
# ERCOT REQUIREMENTS TO INTEGRATE ENTERGY GULF STATES - TEXAS INTO ERCOT

## PHASE II STUDY REPORT

Regional Planning

December 2006

# EXECUTIVE SUMMARY

This report documents the study that was undertaken by ERCOT, with input from Entergy and ERCOT stakeholders through the ERCOT Regional Planning Groups (RPGs), to determine the transmission system improvements that would be required to reliably and efficiently integrate the Texas portion of the Entergy Gulf States system (EGSI-TX or Entergy Texas) into the ERCOT system after disconnecting EGSI-TX from the Eastern Interconnection generally along the Texas/Louisiana border. This Phase II study follows on the screening-level analysis of these requirements (the Phase I study) that was performed by ERCOT staff and Entergy in early 2006, the results of which were presented at the March 29, 2006 Public Utility Commission of Texas (PUCT) workshop in Project 32217.

The purpose of the Phase II study was to more fully evaluate and optimize the required transmission improvements, including other transmission alternatives, existing Entergy transmission service obligations, and other considerations submitted by stakeholders.

The minimum set of transmission projects that would be required to reliably serve load in ERCOT after the integration was complete was identified. The estimated total capital cost for this set of projects was $158 million. These projects are:

- Construct a new 345/138kV substation called Quarry in the 345kV line from Grimes to Crockett
- Add a new 345kV line from Quarry to new Rivtrin 345/138kV substation
- Add a new 345kV line from modified Grimes to modified Roans Prairie substation
- Loop the Kuykendahl-King 345kV line into new Porter 345/138kV substation
- Add a new 230kV line from Sabine to modified Hartburg substation with additional 345/138kV autotransformer at Hartburg substation
- Close the Etoile tie between TXUED and Deep East Texas Cooperative
- Upgrade the Crosby-Dayton and Oakridge to Porter 138kV lines
- Add 138/69 kV autotransformer at South Beaumont
- Add a new 138kV line from Bon Wier to Kirbyville

Two additional projects are needed to meet existing Entergy contractual obligations. The estimated capital cost of these projects is $90 million. These projects are:

- Add a 150MW asynchronous tie between Quarry and Crockett
- Add a 300MW asynchronous tie between the Hartburg (ERCOT) and Hartburg (Eastern Interconnection) substations

While the addition of these projects would allow the EGSI-TX system to be reliably integrated with ERCOT, the resulting system would not be efficient relative to the rest of ERCOT. Relatively higher cost generation (primarily on the EGSI-TX system) would have to be used to serve load, rather than lower cost generation, in some hours in order to avoid violating transmission security limits. This would cause production costs in the EGSI-TX area to be higher than elsewhere in ERCOT. A set of projects were developed that could relieve most of these transmission system constraints. The estimated capital cost of this set of projects is $278 million. However, the Phase II study showed that this set of projects could be expected to reduce the cost of dispatching higher cost units to meet transmission limits rather than lower cost units by $64 million annually (based on mid-2005 gas price forecasts; a calculation using updated gas price forecasts is also provided in the report). These production cost savings are more than sufficient to justify the $278 million capital expenditure on these projects. These projects are:

- Add a 345kV line from Nacogdoches to Lufkin
- Add a 345kV double circuit line from Lufkin through Cypress and China to Cedar Bayou
- Add substations at Cypress and China

Entergy requested that, in addition to the proposed 300 MW asynchronous tie at the Hartburg substation, an additional 600 MW of tie be analyzed at that location. The addition of a second 230kv line from Hartburg to Sabine is needed to provide sufficient transmission capacity away from the Hartburg substation with the addition of this tie. The estimated cost of this second circuit is $25 million.

The resulting synchronous interconnections between the existing ERCOT system and the EGSI-TX system would be at Porter, Roans Prairie to Grimes, Lufkin to Cypress and Cedar Bayou to China, all at 345kV, and at Etoile and Dayton to Crosby at 138kV. The asynchronous interconnections would be 150MW with SPP at Quarry and 300 MW (or 900MW) from Entergy (Eastern Interconnection) at Hartburg.

The Lewis Creek units would still be required to be available. For exports over the Quarry tie, one of the Lewis Creek units would have to be on-line. If exports of over 80MW are required over this tie, an additional $11 million transmission project (Grimes to Mt. Zion to Huntsville 138kV upgrade) would be required.

Detailed descriptions of input assumptions, analysis methodology and study results are provided in the complete report.

# EGSI-TX INTEGRATION STUDY
# PROJECT No. 32217
# PHASE II REPORT

## 1. Introduction

At the March 29th, 2006 workshop in Project 32217 at the Public Utility Commission of Texas (PUCT), ERCOT presented the result of a screening-level study (the Phase I study) of the system upgrades necessary to reliably and economically integrate the Texas portion of the Entergy Gulf States system (EGSI-TX) synchronously into ERCOT, after disconnecting EGSI-TX from the Eastern Interconnection generally along the Texas/Louisiana border. ERCOT recommended, and was later directed by the PUCT to perform, additional studies through the ERCOT Regional Planning Group (RPG) process to better optimize and test the set of projects which would be needed.

In this Phase II study, ERCOT has worked with Entergy and interested ERCOT RPG members to identify and evaluate alternative transmission upgrades to optimize the integrated ERCOT total system needs and benefit, including stability analysis. Regular status reports were given at RPG meetings and published to the ERCOT website. Comments and input were solicited and received from stakeholders via email and through conversations with ERCOT staff.

## 2. Requirements

The primary requirements for the Phase II study were to:

a. Meet ERCOT reliability criteria economically
b. Provide 150MW import capacity from SPP and 300MW from Entergy to meet East Texas Electric Cooperative (ETEC) existing firm service arrangements
c. Study an additional 600MW asynchronous tie at Hartburg for EGSI-TX to serve their customers with their resources located outside of Texas

# 3. Process

## a. Topology

Based on feedback from ERCOT stakeholders on the Phase I study, ERCOT became aware that the system topology used for the Phase I study included several changes to the existing topology of the EGSI-TX system which are not in Entergy's firm transmission plans. ERCOT and Entergy staffs worked together to identify all changes that were necessary to build a powerflow case to be used for the Phase II study that only contained lines (and their corresponding characteristics) that exist today or for which Entergy has firm plans to upgrade. The ERCOT portion of the combined network remained the same as what was used for the Phase I study. The resulting combined topology was used as the base case for the Phase II study.

