PID 278
Feasibility Study Report
3.2MW Distribution Inter-Connection
Loblolly Substation

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Rev	Issue Date	Description of Revision	Revised By
0	April 27. 2011	Initial Review	M. Charleville
A	May 10, 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 Loblolly 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 278 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 278 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 278 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 278 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 twelve 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 278.

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 Loblolly 324LL 13.2kV system due to the proposed inter-connection of PID 278 generation are as follows:

- Loading of 2AA and mixture of 2AA/0AA conductor from Hwy 190 down Woodside Drive to the proposed site (3.2MW at .80 power factor). In addition, with the possibility of an additional 1.6MW generator in future years (4.8MW at .80 power factor) will cause increased loading issues
- Loading of S&C 150QR fuses at Hwy 190
- High voltage to immediate local customers
- Increased backbone exposure

Once specific operating parameters of the synchronous generators are determined:

- Ensure area operating voltage within ± 5%
- Ensure area feeder power factor meets system requirements

D. PROBLEM RESOLUTION

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

- Reconductor approximately 3500' of three phase primary to 336ACSR
- Install (9) Under Arm Disconnects, (9) fuse cutouts, and necessary crossarms, poles, hardware 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):

Reconductor 3500' of primary to 336ACSR……
Install (9) UADs, (9) fuse cutouts, poles, crossarms, etc ……..
Total estimated cost of listed work to be performed……..... $105,000

3. INTERCONNECTION FACILITIES

The Interconnection Customer's designated Point of Interconnection (POI) is a local 13.2 kV distribution feeder, 324LL, sourced from Loblolly 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 278 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 Loblolly 13.2 kV bus.

B. ANALYSIS RESULTS

The evaluation projected an increase of less than 300 Amps at the Loblolly 69kV bus. The present interrupting duty of the breakers installed at Coly 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-278 generation.

2. LOAD FLOW ANALYSIS

A. LOAD FLOW ANALYSIS

The maximum power that the customer plans to export at the distribution level is approximately 3.2MW. The minimum load presently connected at Loblolly 69kV is in excess of 6.49MVA, therefore, a 3.2MW injection at the distribution level will not impact Entergy’s transmission facilities.

B. PROBLEM RESOLUTION

There were no problems identified for this part of the study that were a result of the PID-278 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 the CAT3520 generators and transformer* secondary side connection will be 3 phase, 4160 volts, delta. The transformer primary side will connect 3 phase, voltage 13.8kV (utility operates a 13.2kV system), wye grounded. A system diagram indicates a 200A, 2400 VAC, 10 sec neutral grounding resistor connected to each generator.

* The PID 278 transformer is noted to be 3 phase, 3750kVA base, with 6.5% impedance. A single line diagram illustrates a 1200A, 250MVA, 5kV vacuum circuit breaker between the generator and transformer, a fault interrupter 600A, 3 phase, 24VDC motor operated, shunt trip AIC 12,500 rated 25,000 volts 125kV BIL between customer and Entergy tie, and Schweitzer relaying.

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.