



**System Impact Study Report
PID 213
41 MW Plant
Waterford**

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Objective:

This System Impact Study is the second step of the interconnection process and is based on the PID-213 request for interconnection on Entergy's transmission system at the Waterford substation. This report is organized in two sections, namely, Section – A, Energy Resource Interconnection Service (ERIS) and Section – B, Network Resource Interconnection Service (NRIS – Section B).

The Scope for the ERIS section (Section – A) includes load flow (steady state) analysis, 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-213 did request ERIS, however it was determined that a load flow (steady state) analysis was not required because the generator would not be exporting power. Therefore Section-B is not included in this report.

PID 213 intends to install a Black Start Generator with a maximum capacity of 43 MVA. The point of interconnection will be connected at the existing Waterford substation. The study evaluates injection of 41 MW from the Waterford substation to the Entergy Transmission System.

The proposed in-service date for this facility is June 1, 2008.

Section – A

Energy Resource Interconnection Service

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I. Introduction

This Energy Resource Interconnection Service (ERIS) is based on the PID 213 request for interconnection on Entergy's transmission system at the Waterford substation. The objective of this study is to assess the reliability impact of the new facility on the Entergy transmission system with respect to the steady state and transient stability performance of the system as well as its effects on the system's existing short circuit current capability. It is also intended to determine whether the transmission system meets standards established by NERC Reliability Standards and Entergy's planning guidelines when the plant is connected to Entergy's transmission system. If not, transmission improvements will be identified.

The System Impact Study process required a load flow analysis to determine if the existing transmission lines are adequate to handle the full output from the plant for simulated transfers to adjacent control areas. A short circuit analysis was performed to determine 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.

This ERIS System Impact Study was based on information provided by PID 213 and assumptions made by Entergy's Transmission Technical System Planning group. All supplied information and assumptions are documented in this report. If the actual equipment installed is different from the supplied information or the assumptions made, the results outlined in this report are subject to change.

II. Short Circuit Analysis / Breaker Rating Analysis

A. Model Information

The short circuit analysis was performed on the Entergy system short circuit model using ASPEN software. This model includes all generators interconnected to the Entergy system or interconnected to an adjacent system and having an impact on this interconnection request, IPP's with signed IOAs, and approved future transmission projects on the Entergy transmission system including the proposed PID 213 unit.

B. Short Circuit Analysis

The method used to determine if any short circuit problems would be caused by the addition of the PID 213 generation is as follows:

1. Three phase and single phase to ground faults were simulated on the Entergy base case short circuit model and the worst case short circuit level was determined at each station. The PID 213 generator as well as the necessary NRIS upgrades shown in Section B, IV were then modeled in the base case to generate a revised short circuit model. The base case short circuit results were then compared with the results from the revised model to identify any breakers that were under-rated as a result of additional short circuit contribution from PID 213 generation. The breakers identified to be upgraded through this comparison are *mandatory* upgrades.

C. Analysis Results

The results of the short circuit analysis indicates that the additional generation due to PID 213 generator does not cause an increase in short circuit current such that they exceed the fault

interrupting capability of the high voltage circuit breakers within the Entergy Transmission system.

D. Problem Resolution

There were no problems identified for this part of the study that were a result of the additional PID 213 generation.

III. Load Flow Analysis

A. Model Information

The load flow analysis was performed based on the projected 2008 and 2014 summer peak load flow models. 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 years 2008 and 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 PID 213 generation and the associated facilities were then modeled in the cases to build revised cases for the load flow analysis. Transfers were simulated between thirteen (13) control areas and Entergy using requesting generator as the source and adjacent control area as sink.

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

The generator step-up transformers, generators, and interconnecting lines were modeled according to the information provided by the Customer. The customer supplied data is shown in Appendix A. The data used to build the load flow and dynamic models are also shown in Appendix A.

The following transactions were included in this System Impact Study:

Study Queue

OASIS #	PSE	MW	Begin	End
1338840	Louisiana Energy & Power Authority	150	9/1/2005	9/1/2010
1338849	Louisiana Energy & Power Authority	45	9/1/2005	9/1/2010
1384737	Louisiana Energy & Power Authority	13	9/1/2005	9/1/2010
1460876	Aquila Networks - MPS	75	3/1/2009	3/1/2029
1460878	Aquila Networks - MPS	75	3/1/2009	3/1/2029
1460879	Aquila Networks - MPS	75	3/1/2009	3/1/2029
1460881	Aquila Networks - MPS	75	3/1/2009	3/1/2029
1460900	Louisiana Energy & Power Authority	116	1/1/2009	1/1/2030
1468113	Municipal Energy Agency of Miss	20	6/1/2011	6/1/2041
1468285	MidAmerican Energy, Inc.	103	9/1/2007	9/1/2008
1468286	MidAmerican Energy, Inc.	103	9/1/2007	9/1/2008
1468288	MidAmerican Energy, Inc.	103	1/1/2008	1/1/2009
1468289	MidAmerican Energy, Inc.	103	1/1/2008	1/1/2009
1478781	Entergy Services, Inc. (EMO)	804	1/1/2008	1/1/2058
1481059	Constellation Energy Group	60	2/1/2011	2/1/2030
1481111	City of Conway	50	2/1/2011	2/1/2046
1481119	Constellation Energy Group	30	2/1/2011	2/1/2030
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
PID 207		1594	1/1/2015	
PID 208		1594	1/1/2015	

B. Load Flow Analyses

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.

i) 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).

B) Under Contingencies

- The MVA flow through any facility should not exceed Rate A.

ii) Power Factor Consideration / Criteria

Entergy, consistent with the FERC Large Generator Interconnection Procedures (LGIP) requires the customer to be capable of supplying at least 0.33 MVAR (*i.e.*, 0.95 lagging power factor) and absorbing at least 0.33 MVAR (*i.e.*, 0.95 leading power factor) for every MW of power injected into the grid. In the event that, under normal operating conditions, the customer facility does not meet the prescribed power factor requirements at the point of interconnection, the customer shall take necessary steps, such as the installation of reactive power compensating devices, to achieve the desired power factor.

C. Analysis Results

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

Table II-C Summary of Results for PID 213 Waterford – 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.	2008 Summer Peak for Scenarios 1 & 3	0	0	0	0
AMRN	Ameren Transmission		0	0	0	0
CLEC	CLECO		0	0	0	0

AEP-W	American Electric Power - West	2014 Summer Peak for Scenarios 2 & 4	0	0	0	0
EDE	Empire District Electric Co		0	0	0	0
LAF	Lafayette Utilities Systeem		0	0	0	0
LAGN	Louisiana Generating, LLC		41	0	0	0
LEPA	Louisiana Energy & Power Authority		0	0	0	0
OGE	Oklahoma Gas & Electric Company		0	0	0	0
SME	South Mississippi Electric Power Assoc.		0	0	0	0
SOCO	Southern Company		0	0	0	0
SPA	Southwest Power Administration		0	0	0	0
TVA	Tennessee Valley Authority		0	0	0	0

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

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

2008 Summer Peak	Interface														
Limiting Element	Cost	AECI	AEPW	AMRN	CLECO	EES	EMDE	LAFa	LAGN	LEPA	OKGE	SMEPA	SOCO	SWPA	TVA
Addis - Willow Glen 138kV	9,585,000	X	X	X	X	X	X	X		X	X			X	X
Bonin 230/138kV transformer (LAFa)	\$5,000,000									X					
Champagne - East Opelousas 138kV	\$1,397,500		X		X			X							
Champagne - Krotz Spring 138kV	\$15,569,784	X	X	X	X	X	X	X			X		X	X	X
Fairview - Gypsy 230kV	34,728,000											X	X		X
Gibson - Humphrey 115kV	\$21,584,961	X	X	X	X	X	X	X		X	X	X	X	X	X
Gibson - Ramos 138kV	\$5,753,263	X	X	X	X	X	X	X		X	X	X	X	X	X
Gibson 138/115kV transformer	\$3,375,000	X	X	X	X	X	X	X		X	X	X	X	X	X
Greenwood - Humphery 115kV	\$2,667,252	X	X	X	X	X	X	X		X	X	X	X	X	X
Greenwood - Terrebone 115kV	\$22,113,272	X	X	X	X	X	X	X		X	X	X	X	X	X
Krotz Spring - Line 642 Tap 138kV	\$136,701	X	X	X	X	X	X	X			X		X	X	X
Livonia - Line 642 Tap 138kV	\$4,367,250	X	X	X	X	X	X	X			X		X	X	X
Livonia - Wilbert 138kV	\$22,428,239	X	X	X	X	X	X	X			X		X	X	X
Porter - Tamina 138kV	\$172,125		X												
Sterlington 500/115kV transformer 1	\$8,100,000					X									
Sterlington 500/115kV transformer 2	\$8,100,000	X	X	X	X	X	X				X			X	
Webre - Wells 500kV	216,346,904	X	X	X	X	X	X			X	X	X	X	X	X

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

2014 Summer Peak	Interface														
Limiting Element	Cost	AECI	AEPW	AMRN	CLECO	EES	EMDE	LAFa	LAGN	LEPA	OKGE	SMEPA	SOCO	SWPA	TVA
Acadia - Colonial Academy 138kV	\$2,092,500							X							
Acadia GSU - Scanlan 138kV	\$485,000							X							
ANO - Russellville North 161kV	\$2,197,500		X				X				X			X	
Bonin 230/138kV transformer (LAFa)	\$5,000,000									X					
Bull Shoals - Bull Shoals Dam SPA 161kV	\$142,500						X								
BUS 'BRKN BW4 138' TO BUS 'BETHEL 4 138'	TBD										X				
Calico Rock - Melborne 161kV	\$6,735,150													X	
Calico Rock - Norfolk 161kV	\$3,288,600													X	
Carroll 230/138kV transformer (CLECO)	\$5,000,000		X				X				X			X	
Cedar Hill - Tamina 138kV	\$970,000		X												
Chauvin - Ashland 115kV	\$4,606,875									X					
Colonial Academy - Richard 138kV	\$2,652,500							X							
Conroe Bulk - Plantation 138kV	\$732,500		X												
Danville - North Magazine REA 161kV	\$6,500,000													X	
Fairview - Gypsy 230kV	34,728,000	X	X	X	X	X	X	X	X	X	X	X	X	X	X
French Settlement - Sorrento 230kV	\$3,345,300	X	X	X		X	X				X	X	X	X	X
Front Street - Michoud 230kV	8,055,450	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Greenwood - Terrebone 115kV	\$22,113,272		X		X			X	X	X					
Habetz - Richard 138kV	\$3,272,500							X		X					
Harrison East - Everton 161kV	5,602,000						X								
Harrison East - Summit 161kV	\$5,395,000						X								

2014 Summer Peak	Interface														
Limiting Element	Cost	AECI	AEPW	AMRN	CLECO	EES	EMDE	LAFa	LAGN	LEPA	OKGE	SMEPA	SOCO	SWPA	TVA
Hartburg 500/230kV transformer 1	\$7,000,000		X		X	X	X				X				
International Paper - Mansfield 138kV (CLECO)	TBD		X				X				X			X	
International Paper - Wallake 138kV (CLECO)	TBD		X				X				X			X	
Jonesboro - Jonesboro North (AECC) 161kV	\$1,570,000													X	
Judice - Scott 138kV	10,000,000									X					
Lakeover 500/115kV transformer	\$8,100,000			X								X	X		
Melborne - Sage 161kV	\$1,192,500						X				X			X	
North Crowley - Richard 138kV	3,776,625							X							
North Crowley - Scott1 138kV	\$4,265,000				X			X							
Plantation - Cedar Hill 138kV	\$1,056,375		X												
Pleasant Hill 500/161kV transformer	30,389,000						X							X	
Porter - Tamina 138kV	\$33,750		X												
Raceland - Coteau 115kV	\$3,065,000									X					
Ray Braswell - Grand Gulf 500kV	\$171,034,989	X	X	X	X	X	X				X	X	X	X	X
Ray Braswell 500/115kV transformer 1	\$8,100,000											X			
Ray Braswell 500/230kV transformer 1	\$7,000,000					X						X			
Ray Braswell 500/230kV transformer 2	\$7,000,000					X						X			
Richard - Scott 138kV	\$9,531,000							X							
Russellville East - Russellville North 161kV	\$1,291,950		X				X				X			X	
Russellville East - Russellville South 161kV	\$1,660,500	X	X	X			X				X			X	
Russellville South - Dardanelle Dam 161kV	\$7,142,000	X		X										X	
Scott1 - Bonin 138kV	\$1,755,000							X							
Semere - Scott2 138kV	\$5,477,625							X							
St. Joe - Hilltop 161kV	2,970,000						X								
Sterlington 500/115kV transformer 1	\$8,100,000					X								X	
Sterlington 500/115kV transformer 2	\$8,100,000		X		X	X	X				X			X	

2014 Summer Peak	Interface														
Limiting Element	Cost	AECI	AEPW	AMRN	CLECO	EES	EMDE	Lafa	Lagn	LEPA	OKGE	SMEPA	SOCO	SWPA	TVA
West New Roads - NewRoads (LEPA) 230kV	TBD									X					
Winnfield 230/115kV transformer	\$4,050,000	X	X				X				X			X	

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

2008 Summer Peak + Approved Upgrades	Interface														
Limiting Element	Cost	AECI	AEPW	AMRN	CLECO	EES	EMDE	Lafa	LAGN	LEPA	OKGE	SMEPA	SOCO	SWPA	TVA
Addis - Willow Glen 138kV	9,585,000	X	X	X	X	X	X	X		X	X			X	X
Belle Point - Gypsy 230kV	9,386,000	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Champagne - East Opelousas 138kV	\$1,397,500		X		X			X							
Champagne - Krotz Spring 138kV	\$15,569,784	X	X	X	X	X	X	X			X		X	X	X
Gibson - Humphrey 115kV	\$21,584,961	X	X	X	X	X	X	X		X	X	X	X	X	X
Gibson - Ramos 138kV	\$5,753,263	X	X	X	X	X	X	X		X	X	X	X	X	X
Gibson 138/115kV transformer	\$3,375,000	X	X	X	X	X	X	X		X	X	X	X	X	X
Greenwood - Humphery 115kV	\$2,667,252	X	X	X	X	X	X	X		X	X	X	X	X	X
Greenwood - Terrebone 115kV	\$22,113,272	X	X	X	X	X	X	X		X	X	X	X	X	X
Krotz Spring - Line 642 Tap 138kV	\$136,701	X	X	X	X	X	X	X			X		X	X	X
Livonia - Line 642 Tap 138kV	\$4,367,250	X	X	X	X	X	X	X			X		X	X	X
Livonia - Wilbert 138kV	\$22,428,239	X	X	X	X	X	X	X			X		X	X	X
Porter - Tamina 138kV	\$33,750		X												
Scott1 - Bonin 138kV	\$1,755,000							X							
Semere - Scott2 138kV	\$5,477,625							X							
Sterlington 500/115kV transformer 1	\$8,100,000					X									

Sterlington 500/115kV transformer 2	\$8,100,000	X	X	X	X	X	X				X			X	
Webre - Wells 500kV	216,346,904	X	X	X	X	X	X	X		X	X	X	X	X	X
Wells 500/230kV transformer	\$7,000,000							X				X			

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

2014 Summer Peak + Approved Upgrades and Prior Transmission Service Requests	Interface															
	Limiting Element	Cost	AECI	AEPW	AMRN	CLECO	EES	EMDE	LAFa	LAGN	LEPA	OKGE	SMEPA	SOCO	SWPA	TVA
Acadia - Colonial Academy 138kV	\$2,092,500								X							
Acadia GSU - Scanlan 138kV	\$485,000								X							
ANO - Russellville North 161kV	\$2,197,500		X				X				X				X	
Bonin 230/138kV transformer (LAFa)	\$5,000,000									X						
Bull Shoals - Bull Shoals Dam SPA 161kV	\$142,500						X									
BUS 'BRKN BW4 138' TO BUS 'BETHEL 4 138'	TBD										X					
Calico Rock - Melbourne 161kV	\$6,735,150						X				X				X	
Calico Rock - Norfolk 161kV	\$3,288,600						X				X				X	
Carroll 230/138kV transformer (CLECO)	\$5,000,000		X				X				X				X	
Cedar Hill - Tamina 138kV	\$970,000		X													
Chauvin - Ashland 115kV	\$4,606,875									X						
Colonial Academy - Richard 138kV	\$2,652,500								X							
Conroe Bulk - Plantation 138kV	\$732,500		X													
Danville - North Magazine REA 161kV	\$6,500,000		X				X				X				X	
Fairview - Gypsy 230kV	34,728,000	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
French Settlement - Sorrento 230kV	\$3,345,300	X	X	X	X	X	X				X	X	X	X	X	X
Front Street - Michoud 230kV	8,055,450											X				

2014 Summer Peak + Approved Upgrades and Prior Transmission Service Requests		Interface													
Limiting Element	Cost	AECI	AEPW	AMRN	CLECO	EES	EMDE	LAFa	LAgN	LEPA	OKGE	SMEPA	SOCO	SWPA	TVA
Habetz - Richard 138kV	\$3,272,500							X		X					
Harrison East - Everton 161kV	5,602,000						X								
Harrison East - Summit 161kV	\$5,395,000						X								
Hartburg 500/230kV transformer 1	\$7,000,000		X		X	X	X				X			X	
International Paper - Mansfield 138kV (CLECO)	TBD		X				X				X			X	
International Paper - Wallake 138kV (CLECO)	TBD		X				X				X			X	
Jonesboro - Jonesboro North (AECC) 161kV	\$1,570,000													X	
Judice - Meaux 138kV	10,000,000									X					
Judice - Scott 138kV	10,000,000									X					
Lakeover 500/115kV transformer	\$8,100,000			X								X	X		X
Melborne - Sage 161kV	\$1,192,500						X				X			X	
North Crowley - Richard 138kV	3,776,625							X							
North Crowley - Scott1 138kV	\$4,265,000				X			X							
Plantation - Cedar Hill 138kV	\$1,056,375		X												
Pleasant Hill 500/161kV transformer	\$5,000,000						X							X	
Porter - Tamina 138kV	\$33,750		X												
Raceland - Coteau 115kV	\$3,065,000				X			X		X					
Ray Braswell - Grand Gulf 500kV	\$171,034,989	X	X	X	X	X	X				X	X	X	X	X
Ray Braswell 500/115kV transformer 1	\$8,100,000											X			
Ray Braswell 500/230kV transformer 1	\$7,000,000					X						X			
Ray Braswell 500/230kV transformer 2	\$7,000,000					X						X			
Richard - Scott 138kV	\$9,531,000							X							

2014 Summer Peak + Approved Upgrades and Prior Transmission Service Requests		Interface													
Limiting Element	Cost	AECI	AEPW	AMRN	CLECO	EES	EMDE	Lafa	LAGN	LEPA	OKGE	SMEPA	SOCO	SWPA	TVA
Russellville East - Russellville North 161kV	\$1,291,950		X				X				X			X	
Russellville East - Russellville South 161kV	\$1,660,500	X	X	X			X				X			X	
Russellville South - Dardanelle Dam 161kV	\$7,142,000		X				X				X			X	
Ruston East - Vienna 115kV	\$1,049,625		X												
Scott1 - Bonin 138kV	\$1,755,000							X							
Semere - Scott2 138kV	\$5,477,625							X							
St. Joe - Hilltop 161kV	2,970,000						X				X			X	
Sterlington 500/115kV transformer 1	\$19,401,441		X		X	X					X			X	
Sterlington 500/115kV transformer 2	\$8,100,000		X		X	X	X				X			X	
Terrebone 230/115kV transformer	\$4,050,000									X					
West New Roads - NewRoads (LEPA) 230kV	TBD									X					

APPENDIX A-C: DETAILS OF SCENARIO 1

(Without Future Projects and Without Pending Transmission Service & Study Request)

AECI

Limiting Element	Contingency Element	ATC
Livonia - Wilbert 138kV	Webre - Wells 500kV	0
Greenwood - Terrebone 115kV	Webre - Wells 500kV	0
Livonia - Line 642 Tap 138kV	Webre - Wells 500kV	0
Krotz Spring - Line 642 Tap 138kV	Webre - Wells 500kV	0
Greenwood - Humphery 115kV	Webre - Wells 500kV	0
Gibson - Humphrey 115kV	Webre - Wells 500kV	0
Sterlington 500/115kV transformer 2	Eldorado EHV - Sterlington 500kV	0
Champagne - Krotz Spring 138kV	Webre - Wells 500kV	0
Greenwood - Terrebone 115kV	Richard - Wells 500kV	0
Gibson - Ramos 138kV	Webre - Wells 500kV	0
Addis - Willow Glen 138kV	Webre - Wells 500kV	0
Livonia - Wilbert 138kV	Richard - Wells 500kV	0
Gibson 138/115kV transformer	Webre - Wells 500kV	0
Webre - Wells 500kV	Franklin - McKnight 500kV	0
Greenwood - Humphery 115kV	Richard - Wells 500kV	0