## b. Stakeholder Upgrade Alternatives

ERCOT posted the base case data and encouraged RPG members to submit transmission upgrade suggestions which might have lower total capital costs or result in greater savings than the set of projects which were presented in the Phase I study. ERCOT received a number of responses from Entergy, TXU, CenterPoint, Cottonwood, Constellation, Tenaska, and SPP.

ERCOT worked with affected TDSPs and Entergy to select several potential set of projects for detailed study, based on whether the alternative projects, when compared to the projects included in the Phase I study, had a lower capital cost, would be quicker to build, could potentially serve ERCOT system reliability and economic needs better (for example, to eliminate existing or potential congestion, or to utilize existing or potential stability devices, etc.), and were feasible to route and construct.

## c. Tools used for studies

ERCOT performed all studies using a model (UPlan) which simulated the security-constrained unit commitment and economic dispatch of the combined system resources to serve the combined system load. ERCOT also tested the results for certain hours with an AC power flow tool (Powerworld). The stability studies were performed by Powertech Inc. using TSAT.

## d. Create a reliability case

From the selected set of projects to be studied, ERCOT determined the lowest capital cost set of projects which met the thermal reliability criteria. The on-going effort between Entergy and SPP to determine the "tie-backs" that would be necessary to maintain reliability on the Eastern Interconnection side has fed additional

requirements and system modifications that had to be incorporated into this part of the study.

### e. Determine economic projects

The set of projects included in the reliability case resulted in a system that should be able to meet the steady-state reliability requirements, but would require running relatively higher cost generation to relieve transmission constraints. However, the ability to avoid running the higher cost generation to relieve transmission constraints (rather than lower cost generation that is available on the system) might more than pay for the cost of certain additional transmission upgrades over time. Thus, certain additional upgrades were evaluated to determine if they were cost effective and which resulted in the highest economic savings. In addition, the sensitivity of these savings to natural gas prices was evaluated.

### f. Study an additional 600MW Asynchronous tie at Hartburg

Identified and studied several alternative transmission options to optimize system with an additional 600MW asynchronous tie and associated baseload generation from the Entergy System outside of Texas.

# 4. Assumptions

a. Study Case

Combined ERCOT 2009 Pre-nodal recommendation topology with EGSI-TX 2010 system topology and included only EGSI-TX firm and non-deferrable transmission upgrades prior to the integration time frame.

b. Year of study

- 2009-2010

c. Fuel Price

Used natural gas price forecast from pre-nodal study that had been developed in mid-2005 ($5/MMBTU) for initial analysis of reliability and economic transmission projects. Updated $7/MMBTU natural gas price forecast was also run for comparison and reporting purposes. Monthly average fuel prices used in study are on Appendix 6.

d. Transmission Project Capital Costs

Capital cost estimations were obtained from affected transmission owners and Entergy. Basic cost per mile or per MW can be found on Appendix 2. ERCOT assumed to use the lowest cost breaker scheme topology for new stations.

e. Contingency assumption

For all studies: Apply ERCOT Category B Contingencies Assumptions under ERCOT Operating Guides (Section 5: Planning):

a) Include all single line or single transformer contingencies and all multi-line contingencies which are defined as two lines sharing the same tower of 0.5 mile or more.
b) Include all single generator contingencies.
c) Combination of a) and b) above. Note that to reduce the number of contingency runs; selected essential generators in the study area were analyzed. This method is only used to determine reliability projects.

f. Installed Generation

- ERCOT assumed that all generators in ERCOT and EGSI-TX areas are available to be dispatched for all studies. To identify reliability projects, the selected largest unit in EGSI-TX area will be assumed unavailable for re-dispatch, pursuant to the ERCOT Category B contingency assumptions.
- Only current generators and generators which have had signed interconnection agreement with ERCOT will be included in the case for study and analysis. Additional mothballed generators may be brought on-line.

g. Asynchronous ties assumption

- At least 450MW of asynchronous ties are included in all cases, based on existing Entergy contractual agreements.
- 150 MW of this new tie capacity is needed into ERCOT at Quarry substation from SPP and 300 MW into ERCOT at Hartburg substation from Entergy.
- Asynchronous system technology type is not within this study scope. It maybe determined when the stability study is finalized.

- An additional 600 MW into ERCOT at Hartburg was included in the "Economic plus 600 MW asynchronous tie case".

# 5. Minimum Reliability Projects

The first step in the analysis for Phase II of the Entergy Integration Analysis was to develop the set of projects which, along with the security-constrained dispatch of the system, allowed the ERCOT reliability criteria to be met. Generally, this minimum reliability base case contained the minimum capital cost upgrades necessary to reliably serve load, but did not consider the economic production cost savings to be gained by additional transmission system improvements. The method to develop the minimum reliability base case was to identify the sets of projects which were able to meet the steady-state reliability criteria. From these sets, the set that resulted in the lowest total cost, including capital costs and system production costs, was selected.

ERCOT stakeholders suggested several suggested transmission system improvement options to be considered as alternatives to the upgrades included in the March 29 case. Generally, these options were related to the western part of the EGSI-TX area. ERCOT evaluated these suggestions, along with alternatives suggested by Entergy and utilized them to develop the minimum base case. Shown in Appendix 1 is an illustration of each of these suggested options.

ERCOT, Entergy and stakeholders developed a list of potential projects to meet the needs of the eastern portion of the Entergy Texas transmission system. The initial upgrades identified for the eastern portion of the transmission system were related to providing sufficient "get away" transmission capacity for the generation at the Hartburg substation after the integration is complete. In the present configuration, the Hartburg substation consists of three(3) 500kv transmission lines, one(1) 230kv line and one(1) 500/230kv autotransformer**.** After the integration is complete, the Hartburg substation will consist of one(1) 500kv line, one 230kv line and one(1) 500/230kv 800 MVA autotransformer. The generation at Hartburg is approximately 1250 MW plus the proposed 300 MW asynchronous tie. The concern pertains to the contingency outage of the remaining 500kv line. The loss of this line will force curtailment of the existing and planned generation at Hartburg to a maximum generation of 800 MW, a reduction of approximately 48% when considering the proposed additional generation. The minimum capital cost to correct this curtailment involved the installation of a second 500/230kv autotransformer at the Hartburg Substation and the construction of a new Hartburg to Sabine 230kv transmission line. The estimated additional capital cost was $42.9 million. Other options were considered but involved higher capital costs.

Although the revised Hartburg interconnection satisfied the "get-away" capability problem, there was still insecure energy in the Entergy Texas system. There are three main areas of congestion that remained. These areas identified were the Lewis Creek area, the Sabine area and area in the general vicinity of Sam Rayburn Lake.

