PID-281
Feasibility Study Report
19.95MW Distribution Inter-Connection
Turnerville Substation

Prepared by:

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Rev	Issue Date	Description of Revision	Revised By
1	September 29, 2011	Initial Review	D. Robey C. Adams
A	September 30, 2011	Approved for Release	A.Donaldson S. Kolluri

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 Turnerville 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-281 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-281 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-281 generation.

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

C. ANALYSIS RESULTS

The results of the short circuit analysis indicate that the additional fault current introduced to the 13.2kV distribution system by the PID-281 generation will be approximately 1100A. This will 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.

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 15 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-281.

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

Turnerville Substation has a 9.375 MVA, 69-13.2kV transformer connected to a 13.2kV bus that currently serves a total load of approximately 5MW on two distribution feeders.

Regarding the proposal of a 19.95MW generation interconnection to Turnerville substation's existing low voltage bus, below are some observations made as a result of performing the analysis:

- With the existing distribution configuration, a 13.2kV Wye-grounded source must be used for interconnection.
- 19.95MW's of generation that will be made available with only 5MW's of load at Turnerville results in 15MWs of generation being introduced onto the 69kV transmission grid through the substation transformer. The existing 9.375 MVA transformer at Turnerville would be overloaded.
- Adding 19.95MW's of generation at a voltage of 13.2kV will exceed the capacity of Turnerville's existing distribution feeders. Thus, a new dedicated feeder with adequate capacity, considering acceptable power factor, would be required from the Customer's facility to Turnerville substation.
- A Transmission line to ground fault not being cleared from the interconnected generator in a timely manner will result in a generator contribution to the fault through the delta windings of the substation transformer, producing a possible overvoltage on the two ungrounded phases. This presents the potential for damage to 69kV arrestors and other utility equipment.
- If Turnerville Substation would be immediately islanded from the transmission grid, possibly from a fault, then the existing voltage regulation of 19.95MW's on the 13.2kV bus will temporarily remain on the resulting 5MW's of load until voltage regulation has time to adjust accordingly. Consequently, this will create a large voltage swing greater than the allowable 4%, which will present an overvoltage condition for the other distribution customers. Considering the 7.25% impedance of the source transformer, the sudden decline of full load by ¾ will produce a voltage swing greater than 4%.
- Intermittent cloud cover or cloudy overcasts could cause voltage flickers or swings greater than 4% from sudden changes in the amount of available generation.

D. PROBLEM RESOLUTION

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

With evidence of possible intermittent voltage flickers and large voltage swings due to the amount of generation made available relative to the existing distribution load, it is concluded that there is no manageable and feasible resolution for the proposed generation interconnection to the existing Turnerville Substation's 13.2kV bus. Therefore, the recommended resolution is:

- Add a new 25MVA dedicated transformer (with LTC) at Turnerville Substation to separate the existing distribution from the voltage variation that can potentially be introduced by PID-281.
- Add a new 1200A main breaker along with other transformer protection and isolation devices on high/low sides of new substation transformer.
- Reconfigure existing line bay to make room for new transformer bay.

Estimated Cost for above work……$3,200,000

Please note that this cost estimate does not include the cost to build a new 13.2kV distribution feeder to Turnerville Substation, which is the customer's responsibility.

3. INTERCONNECTION FACILITIES

The Interconnection Customer's designated Point of Interconnection (POI) is Turnerville Substation. The interconnection customer is responsible for all facilities required to connect the generator to the POI.

The estimated cost of a typical 13.2 kV Interconnection is $20,000. This cost is based on parametric estimating techniques for primary metering and associated hardware "typical" to a 13.2 kV interconnection.

A detailed evaluation of the interconnection facilities has not been performed at this time. A specific estimate for PID 281 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 the 13.2kV bus connected to the Turnerville 69kV substation.

B. ANALYSIS RESULTS

The evaluation projected an increase of approximately 280 Amps at the Turnerville 69kV bus. The present interrupting duty of the breakers installed at Turnerville 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-281 generation.

2. LOAD FLOW ANALYSIS

A. MODEL INFORMATION

The load flow analysis was performed based on the projected 2012 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 2012 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 19.95MW PID-281 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-281 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

Solidly grounded -wye generation connected through solidly grounded wye-wye transformation is preferred. Other generator/inverter connections & transformations may be deemed acceptable, but will require further study in a System Impact Study.

