	25	10/1/2009	10/1/2010
1591402	CLECO Power LLC	12	1/1/2009	1/1/2011
1591404	CLECO Power LLC	5	1/1/2009	1/1/2011
1591405	CLECO Power LLC	7	1/1/2009	1/1/2011
1595537	Constellation Energy Grp	25	10/1/2009	10/1/2010
1598291	Energy Services (EMO)	206	6/1/2012	6/1/2042

Contingencies and Monitored Elements

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

Generation used for the transfer

The Big Cajun 2 Unit 3 generators were used as the source for the deliverability to generation test.

Results

Deliverability to Generation (DFAX) Test:

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

Constraints:

Study Case	Study Case with Priors
Sterlington 500/115kV transformer 2	NONE
Greenwood - Terrebone 115kV	
Greenwood - Humphrey 115kV	
Gibson - Humphrey 115kV	
Livonia - Wilbert 138kV	
Livonia - Line 642 Tap 138kV	
Louisiana Station - Thomas 138kV	
Krotz Spring - Line 642 Tap 138kV	
Champagne - East Opelousas 138kV	

DFAX Study Case Results:

Limiting Element	Contingency Element	ATC(MW)
Sterlington 500/115kV transformer 2	Sterlington 500/115kV transformer 1	0
Greenwood - Terrebone 115kV	Webre - Wells 500kV	0
Greenwood - Humphrey 115kV	Webre - Wells 500kV	0
Gibson - Humphrey 115kV	Webre - Wells 500kV	0
Livonia - Wilbert 138kV	Webre - Wells 500kV	0
Sterlington 500/115kV transformer 2	Eldorado EHV - Sterlington 500kV	0
Livonia - Line 642 Tap 138kV	Webre - Wells 500kV	0
Louisiana Station - Thomas 138kV	Webre - Wells 500kV	0
Krotz Spring - Line 642 Tap 138kV	Webre - Wells 500kV	0
Champagne - East Opelousas 138kV	Webre - Wells 500kV	0

DFAX Study Case with Priors Results:

Limiting Element	Contingency Element	ATC(MW)
NONE	NONE	13

Deliverability to Load Test:

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

Amite South: Passed

WOTAB: Passed

Western Region: Passed

Required Upgrades for NRIS

Preliminary Estimates of Direct Assignment of Facilities and Network Upgrades

Without priors

Limiting Element	Planning Estimate for Upgrade
Webre – Richard 500kV transmission line (56 miles triple bundled 954)	$229,336,645

No upgrades identified for with priors

Note 1: identified as long term reliability project

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

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

1. Overview

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

1.1 The "From Generation" Test for Deliverability

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

1.2 The "To Load" Test for Deliverability

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

1.3 Required Upgrades.

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

Appendix B-B – NRIS Deliverability Test

Description of Deliverability Test

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

Deliverability Test Procedure:

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

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

1) Deliverability of Generation

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

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

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

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

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

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

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

2) Deliverability to Load

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

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

An acceptable level of import capability for each sub-zone will have been determined by Entergy Transmission based on their experience and modeling of joint transmission and generating unit contingencies. Typically the acceptable level of transmission import capacity into the sub-zones will be that which is limited by first-contingency conditions on the transmission system when generating units within the sub-region are experiencing an abnormal level of outages and peak loads.

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

Other Modeling Assumptions:

1) Modeling of Other Resources

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

2) Must-run Units

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

3) Base-line Transmission Model

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