### a. Lewis Creek Area

The Lewis Creek area consists of heavy residential and commercial loads. The bulk of this load is centered just north of the Houston area. Contingency outage of transmission lines into the Lewis Creek area primarily from the western and southern edge result in insecure energy for the Lewis Creek area. All of the proposed interconnections received from stakeholders addressed interconnections that pertained to the Lewis Creek area and the southern part of the Entergy Texas system near the Porter area. Each combination and variation of received interconnections was assigned a numeric label. Although the proposed interconnections received were in the general area of congestion in the western and southern portion of the Entergy Texas system, none of the interconnections or combinations of interconnections resulted in zero insecure energy for this area. After numerous runs, a single interconnection emerged that minimized most of the insecure energy in this area. This interconnection was labeled LC1.

The LC1 interconnection, a combination of Configuration #2 and #4 shown in Appendix 1, consisted of a new looped transmission line from the existing CenterPoint King – Kuykendahl 345kv transmission line into a new Porter 345 Substation. In addition, a new 345/138 kV autotransformer will be installed to connect to Entergy's existing Porter 138kv Substation with the new Porter 345kv Substation. Also the 150MW asynchronous tie on the Grimes-Crockett 345kV line was included in the LC1 topology at a new Quarry 345kv Substation. The new Quarry Substation will be looped into the existing Grimes – Crockett 345kv transmission line. From the new Quarry 345kv Substation, a new single 345kv line will be built to a new Rivtrin 345kv Substation. A new 345/138kv autotransformer will be installed to connect the new Rivtrin 345kv substation to the existing Rivtrin 138kv Substation.

Additional transmission improvements would be required to eliminate all insecure energy in the western and southern half of the Entergy Texas system. These additional improvements consisted of a second Roans Prairie – Grimes 345kv line(approximately 1.5 miles) on separate transmission structures. Also, the Crosby – Dayton 138kv line will be upgraded to 185 MVA and the Oakridge – Porter 138kv line will be upgraded to 531 MVA along with substation bus work at Roans Prairie. The total capital cost for the LC1 configuration was $130.1 million. Table 1 shows the breakdown of the LC1 configuration capital costs in millions of dollars:

| | |
|---|---|
| BUILD ROANS PRAIRIE – GRIMES 345KV LINE | $6.50 |
| ADDITIONAL SUBSTATION WORK AT ROANS PRAIRIE | $5.00 |
| UPGRADE CROSBY – DAYTON 138KV LINE | $10.00 |
| INSTALL QUARRY 345KV SUBSTATION | $7.5 |
| INSTALL RIVTRIN 345KV SUBSTATION WITH 345/138KV AUTO | $14.55 |
| BUILD QUARRY – RIVTRIN 345KV LINE | $20.00 |
| INSTALL PORTER 345KV SUBSTATION WITH 345/138KV AUTO | $14.55 |
| LOOP KUYD – KING 345KV LINE INTO NEW PORTER 345KV SUB | $17.50 |
| UPGRADE OAKRIDGE – PORTER 138KV LINE | $4.50 |
| INSTALL 150 MW ASYNCHRONOUS TIE @QUARRY | $30.00 |
| TOTAL = | $ 130.10 |

Table 1

Although the LC1 configuration satisfied insecure energy in the western and southern half of the Entergy Texas system, additional transmission improvements are still required on the eastern half of the Entergy Texas system. As previously mentioned, the areas of concern are the Sabine area and the Sam Rayburn lake area.

### b. Sabine Area

The Sabine area consists primarily of the cities Beaumont, Port Arthur and Orange. This area is significant petrochemical plant type base load as well as residential/commercial load. The transmission system is primarily 69kv with some 138kv and 230kv. Contingency outage analysis of the area identified problems in the 69kv system in the vicinity of the Beaumont area. Inadequate 138/69kv autotransformer capacity for selected contingencies results in insecure energy on the 69kv system in the south Beaumont area. The installation of an additional 138/69 kV autotransformer at the South Beaumont 138kv substation addresses the insecure energy in this area. There continues to be congestion in this area but none that results in insecure energy. The estimated cost for the autotransformer is approximately $3.48 million.

### c. Sam Rayburn Area

The vicinity around the Sam Rayburn lake area is primarily small towns mixed with scattered rural areas. In the initial analysis, it was assumed that the Toledo Bend generation would be in the ERCOT region. However, this assumption was changed during the “tie back” discussions between Entergy and SPP. The only generators in this area that will remain on the ERCOT system are the hydro-electric units at Sam Rayburn Lake, which have low capacity factors in the summer months. The area is

served on the western side from the Doucette 138kv Substation and the south by the Evadale 138kv Substation. The worst contingency is the loss of the 138kv connection from Evadale. This contingency forces power to flow from the Doucette substation to serve all load in the Sam Rayburn area and beyond toward Evadale. Inadequate transmission capacity from Doucette towards the Sam Rayburn Lake area and points south from there results in insecure energy in this area for this worst contingency outage.

Several options to alleviate the insecure energy were examined. The primary objective of each option was to replace power injection into the area which is currently supplied by the Toledo Bend generation. Proposed 138kv ties from the TXU area were explored. However, these options would be difficult or expensive to construct since they would be going through the Angelina National Forest.

In the course of investigating proposed ties from TXU, it was discovered that an existing open tie between TXU and the Deep East Texas Cooperative currently exists at the Etoile 138kv Substation. This tie was actually closed during storm recovery efforts after Hurricane Rita. UPLAN analysis of this tie connection indicated that all insecure energy was eliminated when this tie connection was closed. The cost associated with closing this tie is small. There may be some reactive support additions required in this area. ERCOT understands that Entergy has discussed this option with ETEC.

ERCOT also explored other, more costly options to support the Sam Rayburn Lake area from the south. Two options were found to work. The first was the construction of a new 138kv transmission line from Orange Bulk to Fawil 138kv Substation, primarily using the existing right-of-way currently occupied by a normally-open Entergy 69kV transmission line from Deweyville to Fawil. The estimated cost for this 52 mile transmission line is approximately $32.75 million which includes a new transmission line cost of $28.5 million and a new Deweyville to Echo 69kv line at a cost of $4.25 million. The second option is a new Hartburg to Fawil 230kv line, which would be approximately 38 miles at a cost of $32.35 million. In addition, a new 230/138kv autotransformer will be required at the Fawil Substation at an estimated cost of $ 8.45 million. Therefore, the total estimated cost for the Fawil 230kv tie is approximately $45.05 million which includes the new Deweyville to Echo 69kv line cost of $4.25 million.

