System Impact Study Report
875 MW Plant,
PID 221

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Executive Summary:

This System Impact Study is the second step of the interconnection process and is based on the PID-221 request for interconnection on Entergy's transmission system at the Wolf Creek 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-221 did request NRIS, but did not request ERIS, therefore, under Section - A (ERIS) a load flow analysis was not performed. Additionally, a short circuit analysis and a transient stability analysis was not needed due to having an interconnection agreement in place with Entergy. PID 221 is an existing facility consisting of 3 combustion turbines and 4 steam turbines. The requestor has a dual electric interconnection; one at Wolf Creek with Entergy and one at French Camp with TVA. The study evaluates connection of 875 MW to the Entergy Transmission System. The proposed in-service date for NRIS is January 1, 2009.

Results of the System Impact Study contend that under NRIS, the estimated upgrade cost with priors is $54,300,000 and without priors is $4,100,000.

Estimated Project Planning Upgrades for PID 221

Study	Estimated cost With Priors ($)	Estimated cost Without Priors ($)
NRIS	$54,300,000 +TBD	$4,100,000 + TBD

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

Section – B

Network Resource Interconnection Service

TABLE OF CONTENTS FOR NRIS

Introduction:

A Network Resource Interconnection Services (NRIS) study was requested by to serve 875 MW of Entergy network load. The expected in service date for this NRIS generator is 1/1/2009. The tests were performed with only confirmed transmission reservations and existing network generators and with transmission service requests in study mode.

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

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

Analysis:

A. Models

The models used for this analysis is the 2009 and 2015 summer and winter peak cases developed in July 2008.

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 2009 - 2015.
- Approved transmission reliability upgrades for 2007 – 2010 were included in the base case. These upgrades can be found at Entergy's OASIS web page, http://www.entergy.com/etroasis/, under approved future projects.

PID	Substation	MW	In Service Date
PID 208	Fancy Point	1594	1/1/2015
PID 211	Lewis Creek	570	6/1/2011
PID 216	Wilton 230kV	251	1/1/2010

Prior transmission service requests that were included in this study:

OASIS #	PSE	MW	Begin	End
1460900	Louisiana Energy & Power Authority	116	1/1/2009	1/1/2030
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
1520043	Municipal Energy Agency of Miss	20	1/1/2011	1/1/2026
1547988	West Star Energy Generation & Marketing	27	6/1/2010	6/1/2040
1551562	CLECO Power LLC	11	6/1/2009	6/1/2018
1552146	Entergy Services (EMO)	1	1/1/2009	1/1/2014
1552148	Entergy Services (EMO)	1	1/1/2009	1/1/2014
1555717	East Texas Electric Coop	1	1/1/2010	1/1/2015
1555718	Entergy Services (EMO)	158	1/1/2010	1/1/2015
1557602	East Texas Electric Coop	1	1/1/2009	1/1/2017
1558905	NRG Power Marketing	250	7/1/2009	7/1/2014
1558911	NRG Power Marketing	100	1/1/2009	1/1/2014
1559579	NRG Power Marketing	500	5/1/2010	5/1/2015
1559580	NRG Power Marketing	500	5/1/2010	5/1/2015
1559581	NRG Power Marketing	150	5/1/2010	5/1/2015
1560024	NRG Power Marketing	15	1/1/2009	1/1/2014

OASIS #	PSE	MW	Begin	End
1560025	NRG Power Marketing	15	1/1/2009	1/1/2014
1560026	NRG Power Marketing	15	1/1/2009	1/1/2014

Contingencies and Monitored Elements

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

Generation used for the transfer

The Wolfcreek generators were used as the source for the deliverability to generation test.

Results

Deliverability to Generation (DFAX) Test:

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

Table III-1 Summary of Results of DFAX Test

The following elements did not meet DFAX Criteria test.

Study Case without Priors	Study Case with Priors
McAdams 500/230kV transformer 1	McAdams 500/230kV transformer 1
Sterlington 500/115kV transformer 1	McAdams - Wolf Creek 500kV
Sterlington 500/115kV transformer 2	Sterlington 500/115kV transformer 1
	Sterlington 500/115kV transformer 2

Detailed results provided in the following tables.

Table III-2 2009 DFAX Study Case Results without priors:

Limiting Element	Contingency Element	ATC(MW)
Sterlington 500/115kV transformer 2	Sterlington 500/115kV transformer 1	0
Sterlington 500/115kV transformer 1	Sterlington 500/115kV transformer 2	0
McAdams 500/230kV transformer 1	Choctaw - FrenchCamp 500kV (TVA)	483
McAdams 500/230kV transformer 1	Choctaw - West Point 500kV (TVA)	484
McAdams 500/230kV transformer 1	Lakeover - McAdams 500kV	816

Table III-3 2015 DFAX Study Case Results without Priors:

Limiting Element	Contingency Element	ATC(MW)
Sterlington 500/115kV transformer 2	Sterlington 500/115kV transformer 1	0
Sterlington 500/115kV transformer 1	Sterlington 500/115kV transformer 2	0
Hartburg - Inland Orange 230kV	Cypress - Hartburg 500kV	0
McAdams 500/230kV transformer 1	Choctaw - West Point 500kV (TVA)	232
McAdams 500/230kV transformer 1	Charity Church - Lakeover 230kV	458
McAdams 500/230kV transformer 1	Lakeover - McAdams 500kV	467
McAdams 500/230kV transformer 1	Choctaw - FrenchCamp 500kV (TVA)	480
Inland - McLewis 230kV	Cypress - Hartburg 500kV	509
Helbig - McLewis 230kV	Cypress - Hartburg 500kV	677
McAdams 500/230kV transformer 1	Charity Church - Hoy RD. 230kV	701
Grimes - Grimes 345/138kV transformer 1	Grimes - Grimes 345/138kV transformer 2	780
Grimes - Grimes 345/138kV transformer 2	Grimes - Grimes 345/138kV transformer 1	780
McAdams 500/230kV transformer 1	Lakeover 500/115kV transformer	787
McAdams 500/230kV transformer 1	Gerald Andrus SES - Indianola 230kV	864

