PID 274
Feasibility Study Report
13.7 MW Distribution Inter-Connection
Buras Substation

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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.

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I. Introduction

The following Feasibility Study is based on the request for inter-connection of Entergy's distribution system south of Buras substation by PID 274. 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 274 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 274 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 274 generation.

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

C. ANALYSIS RESULTS

The existing maximum available three phase fault current on Buras Y6513 at PID 274's facility is approximately 1,049 amps. With PID 274's generator running in parallel, an additional 2,546 amps of fault current would be present at the delivery point, totaling approximately 3,595 amps of three phase fault current.

The results of the short circuit analysis indicate that the additional generation causes no increase in Steady-State short circuit current such that it exceeds the fault interrupting capability.

It should be noted that Transient studies were not performed; more detailed data will be necessary to perform a System Impact study.

D. PROBLEM RESOLUTION

As a result of the short circuit analysis findings, currently no resolution is required. However, in order to study the full effects of transients due to the generator, a full System Impact study will need to be performed.

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 SCADA load data from the past 13 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 transformer, generator, and interconnecting lines were modeled according to the information provided by PID 274.

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 steady state study show no potential overloads on Entergy's distribution facilities.

PID 274's site is fed by the Buras Y6513 - 34.5kv feeder; this feeder is 795kcm al and is sufficient to serve the load/generation. Buras Substation is however fed by Happy Jack Substation W4012 & W4013 – 34.5kv feeders. The Happy Jack transformer load runs between a minimum of 7.3 mva to a maximum of 30.8mva. When the PID 274 generator is running at maximum export (13.7 MW), and the distribution system is at minimum load (7.3mva), power will flow into the 115kv transmission system. Special relay coordination will be needed to address this issue. Connection of a generator this size to the distribution system will usually require a relayed recloser/breaker for communication and coordination.

D. PROBLEM RESOLUTION

There appear to be no problems identified for this part of the study (steady state) that were a result of the additional generation. However, in order to study the full effects of transients due to the generator, a full System Impact study will need to be performed.

Distribution Line connections, primary metering and recloser installations usually cost approximately $70K.

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 Buras 34.5kV bus

B. ANALYSIS RESULTS

The evaluation projected an increase of less than 765 Amps at the Alliance 115kV bus. The present interrupting duty of the breaker installed at Alliance 115kV has 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 274 generation.

2. LOAD FLOW ANALYSIS

A. MODEL INFORMATION

The load flow analysis was performed based on the projected 2014 summer peak load flow model using PSS™E 30.3 and PSS™MUST 9.0. 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 year 2014 excluding short-term 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 13.7MW PID 274 generation was then modeled in the case to build a revised case for the load flow analysis.

B. LOAD FLOW ANALYSIS

Single contingency analyses on Entergy's transmission facilities (including tie lines) 69kV and above were considered. All transmission facilities on the Entergy transmission system above 69kV were monitored.

C. PROBLEM RESOLUTION

There were no problems identified for this part of the study that were the result of PID 274 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 indicated that the generator will be connected to the distribution system through a step-up transformer. The 3 phase 17mva 8% impedance transformer will be connected 13.8kv delta on the generator side to 34.5kv wye grounded on the Entergy distribution side.

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.

Relay upgrades will be needed on Buras Y6513 to accommodate reverse power flow.

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. Communications distance from PID 274’s site to Buras sub is 18.9 circuit miles and 36.4 miles to Happy Jack sub.

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.