The Fawil 230kv tie saved approximately $5 million in annual production cost savings over the Orange Bulk to Fawil 138kv tie and approximately $8 million over the Etoile 138kv tie option. Therefore, the Fawil option had a cost/benefit slightly less than 1. However, the Etoile tie meets the minimum reliability criteria at minimal capital cost ($0.5 million). Therefore, it was decided to proceed with the Etoile tie connection for economic analysis portion of the study.

The study label for the configuration of the reliability projects in the Eastern area of the Entergy Texas transmission system was SAB34.

Congestion still remains in this minimum reliability base case. The highest concentration of congested lines in the EGSI-TX system is in the Dayton, Lewis Creek and Cypress areas when key single transmission lines into those areas are outaged.

The total capital cost for the SAB34 configuration was $106.88 million. Table 2 shows the breakdown of the SAB34 configuration capital costs in millions of dollars:

| | |
|---|---|
| ETOILE 138KV TIE | $0.50 |
| BUILD HARTBURG - SABINE 230KV LINE | $26.10 |
| INSTALL HARTBURG 500/230KV AUTOTRANSFORMER | $16.80 |
| INSTALL S. BEAUMONT 138/69KV AUTOTRANSFORMER | $3.48 |
| INSTALL 300 MW ASYNCHRONOUS TIE @HARTBURG | $60.00 |
| | TOTAL = $ 106.88 |

Table 2

Therefore, the cost of the selected minimum reliability base case, LC1_SAB34, is the LC1 cost of $ 130.1 million and the SAB34 cost of $ 106.88 for a total cost of $236.98 million.

One additional upgrade is needed that was not included in the SAB34 set of upgrades. The approximately 60 MW of load on the 138kV line east of the Rayburn substation to Jasper will be served radially out of Rayburn. To alleviate this condition, a new 138kv line would be constructed from the Bon Wier Substation to the Kirbyville Substation. The estimated capital cost for this line is $10 million.

### d. Quarry Tie Export to SPP

In the course of the reliability study, Entergy informed ERCOT that the SPP needed the 150 MW asynchronous tie at the new Quarry 345kv Substation to be able to export power from ERCOT onto the SPP to support SPP load in the Crockett area under contingency of the 345kV line serving that area from the north. Up to this point, ERCOT had only studied power flowing from SPP to ERCOT under existing contractual arrangements across the asynchronous tie. It was unclear exactly how much power over the Quarry tie would be needed by SPP to maintain the reliability in this area, so ERCOT was required to study several options and document them herein.

With this change to the back to back asynchronous tie scenario, the Fawil 230kv and Etoile options were again evaluated. Neither of these options would allow 150MW to be exported over the tie and meet ERCOT reliability criteria. With the Fawil 230kv line in place, the Quarry tie could export up to 140 MW. With only the Etoile tie, the

Quarry tie export would be limited to a maximum of 80 MW. In both cases, a unit at Lewis Creek must be on line in order for any export to be supported.

Several options were investigated to increase the amount that could be exported with the Etoile tie option to 150MW. The preferred option, if it is necessary to export more than 80MW to meet reliability needs on the SPP system, is to upgrade the Grimes to Mt. Zion to Huntsville 138kv line to 313 MVA at an estimated capital cost of $11 million. A unit at Lewis Creek must still be on line in order for the export to be supported.

# 6. Economic Projects

## a. Background

While the minimum reliability case was able to meet the ERCOT steady state reliability criteria, this could only be accomplished by dispatching certain relatively higher cost generating units in a large number of hours so that the transmission system security limits are not exceeded. Figure 1 shows the annual relative marginal costs of each bus on the combined system across all hours for the minimum reliability case, which shows that costs to serve load in the EGSI-TX area are higher than in the rest of ERCOT with only these minimum reliability projects in place.

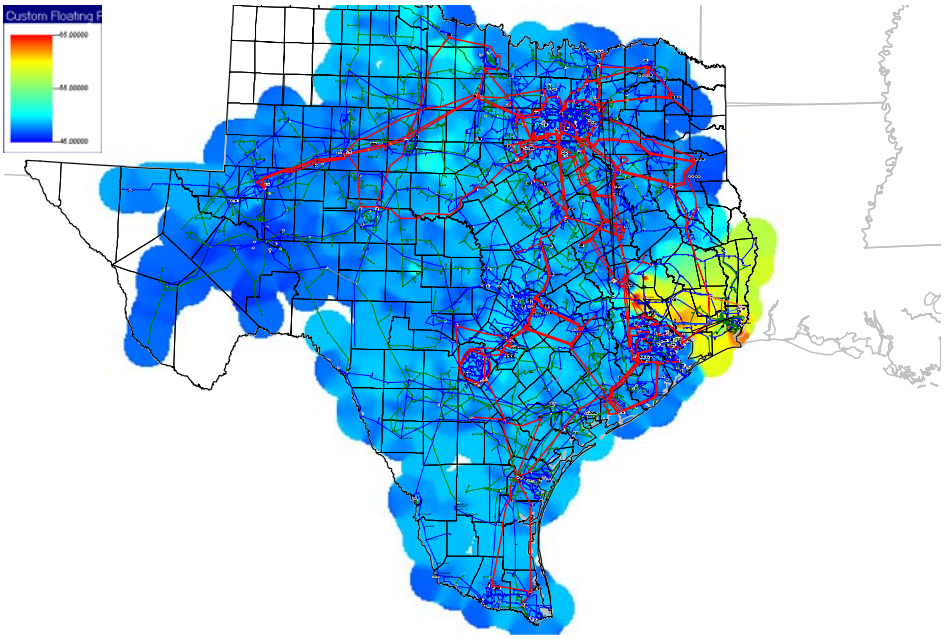


**Figure 1 – Annual Relative Marginal Costs for Minimum Reliability Case**

However, there may be transmission projects that increase those transmission system limits and allow lower cost generation to be dispatched rather than the relatively higher cost generation that would be required to be dispatched without to the transmission upgrade. If the cost savings from generating with the lower cost generation, over time, is projected to exceed the capital cost of the transmission upgrades, those upgrades are economically justified.

Note that the underlying reason for economic transmission upgrades is the need to meet system reliability criteria; the only difference between the minimum reliability projects and the economic projects is that there is no viable alternative to transmission construction to meet the needs addressed by the reliability projects, whereas for the economic projects there is the alternative, albeit expensive, to continue to generate with the relatively higher cost generation. For the needs addressed by the reliability projects, selecting the preferred solution is a matter of selecting the lowest capital cost alternative. For economic projects, there is an additional criteria, which is that the economic projects must be lower cost (considering both capital and production costs) than the alternative of continuing the higher cost dispatch.

