System Impact Study
PID 240
650MW Plant

Prepared by:

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Rev	Issue Date	Description of Revision	Revised By	Project Manager
0	4/5/2010	Posting System Impact Study	MEC	JDH
1	4/16/2010	Customer request edits and update PID prior table	MEC	JDH

Contents

Executive Summary

This System Impact Study is the second step of the interconnection process and is based on the PID-240 request for interconnection on Entergy's transmission system at the Malvern, AR.

The NRIS section contains details of load flow (steady state) analysis only.

Customer for PID-240 requested a study to identify the requirements necessary to change from ERIS to NRIS status. PID-240 will study an existing facility that is not changing any of its generating characteristics; therefore neither a stability study nor a short circuit study will be required. The study evaluates connection of 650MW to the Entergy Transmission System. The load flow study was performed on the latest available 2014 Summer Peak Case, using PSS/E and MUST software by Siemens Power Technologies International (Siemens-PTI). The proposed in-service date for NRIS is October 1, 2010.

Results of the System Impact Study indicated that under NRIS the upgrades listed below would be required for interconnection on Entergy's transmission system at the proposed POI.

Estimated NRIS Project Planning Upgrades for PID 240

Limiting Element	Planning Estimate for Upgrade*
Lakeover 500/115kV transformer	$15,000,000
McAdams - Pickens 230kV	Included in ICT 2010 Base Plan
McAdams 500/230kV transformer 1	Included in ICT 2010 Base Plan
TOTAL	**$15,000,000**

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

Network Resource Interconnection Service

1. Introduction

A Network Resource Interconnection Services (NRIS) study was requested by the Customer to serve 650MW of Entergy network load. The expected in service date for this NRIS generator is 10/1/2010. The tests were performed with only confirmed transmission reservations and existing network generators and with transmission service requests in study mode.

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

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

2. Analysis

2.1 Models

The models used for this analysis is the 2014 summer peak cases developed in 2009.

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

- Non-Firm IPPs within the local region of the study generator were turned off and other non-firm IPPs outside the local area were increased to make up the difference.
- Confirmed firm transmission reservations were modeled for the year 2014.
- Approved transmission reliability upgrades for 2012 – 2014 were included in the base case. These upgrades can be found at Entergy's OASIS web page http://www.oatioasis.com/EES/EESDocs/Disclaimer.html, under approved future projects. Reference Appendix A.

2.2 Contingencies and Monitored Elements

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

3. Generation used for the transfer

The Customer's generators were used as the source for the deliverability to generation test.

4. Results

4.1 Deliverability to Generation (DFAX) Test

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

4.2 Constraints:

Study Case	Study Case with Priors
McAdams 500/230kV transformer 1	Bogalusa - Adams Creek 500/230kV transformer
	Coly 500/230kV transformer
	Franklin - Ray Braswell 500kV
	Grimes - Grimes 345/138kV transformer 1
	Grimes - Grimes 345/138kV transformer 2
	Lakeover 500/115kV transformer
	McAdams - Pickens 230kV
	McAdams 500/230kV transformer 1
	Webre - Bayou LaBoutte 500kV ckt1
	Willow Glen 500/230kV Transformer

4.3 DFAX Study Case without Priors Results

Limiting Element	Contingency Element	ATC (MW)
McAdams 500/230kV transformer 1	Lakeover - McAdams 500kV	0