AEPW

Limiting Element	Contingency Element	ATC
Greenwood - Terrebone 115kV	Webre - Wells 500kV	0
Livonia - Wilbert 138kV	Webre - Wells 500kV	0
Livonia - Line 642 Tap 138kV	Webre - Wells 500kV	0
Krotz Spring - Line 642 Tap 138kV	Webre - Wells 500kV	0
Greenwood - Humphery 115kV	Webre - Wells 500kV	0
Gibson - Humphrey 115kV	Webre - Wells 500kV	0
Champagne - East Opelousas 138kV	Webre - Wells 500kV	0
Sterlington 500/115kV transformer 2	Eldorado EHV - Sterlington 500kV	0
Greenwood - Terrebone 115kV	Richard - Wells 500kV	0
Champagne - Krotz Spring 138kV	Webre - Wells 500kV	0
Gibson - Ramos 138kV	Webre - Wells 500kV	0
Addis - Willow Glen 138kV	Webre - Wells 500kV	0
Livonia - Wilbert 138kV	Richard - Wells 500kV	0
Porter - Tamina 138kV	Oak Ridge - Porter 138kV	0
Gibson 138/115kV transformer	Webre - Wells 500kV	0
Webre - Wells 500kV	Franklin - McKnight 500kV	0
Greenwood - Humphery 115kV	Richard - Wells 500kV	0
Webre - Wells 500kV	Franklin - Mcknight 500kV	0

AMRN

Limiting Element	Contingency Element	ATC
Livonia - Wilbert 138kV	Webre - Wells 500kV	0
Greenwood - Terrebone 115kV	Webre - Wells 500kV	0
Livonia - Line 642 Tap 138kV	Webre - Wells 500kV	0
Krotz Spring - Line 642 Tap 138kV	Webre - Wells 500kV	0
Greenwood - Humphery 115kV	Webre - Wells 500kV	0
Gibson - Humphrey 115kV	Webre - Wells 500kV	0
Sterlington 500/115kV transformer 2	Eldorado EHV - Sterlington 500kV	0
Champagne - Krotz Spring 138kV	Webre - Wells 500kV	0
Greenwood - Terrebone 115kV	Richard - Wells 500kV	0
Gibson - Ramos 138kV	Webre - Wells 500kV	0
Addis - Willow Glen 138kV	Webre - Wells 500kV	0
Livonia - Wilbert 138kV	Richard - Wells 500kV	0
Gibson 138/115kV transformer	Webre - Wells 500kV	0
Webre - Wells 500kV	Franklin - McKnight 500kV	0
Greenwood - Humphery 115kV	Richard - Wells 500kV	0

CLECO

Limiting Element	Contingency Element	ATC
Sterlington 500/115kV transformer 2	Eldorado EHV - Sterlington 500kV	0
Livonia - Wilbert 138kV	Webre - Wells 500kV	0
Greenwood - Terrebone 115kV	Webre - Wells 500kV	0
Champagne - East Opelousas 138kV	Webre - Wells 500kV	0
Livonia - Line 642 Tap 138kV	Webre - Wells 500kV	0
Krotz Spring - Line 642 Tap 138kV	Webre - Wells 500kV	0
Greenwood - Humphery 115kV	Webre - Wells 500kV	0
Gibson - Humphrey 115kV	Webre - Wells 500kV	0
Champagne - Krotz Spring 138kV	Webre - Wells 500kV	0
Greenwood - Terrebone 115kV	Richard - Wells 500kV	0
Gibson - Ramos 138kV	Webre - Wells 500kV	0
Addis - Willow Glen 138kV	Webre - Wells 500kV	0
Livonia - Wilbert 138kV	Richard - Wells 500kV	0
Gibson 138/115kV transformer	Webre - Wells 500kV	0
Webre - Wells 500kV	Franklin - McKnight 500kV	0
Greenwood - Humphery 115kV	Richard - Wells 500kV	0
Gibson - Humphrey 115kV	Richard - Wells 500kV	28

EES

Limiting Element	Contingency Element	ATC
Sterlington 500/115kV transformer 2	Sterlington 500/115kV transformer 1	0
Sterlington 500/115kV transformer 1	Sterlington 500/115kV transformer 2	0
Livonia - Wilbert 138kV	Webre - Wells 500kV	0
Greenwood - Terrebone 115kV	Webre - Wells 500kV	0
Livonia - Line 642 Tap 138kV	Webre - Wells 500kV	0
Krotz Spring - Line 642 Tap 138kV	Webre - Wells 500kV	0
Greenwood - Humphery 115kV	Webre - Wells 500kV	0
Gibson - Humphrey 115kV	Webre - Wells 500kV	0
Sterlington 500/115kV transformer 2	Eldorado EHV - Sterlington 500kV	0
Champagne - Krotz Spring 138kV	Webre - Wells 500kV	0
Greenwood - Terrebone 115kV	Richard - Wells 500kV	0
Gibson - Ramos 138kV	Webre - Wells 500kV	0
Addis - Willow Glen 138kV	Webre - Wells 500kV	0
Livonia - Wilbert 138kV	Richard - Wells 500kV	0
Gibson 138/115kV transformer	Webre - Wells 500kV	0
Webre - Wells 500kV	Franklin - McKnight 500kV	0
Greenwood - Humphery 115kV	Richard - Wells 500kV	0

EMDE

Limiting Element	Contingency Element	ATC
Livonia - Wilbert 138kV	Webre - Wells 500kV	0
Greenwood - Terrebone 115kV	Webre - Wells 500kV	0
Livonia - Line 642 Tap 138kV	Webre - Wells 500kV	0
Krotz Spring - Line 642 Tap 138kV	Webre - Wells 500kV	0
Greenwood - Humphery 115kV	Webre - Wells 500kV	0
Gibson - Humphrey 115kV	Webre - Wells 500kV	0
Sterlington 500/115kV transformer 2	Eldorado EHV - Sterlington 500kV	0
Champagne - Krotz Spring 138kV	Webre - Wells 500kV	0
Greenwood - Terrebone 115kV	Richard - Wells 500kV	0
Gibson - Ramos 138kV	Webre - Wells 500kV	0
Addis - Willow Glen 138kV	Webre - Wells 500kV	0
Livonia - Wilbert 138kV	Richard - Wells 500kV	0
Gibson 138/115kV transformer	Webre - Wells 500kV	0
Webre - Wells 500kV	Franklin - McKnight 500kV	0
Greenwood - Humphery 115kV	Richard - Wells 500kV	0

LAF

Limiting Element	Contingency Element	ATC
Greenwood - Terrebone 115kV	Webre - Wells 500kV	0
Livonia - Wilbert 138kV	Webre - Wells 500kV	0
Livonia - Line 642 Tap 138kV	Webre - Wells 500kV	0
Greenwood - Humphery 115kV	Webre - Wells 500kV	0
Krotz Spring - Line 642 Tap 138kV	Webre - Wells 500kV	0
Gibson - Humphrey 115kV	Webre - Wells 500kV	0
Greenwood - Terrebone 115kV	Richard - Wells 500kV	0
Champagne - Krotz Spring 138kV	Webre - Wells 500kV	0
Gibson - Ramos 138kV	Webre - Wells 500kV	0
Champagne - East Opelousas 138kV	Webre - Wells 500kV	0
Addis - Willow Glen 138kV	Webre - Wells 500kV	0
Livonia - Wilbert 138kV	Richard - Wells 500kV	0
Gibson 138/115kV transformer	Webre - Wells 500kV	0
Greenwood - Humphery 115kV	Richard - Wells 500kV	0
Gibson - Humphrey 115kV	Richard - Wells 500kV	28

LAGN

Limiting Element	Contingency Element	ATC
NONE	NONE	41

LEPA

Limiting Element	Contingency Element	ATC
Greenwood - Terrebone 115kV	Webre - Wells 500kV	0
Greenwood - Humphery 115kV	Webre - Wells 500kV	0
Gibson - Humphrey 115kV	Webre - Wells 500kV	0
Greenwood - Terrebone 115kV	Richard - Wells 500kV	0
Gibson - Ramos 138kV	Webre - Wells 500kV	0
Bonin 230/138kV transformer (LAF)	Acadian - Bonin 230kV (LAF)	0
Addis - Willow Glen 138kV	Webre - Wells 500kV	0
Gibson 138/115kV transformer	Webre - Wells 500kV	0
Webre - Wells 500kV	Franklin - Mcknight 500kV	0
Greenwood - Humphery 115kV	Richard - Wells 500kV	0

OKGE

Limiting Element	Contingency Element	ATC
Livonia - Wilbert 138kV	Webre - Wells 500kV	0
Greenwood - Terrebone 115kV	Webre - Wells 500kV	0
Livonia - Line 642 Tap 138kV	Webre - Wells 500kV	0
Krotz Spring - Line 642 Tap 138kV	Webre - Wells 500kV	0
Greenwood - Humphery 115kV	Webre - Wells 500kV	0
Gibson - Humphrey 115kV	Webre - Wells 500kV	0
Sterlington 500/115kV transformer 2	Eldorado EHV - Sterlington 500kV	0
Champagne - Krotz Spring 138kV	Webre - Wells 500kV	0
Greenwood - Terrebone 115kV	Richard - Wells 500kV	0
Gibson - Ramos 138kV	Webre - Wells 500kV	0
Addis - Willow Glen 138kV	Webre - Wells 500kV	0
Livonia - Wilbert 138kV	Richard - Wells 500kV	0
Gibson 138/115kV transformer	Webre - Wells 500kV	0
Webre - Wells 500kV	Franklin - McKnight 500kV	0
Greenwood - Humphery 115kV	Richard - Wells 500kV	0

SMEPA

Limiting Element	Contingency Element	ATC
Greenwood - Terrebone 115kV	Webre - Wells 500kV	0
Greenwood - Humphery 115kV	Webre - Wells 500kV	0
Gibson - Humphrey 115kV	Webre - Wells 500kV	0
Greenwood - Terrebone 115kV	Richard - Wells 500kV	0
Gibson - Ramos 138kV	Webre - Wells 500kV	0
Gibson 138/115kV transformer	Webre - Wells 500kV	0
Webre - Wells 500kV	Franklin - McKnight 500kV	0
Greenwood - Humphery 115kV	Richard - Wells 500kV	0
Fairview - Gypsy 230kV	Front Street - Slidell 230kV	36

SOCO

Limiting Element	Contingency Element	ATC
Livonia - Wilbert 138kV	Webre - Wells 500kV	0
Greenwood - Terrebone 115kV	Webre - Wells 500kV	0
Livonia - Line 642 Tap 138kV	Webre - Wells 500kV	0
Krotz Spring - Line 642 Tap 138kV	Webre - Wells 500kV	0
Greenwood - Humphery 115kV	Webre - Wells 500kV	0
Gibson - Humphrey 115kV	Webre - Wells 500kV	0
Champagne - Krotz Spring 138kV	Webre - Wells 500kV	0
Greenwood - Terrebone 115kV	Richard - Wells 500kV	0
Gibson - Ramos 138kV	Webre - Wells 500kV	0
Livonia - Wilbert 138kV	Richard - Wells 500kV	0
Gibson 138/115kV transformer	Webre - Wells 500kV	0
Webre - Wells 500kV	Franklin - McKnight 500kV	0
Greenwood - Humphery 115kV	Richard - Wells 500kV	0
Fairview - Gypsy 230kV	Front Street - Slidell 230kV	42

SWPA

Limiting Element	Contingency Element	ATC
Livonia - Wilbert 138kV	Webre - Wells 500kV	0
Greenwood - Terrebone 115kV	Webre - Wells 500kV	0
Livonia - Line 642 Tap 138kV	Webre - Wells 500kV	0
Krotz Spring - Line 642 Tap 138kV	Webre - Wells 500kV	0
Greenwood - Humphery 115kV	Webre - Wells 500kV	0
Gibson - Humphrey 115kV	Webre - Wells 500kV	0
Sterlington 500/115kV transformer 2	Eldorado EHV - Sterlington 500kV	0
Champagne - Krotz Spring 138kV	Webre - Wells 500kV	0
Greenwood - Terrebone 115kV	Richard - Wells 500kV	0
Gibson - Ramos 138kV	Webre - Wells 500kV	0
Addis - Willow Glen 138kV	Webre - Wells 500kV	0
Livonia - Wilbert 138kV	Richard - Wells 500kV	0
Gibson 138/115kV transformer	Webre - Wells 500kV	0
Webre - Wells 500kV	Franklin - McKnight 500kV	0
Greenwood - Humphery 115kV	Richard - Wells 500kV	0

TVA

Limiting Element	Contingency Element	ATC
Livonia - Wilbert 138kV	Webre - Wells 500kV	0
Greenwood - Terrebone 115kV	Webre - Wells 500kV	0
Livonia - Line 642 Tap 138kV	Webre - Wells 500kV	0
Krotz Spring - Line 642 Tap 138kV	Webre - Wells 500kV	0
Greenwood - Humphery 115kV	Webre - Wells 500kV	0
Gibson - Humphrey 115kV	Webre - Wells 500kV	0
Champagne - Krotz Spring 138kV	Webre - Wells 500kV	0
Greenwood - Terrebone 115kV	Richard - Wells 500kV	0
Gibson - Ramos 138kV	Webre - Wells 500kV	0
Addis - Willow Glen 138kV	Webre - Wells 500kV	0
Livonia - Wilbert 138kV	Richard - Wells 500kV	0
Gibson 138/115kV transformer	Webre - Wells 500kV	0
Webre - Wells 500kV	Franklin - McKnight 500kV	0
Greenwood - Humphery 115kV	Richard - Wells 500kV	0
Fairview - Gypsy 230kV	Front Street - Slidell 230kV	44

APPENDIX A-D: DETAILS OF SCENARIO 2

(Without Future Projects and With Pending Transmission Service & Study Request)

AECI

Limiting Element	Contingency Element	ATC
Russellville East - Russellville South 161kV	ANO - Fort Smith 500kV	0
Ray Braswell - Grand Gulf 500kV	Baxter Wilson - Grand Gulf 500kV	0
French Settlement - Sorrento 230kV	Franklin - McKnight 500kV	0
Fairview - Gypsy 230kV	French Settlement - Sorrento 230kV	0
Winnfield 230/115kV transformer	Clarence (CLECO) - Montgomery 230kV	0
Fairview - Gypsy 230kV	Front Street - Slidell 230kV	0
Fairview - Gypsy 230kV	Bogalusa - Adams Creek 500/230kV transformer	0
Fairview - Gypsy 230kV	Bogalusa - Franklin 500kV	0
Fairview - Gypsy 230kV	Franklin - McKnight 500kV	0
Fairview - Gypsy 230kV	French Settlement - Springfield 230kV	0
Front Street - Michoud 230kV	Franklin - McKnight 500kV	29
Winnfield 230/115kV transformer	Clarence - Messick 230kV (CLECO)	31

AEPW

Limiting Element	Contingency Element	ATC
Porter - Tamina 138kV	Oak Ridge - Porter 138kV	0
Cedar Hill - Tamina 138kV	Oak Ridge - Porter 138kV	0
Plantation - Cedar Hill 138kV	Oak Ridge - Porter 138kV	0
ANO - Russellville North 161kV	ANO - Fort Smith 500kV	0
Conroe Bulk - Plantation 138kV	Oak Ridge - Porter 138kV	0
Ray Braswell - Grand Gulf 500kV	Baxter Wilson - Grand Gulf 500kV	0
International Paper - Mansfield 138kV (CLECO)	Dolet Hills - S.W. Shreevport 345kV (CLECO)	0
Hartburg 500/230kV transformer 1	Cypress - Hartburg 500kV	0
International Paper - Wallake 138kV (CLECO)	Dolet Hills - S.W. Shreevport 345kV (CLECO)	0
Porter - Tamina 138kV	Metro - Oak Ridge 138kV	0
'MANSFLD4 138' TO BUS 'IPAPER 4 138'	Contingency of FlowGate 5029 DOLHILL7 345 TO SW SHV 7 345	0
Fairview - Gypsy 230kV	French Settlement - Sorrento 230kV	0
Russellville East - Russellville North 161kV	ANO - Fort Smith 500kV	0
Russellville East - Russellville South 161kV	ANO - Fort Smith 500kV	0
Fairview - Gypsy 230kV	Front Street - Slidell 230kV	0
Winnfield 230/115kV transformer	Clarence (CLECO) - Montgomery 230kV	0
French Settlement - Sorrento 230kV	Franklin - McKnight 500kV	0
Sterlington 500/115kV transformer 2	Eldorado EHV - Sterlington 500kV	0
Fairview - Gypsy 230kV	Franklin - McKnight 500kV	0
Fairview - Gypsy 230kV	Bogalusa - Adams Creek 500/230kV transformer	0
Fairview - Gypsy 230kV	Bogalusa - Franklin 500kV	0
Front Street - Michoud 230kV	Franklin - McKnight 500kV	0
Front Street - Michoud 230kV	Fairview - Gypsy 230kV	0
Cedar Hill - Tamina 138kV	Metro - Oak Ridge 138kV	0
Carroll 230/138kV transformer (CLECO)	Dolet Hills - S.W. Shreevport 345kV (CLECO)	0
Winnfield 230/115kV transformer	Clarence - Messick 230kV (CLECO)	32

AMRN

Limiting Element	Contingency Element	ATC
Russellville East - Russellville South 161kV	ANO - Fort Smith 500kV	0
Lakeover 500/115kV transformer	Lakeover - McAdams 500kV	0
Ray Braswell - Grand Gulf 500kV	Baxter Wilson - Grand Gulf 500kV	0
French Settlement - Sorrento 230kV	Franklin - McKnight 500kV	0
Fairview - Gypsy 230kV	French Settlement - Sorrento 230kV	0
Fairview - Gypsy 230kV	Front Street - Slidell 230kV	0
Fairview - Gypsy 230kV	Bogalusa - Adams Creek 500/230kV transformer	0
Fairview - Gypsy 230kV	Bogalusa - Franklin 500kV	0
Fairview - Gypsy 230kV	Franklin - McKnight 500kV	0
Fairview - Gypsy 230kV	French Settlement - Springfield 230kV	0
Front Street - Michoud 230kV	Franklin - McKnight 500kV	28

CLECO

Limiting Element	Contingency Element	ATC
Ray Braswell - Grand Gulf 500kV	Baxter Wilson - Grand Gulf 500kV	0
Hartburg 500/230kV transformer 1	Cypress - Hartburg 500kV	0
Fairview - Gypsy 230kV	French Settlement - Sorrento 230kV	0
Fairview - Gypsy 230kV	Front Street - Slidell 230kV	0
Fairview - Gypsy 230kV	Franklin - McKnight 500kV	0
Sterlington 500/115kV transformer 2	Eldorado EHV - Sterlington 500kV	0
Fairview - Gypsy 230kV	Bogalusa - Adams Creek 500/230kV transformer	0
Fairview - Gypsy 230kV	Bogalusa - Franklin 500kV	0
Fairview - Gypsy 230kV	French Settlement - Springfield 230kV	0
Front Street - Michoud 230kV	Franklin - McKnight 500kV	0
Front Street - Michoud 230kV	Fairview - Gypsy 230kV	0
Greenwood - Terrebone 115kV	Bonin - Labbe 230kV (LAFA)	33

EES

Limiting Element	Contingency Element	ATC
Sterlington 500/115kV transformer 2	Sterlington 500/115kV transformer 1	0
Sterlington 500/115kV transformer 1	Sterlington 500/115kV transformer 2	0
Sterlington 500/115kV transformer 2	Eldorado EHV - Sterlington 500kV	0
Ray Braswell 500/230kV transformer 2	Ray Braswell 500/230kV transformer 1	0
Ray Braswell 500/230kV transformer 1	Ray Braswell 500/230kV transformer 2	0
Ray Braswell - Grand Gulf 500kV	Baxter Wilson - Grand Gulf 500kV	0
Hartburg 500/230kV transformer 1	Cypress - Hartburg 500kV	0
French Settlement - Sorrento 230kV	Franklin - McKnight 500kV	0
Fairview - Gypsy 230kV	French Settlement - Sorrento 230kV	0
Fairview - Gypsy 230kV	Front Street - Slidell 230kV	0
Fairview - Gypsy 230kV	Bogalusa - Adams Creek 500/230kV transformer	0
Fairview - Gypsy 230kV	Bogalusa - Franklin 500kV	0
Fairview - Gypsy 230kV	Franklin - McKnight 500kV	0
Fairview - Gypsy 230kV	French Settlement - Springfield 230kV	0
Front Street - Michoud 230kV	Franklin - McKnight 500kV	24