The basic method to determine economic projects is to incrementally add each transmission line project to the minimum reliability base case. The incremental annual production cost savings above the base case must be greater than the incremental annualized capital cost of the line. This criterion considers the incremental economic value of the project from a societal viewpoint, and thus does not consider the impacts on particular entities. The ratio of cost to savings is known as the benefit cost ratio and must be equal or less than 1.0. The standard annual carrying charge rate for transmission investment used by ERCOT to annualize the capital cost of transmission is 16.8%, or roughly 1/6 of the capital cost.

The incremental capital cost and incremental savings is measured relative to the capital and production costs of the case containing the preceding added transmission elements. An example is shown below:

Project A: Incremental Capital Cost = $13.00 million

Incremental Production Cost Savings = $3.00 million

Cost/Benefit Ratio = $13.00 million/ ($3.00 million x 6) = 0.722

Therefore, based upon this example, Project A is economic.

## b. Economic Project Analysis

The number of combinations of potential economic projects is quite large. In order to minimize computer run times, storage requirements and not to affect other project studies currently being studied by ERCOT, a "base case" economic case was established based upon all of the analysis done in the Phase 1 study. The economic merits of this base case were evaluated and then different line options were incrementally evaluated.

Shown below are the capital costs for the transmission projects that form the economic base case that other potential economic projects will be compared:

| | |
|---|---|
| NACO – LUFKIN 345KV SINGLE LINE | $15.00 |
| LUFKIN – CYPRESS 345KV DOUBLE CKTS. | $110.00 |
| CYPRESS 345/230KV & 345/138KV AUTOTRANSFORMERS | $ 30.25 |
| CHINA – CEDAR BAYOU 345KV DOUBLE CKTS. | $ 60.00 |
| CHINA 2 - 345/230KV AUTOTRANSFORMERS | $31.40 |
| | TOTAL COST = $ 246.65 |

**Table 3**

Shown in Appendix 3 is the baseline economic base case transmission representation with the base line economic projects shown in solid lines and potential economic projects indicated as dashed lines.

Shown in Appendix 4 is the economic summary for all combinations of proposed economic projects that were tested incrementally to those included in the economic base case. In comparison to all combinations of economic projects, the case which added the following line to the economic base case (shown as BASE:D in Appendix 4) had the lowest Cost/Benefit ratio.

| | |
|---|---|
| CYPRESS – CHINA 345KV DOUBLE CKTS. | $31.25 |

In addition, no other project, if added to this Base:D case would be incrementally economic.

The total capital cost for all economic projects would thus be $277.9 million.

The incremental annual production cost savings when compared to the minimum reliability base case was $63.44 million as shown in Appendix 4. This resulted in a cost benefit ratio of 0.73.

Figure 2 shows the annual relative marginal costs of each bus on the combined system across all hours for the case with the economic projects in place. The cost to serve load in the EGSI-TX area is similar to that in the rest of ERCOT.

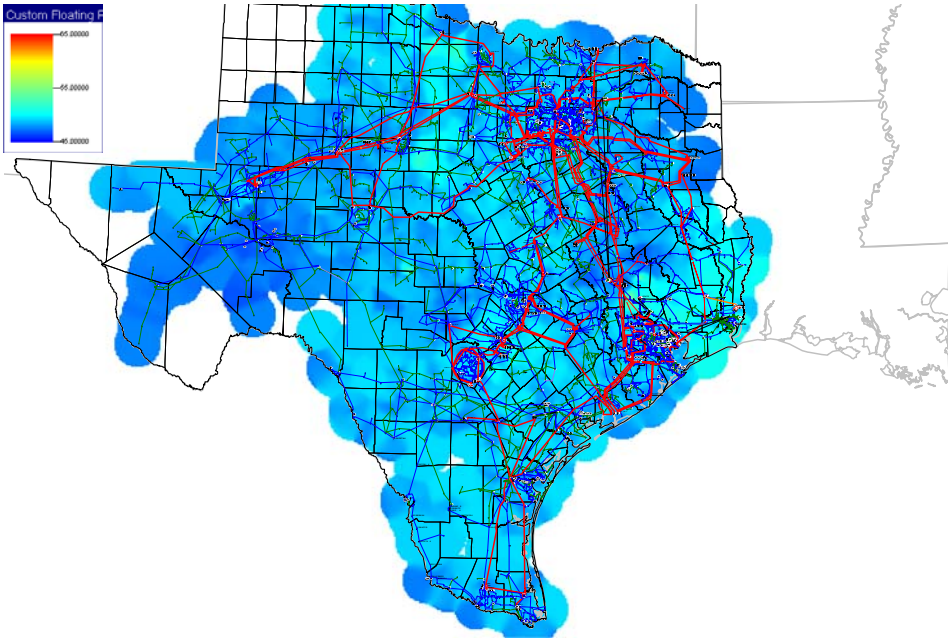


**Figure 2 – Annual Relative Marginal Costs for Case with Reliability and Economic Projects**

## c. Must Run Units

In the Phase I study, the recommended transmission improvements appeared to be sufficient to relieve the must run requirement that currently exists for the Lewis Creek and Sabine units. Although this issue was not originally a part of the Phase Two study scope, ERCOT staff was concerned that stakeholders might assume that these units were similarly not needed once the upgrades recommended in Phase II were complete. Therefore, an additional test of the selected package of reliability and economic projects was performed. All the Lewis Creek and Sabine units were modeled as unavailable and the economic unit commitment and dispatch of the system was simulated. Analysis of the results revealed that the Sabine units are no longer must run, but insecure energy resulted with the final set of reliability and economic transmission projects if both units at Lewis Creek were modeled as unavailable.

The lowest cost transmission projects identified to correct the insecure energy was an upgrade of the existing 138kv circuit from Lewis Creek to Goree to Rivtrin and a new Lewis Creek to Porter 138kv single transmission line. The estimated total capital cost of these projects is $80 million. It is not recommended that these projects be initiated at this time; they would only be needed if the Lewis Creek units sought to provide Reliability Must Run (RMR) Service under the ERCOT Protocols and the projects were found to be more economic than the continued use of these units as RMR units. ERCOT has made no assessment of whether these units might seek RMR treatment or whether these transmission projects would be economic in that event.

Even with these two transmission projects in place, no export of power over the Quarry tie could reliably occur without the Lewis Creek units online.

