

***PID 272***  
**Feasibility Study Report**  
**5MW Distribution Inter-Connection**  
**Five Points 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 at Five Points 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 272 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 272 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 272 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 272 generation causes negligible increase in short circuit current such that the increase does not 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 and the system impact study is complete. Max three phase fault current and max line to ground fault current does not exceed 3,700 amps.

### **D. PROBLEM RESOLUTION**

As a result of the short circuit analysis findings, no resolution is required until system impact study is complete to verify this analysis.

## **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 12 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 272.

### **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**

Noted issues to the Five Points 13.2kV system due to the proposed inter-connection of PID 272 generation are as follows:

- With PID 272 generation of 5MW(.80 pf) the loading of 2AA conductor from Senior High Drive and N. Lafayette Rd. for 1 mile south to five points substation is in excess of its 100% thermal rating.
- Loading of S&C,100QR fuses at L26831are in excess of 100%.
- Increased backbone exposure.

### **D. PROBLEM RESOLUTION**

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

- Reconductor approximately 1 mile of three phase primary to 336ACSR
- Remove 100 amp fuses from system.

Design group estimate (based on recent projects in south Abbeville area):

Reconductor approx. 1 mile of three phase primary to 336ACSR...	\$350,000
Total estimated cost of listed work to be performed.....	\$350,000

## **3. INTERCONNECTION FACILITIES**

The Interconnection Customer's designated Point of Interconnection (POI) is a local 13.8 kV distribution feeder, 811FP, sourced from Five Points 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 272 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 Five Points 13.2kV bus.

##### **B. ANALYSIS RESULTS**

The evaluation projected an increase of less than 130 Amps at the Five Points 69kV bus. The present interrupting duty of the breakers installed at Five Points 69kV 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-272 generation.

#### **2. LOAD FLOW ANALYSIS**

##### **A. MODEL INFORMATION**

The load flow analysis was performed based on the projected 2013 summer peak load flow models using PSS<sup>TM</sup>E 30.3 and PSS<sup>TM</sup>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 2013 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 5MW PID-272 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 a result of PID-272 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 indicates that PID 272 will use (10) 500KVA transformers between the generator and PCC. The primary side is listed as 12,470 volts and will need to be adjusted or regulated to synchronize to Entergy system primary 13.2KV, Wye grounded. The secondary side connection will be 3 phase, 200 volts, Delta. Transformer Impedance is 6.75% on a 1000KVA base.

Transformer fuse data: Cooper, Bay-O-Net, ESLP, Size TBD, Speed TBD,

Interconnection Circuit Breaker: Cutler Hammer, VCP-W, 600 amps (TBD), Interrupting rating 16KA, Trip speed 5 cycles.

Current transformer data: TBD

## **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 interconnection 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.