EMDE

Limiting Element	Contingency Element	ATC
Hartburg 500/230kV transformer 1	Cypress - Hartburg 500kV	0
International Paper - Mansfield 138kV (CLECO)	Dolet Hills - S.W. Shreevport 345kV (CLECO)	0
International Paper - Wallake 138kV (CLECO)	Dolet Hills - S.W. Shreevport 345kV (CLECO)	0
'MANSFLD4 138' TO BUS 'IPAPER 4 138'	Contingency of FlowGate 5029 DOLHILL7 345 TO SW SHV 7 345	0
Ray Braswell - Grand Gulf 500kV	Baxter Wilson - Grand Gulf 500kV	0
ANO - Russellville North 161kV	ANO - Fort Smith 500kV	0
Pleasant Hill 500/161kV transformer	ANO 500/161kV transformer	0
Bull Shoals - Bull Shoals Dam SPA 161kV	St. Joe - Hilltop 161kV	0
Bull Shoals - Bull Shoals Dam SPA 161kV	Everton - St. Joe 161kV	0
Fairview - Gypsy 230kV	French Settlement - Sorrento 230kV	0
Bull Shoals - Bull Shoals Dam SPA 161kV	Harrison East - Everton 161kV	0
Russellville East - Russellville North 161kV	ANO - Fort Smith 500kV	0
Winnfield 230/115kV transformer	Clarence (CLECO) - Montgomery 230kV	0
Fairview - Gypsy 230kV	Front Street - Slidell 230kV	0
Russellville East - Russellville South 161kV	ANO - Fort Smith 500kV	0
Sterlington 500/115kV transformer 2	Eldorado EHV - Sterlington 500kV	0
French Settlement - Sorrento 230kV	Franklin - McKnight 500kV	0
St. Joe - Hilltop 161kV	Bull Shoals - Bull Shoals Dam SPA 161kV	0
St. Joe - Hilltop 161kV	Bull Shoals - Flippin 161kV	0
Fairview - Gypsy 230kV	Franklin - McKnight 500kV	0
Fairview - Gypsy 230kV	Bogalusa - Adams Creek 500/230kV transformer	0
Fairview - Gypsy 230kV	Bogalusa - Franklin 500kV	0
ANO - Russellville North 161kV	Morrilton East - Pleasant Hill 161kV	0
St. Joe - Hilltop 161kV	Flippin - Summit 161kV	0
Harrison East - Summit 161kV	St. Joe - Hilltop 161kV	0
Harrison East - Everton 161kV	Bull Shoals - Bull Shoals Dam SPA 161kV	0
Front Street - Michoud 230kV	Franklin - McKnight 500kV	0
Harrison East - Summit 161kV	Everton - St. Joe 161kV	0
Front Street - Michoud 230kV	Fairview - Gypsy 230kV	0
Harrison East - Everton 161kV	Bull Shoals - Flippin 161kV	0
Melborne - Sage 161kV	ANO - Fort Smith 500kV	0
Carroll 230/138kV transformer (CLECO)	Dolet Hills - S.W. Shreevport 345kV (CLECO)	0
Bull Shoals - Bull Shoals Dam SPA 161kV	Bull Shoals - Lead Hills 161kV	0
Harrison East - Summit 161kV	Harrison East - Everton 161kV	19
St. Joe - Hilltop 161kV	Eureka Springs - Osage Springs 161kV	27
St. Joe - Hilltop 161kV	Harrison East - Summit 161kV	31
Winnfield 230/115kV transformer	Clarence - Messick 230kV (CLECO)	35
Bull Shoals - Bull Shoals Dam SPA 161kV	Clevcov - Lead HL 161kV	37

LAF

Limiting Element	Contingency Element	ATC
Fairview - Gypsy 230kV	French Settlement - Sorrento 230kV	0
Semere - Scott2 138kV	Bonin - Labbe 230kV (LAF)	0
Fairview - Gypsy 230kV	Front Street - Slidell 230kV	0
North Crowley - Scott1 138kV	Bonin - Labbe 230kV (LAF)	0
Fairview - Gypsy 230kV	Franklin - McKnight 500kV	0
Colonial Academy - Richard 138kV	Bonin - Labbe 230kV (LAF)	0
Fairview - Gypsy 230kV	Bogalusa - Franklin 500kV	0
Fairview - Gypsy 230kV	Bogalusa - Adams Creek 500/230kV transformer	0
Fairview - Gypsy 230kV	French Settlement - Springfield 230kV	0
Semere - Scott2 138kV	Point Des Mouton - Wells 230kV	0
Semere - Scott2 138kV	Point Des Mouton (LAF) - Labbe (LAF) 230kV	0
North Crowley - Scott1 138kV	Point Des Mouton - Wells 230kV	0
Front Street - Michoud 230kV	Franklin - McKnight 500kV	0
North Crowley - Scott1 138kV	Point Des Mouton (LAF) - Labbe (LAF) 230kV	0
Richard - Scott 138kV	Bonin - Labbe 230kV (LAF)	0
Acadia - Colonial Academy 138kV	Bonin - Labbe 230kV (LAF)	0
Colonial Academy - Richard 138kV	Point Des Mouton - Wells 230kV	0
Front Street - Michoud 230kV	Fairview - Gypsy 230kV	0
Scott1 - Bonin 138kV	Bonin - Labbe 230kV (LAF)	0
Semere - Scott2 138kV	Wells 500/230kV transformer	0
North Crowley - Scott1 138kV	Richard - Scott 138kV	0
Colonial Academy - Richard 138kV	Point Des Mouton (LAF) - Labbe (LAF) 230kV	0
Habetz - Richard 138kV	Bonin - Labbe 230kV (LAF)	9
Acadia GSU - Scanlan 138kV	Bonin - Labbe 230kV (LAF)	12
Semere - Scott2 138kV	Greenwood - Terrebone 115kV	12
Richard - Scott 138kV	Point Des Mouton - Wells 230kV	13
Acadia - Colonial Academy 138kV	Point Des Mouton - Wells 230kV	15
Semere - Scott2 138kV	Bonin - Cecelia 138kV	15
North Crowley - Scott1 138kV	Wells 500/230kV transformer	23
Greenwood - Terrebone 115kV	Bonin - Labbe 230kV (LAF)	27
Scott1 - Bonin 138kV	Point Des Mouton - Wells 230kV	32
Semere - Scott2 138kV	Richard - Scott 138kV	38

LAGN

Limiting Element	Contingency Element	ATC
Fairview - Gypsy 230kV	French Settlement - Sorrento 230kV	0
Fairview - Gypsy 230kV	Front Street - Slidell 230kV	0
Fairview - Gypsy 230kV	Franklin - McKnight 500kV	0
Fairview - Gypsy 230kV	Bogalusa - Adams Creek 500/230kV transformer	0
Fairview - Gypsy 230kV	Bogalusa - Franklin 500kV	0
Fairview - Gypsy 230kV	French Settlement - Springfield 230kV	0
Front Street - Michoud 230kV	Franklin - McKnight 500kV	0
Front Street - Michoud 230kV	Fairview - Gypsy 230kV	0
Fairview - Madisonville 230kV	Greenwood - Terrebone 115kV	0

LEPA

Limiting Element	Contingency Element	ATC
Bonin 230/138kV transformer (LAFA)	Acadian - Bonin 230kV (LAFA)	0
Fairview - Gypsy 230kV	Front Street - Slidell 230kV	0
Bonin 230/138kV transformer (LAFA)	Flander - Acadian 230kV (LAFA)	0
Judice - Scott 138kV	Flander - Hopkins 138kV (CLECO/LAFA)	0
Judice - Scott 138kV	Greenwood - Terrebone 115kV	0
Front Street - Michoud 230kV	Fairview - Gypsy 230kV	0
Habetz - Richard 138kV	Bonin - Labbe 230kV (LAFA)	28

OKGE

Limiting Element	Contingency Element	ATC
International Paper - Mansfield 138kV (CLECO)	Dolet Hills - S.W. Shreevport 345kV (CLECO)	0
Hartburg 500/230kV transformer 1	Cypress - Hartburg 500kV	0
International Paper - Wallake 138kV (CLECO)	Dolet Hills - S.W. Shreevport 345kV (CLECO)	0
Ray Braswell - Grand Gulf 500kV	Baxter Wilson - Grand Gulf 500kV	0
'MANSFLD4 138' TO BUS 'IPAPER 4 138'	Contingency of FlowGate 5029 DOLHILL7 345 TO SW SHV 7 345	0
ANO - Russellville North 161kV	ANO - Fort Smith 500kV	0
Fairview - Gypsy 230kV	French Settlement - Sorrento 230kV	0
Winnfield 230/115kV transformer	Clarence (CLECO) - Montgomery 230kV	0
Fairview - Gypsy 230kV	Front Street - Slidell 230kV	0
Russellville East - Russellville North 161kV	ANO - Fort Smith 500kV	0
Russellville East - Russellville South 161kV	ANO - Fort Smith 500kV	0
French Settlement - Sorrento 230kV	Franklin - McKnight 500kV	0
Sterlington 500/115kV transformer 2	Eldorado EHV - Sterlington 500kV	0
Fairview - Gypsy 230kV	Franklin - McKnight 500kV	0
Fairview - Gypsy 230kV	Bogalusa - Adams Creek 500/230kV transformer	0
Fairview - Gypsy 230kV	Bogalusa - Franklin 500kV	0
Front Street - Michoud 230kV	Franklin - McKnight 500kV	0
Front Street - Michoud 230kV	Fairview - Gypsy 230kV	0
Melborne - Sage 161kV	ANO - Fort Smith 500kV	0
Carroll 230/138kV transformer (CLECO)	Dolet Hills - S.W. Shreevport 345kV (CLECO)	0
Winnfield 230/115kV transformer	Clarence - Messick 230kV (CLECO)	34

SWPA

Limiting Element	Contingency Element	ATC
Sterlington 500/115kV transformer 2	Eldorado EHV - Sterlington 500kV	0
International Paper - Mansfield 138kV (CLECO)	Dolet Hills - S.W. Shreevport 345kV (CLECO)	0
International Paper - Wallake 138kV (CLECO)	Dolet Hills - S.W. Shreevport 345kV (CLECO)	0
'MANSFLD4 138' TO BUS 'IPAPER 4 138'	Contingency of FlowGate 5029 DOLHILL7 345 TO SW SHV 7 345	0
ANO - Russellville North 161kV	ANO - Fort Smith 500kV	0
Ray Braswell - Grand Gulf 500kV	Baxter Wilson - Grand Gulf 500kV	0
Russellville East - Russellville North 161kV	ANO - Fort Smith 500kV	0
Russellville East - Russellville South 161kV	ANO - Fort Smith 500kV	0
Pleasant Hill 500/161kV transformer	ANO 500/161kV transformer	0
French Settlement - Sorrento 230kV	Franklin - McKnight 500kV	0
Jonesboro - Jonesboro North (AECC) 161kV	Hergett JCWL - Jonesboro 161kV	0
Fairview - Gypsy 230kV	French Settlement - Sorrento 230kV	0
Winnfield 230/115kV transformer	Clarence (CLECO) - Montgomery 230kV	0
Carroll 230/138kV transformer (CLECO)	Dolet Hills - S.W. Shreevport 345kV (CLECO)	0
Sterlington 500/115kV transformer 1	Eldorado EHV - Sterlington 500kV	0
ANO - Russellville North 161kV	Morrilton East - Pleasant Hill 161kV	0
Melborne - Sage 161kV	ANO - Fort Smith 500kV	0
Fairview - Gypsy 230kV	Front Street - Slidell 230kV	0
Danville - North Magazine REA 161kV	ANO - Fort Smith 500kV	0
Fairview - Gypsy 230kV	Bogalusa - Adams Creek 500/230kV transformer	0
Fairview - Gypsy 230kV	Bogalusa - Franklin 500kV	0
Fairview - Gypsy 230kV	Franklin - McKnight 500kV	0
Melborne - Sage 161kV	Newport - Newport Industrial 161kV	0
Jonesboro - Jonesboro North (AECC) 161kV	Independence SES - Moorefield 161kV	0
Melborne - Sage 161kV	Newport AB - Newport Industrial 161kV	0
Melborne - Sage 161kV	Dell - Independence SES 500kV	0
Fairview - Gypsy 230kV	French Settlement - Springfield 230kV	0
Melborne - Sage 161kV	Cash - Newport AB 161kV	0
Melborne - Sage 161kV	Newport - Swifton 161kV	0
Melborne - Sage 161kV	Cash - Jonesboro 161kV	0
Jonesboro - Jonesboro North (AECC) 161kV	Batesville - Moorefield 161kV	0
Calico Rock - Melborne 161kV	ANO - Fort Smith 500kV	0
Melborne - Sage 161kV	Plum Point - Shelby(TVA) 500kV	0
Melborne - Sage 161kV	Sage - Guion 161kV	0
Melborne - Sage 161kV	Hoxies AECC - Swifton 161 kV	0
Melborne - Sage 161kV	Independence SES - Keo 500kV	0
Melborne - Sage 161kV	Hoxies AECC - Walnut Ridge 161kV	0
Melborne - Sage 161kV	Mountain View - Guion 161kV	0
Calico Rock - Norfolk 161kV	ANO - Fort Smith 500kV	0
Melborne - Sage 161kV	Searcy Price 161/115kV transformer	6
Melborne - Sage 161kV	Water Valley SPA - Ash Flat 161kV	21
Melborne - Sage 161kV	Bee Branch AECC - Quitman 161kV	21
Russellville South - Dardanelle Dam 161kV	ANO - Fort Smith 500kV	24
Front Street - Michoud 230kV	Franklin - McKnight 500kV	29
Winnfield 230/115kV transformer	Clarence - Messick 230kV (CLECO)	30
Melborne - Sage 161kV	Bee Branch AECC - Clinton 161kV	39

SMEPA

Limiting Element	Contingency Element	ATC
Ray Braswell - Grand Gulf 500kV	Baxter Wilson - Grand Gulf 500kV	0
Lakeover 500/115kV transformer	Ray Braswell 500/115kV transformer 1	0
Ray Braswell 500/115kV transformer 1	Lakeover 500/115kV transformer	0
Ray Braswell 500/230kV transformer 2	Ray Braswell 500/230kV transformer 1	0
Ray Braswell 500/230kV transformer 1	Ray Braswell 500/230kV transformer 2	0
Lakeover 500/115kV transformer	Lakeover - McAdams 500kV	0
Lakeover 500/115kV transformer	Ray Braswell 500/230kV transformer 1	0
Lakeover 500/115kV transformer	Ray Braswell 500/230kV transformer 2	0
Ray Braswell 500/115kV transformer 1	Ray Braswell 500/230kV transformer 1	0
Ray Braswell 500/115kV transformer 1	Ray Braswell 500/230kV transformer 2	0
Lakeover 500/115kV transformer	Northside - Ray Braswell 230kV	0
French Settlement - Sorrento 230kV	Franklin - McKnight 500kV	0
Fairview - Gypsy 230kV	French Settlement - Sorrento 230kV	0
Lakeover 500/115kV transformer	Northside - Rex Brown 230kV	0
Fairview - Gypsy 230kV	Front Street - Slidell 230kV	0
Ray Braswell 500/230kV transformer 1	Ray Braswell 500/115kV transformer 1	0
Ray Braswell 500/230kV transformer 2	Ray Braswell 500/115kV transformer 1	0
Fairview - Gypsy 230kV	Bogalusa - Adams Creek 500/230kV transformer	0
Fairview - Gypsy 230kV	Bogalusa - Franklin 500kV	0
Fairview - Gypsy 230kV	Franklin - McKnight 500kV	0
Ray Braswell 500/230kV transformer 1	Lakeover 500/115kV transformer	0
Ray Braswell 500/230kV transformer 2	Lakeover 500/115kV transformer	0
French Settlement - Sorrento 230kV	Bogalusa - Adams Creek 500/230kV transformer	0
French Settlement - Sorrento 230kV	Bogalusa - Franklin 500kV	0
Fairview - Gypsy 230kV	French Settlement - Springfield 230kV	0
Front Street - Michoud 230kV	Franklin - McKnight 500kV	23

SOCO

Limiting Element	Contingency Element	ATC
Lakeover 500/115kV transformer	Lakeover - McAdams 500kV	0
Ray Braswell - Grand Gulf 500kV	Baxter Wilson - Grand Gulf 500kV	0
French Settlement - Sorrento 230kV	Franklin - McKnight 500kV	0
Fairview - Gypsy 230kV	French Settlement - Sorrento 230kV	0
Fairview - Gypsy 230kV	Front Street - Slidell 230kV	0
Fairview - Gypsy 230kV	Bogalusa - Adams Creek 500/230kV transformer	0
Fairview - Gypsy 230kV	Bogalusa - Franklin 500kV	0
Fairview - Gypsy 230kV	Franklin - McKnight 500kV	0
Fairview - Gypsy 230kV	French Settlement - Springfield 230kV	0
Front Street - Michoud 230kV	Franklin - McKnight 500kV	27

TVA

Limiting Element	Contingency Element	ATC
Lakeover 500/115kV transformer	Lakeover - McAdams 500kV	0
Ray Braswell - Grand Gulf 500kV	Baxter Wilson - Grand Gulf 500kV	0
French Settlement - Sorrento 230kV	Franklin - McKnight 500kV	0
Fairview - Gypsy 230kV	French Settlement - Sorrento 230kV	0
Fairview - Gypsy 230kV	Front Street - Slidell 230kV	0
Fairview - Gypsy 230kV	Bogalusa - Adams Creek 500/230kV transformer	0
Fairview - Gypsy 230kV	Bogalusa - Franklin 500kV	0
Fairview - Gypsy 230kV	Franklin - McKnight 500kV	0
Fairview - Gypsy 230kV	French Settlement - Springfield 230kV	0
Front Street - Michoud 230kV	Franklin - McKnight 500kV	27

APPENDIX A-E: DETAILS OF SCENARIO 3
 (With Future Projects and Without Pending Transmission Service & Study Request)

AECI

Limiting Element	Contingency Element	ATC
Livonia - Wilbert 138kV	Webre - Wells 500kV	0
Greenwood - Terrebone 115kV	Webre - Wells 500kV	0
Livonia - Line 642 Tap 138kV	Webre - Wells 500kV	0
Krotz Spring - Line 642 Tap 138kV	Webre - Wells 500kV	0
Greenwood - Humphery 115kV	Webre - Wells 500kV	0
Gibson - Humphrey 115kV	Webre - Wells 500kV	0
Sterlington 500/115kV transformer 2	Eldorado EHV - Sterlington 500kV	0
Champagne - Krotz Spring 138kV	Webre - Wells 500kV	0
Greenwood - Terrebone 115kV	Richard - Wells 500kV	0
Gibson - Ramos 138kV	Webre - Wells 500kV	0
Addis - Willow Glen 138kV	Webre - Wells 500kV	0
Livonia - Wilbert 138kV	Richard - Wells 500kV	0
Belle Point - Gypsy 230kV	Frisco - Waterford 230kV	0
Gibson 138/115kV transformer	Webre - Wells 500kV	0
Webre - Wells 500kV	Franklin - McKnight 500kV	0
Webre - Wells 500kV	Franklin - Mcknight 500kV	0
Greenwood - Humphery 115kV	Richard - Wells 500kV	0

AEPW

Limiting Element	Contingency Element	ATC
Greenwood - Terrebone 115kV	Webre - Wells 500kV	0
Livonia - Wilbert 138kV	Webre - Wells 500kV	0
Livonia - Line 642 Tap 138kV	Webre - Wells 500kV	0
Krotz Spring - Line 642 Tap 138kV	Webre - Wells 500kV	0
Greenwood - Humphery 115kV	Webre - Wells 500kV	0
Gibson - Humphrey 115kV	Webre - Wells 500kV	0
Champagne - East Opelousas 138kV	Webre - Wells 500kV	0
Sterlington 500/115kV transformer 2	Eldorado EHV - Sterlington 500kV	0
Greenwood - Terrebone 115kV	Richard - Wells 500kV	0
Champagne - Krotz Spring 138kV	Webre - Wells 500kV	0
Gibson - Ramos 138kV	Webre - Wells 500kV	0
Addis - Willow Glen 138kV	Webre - Wells 500kV	0
Livonia - Wilbert 138kV	Richard - Wells 500kV	0
Belle Point - Gypsy 230kV	Frisco - Waterford 230kV	0
Porter - Tamina 138kV	Oak Ridge - Porter 138kV	0
Gibson 138/115kV transformer	Webre - Wells 500kV	0
Webre - Wells 500kV	Franklin - McKnight 500kV	0
Greenwood - Humphery 115kV	Richard - Wells 500kV	0

