

PID 277
Feasibility Study Report
3.2MW Distribution Inter-Connection
Russell Sage Substation

Prepared by:

Entergy Services, Inc.
T & D Planning
639 Loyola Avenue
New Orleans, LA 70113

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DISCLAIMER

This study has been prepared without the benefit of detailed engineering or study data. The solution set reflects the current understanding of the proposed project. **This study is intended to be used as a screening tool by the Customer.** There are many variables which are unknown at this time. These variables could significantly change the scope of work and estimated cost. In order to proceed with the project, a System Impact Study and Facility Study will need to be developed.

TABLE OF CONTENTS

I. INTRODUCTION.....	3
II. DISTRIBUTION SYSTEM ANALYSIS	3
1. SHORT CIRCUIT ANALYSIS/BREAKER RATING ANALYSIS.....	3
A. MODEL INFORMATION.....	3
B. SHORT CIRCUIT ANALYSIS.....	3
C. ANALYSIS RESULTS	4
D. PROBLEM RESOLUTION	4
2. LOAD FLOW ANALYSIS.....	4
A. MODEL INFORMATION.....	4
B. LOAD FLOW ANALYSIS.....	4
<i>i) Circuit Loading Criteria</i>	<i>4</i>
<i>ii) Power Factor Criteria</i>	<i>4</i>
C. ANALYSIS RESULTS	5
D. PROBLEM RESOLUTION	5
3. INTERCONNECTION FACILITIES	5
III. TRANSMISSION SYSTEM ANALYSIS	5
1. SHORT CIRCUIT ANALYSIS/BREAKER RATING ANALYSIS.....	5
A. MODEL INFORMATION.....	6
B. ANALYSIS RESULTS	6
C. PROBLEM RESOLUTION	6
2. LOAD FLOW ANALYSIS.....	6
A. LOAD FLOW ANALYSIS.....	6
B. PROBLEM RESOLUTION.....	6
IV. GROUNDING	7
1. GROUNDING INFORMATION	7
V. COORDINATION.....	7
1. COORDINATION INFORMATION	7

I. Introduction

The following Feasibility Study is based on the request for inter-connection of Entergy's distribution system at Russell Sage substation. The objective of this study is to assess the impact of the new facility on the Entergy distribution and transmission system by identifying:

- Any system protection equipment short circuit capacity limits exceeded
- Thermal overload, frequency, or voltage limitations
- Grounding requirements and coordination

The study is intended to determine whether the distribution and transmission system planning criteria are met when the facility is connected to Entergy's system. If not, appropriate system improvements will be identified.

The Feasibility Study process required a load flow analysis to determine if the existing distribution and transmission lines are adequate to handle the full output from the proposed generation facility. A short circuit analysis is performed to determine if the generation would cause the available fault current to exceed the fault duty of existing equipment within the Entergy distribution and transmission system.

This study was based on information provided by PID 277 and assumptions made by Entergy's Distribution and Transmission Planning groups. 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. Distribution System Analysis

1. SHORT CIRCUIT ANALYSIS/BREAKER RATING ANALYSIS

A. MODEL INFORMATION

The short circuit analysis was performed on the Entergy system using SynerGEE software. This model includes all proposed generators and transformers interconnected to the Entergy system, and any approved future distribution projects.

B. SHORT CIRCUIT ANALYSIS

The method used to determine if any short circuit problems would be caused by the addition of the PID 277 generation is as follows:

Three phase and single phase to ground faults were simulated on the Entergy system. Facility generators and transformers were modeled to generate a revised short circuit model. The base 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 277 generation.

Any breakers identified to be upgraded through this process are mandatory upgrades.

C. ANALYSIS RESULTS

Initially, the results of the short circuit analysis indicate that the additional PID 277 generation causes no increase in short circuit current such that they exceed the fault interrupting capability of the circuit breakers within the vicinity of the proposed generation site. A more detailed analysis can be performed once specific nameplate data of the transformer can be provided.

D. PROBLEM RESOLUTION

As a result of the short circuit analysis findings, currently no resolution is required.