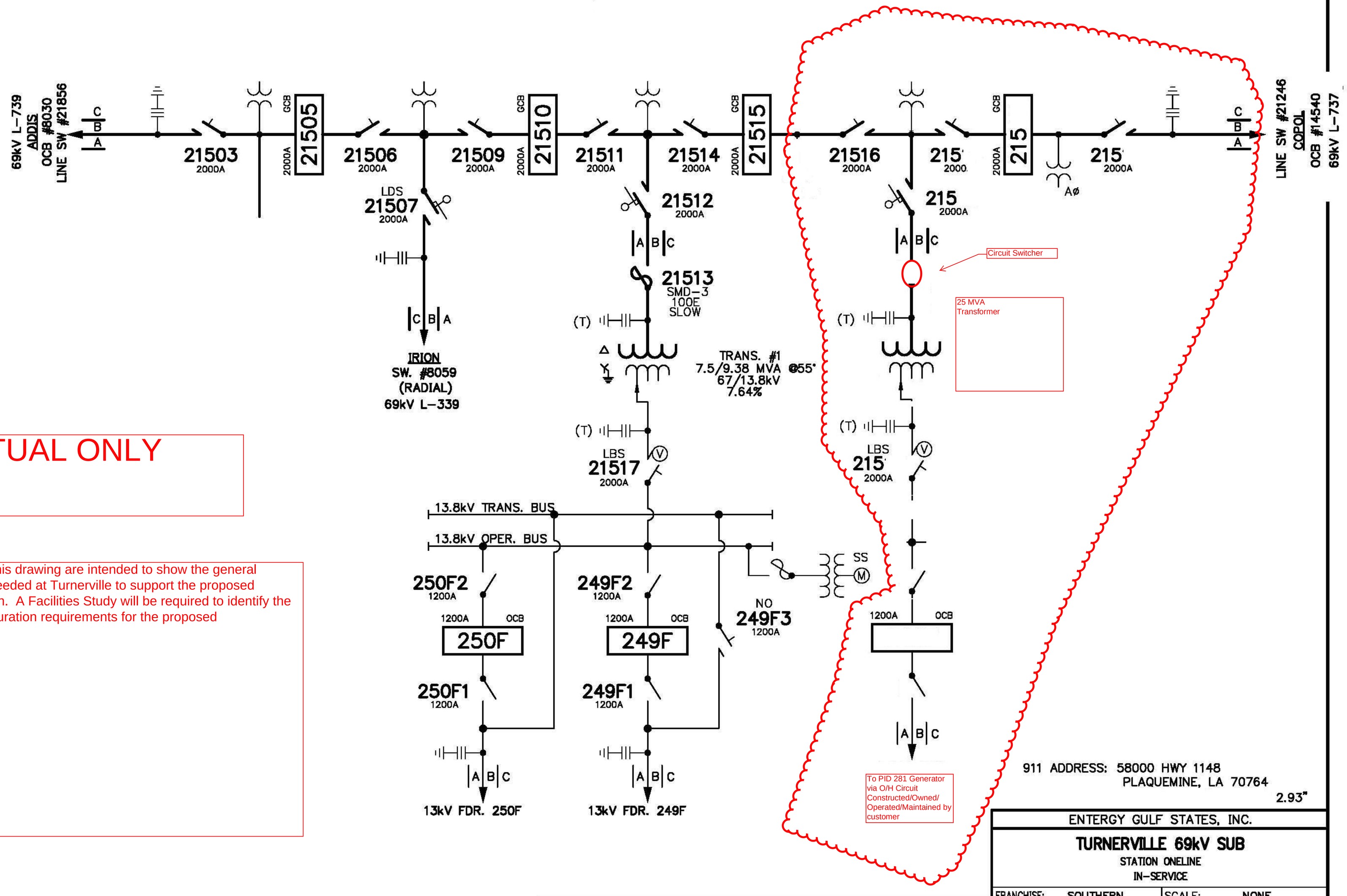
V. Coordination

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.



CONCEPTUAL ONLY

Upgrades identified on this drawing are intended to show the general configuration changes needed at Turnerville to support the proposed generator interconnection. A Facilities Study will be required to identify the specific upgrades/configuration requirements for the proposed interconnection.

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PLAQUEMINE, LA 70764

2.93"

NO.	DATE:	REVISION	BY:	CHK:	APPR:
5	02-07-11	ROTATED SW 21517 PER FIELD MARKUP	HDR	GM	BS
4	12-03-02	ADDED NORTH ARROW & UPDATED LINE DESIGNATION	HDR		

ENTERGY GULF STATES, INC.

TURNERVILLE 69kV SUB

STATION ONELINE
IN-SERVICE

FRANCHISE: SOUTHERN | SCALE: NONE

Entergy

No. G7272S01

PLOT 1=1 | SH. 1 OF 1

hrondaz 3/10/2011