AMRN

Limiting Element	Contingency Element	ATC
Livonia - Wilbert 138kV	Webre - Wells 500kV	0
Greenwood - Terrebone 115kV	Webre - Wells 500kV	0
Livonia - Line 642 Tap 138kV	Webre - Wells 500kV	0
Krotz Spring - Line 642 Tap 138kV	Webre - Wells 500kV	0
Greenwood - Humphery 115kV	Webre - Wells 500kV	0
Gibson - Humphrey 115kV	Webre - Wells 500kV	0
Sterlington 500/115kV transformer 2	Eldorado EHV - Sterlington 500kV	0
Champagne - Krotz Spring 138kV	Webre - Wells 500kV	0
Greenwood - Terrebone 115kV	Richard - Wells 500kV	0
Gibson - Ramos 138kV	Webre - Wells 500kV	0
Addis - Willow Glen 138kV	Webre - Wells 500kV	0
Livonia - Wilbert 138kV	Richard - Wells 500kV	0
Belle Point - Gypsy 230kV	Frisco - Waterford 230kV	0
Gibson 138/115kV transformer	Webre - Wells 500kV	0
Webre - Wells 500kV	Franklin - McKnight 500kV	0
Greenwood - Humphery 115kV	Richard - Wells 500kV	0

CLECO

Limiting Element	Contingency Element	ATC
Sterlington 500/115kV transformer 2	Eldorado EHV - Sterlington 500kV	0
Livonia - Wilbert 138kV	Webre - Wells 500kV	0
Greenwood - Terrebone 115kV	Webre - Wells 500kV	0
Champagne - East Opelousas 138kV	Webre - Wells 500kV	0
Livonia - Line 642 Tap 138kV	Webre - Wells 500kV	0
Krotz Spring - Line 642 Tap 138kV	Webre - Wells 500kV	0
Greenwood - Humphery 115kV	Webre - Wells 500kV	0
Gibson - Humphrey 115kV	Webre - Wells 500kV	0
Champagne - Krotz Spring 138kV	Webre - Wells 500kV	0
Greenwood - Terrebone 115kV	Richard - Wells 500kV	0
Gibson - Ramos 138kV	Webre - Wells 500kV	0
Addis - Willow Glen 138kV	Webre - Wells 500kV	0
Belle Point - Gypsy 230kV	Frisco - Waterford 230kV	0
Livonia - Wilbert 138kV	Richard - Wells 500kV	0
Gibson 138/115kV transformer	Webre - Wells 500kV	0
Webre - Wells 500kV	Franklin - McKnight 500kV	0
Greenwood - Humphery 115kV	Richard - Wells 500kV	0
Gibson - Humphrey 115kV	Richard - Wells 500kV	37

EES

Limiting Element	Contingency Element	ATC
Sterlington 500/115kV transformer 2	Sterlington 500/115kV transformer 1	0
Sterlington 500/115kV transformer 1	Sterlington 500/115kV transformer 2	0
Livonia - Wilbert 138kV	Webre - Wells 500kV	0
Greenwood - Terrebone 115kV	Webre - Wells 500kV	0
Livonia - Line 642 Tap 138kV	Webre - Wells 500kV	0
Krotz Spring - Line 642 Tap 138kV	Webre - Wells 500kV	0
Greenwood - Humphery 115kV	Webre - Wells 500kV	0
Gibson - Humphrey 115kV	Webre - Wells 500kV	0
Sterlington 500/115kV transformer 2	Eldorado EHV - Sterlington 500kV	0
Champagne - Krotz Spring 138kV	Webre - Wells 500kV	0
Greenwood - Terrebone 115kV	Richard - Wells 500kV	0
Gibson - Ramos 138kV	Webre - Wells 500kV	0
Addis - Willow Glen 138kV	Webre - Wells 500kV	0
Livonia - Wilbert 138kV	Richard - Wells 500kV	0
Belle Point - Gypsy 230kV	Frisco - Waterford 230kV	0
Gibson 138/115kV transformer	Webre - Wells 500kV	0
Webre - Wells 500kV	Franklin - McKnight 500kV	0
Greenwood - Humphery 115kV	Richard - Wells 500kV	0

EMDE

Limiting Element	Contingency Element	ATC
Livonia - Wilbert 138kV	Webre - Wells 500kV	0
Greenwood - Terrebone 115kV	Webre - Wells 500kV	0
Livonia - Line 642 Tap 138kV	Webre - Wells 500kV	0
Krotz Spring - Line 642 Tap 138kV	Webre - Wells 500kV	0
Greenwood - Humphery 115kV	Webre - Wells 500kV	0
Gibson - Humphrey 115kV	Webre - Wells 500kV	0
Sterlington 500/115kV transformer 2	Eldorado EHV - Sterlington 500kV	0
Champagne - Krotz Spring 138kV	Webre - Wells 500kV	0
Greenwood - Terrebone 115kV	Richard - Wells 500kV	0
Gibson - Ramos 138kV	Webre - Wells 500kV	0
Addis - Willow Glen 138kV	Webre - Wells 500kV	0
Livonia - Wilbert 138kV	Richard - Wells 500kV	0
Belle Point - Gypsy 230kV	Frisco - Waterford 230kV	0
Gibson 138/115kV transformer	Webre - Wells 500kV	0
Webre - Wells 500kV	Franklin - McKnight 500kV	0
Greenwood - Humphery 115kV	Richard - Wells 500kV	0

LAF A

Limiting Element	Contingency Element	ATC
Greenwood - Terrebone 115kV	Webre - Wells 500kV	0
Livonia - Wilbert 138kV	Webre - Wells 500kV	0
Livonia - Line 642 Tap 138kV	Webre - Wells 500kV	0
Greenwood - Humphery 115kV	Webre - Wells 500kV	0
Krotz Spring - Line 642 Tap 138kV	Webre - Wells 500kV	0
Gibson - Humphrey 115kV	Webre - Wells 500kV	0
Greenwood - Terrebone 115kV	Richard - Wells 500kV	0
Champagne - Krotz Spring 138kV	Webre - Wells 500kV	0
Champagne - East Opelousas 138kV	Webre - Wells 500kV	0
Gibson - Ramos 138kV	Webre - Wells 500kV	0
Addis - Willow Glen 138kV	Webre - Wells 500kV	0
Belle Point - Gypsy 230kV	Frisco - Waterford 230kV	0
Livonia - Wilbert 138kV	Richard - Wells 500kV	0
Gibson 138/115kV transformer	Webre - Wells 500kV	0
Webre - Wells 500kV	Franklin - McKnight 500kV	0
Greenwood - Humphery 115kV	Richard - Wells 500kV	0
Gibson - Humphrey 115kV	Richard - Wells 500kV	37

LAGN

Limiting Element	Contingency Element	ATC
Belle Point - Gypsy 230kV	Frisco - Waterford 230kV	0

LEPA

Limiting Element	Contingency Element	ATC
Greenwood - Terrebone 115kV	Webre - Wells 500kV	0
Greenwood - Humphery 115kV	Webre - Wells 500kV	0
Gibson - Humphrey 115kV	Webre - Wells 500kV	0
Belle Point - Gypsy 230kV	Frisco - Waterford 230kV	0
Greenwood - Terrebone 115kV	Richard - Wells 500kV	0
Gibson - Ramos 138kV	Webre - Wells 500kV	0
Webre - Wells 500kV	Franklin - McKnight 500kV	0
Addis - Willow Glen 138kV	Webre - Wells 500kV	0
Gibson 138/115kV transformer	Webre - Wells 500kV	0
Greenwood - Humphery 115kV	Richard - Wells 500kV	0
Gibson - Humphrey 115kV	Richard - Wells 500kV	17

OKGE

Limiting Element	Contingency Element	ATC
Livonia - Wilbert 138kV	Webre - Wells 500kV	0
Greenwood - Terrebone 115kV	Webre - Wells 500kV	0
Livonia - Line 642 Tap 138kV	Webre - Wells 500kV	0
Krotz Spring - Line 642 Tap 138kV	Webre - Wells 500kV	0
Greenwood - Humphery 115kV	Webre - Wells 500kV	0
Gibson - Humphrey 115kV	Webre - Wells 500kV	0
Sterlington 500/115kV transformer 2	Eldorado EHV - Sterlington 500kV	0
Champagne - Krotz Spring 138kV	Webre - Wells 500kV	0
Greenwood - Terrebone 115kV	Richard - Wells 500kV	0
Gibson - Ramos 138kV	Webre - Wells 500kV	0
Addis - Willow Glen 138kV	Webre - Wells 500kV	0
Livonia - Wilbert 138kV	Richard - Wells 500kV	0
Belle Point - Gypsy 230kV	Frisco - Waterford 230kV	0
Gibson 138/115kV transformer	Webre - Wells 500kV	0
Webre - Wells 500kV	Franklin - McKnight 500kV	0
Greenwood - Humphery 115kV	Richard - Wells 500kV	0

SWPA

Limiting Element	Contingency Element	ATC
Livonia - Wilbert 138kV	Webre - Wells 500kV	0
Greenwood - Terrebone 115kV	Webre - Wells 500kV	0
Livonia - Line 642 Tap 138kV	Webre - Wells 500kV	0
Krotz Spring - Line 642 Tap 138kV	Webre - Wells 500kV	0
Greenwood - Humphery 115kV	Webre - Wells 500kV	0
Gibson - Humphrey 115kV	Webre - Wells 500kV	0
Sterlington 500/115kV transformer 2	Eldorado EHV - Sterlington 500kV	0
Champagne - Krotz Spring 138kV	Webre - Wells 500kV	0
Greenwood - Terrebone 115kV	Richard - Wells 500kV	0
Gibson - Ramos 138kV	Webre - Wells 500kV	0
Addis - Willow Glen 138kV	Webre - Wells 500kV	0
Livonia - Wilbert 138kV	Richard - Wells 500kV	0
Belle Point - Gypsy 230kV	Frisco - Waterford 230kV	0
Gibson 138/115kV transformer	Webre - Wells 500kV	0
Webre - Wells 500kV	Franklin - McKnight 500kV	0
Greenwood - Humphery 115kV	Richard - Wells 500kV	0

SMEPA

Limiting Element	Contingency Element	ATC
Wells 500/230kV transformer	Richard - Wells 500kV	0
Greenwood - Terrebone 115kV	Webre - Wells 500kV	0
Greenwood - Humphery 115kV	Webre - Wells 500kV	0
Gibson - Humphrey 115kV	Webre - Wells 500kV	0
Greenwood - Terrebone 115kV	Richard - Wells 500kV	0
Gibson - Ramos 138kV	Webre - Wells 500kV	0
Belle Point - Gypsy 230kV	Frisco - Waterford 230kV	0
Gibson 138/115kV transformer	Webre - Wells 500kV	0
Webre - Wells 500kV	Franklin - McKnight 500kV	0
Greenwood - Humphery 115kV	Richard - Wells 500kV	0

SOCO

Limiting Element	Contingency Element	ATC
Livonia - Wilbert 138kV	Webre - Wells 500kV	0
Greenwood - Terrebone 115kV	Webre - Wells 500kV	0
Livonia - Line 642 Tap 138kV	Webre - Wells 500kV	0
Krotz Spring - Line 642 Tap 138kV	Webre - Wells 500kV	0
Greenwood - Humphery 115kV	Webre - Wells 500kV	0
Gibson - Humphrey 115kV	Webre - Wells 500kV	0
Champagne - Krotz Spring 138kV	Webre - Wells 500kV	0
Greenwood - Terrebone 115kV	Richard - Wells 500kV	0
Gibson - Ramos 138kV	Webre - Wells 500kV	0
Livonia - Wilbert 138kV	Richard - Wells 500kV	0
Belle Point - Gypsy 230kV	Frisco - Waterford 230kV	0
Gibson 138/115kV transformer	Webre - Wells 500kV	0
Webre - Wells 500kV	Franklin - McKnight 500kV	0
Greenwood - Humphery 115kV	Richard - Wells 500kV	0

TVA

Limiting Element	Contingency Element	ATC
Livonia - Wilbert 138kV	Webre - Wells 500kV	0
Greenwood - Terrebone 115kV	Webre - Wells 500kV	0
Livonia - Line 642 Tap 138kV	Webre - Wells 500kV	0
Krotz Spring - Line 642 Tap 138kV	Webre - Wells 500kV	0
Greenwood - Humphery 115kV	Webre - Wells 500kV	0
Gibson - Humphrey 115kV	Webre - Wells 500kV	0
Champagne - Krotz Spring 138kV	Webre - Wells 500kV	0
Greenwood - Terrebone 115kV	Richard - Wells 500kV	0
Gibson - Ramos 138kV	Webre - Wells 500kV	0
Addis - Willow Glen 138kV	Webre - Wells 500kV	0
Livonia - Wilbert 138kV	Richard - Wells 500kV	0
Belle Point - Gypsy 230kV	Frisco - Waterford 230kV	0
Gibson 138/115kV transformer	Webre - Wells 500kV	0
Webre - Wells 500kV	Franklin - McKnight 500kV	0
Greenwood - Humphery 115kV	Richard - Wells 500kV	0

APPENDIX A-F: DETAILS OF SCENARIO 4

(With Future Projects and With Pending Transmission Service & Study Request)

AECI

Limiting Element	Contingency Element	ATC
Russellville East - Russellville South 161kV	ANO - Fort Smith 500kV	0
Ray Braswell - Grand Gulf 500kV	Baxter Wilson - Grand Gulf 500kV	0
French Settlement - Sorrento 230kV	Franklin - McKnight 500kV	0
Fairview - Gypsy 230kV	French Settlement - Sorrento 230kV	0
French Settlement - Sorrento 230kV	Franklin - Mcknight 500kV	0
Winnfield 230/115kV transformer	Clarence (CLECO) - Montgomery 230kV	0
Fairview - Gypsy 230kV	Front Street - Slidell 230kV	0
Fairview - Gypsy 230kV	Bogalusa - Adams Creek 500/230kV transformer	0
Fairview - Gypsy 230kV	Bogalusa - Franklin 500kV	0
Fairview - Gypsy 230kV	Franklin - McKnight 500kV	0
Fairview - Gypsy 230kV	French Settlement - Springfield 230kV	0
French Settlement - Sorrento 230kV	Fairview - Gypsy 230kV	0
Fairview - Gypsy 230kV	Hammond - Springfield 230kV	0

AEPW

Limiting Element	Contingency Element	ATC
Porter - Tamina 138kV	Oak Ridge - Porter 138kV	0
Sterlington 500/115kV transformer 2	Eldorado EHV - Sterlington 500kV	0
Cedar Hill - Tamina 138kV	Oak Ridge - Porter 138kV	0
Plantation - Cedar Hill 138kV	Oak Ridge - Porter 138kV	0
ANO - Russellville North 161kV	ANO - Fort Smith 500kV	0
Hartburg 500/230kV transformer 1	Cypress - Hartburg 500kV	0
Conroe Bulk - Plantation 138kV	Oak Ridge - Porter 138kV	0
Russellville East - Russellville North 161kV	ANO - Fort Smith 500kV	0
Ray Braswell - Grand Gulf 500kV	Baxter Wilson - Grand Gulf 500kV	0
Russellville East - Russellville South 161kV	ANO - Fort Smith 500kV	0
International Paper - Mansfield 138kV (CLECO)	Dolet Hills - S.W. Shreevport 345kV (CLECO)	0
International Paper - Wallake 138kV (CLECO)	Dolet Hills - S.W. Shreevport 345kV (CLECO)	0
Porter - Tamina 138kV	Metro - Oak Ridge 138kV	0
'MANSFLD4 138' TO BUS 'IPAPER 4 138'	Contingency of FlowGate 5029 DOLHILL7 345 TO SW SHV 7 345	0
French Settlement - Sorrento 230kV	Franklin - McKnight 500kV	0
Fairview - Gypsy 230kV	French Settlement - Sorrento 230kV	0
French Settlement - Sorrento 230kV	Franklin - Mcknight 500kV	0
Sterlington 500/115kV transformer 1	Eldorado EHV - Sterlington 500kV	0
Cedar Hill - Tamina 138kV	Metro - Oak Ridge 138kV	0
Ruston East - Vienna 115kV	Eldorado EHV - Sterlington 500kV	0
Winnfield 230/115kV transformer	Clarence (CLECO) - Montgomery 230kV	0
Fairview - Gypsy 230kV	Front Street - Slidell 230kV	0
Danville - North Magazine REA 161kV	ANO - Fort Smith 500kV	0
Plantation - Cedar Hill 138kV	Metro - Oak Ridge 138kV	0
Fairview - Gypsy 230kV	Bogalusa - Adams Creek 500/230kV transformer	0

Limiting Element	Contingency Element	ATC
Fairview - Gypsy 230kV	Bogalusa - Franklin 500kV	0
Carroll 230/138kV transformer (CLECO)	Dolet Hills - S.W. Shreevport 345kV (CLECO)	0
Fairview - Gypsy 230kV	Franklin - McKnight 500kV	0
Fairview - Gypsy 230kV	French Settlement - Springfield 230kV	0
French Settlement - Sorrento 230kV	Fairview - Gypsy 230kV	0
Fairview - Gypsy 230kV	Hammond - Springfield 230kV	0
Russellville South - Dardanelle Dam 161kV	ANO - Fort Smith 500kV	35

AMRN

Limiting Element	Contingency Element	ATC
Russellville East - Russellville South 161kV	ANO - Fort Smith 500kV	0
Lakeover 500/115kV transformer	Lakeover - McAdams 500kV	0
Ray Braswell - Grand Gulf 500kV	Baxter Wilson - Grand Gulf 500kV	0
Fairview - Madisonville 230kV	French Settlement - Springfield 230kV	0
French Settlement - Sorrento 230kV	Franklin - McKnight 500kV	0
Fairview - Gypsy 230kV	French Settlement - Sorrento 230kV	0
Fairview - Gypsy 230kV	Front Street - Slidell 230kV	0
Fairview - Gypsy 230kV	Bogalusa - Adams Creek 500/230kV transformer	0
Fairview - Gypsy 230kV	Bogalusa - Franklin 500kV	0
Fairview - Gypsy 230kV	Franklin - McKnight 500kV	0
Fairview - Gypsy 230kV	French Settlement - Springfield 230kV	0
French Settlement - Sorrento 230kV	Fairview - Gypsy 230kV	0
Fairview - Gypsy 230kV	Hammond - Springfield 230kV	0

CLECO

Limiting Element	Contingency Element	ATC
Ray Braswell - Grand Gulf 500kV	Baxter Wilson - Grand Gulf 500kV	0
Sterlington 500/115kV transformer 2	Eldorado EHV - Sterlington 500kV	0
Hartburg 500/230kV transformer 1	Cypress - Hartburg 500kV	0
Fairview - Gypsy 230kV	French Settlement - Sorrento 230kV	0
Raceland - Coteau 115kV	Terrebone 230/115kV transformer	0
Sterlington 500/115kV transformer 1	Eldorado EHV - Sterlington 500kV	0
Fairview - Gypsy 230kV	Front Street - Slidell 230kV	0
Fairview - Gypsy 230kV	Bogalusa - Adams Creek 500/230kV transformer	0
Fairview - Gypsy 230kV	Bogalusa - Franklin 500kV	0
North Crowley - Scott1 138kV	Wells 500/230kV transformer	0
Fairview - Gypsy 230kV	Franklin - McKnight 500kV	0
French Settlement - Sorrento 230kV	Fairview - Gypsy 230kV	0
Fairview - Gypsy 230kV	French Settlement - Springfield 230kV	0
Fairview - Gypsy 230kV	Hammond - Springfield 230kV	0

EES

Limiting Element	Contingency Element	ATC
Sterlington 500/115kV transformer 2	Sterlington 500/115kV transformer 1	0
Sterlington 500/115kV transformer 1	Sterlington 500/115kV transformer 2	0
Sterlington 500/115kV transformer 2	Eldorado EHV - Sterlington 500kV	0
Ray Braswell 500/230kV transformer 2	Ray Braswell 500/230kV transformer 1	0
Ray Braswell 500/230kV transformer 1	Ray Braswell 500/230kV transformer 2	0
Ray Braswell - Grand Gulf 500kV	Baxter Wilson - Grand Gulf 500kV	0
Hartburg 500/230kV transformer 1	Cypress - Hartburg 500kV	0
French Settlement - Sorrento 230kV	Franklin - McKnight 500kV	0
Fairview - Gypsy 230kV	French Settlement - Sorrento 230kV	0
French Settlement - Sorrento 230kV	Franklin - Mcknight 500kV	0
Fairview - Gypsy 230kV	Front Street - Sidell 230kV	0
Fairview - Gypsy 230kV	Bogalusa - Adams Creek 500/230kV transformer	0
Fairview - Gypsy 230kV	Bogalusa - Franklin 500kV	0
Fairview - Gypsy 230kV	Franklin - McKnight 500kV	0
Fairview - Gypsy 230kV	French Settlement - Springfield 230kV	0
French Settlement - Sorrento 230kV	Fairview - Gypsy 230kV	0
Fairview - Gypsy 230kV	Hammond - Springfield 230kV	0