4.4 DFAX Study Case with Priors Results

Limiting Element	Contingency Element	ATC (MW)
McAdams 500/230kV transformer 1	Lakeover - McAdams 500kV	0
Lakeover 500/115kV transformer	Lakeover - Ray Braswell 500kV	0
McAdams - Pickens 230kV	Lakeover - McAdams 500kV	0
Coly 500/230kV transformer	Coly - Willow Glen 500kV	0
Webre - Bayou LaBoutte 500kV ckt1	Coly - McKnight 500kV	0
Grimes - Grimes 345/138kV transformer 2	Grimes - Grimes 345/138kV transformer 1	0
Grimes - Grimes 345/138kV transformer 1	Grimes - Grimes 345/138kV transformer 2	0
Bogalusa - Adams Creek 500/230kV transformer	Franklin - McKnight 500kV	78
Coly 500/230kV transformer	Fancy Point 500/230kV transformer 1	215
Coly 500/230kV transformer	Bogalusa - Adams Creek 500/230kV transformer	398
Coly 500/230kV transformer	Bogalusa - Franklin 500kV	398
Franklin - Ray Braswell 500kV	Franklin - Grand Gulf 500kV	430
Willow Glen 500/230kV Transformer	Coly 500/230kV transformer	622

4.5 Deliverability to Load Test

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

A. Amite South: Passed

B. WOTAB: Passed

C. Western Region: Passed

5. Required Upgrades for NRIS

5.1 Preliminary Estimates of Direct Assignment of Facilities and Network Upgrades

Limiting Element	Planning Estimate for Upgrade*
Lakeover 500/115kV transformer	$15,000,000
McAdams - Pickens 230kV	Included in ICT 2010 Base Plan
McAdams 500/230kV transformer 1	Included in ICT 2010 Base Plan
TOTAL	**$15,000,000**

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

APPENDIX A: Approved Projects and Transactions in Study Mode

Year	Approved Future Projects
2010 - 2012 EAI	10CP 2009S EAI Blytheville POD - AECC Rev 1.idv 10CP 2009S EAI Conway West - Donaghey 161 kV Line Reconductor.idv 10CP 2009S EAI Gillette 115 kV Substation.idv 10CP 2009S EAI Hamlet 161 kV Substation Rev 1.idv 10CP 2009S EAI Sarepta Project Rev 0.idv 10CP 2009W EAI Harrison East to Everton Road 161 kV Line Rev 1.idv 10CP 2010S EAI AECC Avilla POD Rev 2.idv 10CP 2010S EAI Coffeeville POD - AECC Rev 0.idv 10CP 2010S EAI Melbourne - Sage 161 kV Line Upgrade Line Rev 0.idv 10CP 2010S EAI Parkin to Twist 161 kVLine Trap Rev 0.idv 10CP 2010S EAI Transmission Service (OG&E) Rev 0.idv 10CP 2010S EAI Warren East 115 kV Substation Install Capacitor Bank Rev 1.idv 10CP 2010Z EAI Beebe 115 kV Substation - Install Capacitor Bank Rev 0.idv 10CP 2010Z EAI Donaghey - Conway South 161 kV Rev 1.idv 10CP 2010Z EAI SMEPA (Plum Point) Rev 1.idv 10CP 2011S EAI Osage Creek-Grandview New Line Rev 2.idv 10CP 2012S EAI Albright (HS Hamilton) Substation 2014 Load.idv 10CP 2012S EAI Cofer Road (Crawford) Substation 2014 Load Rev 0.idv 10CP 2011W EAI Transmission Service (Aquilla) Rev 0.idv 10CP 2012S EAI Westar Transmission Service Rev 0.idv rovements_PhaseII.idv
2010 - 2014 EGSL	10CP 2009S EGSL Acadia 138 kV Substation capbank.idv 10CP 2010Z EGSL Addis to Cajun 230kV line upgrade.idv 10CP 2011S EGSL Acadiana Area Improvement Project Phase 1 Rev 1.idv 10CP 2011S EGSL Alchem - Monochem 138 kV line upgrade.idv 10CP 2011S EGSL Construct New Youngsville 138 kV Sub (run AAIP 1 first).idv 10CP 2012S EGSL Acadiana Area Improvement Project Phase 2 (run AAIP 1 first).idv 10CP 2012S EGSL Construct new Nelson to Moss Bluff 230 kV line.idv 10CP 2012S EGSL Tejac to Marydale Upgrade 69 kV line.idv 10CP 2012S EGSLELL Loblolly-Hammond Build 230kV Line.idv 10CP 2014S Gulf Oxygen Load Correction.idv
2010 - 2013 ELL	10CP 2009W ELLN Delhi 115 kV Substation - Add Cap Bank.idv 10CP 2010W ELLN Delhi 115 kV Substation - Add series reactor.idv 10CP 2010Z ELLS Bogalusa to Adams Creek 230 kV No 2.idv 10CP 2010Z ELLS Snakefarm to Kenner 115 kV line upgrade.idv 10CP 2011S ELLN Sarepta Project.idv 10CP 2012S ELLS Bayou LaBoutte Construct new 500-230 kV Substation.idv 10CP 2012 ELLN Ouachita Project Set 2 Run Second.idv 10CP 2013S ELLN Ouachita Projects Set 1 Run First.idv
2010 - 2012 EMI	10CP 2009W EMI Grenada-Winona-Greenwood Area Improvement Phase I.idv 10CP 2010S EMI Grand Gulf Uprate Project.idv 10CP 2010S EMI Indianola-Greenwood 115 kV Line Upgrade.idv 10CP 2010S EMI Magee 115 kV substation - Replace switches.idv 10CP 2010Z EMI TVA Affected System Upgrades.idv 10CP 2011S EMI Church Road Substation (2014 load).idv 10CP 2011S EMI Sunnybrook-only-2011.idv 10CP 2011S EMI Waterways - Vicksburg East 115 kV Line Upgrade.idv 10CP 2011Z EMI Florence - Florence SS - Star 115 kV Line Upgrade.idv 10CP 2011Z EMI Grand Gulf Uprate add vars.idv 10CP 2012S EMI Grenada-Winona-Greenwood Area Improvement Phase II.idv 10CP 2012S EMI Ridgeland-Madison Reliability Improvement (Sunnybrook-2014).idv