### c. Additional 600MW Asynchronous tie at Hartburg

Entergy requested ERCOT to model an additional 600 MW of asynchronous transfer capability into ERCOT at the Hartburg Substation. This tie would be used to allow the Entergy Texas portion of the Entergy load to have access to that load's share of the nuclear and coal generation under the Entergy Operating Agreement.

The additional power injection at the Hartburg Substation resulted in physical curtailment of the generation at the Hartburg Substation. An additional transmission line would be required from the Hartburg Substation to accommodate the increase of 600 MW. The best distribution of power injection at the Hartburg Substation would have the existing 300 MW of asynchronous power at the 500KV bus and the new 600 MW of asynchronous power at the 230KV bus. Shown below is a schematic diagram of this configuration.

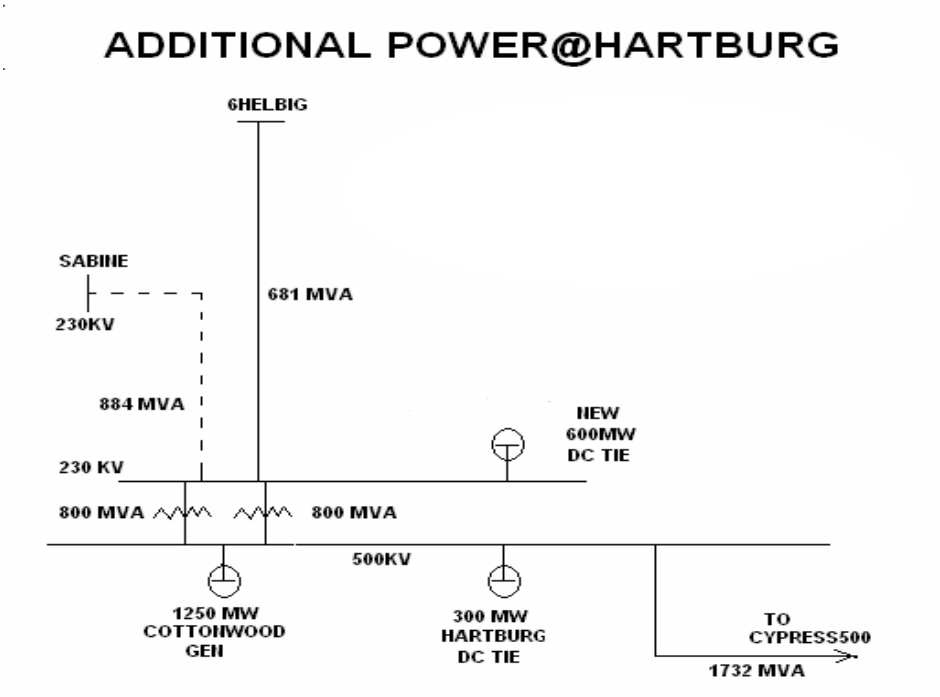



**Figure 3**

A total of eleven variations of proposed transmission lines were evaluated to accommodate the additional 600 MW of power requirements at the Hartburg Substation. The best economic transmission alternative was the $25 million addition of a second 230kv line from Hartburg to Sabine on separate right-of-way from the Hartburg to Sabine 230kV line that is recommended as a reliability project. Annual system production cost savings increased by $7.3 million when the second circuit was added. In addition, it was the only alternative solution that was incrementally economic with a cost to benefit ratio of 0.574.

Shown in Appendix 5 are the economic results, with a description and associated capital cost, for each of the eleven transmission alternatives.

## d. Sensitivity Analyses

ERCOT updated the natural gas forecast to the current higher expectations for the 2009-2010 timeframe. The base natural gas fuel price was increased to $7.0 per MMBTU from $5.0 per MMBTU. The increase in gas fuel price to $7 resulted in an annual system production cost increase in both the minimum reliability case and the economic project cases. The annual production cost savings between the two cases, due to the economic projects, increased from $63.44 million to $95.15 million when $7 average natural gas price was used in the 450MW asynchronous tie cases. The

incremental production cost savings of the economic projects for the 1050 MW asynchronous tie cases with $7 gas was $119.95 million.

Complete comparison of generation capacity factors and net production cost savings table for $7 average natural gas price can be found at Appendix 7.

### e. Displacement of Currently-Planned ERCOT Projects

ERCOT has recently completed a Long Term System Assessment (LTSA) of the needs for generation and transmission on the ERCOT system in the 2016 timeframe. While specific transmission projects were evaluated to support the conclusions of this assessment, the findings that these projects may be justified by 2016 do not constitute a firm recommendation that the lines be constructed. Instead, the LTSA is intended to provide a directional signal to nearer-term analysis and decisions. Firm recommendations on specific projects will occur through the ERCOT Five-Year Plan and ERCOT Regional Planning Group review of individual projects.

With this background, it can be noted that one finding of the LTSA was that an additional 345kV double circuit into the Houston area appeared to be needed to support the reliability of that area by 2016 and that a second 345kV circuit into Houston appeared to be economically justified. The Nacogdoches-Lufkin-Cedar Bayou 345kV double circuit was one of three potential circuits that were investigated and found adequate to meet these needs.

## 7. Stability Studies

Powertech, Inc. was hired to perform various stability analyses to test the dynamic response of the integrated system against reliability criteria for this study. Powertech performed an initial analysis of the integrated system including the upgrades that were included in the March 29, 2006 presentation. As the Phase II study was completed, Powertech performed an analysis of the minimum reliability case, the economic case with 450MW total asynchronous tie capacity, and the economic case with 1050MW total asynchronous tie capacity and the associated 2$^{nd}$ 230kV Hartburg-Sabine line. Powertech found no stability concerns with any of the cases.

While no stability concerns were identified, the installation of 136MVAr of capacitors, at an estimated cost of $3 million, may be required to maintain steady state transmission voltages in the Sabine area at an acceptable level.

# 8. Market Integration and Testing Requirements

ERCOT Market Operations staff also reviewed the expected costs to ERCOT (contained in Appendix 8) and timeline (contained in Appendix 9) for the integration and testing necessary to implement the wholesale and retail markets in the EGSI-TX area. The total cost to ERCOT of these activities is estimated to be $400,000 - $500,000. The longest lead time item would be about two years - for the activities to get Entergy set up and tested as a TSP.