EMDE

Limiting Element	Contingency Element	ATC
Hartburg 500/230kV transformer 1	Cypress - Hartburg 500kV	0
Sterlington 500/115kV transformer 2	Eldorado EHV - Sterlington 500kV	0
International Paper - Mansfield 138kV (CLECO)	Dolet Hills - S.W. Shreevport 345kV (CLECO)	0
International Paper - Wallake 138kV (CLECO)	Dolet Hills - S.W. Shreevport 345kV (CLECO)	0
'MANSFLD4 138' TO BUS 'IPAPER 4 138'	Contingency of FlowGate 5029 DOLHILL7 345 TO SW SHV 7 345	0
ANO - Russellville North 161kV	ANO - Fort Smith 500kV	0
Pleasant Hill 500/161kV transformer	ANO 500/161kV transformer	0
Ray Braswell - Grand Gulf 500kV	Baxter Wilson - Grand Gulf 500kV	0
Russellville East - Russellville North 161kV	ANO - Fort Smith 500kV	0
Bull Shoals - Bull Shoals Dam SPA 161kV	St. Joe - Hilltop 161kV	0
Russellville East - Russellville South 161kV	ANO - Fort Smith 500kV	0
Bull Shoals - Bull Shoals Dam SPA 161kV	Everton - St. Joe 161kV	0
Bull Shoals - Bull Shoals Dam SPA 161kV	Harrison East - Everton 161kV	0
French Settlement - Sorrento 230kV	Franklin - McKnight 500kV	0
ANO - Russellville North 161kV	Morrilton East - Pleasant Hill 161kV	0
Fairview - Gypsy 230kV	French Settlement - Sorrento 230kV	0
St. Joe - Hilltop 161kV	Bull Shoals - Bull Shoals Dam SPA 161kV	0
St. Joe - Hilltop 161kV	Bull Shoals - Flippin 161kV	0
French Settlement - Sorrento 230kV	Franklin - Mcknight 500kV	0
Melborne - Sage 161kV	ANO - Fort Smith 500kV	0
St. Joe - Hilltop 161kV	Flippin - Summit 161kV	0
Harrison East - Summit 161kV	St. Joe - Hilltop 161kV	0
Winnfield 230/115kV transformer	Clarence (CLECO) - Montgomery 230kV	0
Harrison East - Everton 161kV	Bull Shoals - Bull Shoals Dam SPA 161kV	0

Limiting Element	Contingency Element	ATC
Harrison East - Summit 161kV	Everton - St. Joe 161kV	0
Harrison East - Everton 161kV	Bull Shoals - Flippin 161kV	0
Bull Shoals - Bull Shoals Dam SPA 161kV	Bull Shoals - Lead Hills 161kV	0
Carroll 230/138kV transformer (CLECO)	Dolet Hills - S.W. Shreevport 345kV (CLECO)	0
Harrison East - Summit 161kV	Harrison East - Everton 161kV	0
Fairview - Gypsy 230kV	Front Street - Slidell 230kV	0
Melborne - Sage 161kV	Newport - Newport Industrial 161kV	0
St. Joe - Hilltop 161kV	Harrison East - Summit 161kV	0
Danville - North Magazine REA 161kV	ANO - Fort Smith 500kV	0
Bull Shoals - Bull Shoals Dam SPA 161kV	Clevcov - Lead HL 161kV	0
St. Joe - Hilltop 161kV	Eureka Springs - Osage Springs 161kV	0
Melborne - Sage 161kV	Newport AB - Newport Industrial 161kV	0
Harrison East - Everton 161kV	Flippin - Summit 161kV	0
Fairview - Gypsy 230kV	Bogalusa - Adams Creek 500/230kV transformer	0
Fairview - Gypsy 230kV	Bogalusa - Franklin 500kV	0
Melborne - Sage 161kV	Dell - Independence SES 500kV	0
Melborne - Sage 161kV	Cash - Newport AB 161kV	0
Fairview - Gypsy 230kV	Franklin - McKnight 500kV	0
Fairview - Gypsy 230kV	French Settlement - Springfield 230kV	0
Melborne - Sage 161kV	Cash - Jonesboro 161kV	0
Melborne - Sage 161kV	Newport - Swifton 161kV	0
French Settlement - Sorrento 230kV	Fairview - Gypsy 230kV	0
Calico Rock - Melborne 161kV	ANO - Fort Smith 500kV	0
Melborne - Sage 161kV	Plum Point - Shelby(TVA) 500kV	0
Melborne - Sage 161kV	Sage - Guion 161kV	0
Melborne - Sage 161kV	Independence SES - Keo 500kV	0
Melborne - Sage 161kV	Hoxies AECC - Swifton 161 kV	0
Fairview - Gypsy 230kV	Hammond - Springfield 230kV	0
Melborne - Sage 161kV	Hoxies AECC - Walnut Ridge 161kV	0
Melborne - Sage 161kV	Mountain View - Guion 161kV	0
St. Joe - Hilltop 161kV	ANO - Fort Smith 500kV	0
Calico Rock - Norfolk 161kV	ANO - Fort Smith 500kV	0
Harrison East - Everton 161kV	Harrison East - Summit 161kV	4
Fairview - Gypsy 230kV	WESCO - Prospect 230kV	6
Melborne - Sage 161kV	Searcy Price 161/115kV transformer	7
Fairview - Gypsy 230kV	Bayou Steel - Gypsy 230kV	13
Fairview - Gypsy 230kV	Mount Olive - HartMountOlive Line tap 500kV	15
Melborne - Sage 161kV	Bee Branch AECC - Quitman 161kV	25
Melborne - Sage 161kV	Water Valley SPA - Ash Flat 161kV	25
Russellville South - Dardanelle Dam 161kV	ANO - Fort Smith 500kV	28

LAF

Limiting Element	Contingency Element	ATC
Fairview - Gypsy 230kV	French Settlement - Sorrento 230kV	0
Semere - Scott2 138kV	Bonin - Labbe 230kV (LAF)	0
Raceland - Coteau 115kV	Terrebone 230/115kV transformer	0
North Crowley - Scott1 138kV	Bonin - Labbe 230kV (LAF)	0
Colonial Academy - Richard 138kV	Bonin - Labbe 230kV (LAF)	0
Semere - Scott2 138kV	Point Des Mouton - Wells 230kV	0
Fairview - Gypsy 230kV	Front Street - Slidell 230kV	0
Semere - Scott2 138kV	Point Des Mouton (LAF) - Labbe (LAF) 230kV	0
Fairview - Gypsy 230kV	Franklin - McKnight 500kV	0
Fairview - Gypsy 230kV	Bogalusa - Adams Creek 500/230kV transformer	0
Fairview - Gypsy 230kV	Bogalusa - Franklin 500kV	0
Acadia - Colonial Academy 138kV	Bonin - Labbe 230kV (LAF)	0
North Crowley - Scott1 138kV	Point Des Mouton - Wells 230kV	0
Richard - Scott 138kV	Bonin - Labbe 230kV (LAF)	0
North Crowley - Scott1 138kV	Point Des Mouton (LAF) - Labbe (LAF) 230kV	0
North Crowley - Scott1 138kV	Richard - Scott 138kV	0
Semere - Scott2 138kV	Bonin - Cecelia 138kV	0
Fairview - Gypsy 230kV	French Settlement - Springfield 230kV	0
Semere - Scott2 138kV	Wells 500/230kV transformer	0
Colonial Academy - Richard 138kV	Point Des Mouton - Wells 230kV	0
Colonial Academy - Richard 138kV	Point Des Mouton (LAF) - Labbe (LAF) 230kV	0
Acadia GSU - Scanlan 138kV	Bonin - Labbe 230kV (LAF)	0
Semere - Scott2 138kV	Richard - Scott 138kV	0
Semere - Scott2 138kV	Flander - Hopkins 138kV (CLECO/LAF)	0
Habetz - Richard 138kV	Bonin - Labbe 230kV (LAF)	0
Scott1 - Bonin 138kV	Bonin - Labbe 230kV (LAF)	0
Semere - Scott2 138kV	North Crowley - Richard 138kV	0
Semere - Scott2 138kV	Greenwood - Terrebone 115kV	0
Fairview - Gypsy 230kV	Hammond - Springfield 230kV	0
North Crowley - Scott1 138kV	Wells 500/230kV transformer	0
Semere - Scott2 138kV	Habetz - Richard 138kV	0
North Crowley - Richard 138kV	Bonin - Labbe 230kV (LAF)	0
Acadia - Colonial Academy 138kV	Point Des Mouton - Wells 230kV	0
Richard - Scott 138kV	Point Des Mouton - Wells 230kV	0
Semere - Scott2 138kV	North Crowley - Scott1 138kV	0
Semere - Scott2 138kV	Bonin 230/138kV transformer (LAF)	0
Acadia - Colonial Academy 138kV	Point Des Mouton (LAF) - Labbe (LAF) 230kV	0
Richard - Scott 138kV	Point Des Mouton (LAF) - Labbe (LAF) 230kV	0
Semere - Scott2 138kV	Wells 500/230kV transformer	0
Semere - Scott2 138kV	Greenwood - Humphery 115kV	5
Acadia GSU - Scanlan 138kV	Point Des Mouton - Wells 230kV	11
Semere - Scott2 138kV	Judice - Scott 138kV	14
Semere - Scott2 138kV	Flander - Habetz 138kV (CLECO/LAF)	16
Scott1 - Bonin 138kV	Point Des Mouton - Wells 230kV	22
Habetz - Richard 138kV	Point Des Mouton - Wells 230kV	31
North Crowley - Richard 138kV	Point Des Mouton - Wells 230kV	38
Acadia GSU - Scanlan 138kV	Point Des Mouton (LAF) - Labbe (LAF) 230kV	40

LAGN

Limiting Element	Contingency Element	ATC
Fairview - Gypsy 230kV	French Settlement - Sorrento 230kV	0
Fairview - Gypsy 230kV	Front Street - Slidell 230kV	0
Fairview - Gypsy 230kV	Franklin - McKnight 500kV	0
Fairview - Gypsy 230kV	Bogalusa - Adams Creek 500/230kV transformer	0
Fairview - Gypsy 230kV	Bogalusa - Franklin 500kV	0
Fairview - Gypsy 230kV	French Settlement - Springfield 230kV	0
Fairview - Gypsy 230kV	Hammond - Springfield 230kV	0

LEPA

Limiting Element	Contingency Element	ATC
Bonin 230/138kV transformer (LAFA)	Acadian - Bonin 230kV (LAFA)	0
Bonin 230/138kV transformer (LAFA)	Flander - Acadian 230kV (LAFA)	0
Judice - Scott 138kV	Flander - Hopkins 138kV (CLECO/LAFA)	0
Judice - Scott 138kV	Greenwood - Terrebone 115kV	0
Habetz - Richard 138kV	Bonin - Labbe 230kV (LAFA)	0
Judice - Scott 138kV	Greenwood - Humphery 115kV	0
Judice - Scott 138kV	Gibson - Humphrey 115kV	0
Chauvin - Ashland 115kV	Coteau - Houma 115kV	0
Raceland - Coteau 115kV	Terrebone 230/115kV transformer	0
Judice - Scott 138kV	Gibson - Ramos 138kV	0
Judice - Scott 138kV	Gibson 138/115kV transformer	0
West New Roads - NewRoads (LEPA) 230kV	Ritchie - Tunica 230kV	0
West New Roads - NewRoads (LEPA) 230kV	Jena - Midway 115kV	0
West New Roads - NewRoads (LEPA) 230kV	Fish Creek - Longmire 138kV	0
West New Roads - NewRoads (LEPA) 230kV	Jena - Standard 115kV	0
West New Roads - NewRoads (LEPA) 230kV	Bishop - Cedar 138kV	0
West New Roads - NewRoads (LEPA) 230kV	Black River - South Ferriday Tap 115kV	0
West New Roads - NewRoads (LEPA) 230kV	Plantation - South Ferriday Tap 115kV	0
West New Roads - NewRoads (LEPA) 230kV	Plantation - Vidalia 115kV	0
West New Roads - NewRoads (LEPA) 230kV	Murray Hydro - Plantation 115kV	0
West New Roads - NewRoads (LEPA) 230kV	Red Gum - Metropolis 115kV	0
West New Roads - NewRoads (LEPA) 230kV	Red Gum - Standard 115kV	0
West New Roads - NewRoads (LEPA) 230kV	LINE 558 TAP - MT. Zion 138 kV	0
West New Roads - NewRoads (LEPA) 230kV	Metropolis - Wisner 115kV	0
West New Roads - NewRoads (LEPA) 230kV	Temco - EVGRN* 138kV	0
West New Roads - NewRoads (LEPA) 230kV	Winnsboro - Alto 115kV	0
West New Roads - NewRoads (LEPA) 230kV	Georgia - Temco 138kV	0
West New Roads - NewRoads (LEPA) 230kV	Alto - Swartz 115kV	0
West New Roads - NewRoads (LEPA) 230kV	Lacon - Lewis Creek SES 138kV	0
West New Roads - NewRoads (LEPA) 230kV	Columbia - Riverton 115kV	0
West New Roads - NewRoads (LEPA) 230kV	Caney Creek - Lewis Creek SES 138kV	0
Judice - Meaux 138kV	Flander - Hopkins 138kV (CLECO/LAFA)	0
Judice - Scott 138kV	Moril - Cecelia 138kV	23
Terrebone 230/115kV transformer	Raceland - Coteau 115kV	38

OKGE

Limiting Element	Contingency Element	ATC
Hartburg 500/230kV transformer 1	Cypress - Hartburg 500kV	0
Sterlington 500/115kV transformer 2	Eldorado EHV - Sterlington 500kV	0
International Paper - Mansfield 138kV (CLECO)	Dolet Hills - S.W. Shreevport 345kV (CLECO)	0
International Paper - Wallake 138kV (CLECO)	Dolet Hills - S.W. Shreevport 345kV (CLECO)	0
'MANSFLD4 138' TO BUS 'IPAPER 4 138'	Contingency of FlowGate 5029 DOLHILL7 345 TO SW SHV 7 345	0
ANO - Russellville North 161kV	ANO - Fort Smith 500kV	0
Ray Braswell - Grand Gulf 500kV	Baxter Wilson - Grand Gulf 500kV	0
Russellville East - Russellville North 161kV	ANO - Fort Smith 500kV	0
Russellville East - Russellville South 161kV	ANO - Fort Smith 500kV	0
French Settlement - Sorrento 230kV	Franklin - McKnight 500kV	0
Fairview - Gypsy 230kV	French Settlement - Sorrento 230kV	0
Melborne - Sage 161kV	ANO - Fort Smith 500kV	0
French Settlement - Sorrento 230kV	Franklin - Mcknight 500kV	0
Sterlington 500/115kV transformer 1	Eldorado EHV - Sterlington 500kV	0
Winnfield 230/115kV transformer	Clarence (CLECO) - Montgomery 230kV	0
Fairview - Gypsy 230kV	Front Street - Slidell 230kV	0
Carroll 230/138kV transformer (CLECO)	Dolet Hills - S.W. Shreevport 345kV (CLECO)	0
Fairview - Gypsy 230kV	Bogalusa - Adams Creek 500/230kV transformer	0
Fairview - Gypsy 230kV	Bogalusa - Franklin 500kV	0
Danville - North Magazine REA 161kV	ANO - Fort Smith 500kV	0
Fairview - Gypsy 230kV	Franklin - McKnight 500kV	0
Fairview - Gypsy 230kV	French Settlement - Springfield 230kV	0
Calico Rock - Melborne 161kV	ANO - Fort Smith 500kV	0
French Settlement - Sorrento 230kV	Fairview - Gypsy 230kV	0
BUS 'BRKN BW4 138' TO BUS 'BETHEL 4 138'	BUS 'VALIANT7 345' TO BUS 'PITTSB-7 345'	0
Fairview - Gypsy 230kV	Hammond - Springfield 230kV	0
St. Joe - Hilltop 161kV	ANO - Fort Smith 500kV	0
Calico Rock - Norfolk 161kV	ANO - Fort Smith 500kV	0
Russellville South - Dardanelle Dam 161kV	ANO - Fort Smith 500kV	25

SWPA

Limiting Element	Contingency Element	ATC
Hartburg 500/230kV transformer 1	Cypress - Hartburg 500kV	0
Sterlington 500/115kV transformer 2	Eldorado EHV - Sterlington 500kV	0
International Paper - Mansfield 138kV (CLECO)	Dolet Hills - S.W. Shreevport 345kV (CLECO)	0
International Paper - Wallake 138kV (CLECO)	Dolet Hills - S.W. Shreevport 345kV (CLECO)	0
'MANSFLD4 138' TO BUS 'IPAPER 4 138'	Contingency of FlowGate 5029 DOLHILL7 345 TO SW SHV 7 345	0
ANO - Russellville North 161kV	ANO - Fort Smith 500kV	0
Ray Braswell - Grand Gulf 500kV	Baxter Wilson - Grand Gulf 500kV	0
Fairview - Madisonville 230kV	French Settlement - Springfield 230kV	0
French Settlement - Sorrento 230kV	Franklin - McKnight 500kV	0
Russellville East - Russellville North 161kV	ANO - Fort Smith 500kV	0
Jonesboro - Jonesboro North (AECC) 161kV	Hergett JCWL - Jonesboro 161kV	0
Russellville East - Russellville South 161kV	ANO - Fort Smith 500kV	0
Pleasant Hill 500/161kV transformer	ANO 500/161kV transformer	0
Fairview - Gypsy 230kV	French Settlement - Sorrento 230kV	0
Sterlington 500/115kV transformer 1	Eldorado EHV - Sterlington 500kV	0
French Settlement - Sorrento 230kV	Franklin - Mcknight 500kV	0
Winnfield 230/115kV transformer	Clarence (CLECO) - Montgomery 230kV	0
ANO - Russellville North 161kV	Morrilton East - Pleasant Hill 161kV	0
Melborne - Sage 161kV	ANO - Fort Smith 500kV	0
Danville - North Magazine REA 161kV	ANO - Fort Smith 500kV	0
Carroll 230/138kV transformer (CLECO)	Dolet Hills - S.W. Shreevport 345kV (CLECO)	0
Fairview - Gypsy 230kV	Front Street - Slidell 230kV	0
Jonesboro - Jonesboro North (AECC) 161kV	Independence SES - Moorefield 161kV	0
Fairview - Gypsy 230kV	Bogalusa - Adams Creek 500/230kV transformer	0
Fairview - Gypsy 230kV	Bogalusa - Franklin 500kV	0
Melborne - Sage 161kV	Newport - Newport Industrial 161kV	0
Fairview - Gypsy 230kV	Franklin - McKnight 500kV	0
Melborne - Sage 161kV	Newport AB - Newport Industrial 161kV	0
Fairview - Gypsy 230kV	French Settlement - Springfield 230kV	0
Melborne - Sage 161kV	Dell - Independence SES 500kV	0
French Settlement - Sorrento 230kV	Fairview - Gypsy 230kV	0
Melborne - Sage 161kV	Cash - Newport AB 161kV	0
Jonesboro - Jonesboro North (AECC) 161kV	Batesville - Moorefield 161kV	0
Melborne - Sage 161kV	Newport - Swifton 161kV	0
Melborne - Sage 161kV	Cash - Jonesboro 161kV	0
Calico Rock - Melborne 161kV	ANO - Fort Smith 500kV	0
Melborne - Sage 161kV	Plum Point - Shelby(TVA) 500kV	0
Fairview - Gypsy 230kV	Hammond - Springfield 230kV	0
Melborne - Sage 161kV	Sage - Guion 161kV	0
Melborne - Sage 161kV	Independence SES - Keo 500kV	0
Melborne - Sage 161kV	Hoxies AECC - Swifton 161 kV	0
St. Joe - Hilltop 161kV	ANO - Fort Smith 500kV	0
Melborne - Sage 161kV	Hoxies AECC - Walnut Ridge 161kV	0
Melborne - Sage 161kV	Mountain View - Guion 161kV	0

Limiting Element	Contingency Element	ATC
Calico Rock - Norfolk 161kV	ANO - Fort Smith 500kV	0
Melborne - Sage 161kV	Searcy Price 161/115kV transformer	5
Melborne - Sage 161kV	Water Valley SPA - Ash Flat 161kV	18
Melborne - Sage 161kV	Bee Branch AECC - Quitman 161kV	19
Russellville South - Dardanelle Dam 161kV	ANO - Fort Smith 500kV	21
Melborne - Sage 161kV	Bee Branch AECC - Clinton 161kV	35