Table III-4 2015 DFAX Study Case with Priors Results:

Limiting Element	Contingency Element	ATC(MW)
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
McAdams 500/230kV transformer 1	Choctaw - West Point 500kV (TVA)	0
McAdams 500/230kV transformer 1	Charity Church - Lakeover 230kV	210
McAdams 500/230kV transformer 1	Choctaw - FrenchCamp 500kV (TVA)	212
Sterlington 500/115kV transformer 1	Eldorado EHV - Sterlington 500kV	257
McAdams 500/230kV transformer 1	Charity Church - Hoy RD. 230kV	451
McAdams 500/230kV transformer 1	Lakeover 500/115kV transformer	597
McAdams 500/230kV transformer 1	Lakeover - McAdams 500kV	677
McAdams 500/230kV transformer 1	Gerald Andrus SES - Indianola 230kV	681
McAdams 500/230kV transformer 1	Hoy Road - Yandell 230kV	764
McAdams 500/230kV transformer 1	Northside - Ray Braswell 230kV	808
McAdams 500/230kV transformer 1	Tillatoba 230/115kV transformer 1	812

Table III-5 2015 DFAX Study Case with Priors Results and Priors upgrades:

Limiting Element	Contingency Element	ATC(MW)
McAdams 500/230kV transformer 1	Choctaw - West Point 500kV (TVA)	0
McAdams 500/230kV transformer 1	Charity Church - Lakeover 230kV	0
McAdams 500/230kV transformer 1	Charity Church - Hoy Road 230kV	0
McAdams 500/230kV transformer 1	Choctaw - FrenchCamp 500kV (TVA)	127
McAdams 500/230kV transformer 1	Lakeover 500/115kV transformer	167
McAdams 500/230kV transformer 1	Gerald Andrus SES - Indianola 230kV	215
McAdams 500/230kV transformer 1	Hoy Road - Yandell 230kV	234
McAdams 500/230kV transformer 1	Northside - Ray Braswell 230kV	363
McAdams 500/230kV transformer 1	Ray Braswell 500/230kV transformer 1	383
McAdams 500/230kV transformer 1	Ray Braswell 500/230kV transformer 2	383
Lakeover 500/115kV transformer	Choctaw - West Point 500kV (TVA)	526
Lakeover 500/115kV transformer	McAdams 500/230kV transformer 1	579
McAdams - Wolf Creek 500kV	Choctaw - West Point 500kV (TVA)	700
Lakeover 500/115kV transformer	Ray Braswell 500/115kV transformer 1	711
McAdams 500/230kV transformer 1	Base Case	801

With the 2nd 500/230kV transformer at McAdams, additional limiting elements were found based upon a second iteration:

Limiting Element	Contingency Element	ATC
McAdams - Pickens 230kV	Choctaw - West Point 500kV (TVA)	637
McAdams - Wolf Creek 500kV	Choctaw - West Point 500kV (TVA)	700

Deliverability to Load Test:

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

Amite South: Passed

WOTAB: Passed

Western Region: Passed

Required Upgrades for NRIS

Preliminary Estimates of Direct Assignment of Facilities and Network Upgrades

Without prior transmission service requests and NRIS requests:

Limiting Element	Planning Estimate for Upgrade
McAdams 500/230kV transformer 1	Add 36ohm reactor on the 230kV bus that will be inserted when transformer loading exceeds 100% $4,100,000
Sterlington 500/115kV transformer 1	TBD in facility study-Supplemental Upgrade
Sterlington 500/115kV transformer 2	TBD in facility study-Supplemental Upgrade

With prior transmission service requests and NRIS requests:

Limiting Element	Planning Estimate for Upgrade
McAdams 500/230kV transformer 1	Add a parallel 500/230kV transformer at McAdams
McAdams - Wolf Creek 500kV	Increase the terminal equipment at 500kV substations to get 3000Amp rating $26,000,000
McAdams - Pickens 230kV	Upgrade line. $28,350,000
Sterlington 500/115kV transformer 1	Supplemental upgrade for prior transmission service request (Dynegy Ouachita – EMO 804MW). The upgrade included split the 115kV Sterlington bus, adding a 4th 500/115kV transformer, adding a 2nd transformer at Baxter Wilson, and upgrading various transmission lines around Sterlington ---TBD
Sterlington 500/115kV transformer 2	

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

1. Overview

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

1.1 The "From Generation" Test for Deliverability

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

1.2 The "To Load" Test for Deliverability

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

1.3 Required Upgrades.

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

Appendix B-B – NRIS Deliverability Test

Description of Deliverability Test

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

Deliverability Test Procedure:

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

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

1) Deliverability of Generation

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

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

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

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

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

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

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

2) Deliverability to Load

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

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

An acceptable level of import capability for each sub-zone will have been determined by Entergy Transmission based on their experience and modeling of joint transmission and generating unit contingencies. Typically the acceptable level of transmission import capacity into the sub-zones will be that which is limited by first-contingency conditions

on the transmission system when generating units within the sub-region are experiencing an abnormal level of outages and peak loads.

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

Other Modeling Assumptions:

1) Modeling of Other Resources

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

2) Must-run Units

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

3) Base-line Transmission Model

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