2. LOAD FLOW ANALYSIS

A. MODEL INFORMATION

The load flow analysis was performed using a 2010 summer peak model in conjunction with summer peak data, historic Pegasus load data from the past 60 months, proposed future loads, and an area growth rate based on historic peak loading. In addition, the load flow analysis was projected out over five growth years. The transformers, generators (including future considerations), and interconnecting lines were modeled according to the information provided by PID 277

B. LOAD FLOW ANALYSIS

i) Circuit Loading Criteria

As per Distribution Planning Guidelines, the maximum safe, continuous ampacity rating for bare conductor is limited by the effect of high temperature on the mechanical properties of the conductor material. The conductor's 90°C rating is used to determine the maximum operating capacity.

ii) Power Factor Criteria

As per Distribution Planning Guidelines, the target power factor during summer peak for the low voltage bus of substation transformers is 98% lagging. While it is not possible or practical to operate all substation transformers at a 98% lagging power factor, an attempt should be made to maintain that as a system average by load area. 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

The results of the load flow analysis indicate that the additional PID 277 generation will create an overload condition on (3) 100 amp sectionalizers, whereby the rating will be exceeded. In addition, more detail will be needed in the System Impact Study to determine the effects of PID 277's reactive power output on Entergy's system.

D. PROBLEM RESOLUTION

As a result of the load flow analysis findings, the following resolutions would be required:

- Replace (3) 100 amp, 2 shot sectionalizers with an electronic recloser for sectionalization
- Specific attention will be needed in the System Impact Study to establish the limits of operation for the generator's reactive power output

Design group estimate (based on recent projects):

Install (1) electronic recloser with controls.....	\$ 50,000
Total estimated cost of listed work to be performed.....	\$ 50,000

3. INTERCONNECTION FACILITIES

The Interconnection Customer's designated Point of Interconnection (POI) is a local 13.8 kV distribution feeder, N5005, sourced from Russell Sage Substation. The interconnection customer is responsible for all facilities required to connect the generator to the POI.

The estimated cost of a typical 13.8 kV Interconnection is \$20,000. This cost is based on parametric estimating techniques for primary metering and associated hardware "typical" to a 13.8 kV interconnection.

A detailed evaluation of the interconnection facilities has not been performed at this time. A specific estimate for PID 277 will be provided as part of the Facility Study. Typical interconnection cost may not be representative of the costs required to interconnect this generator.

III. Transmission System Analysis

1. SHORT CIRCUIT ANALYSIS/BREAKER RATING ANALYSIS

A. MODEL INFORMATION

The short circuit analysis was performed on the Entergy system 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. Proposed generators were, conservatively, modeled at Russell Sage 13.8kV bus.

B. ANALYSIS RESULTS

The evaluation projected an increase of less than 320 Amps at the Russell Sage 115kV bus. The present interrupting duty of the breakers installed at busses Rilla 115kV and Swartz 115kV have adequate margin to accommodate the projected increase in short circuit current.

C. PROBLEM RESOLUTION

There were no problems identified for this part of the study that were a result of the additional PID 277 generation.

2. LOAD FLOW ANALYSIS

A. LOAD FLOW ANALYSIS

The maximum power that the customer plans to export is approximately equal to the minimum load at the distribution bus where the generating facility plans to connect. Therefore, 3.2MW injection at the distribution level will have minimal impact to Entergy's transmission facilities.

B. PROBLEM RESOLUTION

There were no problems identified for this part of the study that were a result of PID 277 generators.

The load flow results are for information only. This interconnection does not in and of itself convey any transmission service.

IV. Grounding

1. GROUNDING INFORMATION

Information provided by PID 277 indicates that the CAT3516 generators and transformer* secondary side connection will be 3 phase, 4160 volts. The transformer primary side will connect 3 phase 13,800 volts line-line.

* The PID 277 transformer and relay info will be needed to complete grounding study.

V. Coordination

1. COORDINATION INFORMATION

As per the Protection/Interface Requirements section of Entergy Standard DR07-01 titled "Connecting Large Electric Generators to the Entergy Distribution System (500kVA to 20MVA)", protecting both the Customer's facilities and the Entergy facilities are of great importance. Proper protective systems shall be established in the design phase and confirmed prior to start-up of the Customer's generation facilities. An inter-connection between Entergy and the Customer will not be allowed prior to proper coordination of protective devices.

As per the Specifying Protective Equipment section of Entergy Standard DR07-01 titled "Connecting Large Electric Generators to the Entergy Distribution System (500kVA to 20MVA)", Entergy will have the right to specify certain protective devices, including relays and circuit breakers that the customer must install.

Previous studies for generators connected to the Distribution System have identified a need to install Transfer Trip schemes with fiber communications between the generator and Entergy's Substation. A System Impact and/or Facility Study will be required to determine if Transfer Trip Schemes will be required for this project. The cost to implement a Transfer Trip Scheme on a prior project was approximately \$450,000.