SMEPA

Limiting Element	Contingency Element	ATC
Ray Braswell - Grand Gulf 500kV	Baxter Wilson - Grand Gulf 500kV	0
Lakeover 500/115kV transformer	Ray Braswell 500/115kV transformer 1	0
Ray Braswell 500/115kV transformer 1	Lakeover 500/115kV transformer	0
Ray Braswell 500/230kV transformer 1	Ray Braswell 500/230kV transformer 2	0
Ray Braswell 500/230kV transformer 2	Ray Braswell 500/230kV transformer 1	0
Lakeover 500/115kV transformer	Lakeover - McAdams 500kV	0
Lakeover 500/115kV transformer	Ray Braswell 500/230kV transformer 2	0
Lakeover 500/115kV transformer	Ray Braswell 500/230kV transformer 1	0
Ray Braswell 500/115kV transformer 1	Ray Braswell 500/230kV transformer 1	0
Ray Braswell 500/115kV transformer 1	Ray Braswell 500/230kV transformer 2	0
French Settlement - Sorrento 230kV	Franklin - McKnight 500kV	0
Lakeover 500/115kV transformer	Northside - Ray Braswell 230kV	0
Fairview - Gypsy 230kV	French Settlement - Sorrento 230kV	0
French Settlement - Sorrento 230kV	Franklin - Mcknight 500kV	0
Lakeover 500/115kV transformer	Northside - Rex Brown 230kV	0
French Settlement - Sorrento 230kV	Bogalusa - Adams Creek 500/230kV transformer	0
French Settlement - Sorrento 230kV	Bogalusa - Franklin 500kV	0
Ray Braswell 500/230kV transformer 1	Ray Braswell 500/115kV transformer 1	0
Ray Braswell 500/230kV transformer 2	Ray Braswell 500/115kV transformer 1	0
Fairview - Gypsy 230kV	Front Street - Slidell 230kV	0
Ray Braswell 500/230kV transformer 1	Lakeover 500/115kV transformer	0
Ray Braswell 500/230kV transformer 2	Lakeover 500/115kV transformer	0
Fairview - Gypsy 230kV	Franklin - McKnight 500kV	0
Fairview - Gypsy 230kV	Bogalusa - Adams Creek 500/230kV transformer	0
Fairview - Gypsy 230kV	Bogalusa - Franklin 500kV	0
Fairview - Gypsy 230kV	French Settlement - Springfield 230kV	0
French Settlement - Sorrento 230kV	Fairview - Gypsy 230kV	0
Fairview - Gypsy 230kV	Hammond - Springfield 230kV	0
Front Street - Michoud 230kV	Franklin - McKnight 500kV	38

SOCO

Limiting Element	Contingency Element	ATC
Lakeover 500/115kV transformer	Lakeover - McAdams 500kV	0
Ray Braswell - Grand Gulf 500kV	Baxter Wilson - Grand Gulf 500kV	0
Fairview - Madisonville 230kV	French Settlement - Springfield 230kV	0
French Settlement - Sorrento 230kV	Franklin - McKnight 500kV	0
Fairview - Gypsy 230kV	French Settlement - Sorrento 230kV	0
French Settlement - Sorrento 230kV	Bogalusa - Adams Creek 500/230kV transformer	0
French Settlement - Sorrento 230kV	Bogalusa - Franklin 500kV	0
Fairview - Gypsy 230kV	Front Street - Slidell 230kV	0
Fairview - Gypsy 230kV	Bogalusa - Adams Creek 500/230kV transformer	0
Fairview - Gypsy 230kV	Bogalusa - Franklin 500kV	0
Fairview - Gypsy 230kV	Franklin - McKnight 500kV	0
Fairview - Gypsy 230kV	French Settlement - Springfield 230kV	0
French Settlement - Sorrento 230kV	Fairview - Gypsy 230kV	0
Fairview - Gypsy 230kV	Hammond - Springfield 230kV	0

TVA

Limiting Element	Contingency Element	ATC
Lakeover 500/115kV transformer	Lakeover - McAdams 500kV	0
Ray Braswell - Grand Gulf 500kV	Baxter Wilson - Grand Gulf 500kV	0
French Settlement - Sorrento 230kV	Franklin - McKnight 500kV	0
French Settlement - Sorrento 230kV	Bogalusa - Adams Creek 500/230kV transformer	0
French Settlement - Sorrento 230kV	Bogalusa - Franklin 500kV	0
Fairview - Gypsy 230kV	French Settlement - Sorrento 230kV	0
Fairview - Gypsy 230kV	Front Street - Slidell 230kV	0
Fairview - Gypsy 230kV	Bogalusa - Adams Creek 500/230kV transformer	0
Fairview - Gypsy 230kV	Bogalusa - Franklin 500kV	0
Fairview - Gypsy 230kV	Franklin - McKnight 500kV	0
Fairview - Gypsy 230kV	French Settlement - Springfield 230kV	0
French Settlement - Sorrento 230kV	Fairview - Gypsy 230kV	0
Fairview - Gypsy 230kV	Hammond - Springfield 230kV	0

IV. Stability Analysis

ABB Inc – Grid Systems Consulting Technical Report

Southwest Power Pool	No. 2007-11699-R0	
Stability Study for PID-213	3/20/2008	# Pages 66

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Executive Summary

Southwest Power Pool (SPP) has commissioned ABB Inc. to perform a stability study for PID-213, which is an interconnection request for 40.7 MW of generation at the Waterford 230 kV bus in the Entergy transmission system. The feasibility (power flow) study was not performed as a part of this study.

The objective of this study was to evaluate the impact of proposed PID-213 (40.7 MW) on system stability and the nearby transmission system and generating stations. The study was performed on 2012 Summer Peak case, provided by SPP/Entergy.

System was stable following all simulated faults *except* Fault_6a, a 3-phase stuck breaker (3PH1PH-IPO) fault involving loss of Waterford 500/230 kV transformer.

System was found to be UNSTABLE following Fault_6a in both pre- and post-project system conditions. A sensitivity analysis was performed with a faster fault clearing time and reduced local generation. The system was found to be STABLE in both PRE and POST Project cases.

Voltage criteria violations were observed following one normally cleared - Fault_6, fault involving loss of Waterford 500/230 kV transformer - and few three phase stuck breaker faults (3PH1PH-IPO) in both Pre and Post Project cases. No voltage criteria violations were observed following stuck breaker single-line-to-ground faults and other normally cleared three-phase faults.

Based on the results of stability analysis it can be concluded that interconnection of the proposed PID-213 (40.7 MW) generation at the Waterford 230 kV bus does not adversely impact the stability of the Entergy System at reduced generation level 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.

A. INTRODUCTION

SPP has commissioned ABB Inc. to perform a stability study for PID-213, which is an interconnection request for 40.7 MW of generation at the Waterford 230 kV bus in the Entergy transmission system. 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 on system stability after connecting the additional 40.7 MW generation and its impact on the nearby transmission system and generating stations. The study is performed on 2012 Summer Peak case, provided by Entergy. Figure 1-1 shows a one-line of the proposed interconnection with the existing network.

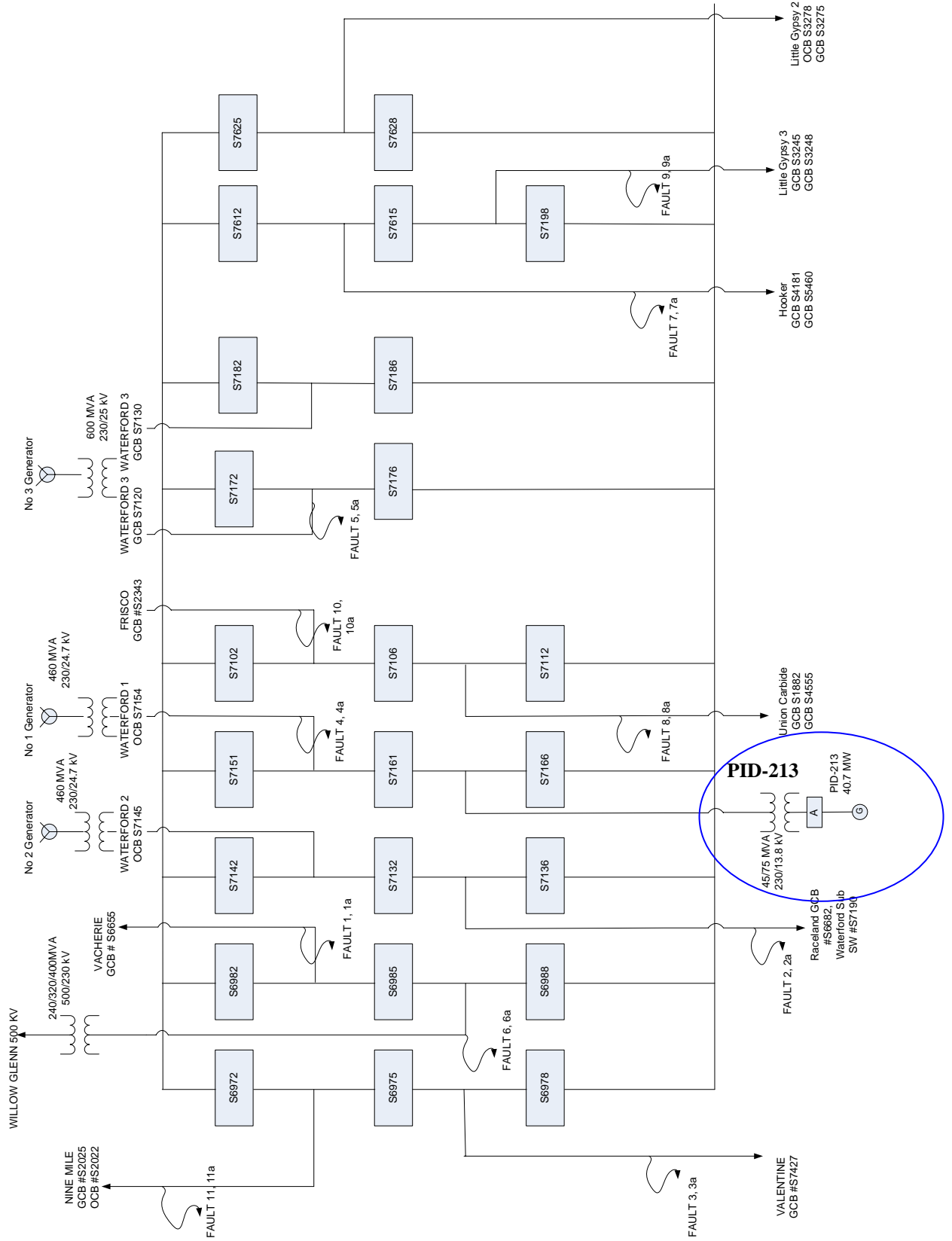


Figure 0-1 Waterford 230 kV substation layout with PID-213

B. STABILITY ANALYSIS

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/ETM dynamics program V29.4.0. Three-phase and single-phase line faults were simulated for the specified durations and the synchronous machine rotor angles were monitored to make sure they maintained synchronism following the fault removal.

All the breakers at Waterford 230 kV substation are Independent Pole Operated (IPO) breakers. Based on the Entergy study criteria, three-phase faults with normal clearing and three phase stuck breaker with IPO breaker (3PH-1PH) were simulated

The 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).

2. STUDY MODEL DEVELOPMENT

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

Power Flow Case

A Powerflow case (pid213-u1-peak.sav) representing the 2012 Summer Peak conditions was provided by SPP/ Entergy.

The proposed PID-213 project will be connected to the 230 kV Waterford bus (98537) with a 230/13.8 kV transformer. The proposed project was added to the pre-project cases and the generation was dispatched against the White Bluff Unit 1. [Table 2-1](#) summarizes the dispatch. Thus a post-project power flow case with PID-213 was established:

- Post_pid213-u1-peak.sav – a 2012 summer peak case

Table 0-1: PID-213 project details

System condition	MW	Point of Interconnection	Sink
Summer Peak	40.7	Waterford 230 kV Substation (#98537)	White Bluff (#99343)

[Figure 2-1](#) and [Figure 2-2](#) show the PSS/E one-line diagrams for the local area without and with the PID-213 project, respectively, for 2012 Summer Peak system conditions.

Stability Database

The pre-project stability database (SERC_old_bus_numbers.dyr) was provided by SPP/Entergy.

The stability data for PID-213 was appended to the pre-project data.

The data provided at the Interconnection Request of PID-213 is included in [Appendix A](#). The PSS/E power flow and stability data for PID-213, used for this study, are included in [Appendix B](#).

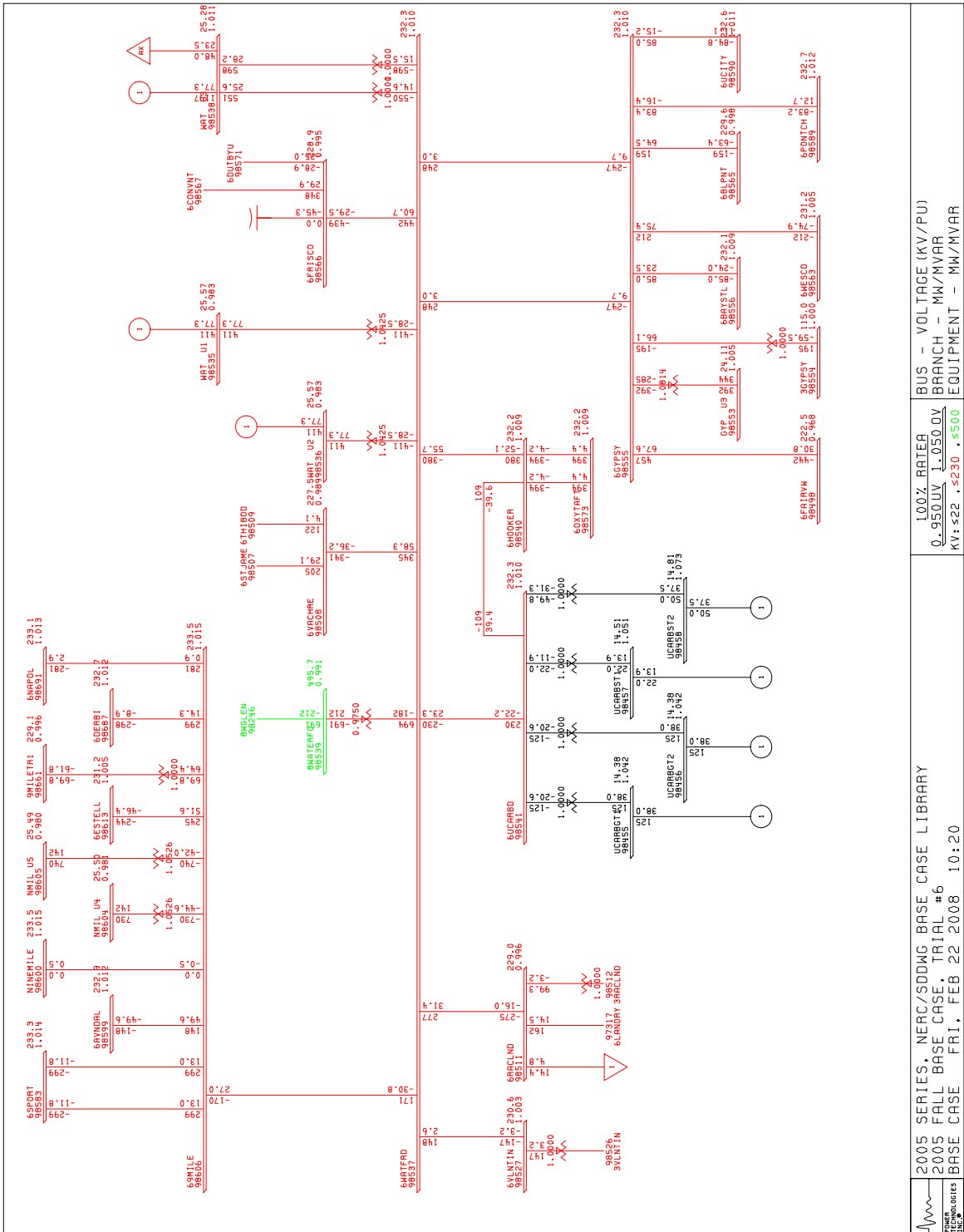


Figure 0-1 2012 Summer Peak Flows and Voltages without PID-213

3. TRANSIENT STABILITY ANALYSIS

Stability simulations were run to examine the transient behavior of the PID-213 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 three phase fault (3PH-1PH) with independent pole operated conditions were simulated. If a 3PH-1PH fault was found to be unstable, then a single-line-to-ground (SLG) fault followed by breaker failure was studied. This procedure is being followed since if the units are stable for a more severe fault (such as three phase fault with breaker failure) then the need to study stability for a less severe fault (such as SLG fault with breaker failure) does not arise. The fault clearing times used for the simulations are given in [Table 2-2](#).

Table 2-2: Fault Clearing Times

Contingency at kV level	Normal Clearing	Delayed Clearing
230	6 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 three-phase stuck-breakers. The 3-phase fault is replaced by a single-line-to-ground fault (2 phases of the faulted-end breaker clear and one phase sticks).
- 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-213 plant.

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

[Table 2-3](#) and [Table 2-4](#) list all the fault cases that were simulated in this study. Fault scenarios were formulated by examining the system configuration shown in [Figure 1-2](#).

Faults 1 through 11 represent the normal clearing 3-phase faults. Faults 1a through 11a represent the 3-phase stuck breaker cases with the appropriate delayed back-up clearing times. Faults 1b through 11b represent the stuck breaker single-line-to-ground faults with the appropriate delayed back-up clearing times.

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

Table 2-3: Fault Cases Simulated for Post-project Case: 3-phase faults with normal clearing

CASE	Prior Outage Element	LOCATION	TYPE	CLEARING TIME (cycles)	PRIMARY BRK TRIP #	TRIPPED FACILITIES	Stable ?	Acceptable Voltages ?
				PRIMARY				
FAULT_1	--	Waterford - Vacherie 230 kV	3PH	6	BRK S6982, S6985, GCB #S6665	Waterford - Vacherie 230 kV	YES	YES
FAULT_2	--	Waterford - Raceland 230 kV	3PH	6	BRK S7136, S7132, GCB #S6682	Waterford - Raceland 230 kV	YES	YES
FAULT_3	--	Waterford - Valentine 230 kV	3PH	6	BRK S6978, S6975, GCB S7427	Waterford - Valentine 230 kV	YES	YES
FAULT_4	--	Waterford 230/26 kV; U1	3PH	6	BRK S7161, BRK S7151, OCB 7154	Waterford 230/26 kV transformer ; U1 (411 MW)	YES	YES
FAULT_5	--	Waterford 230/25 kV transformer #1 (Transformer for U3)	3PH	6	BRK S7176, S7172, GCB #S7120	Waterford 230/25 kV transformer #1 (Transformer for U3)	YES	YES
FAULT_6	--	Waterford 500/230 kV transformer	3PH	6	BRK S6988, S6985, ACB #13015, GCB #13345	Waterford 500/230 kV transformer; Waterford - W. Glenn 500 kV	YES	NO
FAULT_7	--	Waterford - Hooker 230 kV	3PH	6	BRK S7612, S7615, GCB #S4181, S5460	Waterford - Hooker 500 kV	YES	YES
FAULT_8	--	Waterford - Union Carbide 230 kV	3PH	6	BRK S7106, S7112, GCB #S1882, S4555	Waterford - Union Carbide 500 kV	YES	YES
FAULT_9	--	Waterford - Gypsy 230 kV	3PH	6	BRK S7198, S7615, GCB #S3245, S3248	Waterford - Gypsy 230 kV	YES	YES
FAULT_10	--	Waterford - Frisco 230 kV	3PH	6	BRK S7102, S7106, GCB 3S2343	Waterford - Frisco 230 kV	YES	YES
FAULT_11	--	Waterford - Nine Mile 230 kV	3PH	6	BRK S6972, S6975, GCB #S2025, S2022	Waterford - Nine Mile 230 kV	YES	YES

Table 2-4: Fault Cases Simulated for Post-project Case: 3-PH faults with stuck breaker