# 9. Conclusions

The minimum set of transmission projects that would be required to reliably serve load in ERCOT after the integration was complete was identified. The estimated total capital cost for this set of projects was $158 million. These projects are:

- Construct a new 345/138kV substation called Quarry in the 345kV line from Grimes to Crockett
- Add a new 345kV line from Quarry to new Rivtrin 345/138kV substation
- Add a new 345kV line from modified Grimes to modified Roans Prairie substation
- Loop Kuykendahl-King 345kV line into new Porter 345/138kV substation
- Add a new 230kV line from Sabine to modified Hartburg substation with additional 345/138kV autotransformer at Hartburg substation
- Close the Etoile tie between TXUED and Deep East Texas Cooperative
- Upgrade Crosby-Dayton and Oakridge to Porter 138kV lines
- Add 138/69 kV autotransformer at South Beaumont
- Add a new 138kV line from Bon Wier to Kirbyville

Two additional projects are needed to meet existing Entergy contractual obligations. The estimated capital cost of these projects is $90 million. These projects are:

- Add a 150MW asynchronous tie between Quarry and Crockett
- Add a 300MW asynchronous tie between the Hartburg (ERCOT) and Hartburg (Eastern Interconnection) substations

While the addition of these projects would allow the EGSI-TX system to be reliably integrated with ERCOT, the resulting system would not be efficient relative to the rest of ERCOT. Relatively higher cost generation (primarily on the EGSI-TX system) would have to be used in some hours to serve load, rather than lower cost generation, in order to avoid violating transmission security limits. This would cause production costs in the EGSI-TX area to be higher than elsewhere in ERCOT. A set of projects were developed that could relieve most of these transmission system constraints. The estimated capital cost of this set of projects is $278 million. However, the Phase II study showed that this set of projects could be expected to reduce the cost of

dispatching higher cost units to meet transmission limits rather than lower cost units by $64 million annually (based on mid-2005 gas price forecasts; a calculation using updated gas price forecasts is also provided in the report). These production cost savings are more than sufficient to justify the $278 million capital expenditure on these projects. These projects are:

- Add a 345kV line from Nacogdoches to Lufkin
- Add a 345kV double circuit line from Lufkin through Cypress and China to Cedar Bayou
- Add substations at Cypress and China

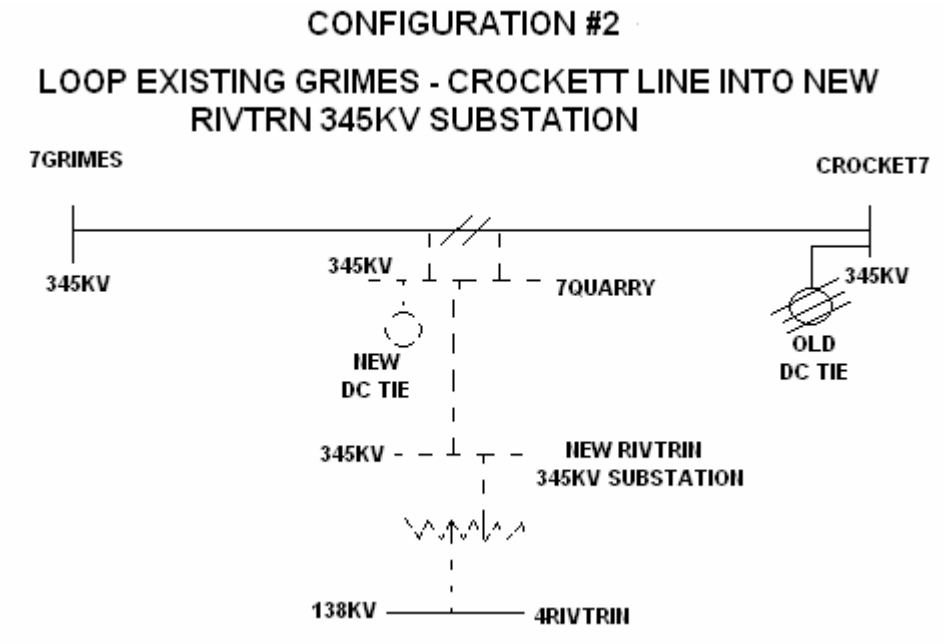
Entergy requested that, in addition to the proposed 300 MW asynchronous tie at the Hartburg substation, an additional 600 MW of tie be analyzed at that location. The addition of a second 230kv line from Hartburg to Sabine is needed to provide sufficient transmission capacity away from the Hartburg substation with the addition of this tie. The estimated cost of this second circuit is $25 million.

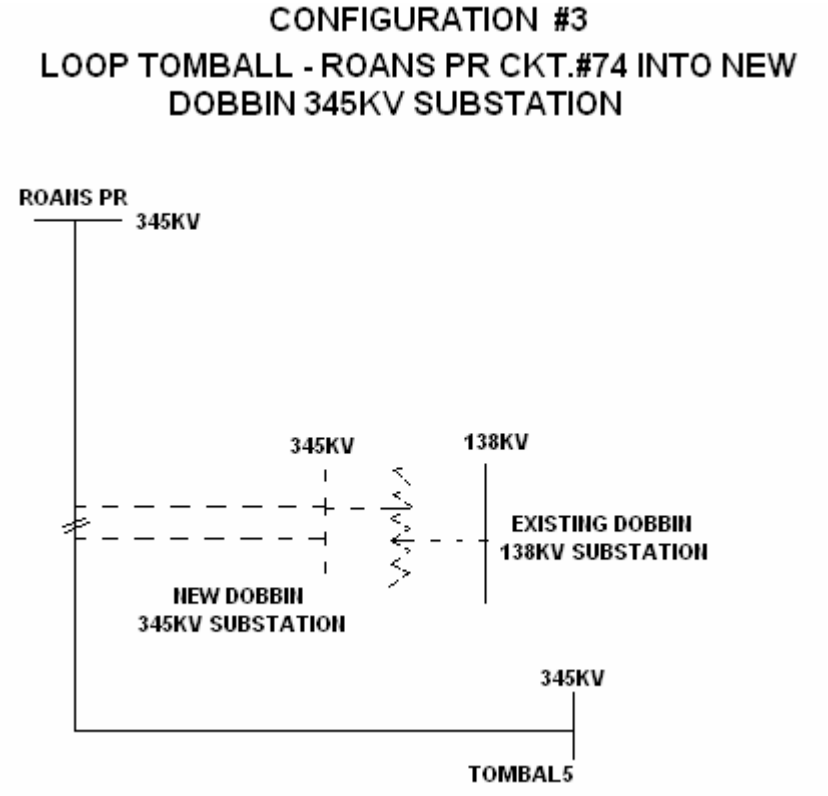
The resulting synchronous interconnections between the existing ERCOT system and the EGSI-TX system would be at Porter, Roans Prairie to Grimes, Lufkin to Cypress and Cedar Bayou to China, all at 345kV, and at Etoile and Dayton to Crosby at 138kV. The asynchronous interconnections would be 150MW with SPP at Quarry and 300 MW (or 900MW) from Entergy (Eastern Interconnection) at Hartburg.