Year	Approved Future Projects
2010 - 2012 ETI	10CP 2009F ETI Gulfway 230kV Substation.idv 10CP 2009S ETI Beaumont 69 kV Improvement Plan Option 2.idv 10CP 2009S ETI Newton Bulk Replace Re-tap CT to Increase Rating on Holly Springs Line.idv 10CP 2009S ETI Porter-Tamina Replace Breaker & Switches.idv 10CP 2009W ETI Fawil Upgrade 138-69 kV Auto.idv 10CP 2010S ETI Temco and Shepherd 138kV Substations.idv 10CP 2010S ETI Western Region Reliability Improvement Plan Phase 3 Interim (Part 1).idv 10CP 2010W ETI Western Region Reliability Improvement Plan Phase 3 Interim (Part 3).idv 10CP 2011S ETI Grand Gulf Uprate Project.idv 10CP 2011S ETI Western Region Reliability Improvement Plan Phase 3 Interim (Part 2).idv 10CP 2011W ETI Tamina to Cedar Hill 138 kV line.idv

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

PID	Substation	MW	In Service Date
PID 221	Wolfcreek	875	In Service
PID 223	PID-223 Tap	125	10/1/2010
PID 224	PID-224 Tap	100	12/1/2009
PID 228	PID-228	115	4/30/2011
PID 233	PID-233	150	12/31/2013
PID 237	PID-237	550	9/1/2010

Prior transmission service requests that were included in this study:

OASIS #	PSE	MW	Begin	End
1668165	Entergy Services (SPO)	600	1/1/2013	1/1/2043
1694305	Entergy Services (SPO)	15	5/1/2010	5/1/2020
1694306	Entergy Services (SPO)	30	5/1/2010	5/1/2020

APPENDIX B: Deliverability Tests for Network Resource Interconnection Service Resources

Overview

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

The "From Generation" Test for Deliverability

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

The "To Load" Test for Deliverability

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

Required Upgrades

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

Description of Deliverability Test

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

Deliverability Test Procedure

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

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

Deliverability of Generation

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

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

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

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

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

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

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

Deliverability to Load

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

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

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

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

Other Modeling Assumptions

Modeling of Other Resources

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

Must-run Units

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

Base-line Transmission Model

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