CASE	LOCATION	TYPE	CLEARING TIME (cycles)		SLG FAULT IMPEDANCE (MVA)	STUCK BRK #	PRIMARY BRK TRIP #	SECONDARY BRK TRIP	TRIPPED FACILITIES	Stable ?	Acceptable Voltages ?
			PRIMAR Y	Back-up							
FAULT_1a	Waterford - Vacherie 230 kV	3PH- 1PH	6	9	1310.91 - j14882.13	S6982	BRK S6985,GCB #S6665	S6972, S6982, S7142, S7151, S7102, S7172, S7182, S7612, S7625	Waterford - Vacherie 230 kV	YES	NO
FAULT_2a	Waterford - Raceland 230 kV	3PH- 1PH	6	9	1320.52 - j14944.41	S7136	BRK S7132, GCB #S6682	S6978, S6988, S7166, S7112, S7176, S7186, S7198, S7628	Waterford - Raceland 230 kV	YES	NO
FAULT_3a	Waterford - Valentine 230 kV	3PH- 1PH	6	9	1333.84 - j15029.49	S6978	BRK S6975, GCB S7427	S7136, S6988, S7166, S7112, S7176, S7186, S7198, S7628	Waterford - Valentine 230 kV	YES	NO
FAULT_4a	Waterford 230/26 kV; U1	3PH- 1PH	6	9	1277.88 - j14063.72	S7151	BRK S7161, BRK S7151, OCB 7154	S6972, S6982, S7142, S6982, S7102, S7172, S7182, S7612, S7625	Waterford 230/26 kV transformer ; U1 (411 MW)	YES	YES
FAULT_5a	Waterford 230/25 kV transformer #1 (Transformer for U3)	3PH- 1PH	6	9	1377.33 - j14754.94	S7176	BRK S7172, GCB #S7120	S7136, S6988, S7166, S7112, S6978, S7186, S7198, S7628	Waterford 230/25 kV transformer #1 (Transformer for U3)	YES	NO
FAULT_6a	Waterford 500/230 kV transformer	3PH- 1PH	6	9	1203.49 - j13487.88	S6988	BRK S6985, ACB #13015, GCB #13345	S7136, S6978, S7166, S7112, S7176, S7186, S7198, S7628	Waterford 500/230 kV transformer; Waterford - W. Glenn 500 kV	NO	NO
FAULT_7a	Waterford - Hooker 230 kV	3PH- 1PH	6	9	1313.58 - j14661.7	S7612	BRK S7615, GCB #S4181, S5460	S6972, S6982, S7142, S7151, S7102, S7172, S7182, S6982, S7625	Waterford - Hooker 500 kV	YES	NO
FAULT_8a	Waterford - Union Carbide 230 kV	3PH- 1PH	6	9	1348.79 - j14777.92	S7112	BRK S7106, GCB #S1882, S4555	S6978, S6988, S7166, S7136, S7176, S7186, S7198, S7628	Waterford - Union Carbide 500 kV	YES	NO
FAULT_9a	Waterford - Gypsy 230 kV	3PH- 1PH	6	9	1280.84 - j14500.73	S7198	BRK S7198,S7615, GCB #S3245,S3248	S6978, S6988, S7166, S7136, S7176, S7186, S7112, S7628	Waterford - Gypsy 230 kV	YES	NO
FAULT_10a	Waterford - Frisco 230 kV	3PH- 1PH	6	9	1281.36 - j14558.35	S7102	BRK S7102, S7106, GCB 3S2343	S6972, S6982, S7142, S7151, S6982, S7172, S7182, S7612, S7625	Waterford - Frisco 230 kV	YES	NO
FAULT_11a	Waterford - Nine Mile 230 kV	3PH- 1PH	6	9	1278.52 - j14487	S6972	BRK S6972, S6975, GCB #S2025, S2022	S7102, S6982, S7142, S7151, S6982, S7172, S7182, S7612, S7625	Waterford - Nine Mile 230 kV	YES	NO

Table 2-5: Fault Cases Simulated for Post-project Case: single-line-to-ground faults with stuck breaker

CASE	LOCATION	TYPE	CLEARING TIME (cycles)		SLG FAULT IMPEDANC E (MVA)	STUCK BRK #	PRIMARY BRK TRIP #	SECONDARY BRK TRIP	TRIPPED FACILITIES	Stable ?	Acceptable Voltages ?
			PRIMAR Y	Back-up							
FAULT_1b	Waterford - Vacherie 230 kV	1PH- 1PH	6	9	1310.91 - j14882.13	S6982	BRK S6985,GCB #S6665	S6972, S6982, S7142, S7151, S7102, S7172, S7182, S7612, S7625	Waterford - Vacherie 230 kV	YES	YES
FAULT_2b	Waterford - Raceland 230 kV	1PH- 1PH	6	9	1320.52 - j14944.41	S7136	BRK S7132, GCB #S6682	S6978, S6988, S7166, S7112, S7176, S7186, S7198, S7628	Waterford - Raceland 230 kV	YES	YES
FAULT_3b	Waterford - Valentine 230 kV	1PH- 1PH	6	9	1333.84 - j15029.49	S6978	BRK S6975, GCB S7427	S7136, S6988, S7166, S7112, S7176, S7186, S7198, S7628	Waterford - Valentine 230 kV	YES	YES
FAULT_4b	Waterford 230/26 kV; U1	1PH- 1PH	6	9	1277.88 - j14063.72	S7151	BRK S7161, BRK S7151, OCB 7154	S6972, S6982, S7142, S6982, S7102, S7172, S7182, S7612, S7625	Waterford 230/26 kV transformer ; U1 (411 MW)	YES	YES
FAULT_5b	Waterford 230/25 kV transformer #1 (Transformer for U3)	1PH- 1PH	6	9	1377.33 - j14754.94	S7176	BRK S7172, GCB #S7120	S7136, S6988, S7166, S7112, S6978, S7186, S7198, S7628	Waterford 230/25 kV transformer #1 (Transformer for U3)	YES	YES
FAULT_6b	Waterford 500/230 kV transformer	1PH- 1PH	6	9	1203.49 - j13487.88	S6988	BRK S6985, ACB #13015, GCB #13345	S7136, S6978, S7166, S7112, S7176, S7186, S7198, S7628	Waterford 500/230 kV transformer; Waterford - W. Glenn 500 kV	YES	YES
FAULT_7b	Waterford - Hooker 230 kV	1PH- 1PH	6	9	1313.58 - j14661.7	S7612	BRK S7615, GCB #S4181, S5460	S6972, S6982, S7142, S7151, S7102, S7172, S7182, S6982, S7625	Waterford - Hooker 500 kV	YES	YES
FAULT_8b	Waterford - Union Carbide 230 kV	1PH- 1PH	6	9	1348.79 - j14777.92	S7112	BRK S7106, GCB #S1882, S4555	S6978, S6988, S7166, S7136, S7176, S7186, S7198, S7628	Waterford - Union Carbide 500 kV	YES	YES
FAULT_9b	Waterford - Gypsy 230 kV	1PH- 1PH	6	9	1280.84 - j14500.73	S7198	BRK S7198,S7615, GCB #S3245,S3248	S6978, S6988, S7166, S7136, S7176, S7186, S7112, S7628	Waterford - Gypsy 230 kV	YES	YES
FAULT_10b	Waterford - Frisco 230 kV	1PH- 1PH	6	9	1281.36 - j14558.35	S7102	BRK S7102, S7106, GCB 3S2343	S6972, S6982, S7142, S7151, S6982, S7172, S7182, S7612, S7625	Waterford - Frisco 230 kV	YES	YES
FAULT_11b	Waterford - Nine Mile 230 kV	1PH- 1PH	6	9	1278.52 - j14487	S6972	BRK S6972, S6975, GCB #S2025, S2022	S7102, S6982, S7142, S7151, S6982, S7172, S7182, S7612, S7625	Waterford - Nine Mile 230 kV	YES	YES

The system was found to be STABLE following all the normally cleared three-phase faults and all stuck breaker three-phase faults **except** Fault_6a.

The system was UNSTABLE following a three-phase stuck breaker fault involving loss of Waterford 500/230 kV transformer (Fault_6a). The fault was repeated on the case without PID-213. The results indicated that the system would be UNSTABLE even without proposed PID-213. Hence, the impact of the proposed PID-213 on the system following the Fault_6a cannot be determined. After consultation with SPP and Entergy Transmission Planning Personnel a sensitivity analysis was conducted and the details of this analysis are presented in [Section 2.4](#). The plots for all the simulated faults are included in [Appendix C](#).

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 buses in the Entergy system (115 kV and above) were monitored during each of the fault cases as appropriate. Voltage criteria violation was observed following a normally cleared three-phase fault involving loss of Waterford 500/230kV transformer. The fault was repeated on the Pre-project case and results indicated that voltage dip criteria violation exists even without PID-213. No voltage violations were observed for other normally cleared 3-Phase faults **except** Fault_6, 3-Phase normally cleared fault involving loss of Waterford 500/230 kV transformer. The voltage criteria violation following Fault_6 was observed in both WITH and WITHOUT PID-213 case.

As there is no specific voltage dip criteria for three-phase stuck breaker faults (3PH-1PH IPO), 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, ten (10) three-phase stuck breaker (3PH-1PH IPO) faults were found to be in violation in both WITH and WITHOUT PID-213 cases. As a next step, the same faults were repeated with stuck breaker single-line-to-ground (1PH-1PH IPO) fault. [Table 2-5](#) shows the details of the faults. The results indicated that there are no voltage dip criteria violations following single-line-to-ground stuck breaker faults.

4. SENSITIVITY ANALYSIS

Stability analysis results indicated that system was UNSTABLE following a three-phase stuck breaker fault involving loss of Waterford 500/230 kV for both pre- and post-project cases. The new unit is connected on a 230kV loop with several generators, e.g. Waterford units 1,2 and 3; Oxytaft units and Union Carbide units. Hence, a sensitivity analysis was conducted by reducing fault clearing time and reducing local generation in the pre-project case. The local area generation in the vicinity of the Waterford in Pre-PID-213 case is listed below. It can be seen that the generation at Waterford 230 kV is approximately 2019 MW in Pre-PID-213 case.

NO	NAME	KV	UNIT ID	STATUS	GENERATION (MW)
98455	UCARBGT1	13.8	1	1	125
98456	UCARBGT2	13.8	1	1	125
98457	UCARBST1	13.8	1	1	22
98458	UCARBST2	13.8	1	1	50
98535	WAT U1	26	1	1	411
98536	WAT U2	26	1	1	411
98538	WAT U3	25	1	1	1197
98551	GYP U1	22	1	1	250
98552	GYP U2	22	1	1	415
98553	GYP U3	24	1	1	392
98574	1GOXY U1	18	1	1	163
98575	1GOXY U2	18	1	1	163
98576	1GOXY U3	18	1	1	163
98577	1SOXY U1	18	1	1	300
98601	NMIL U1	13.8	1	0	23
98602	NMIL U2	13.8	1	1	85
98603	NMIL U3	18	1	1	128
98604	NMIL U4	26	1	1	730
98605	NMIL U5	26	1	1	740

[Table 2-6](#) shows the sensitivity cases with reduced fault clearing time and reduced local generation.

Faster Fault Clearing Time

The Fault_6a was repeated with a faster primary fault clearing time of 4.5 cycles instead of 6 cycles (Case S0). The system was still found to be unstable without proposed PID-213.

Faster Fault Clearing Time and Reduced Generation at Waterford 230 kV

Next, the Fault_6a was repeated with faster primary fault clearing time (4.5 CY) and lower generation at Waterford 230 kV substation. The Waterford U1 Generation (411 MW) was reduced in steps of 50 MW in Pre-contingency condition to identify the generation level at which the system would be stable following Fault_6a. The system was found to be STABLE with 4.5+9 CY fault clearing and Waterford U1 generation at 250 MW (Case S1_Waterford). To identify the impact of the proposed PID-213 project, the PID-213 was added to 'Case S1_Waterford' which resulted in a 'Case S1_PID-213'. The Fault_6a was repeated with 4.5+9 CY fault clearing time. The system was found to be stable following Fault_6a.

Faster Fault Clearing Time and Reduced Oxytaft Generation

The Fault_6a was repeated with faster fault clearing time (4.5 +9 CY) and reduced generation level at Oxytaft. The 163 MW Oxytaft Gas Unit was tripped and Oxytaft Steam Unit generation was reduced from 300 MW to 150 MW (Case S3_Oxy) in Pre-contingency condition. The system was found to be stable following Fault_6a. To identify the impact of proposed PID-213 project, PID-213 (40.7 MW) was added to 'Case S3_Oxy' which resulted in a 'Case S3_PID-213'. The Fault_6a was repeated with 4.5+9 CY fault clearing time. The system was found to be stable following Fault_6a.

The plots are provided in [Appendix D](#).

Table6: Sensitivity Analysis Cases

CASE	GENERATION (MW)				FAULT_6a	
	WATERFOR D U1	OXY GAS U1	OXY STEAM U1	PID-213	CLEARING TIME	SYSTEM
Pre-project	411	163	300	0	6+9 cycles	Unstable
S0	411	163	300	0	4.5+9 cycles	Unstable
S1_Waterford	250	163	300	0	4.5+9 cycles	Stable
S2_Waterford	300	163	300	0	4.5+9 cycles	Unstable
S3_Oxy	411	0	150	0	4.5+9 cycles	Stable
S4_Oxy	411	0	200	0	4.5+9 cycles	Unstable
S1_PID-213	250	163	300	41	4.5+9 cycles	Stable
S3_PID-213	411	0	150	41	4.5+9 cycles	Stable

Hence, it can be concluded that the proposed PID-213 unit does not degrade the Entergy system performance.

C. CONCLUSIONS

The objective of this study was to evaluate the impact of proposed PID-213 (40.7 MW) 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 faults **except** Fault_6a, a 3-phase stuck breaker (3PH1PH-IPO) fault involving loss of Waterford 500/230 kV transformer.

System was found to be UNSTABLE following Fault_6a in both pre- and post-project system conditions. The loss of Waterford 500/230 kV transformer is a known limitation at Waterford 230 kV substation. A sensitivity analysis was performed with a faster fault clearing time and reduced local generation. The system was found to be STABLE in both PRE and POST Project cases. A voltage criteria violation was observed following Fault_6 in both pre- and post-project system conditions.

Voltage criteria violations were observed following one normally cleared - Fault_6, fault involving loss of Waterford 500/230 kV transformer - and few three phase stuck breaker faults (3PH1PH-IPO) in both Pre and Post Project cases. No voltage criteria violations were observed following stuck breaker single-line-to-ground faults and other normally cleared three-phase faults.

Based on the results of stability analysis it can be concluded that interconnection of the proposed PID-213 (40.7 MW) generation at the Waterford 230 kV bus does not adversely impact the stability of the Entergy System at reduced generation level 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**
- APPENDIX B - LOAD FLOW AND STABILITY DATA**
- APPENDIX C - PLOTS FOR STABILITY SIMULATIONS**
- APPENDIX D - PLOTS FOR SENSITIVITY ANALYSIS**

APPENDIX A

DATA PROVIDED BY CUSTOMER (PID 213)



**Attachment A to Appendix 1
Interconnection Request**

LARGE GENERATING FACILITY DATA

UNIT RATINGS

kVA <u>43,150</u> °F <u>95</u>	Voltage <u>13.8 kV</u>
Power Factor <u>0.95</u>	
Speed (RPM) <u>3600</u>	Connection <u>Wye</u>
Short Circuit Ratio <u>1.02</u>	Frequency, Hertz <u>60</u>
Stator Amperes at Rated kVA <u>1,805</u>	Field Volts <u>223</u>
Max Turbine MW <u>41</u> °F <u>95</u>	

COMBINED TURBINE-GENERATOR-EXCITER INERTIA DATA

Inertia Constant, H = 5.7 kW sec/kVA
 Moment-of-Inertia, WR² = 119,000 lb. ft.²

REACTANCE DATA (PER UNIT-RATED KVA)

	DIRECT AXIS		QUADRATURE AXIS
Synchronous – saturated	X _{dv} <u>0.98</u>		X _{qv} <u>0.96</u>
Synchronous – unsaturated	X _{di} <u>1.23</u>		X _{qi} <u>1.20</u>
Transient – saturated	X' _{dv} <u>0.146</u>		X' _{qv} <u>0.22</u>
Transient – unsaturated	X' _{di} <u>0.162</u>		X' _{qi} <u>0.25</u>
Subtransient – saturated	X'' _{dv} <u>0.099</u>		X'' _{qv} <u>0.093</u>
Subtransient – unsaturated	X'' _{di} <u>0.114</u>		X'' _{qi} <u>0.106</u>
Negative Sequence – saturated	X _{2v} <u>0.096</u>		
Negative Sequence – unsaturated	X _{2i} <u>0.110</u>		
Zero Sequence – saturated	X _{0v} <u>0.044</u>		
Zero Sequence – unsaturated	X _{0i} <u>0.049</u>		
Leakage Reactance	X _{lm} <u>0.098</u>		

FIELD TIME CONSTANT DATA (SEC)

Open Circuit	T'_{do}	<u>6.40</u>	T'_{qo}	<u>0.45</u>
Three-Phase Short Circuit Transient	T'_{d3}	<u>0.84</u>	T'_q	<u>0.42</u>
Line to Line Short Circuit Transient	T'_{d2}	<u>1.30</u>		
Line to Neutral Short Circuit Transient	T'_{d1}	<u>1.48</u>		
Short Circuit Subtransient	T''_d	<u>0.037</u>	T''_q	<u>0.037</u>
Open Circuit Subtransient	T''_{do}	<u>0.052</u>	T''_{qo}	<u>0.414</u>

ARMATURE TIME CONSTANT DATA (SEC)

Three Phase Short Circuit	T_{a3}	<u>0.0043</u>
Line to Line Short Circuit	T_{a2}	<u>0.0043</u>
Line to Neutral Short Circuit	T_{a1}	<u>0.0035</u>

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	<u>0.00298</u>
Negative	R_2	<u>0.01028</u>
Zero	R_0	<u>0.00063</u>

Rotor Short Time Thermal Capacity $I_2^2 t =$ 15.0

Field Current at Rated kVA, Armature Voltage and PF = 540 amps

Field Current at Rated kVA and Armature Voltage, 0 PF = N/A amps

Three Phase Armature Winding Capacitance = 0.51 microfarad

Field Winding Resistance = 0.379 ohms 95 °C

Armature Winding Resistance (Per Phase) = 0.00572 ohms 95 °C

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.

See attached document:

“Attachment G Excitation System Data.pdf”

PSS is not required for units smaller than 50 MVA.

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.

See attached document:

“Attachment H Governor System Data.pdf”

WIND GENERATORS

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

Elevation: _____ _____ Single Phase _____ Three Phase

Inverter manufacturer, model name, number, and version:

List of adjustable setpoints for the protective equipment or software:

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

INDUCTION GENERATORS

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

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

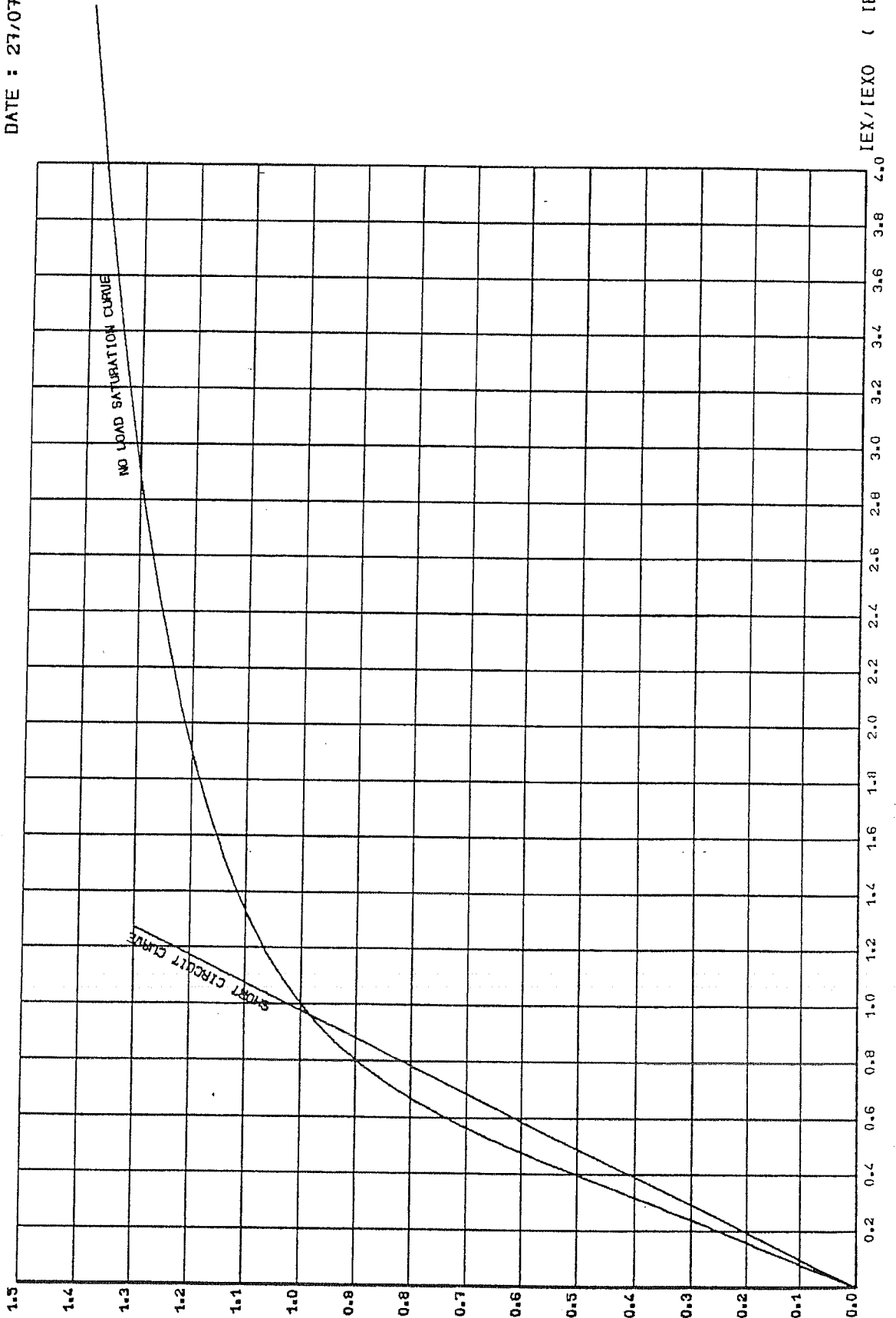
THOMSON U.S.A

NO LOAD SATURATION AND SHORT CIRCUIT CURVES



43150 KVA
UN=13800 VOLTS
IN=1805 A

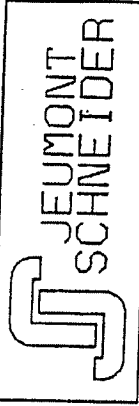
REF. : 6TA0377
DATE : 27/07/89



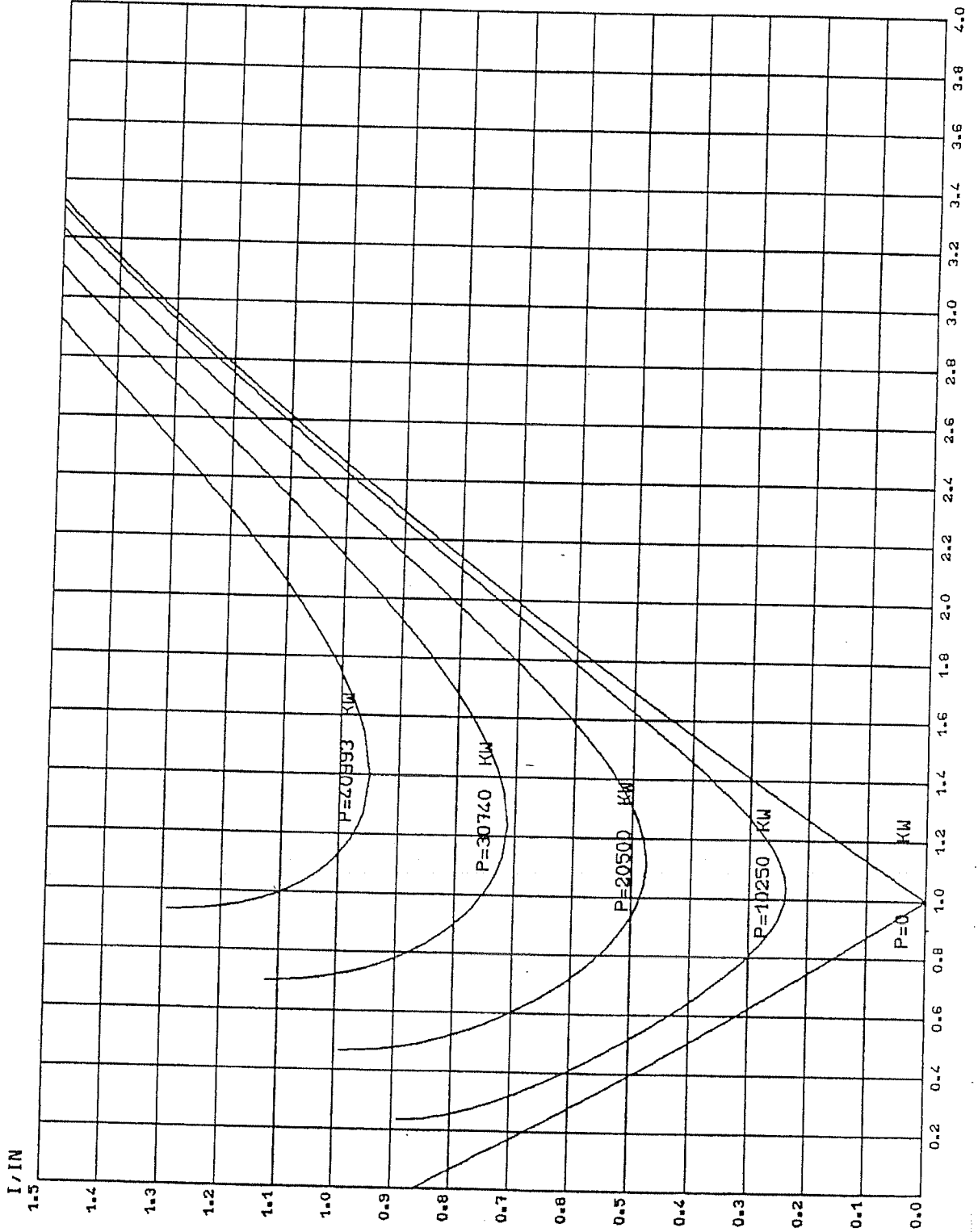
IEX/IE XO (IEXO=307 A)

THOMSON USA

V CURVES



REF : 6TA0379
DATE : 27/07/89
43150 KVA
13800 VOLTS
P.F.=0.950
IN=1805 A
BUS VOLTAGE 1.000PU



IEX/IE XO (IEX=307 A)

ATTACHMENT E

CAPABILITY CURVE



THOMASSEN USA

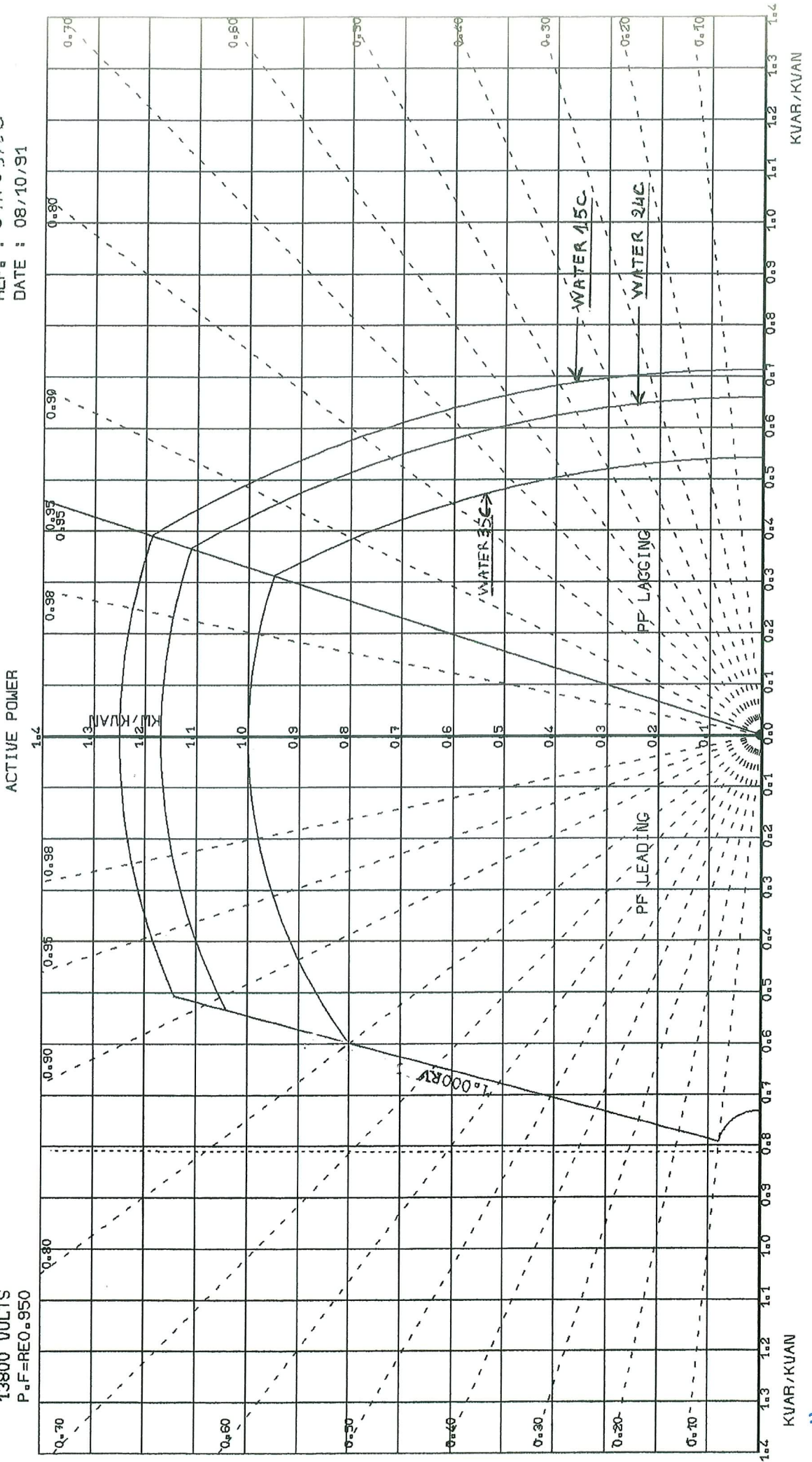
43150 KVA

13800 VOLTS

P.F.=REQ.=950

REF : 6TA 0378 B

DATE : 08/10/91



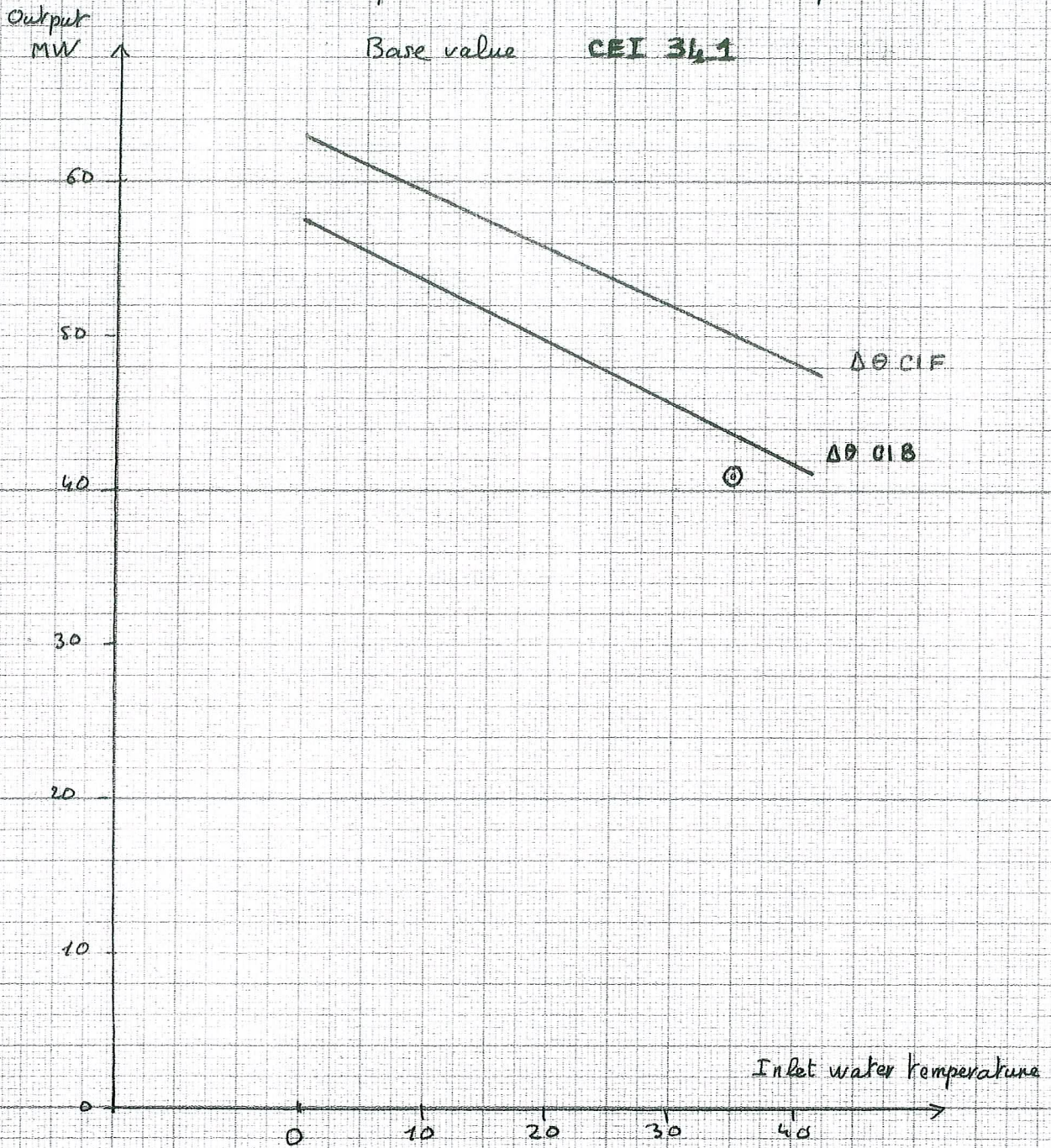
REACTIVE POWER ABSORBED (UNDEREXCITED)

REACTIVE POWER DELIVERED (OVEREXCITED)

TURBOGENERATOR 13,8 kV 3600br/min PF=0,95

Output MW versus inlet water temperature

Base value CEI 31,1



THOMASSEN USA

ETABLISSEMENT

MODIFICATIONS

9/9



JEUMONT SCHNEIDER

A 4

CH
280 E

DOCUMENT N°

6TA0380 AB

Date d'édition 26.07.89

PAGE N°

Nombre de pages 1

PTI-Compatible Exciter Models

Power Technologies, Inc.

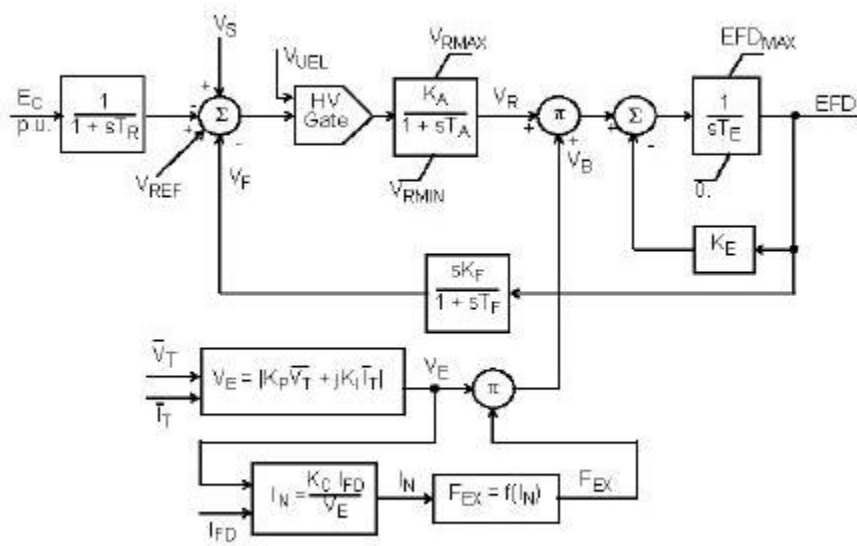
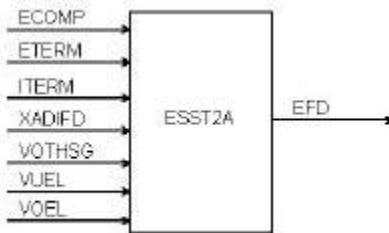
Exciter and Governor Model Data Sheets

ESST2A

IEEE Type ST2A Excitation System

This model is located at system bus
Machine
This model uses CONs starting with

IBUS,
I,
J,



$$V_S = VOTHSG + VOJEL$$

CONs	#	Parameter	Value
J		T_R	0.0
J+1		K_A	120
J+2		T_A	0.05
J+3		V_{RMAX}	1.2
J+4		V_{RMIN}	-1.2
J+5		K_E	1.0
J+6		T_E	0.5
J+7		KF	0.02
J+8		T_F	0.46
J+9		K_P	1.19
J+10		K_I	2.32
J+11		K_C	0.3
J+12		EFD_{MAX}	3.5

PTI-Compatible Governor Models

Power Technologies, Inc.

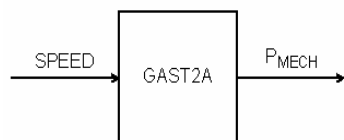
Exciter and Governor Model Data Sheets

GAST

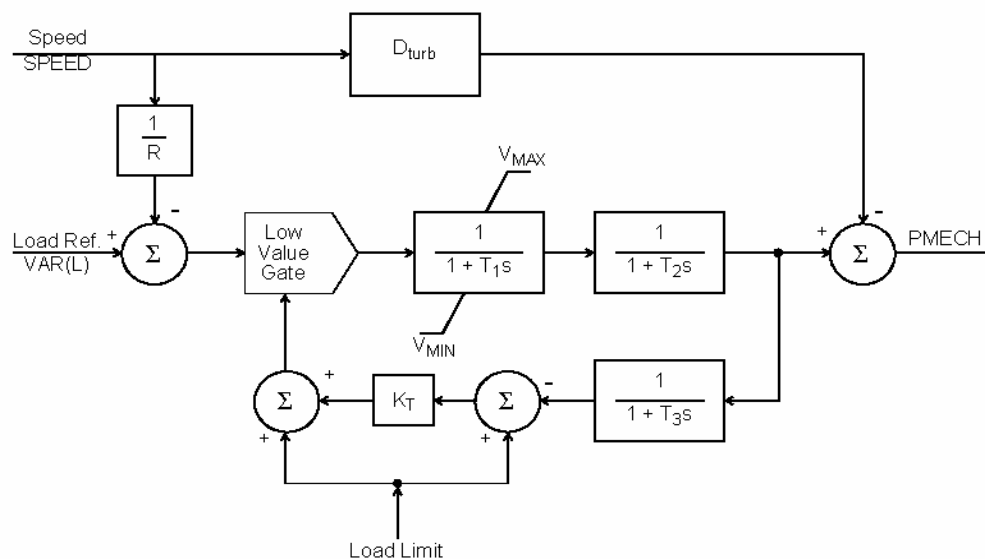
Gas Turbine Model

This model is located at system bus
Machine
This model uses CONs starting with

IBUS,
I.
J,



IBUS, 'GAST', I, R, T₁, T₂, T₃, AT, K_T, V_{MAX}, V_{MIN}, D_{turb}



CONs	#	Value	Description
J		0.05	R(Speed Droop)
J+1		0.4	T ₁ (>0)(Seconds)
J+2		0.1	T ₂ (>0)(Seconds)
J+3		3	T ₃ (>0)(Seconds)
J+4		1	Ambient Temperature Load Limit, AT
J+5		2	K _T
J+6		1	V _{MAX}
J+7		0	V _{MIN}
J+8		0	D _{turb}

APPENDIX B

LOAD FLOW AND STABILITY DATA FOR PID 213



B.1 Power Flow Data

```
98533,'PID-213 ', 13.8000,2, 0.000, 0.000, 151, 122,1.03716, 3.8949, 1
0 / END OF BUS DATA, BEGIN LOAD DATA
0 / END OF LOAD DATA, BEGIN GENERATOR DATA
98533,'1 ', 41.000, 13.450, 13.450, -13.450,1.01000,98537, 43.150, 0.00000, 0.11400,
0.00000, 0.00000,0.00000,1, 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
98533,98537, 0,'1 ',1,2,1, 0.00000, 0.00000,2,'PID-213 ',1, 1,1.0000
0.00290, 0.09790, 45.00
1.00000, 0.000, 0.000, 45.00, 45.00, 45.00, 0, 0, 1.05000, 0.95000, 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
```



B.2 DYNAMICS DATA

```

** GENROU **  BUS X-- NAME --X BASEKV MC   C O N S   S T A T E S
                98533      PID-213  13.800 1   80625-80638   30887-30892

                MBASE      Z S O R C E           X T R A N           GENTAP
                43.2    0.00000+J 0.11400   0.00000+J 0.00000   0.00000

T'D0 T''D0  T'Q0 T''Q0   H  DAMP  XD    XQ    X'D  X'Q  X''D  XL
6.40 0.052  0.45 0.414   5.70  0.00 1.2300 1.2000 0.1620 0.2500 0.1140 0.0980

                S(1.0) S(1.2)
                0.0204 0.6100

** ESST2A **  BUS X-- NAME --X BASEKV MC   C O N S   S T A T E S   VAR
                98533      PID-213  13.800 1   80639-80651   30893-30896   5760

                TR      KA      TA      VRMAX  VRMIN    KE      TE
                0.000   120.0   0.050   1.200  -1.200   1.000   0.500

                KF      TF      KP      KI      KC  EFDMAX  KI VAR
                0.020   0.460   1.190   2.320   0.300  3.500   0.000

** GAST **    BUS X-- NAME --X BASEKV MC   C O N S   S T A T E S   VAR
                98533  PID-213      13.800 1   80652-80660   30897-30899   5761

                R      T1      T2      T3  LOAD LIM  KT      VMAX  VMIN  DT
                0.050  0.400  0.100  3.000   1.000  2.000   1.000  0.000  0.000

```