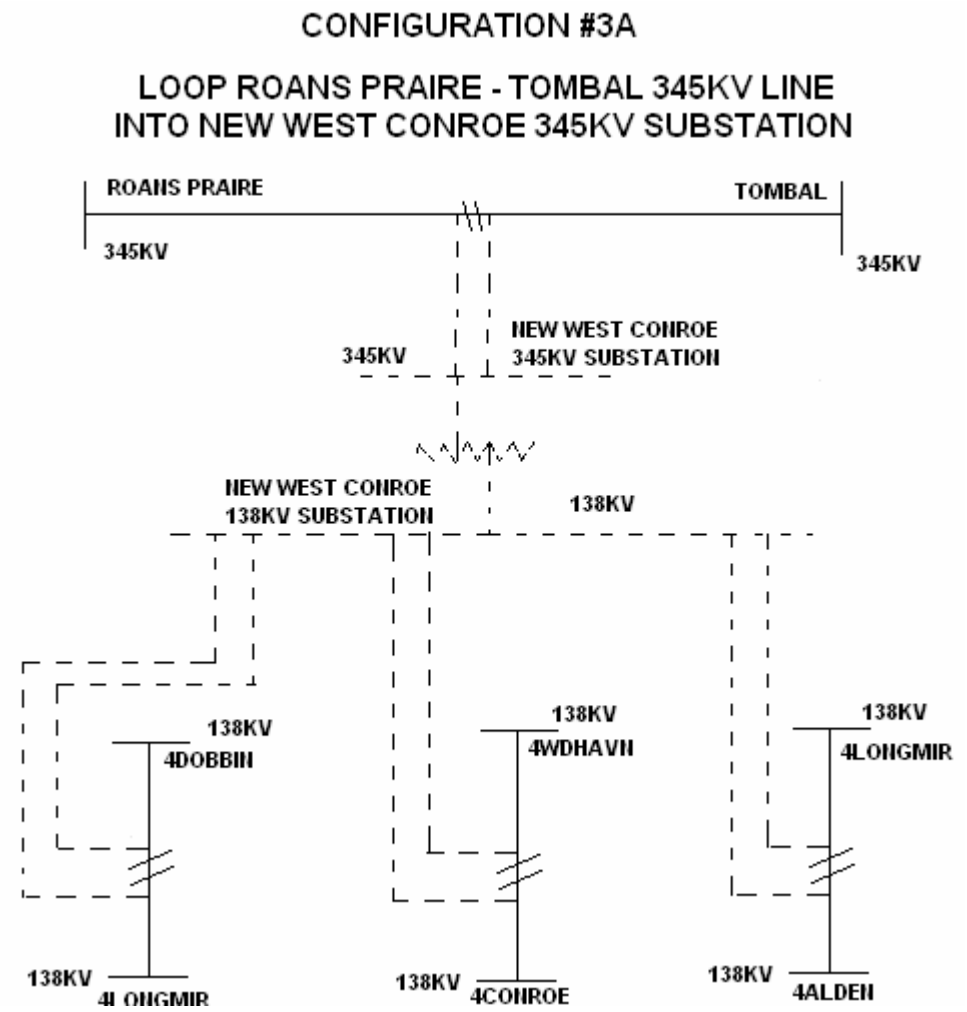
The Lewis Creek units would still be required to be available. For exports over the Quarry tie, one of the Lewis Creek units would have to be on-line. If exports of over 80MW are required over this tie, an additional $11 million transmission project (Grimes to Mt. Zion to Huntsville 138kV upgrade) would be required.

# 10. Appendixes

## APPENDIX 1: STAKEHOLDER SUBMITTED CONFIGURATIONS

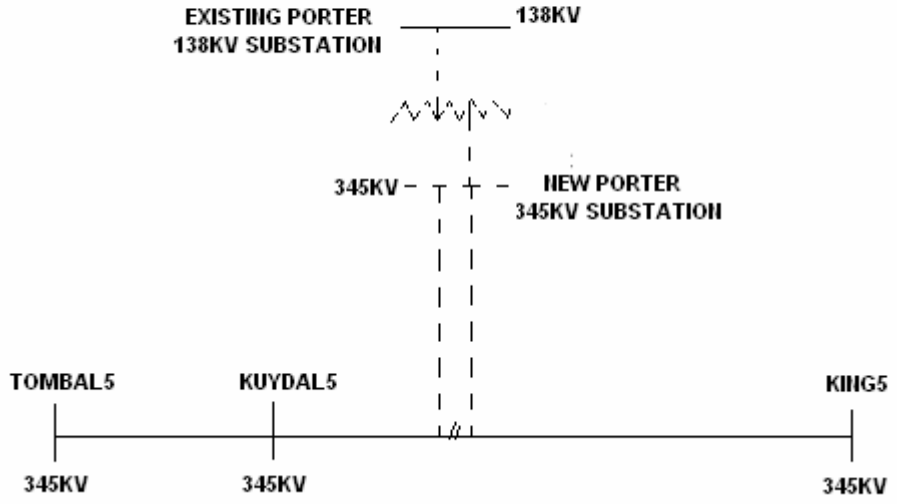



CONFIGURATION #3A
LOOP ROANS PRAIRE - TOMBAL 345KV LINE
INTO NEW WEST CONROE 345KV SUBSTATION
ROANS PRAIRE
345KV
TOMBAL
345KV
NEW WEST CONROE
345KV SUBSTATION
345KV
NEW WEST CONROE
138KV SUBSTATION
138KV
138KV
4DOBBIN
138KV
4WDHAVN
138KV
4LONGMIR
138KV
4LONGMIR
138KV
4CONROE
138KV
4ALDEN

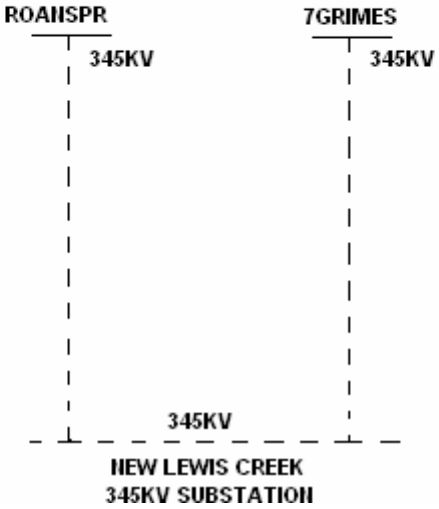
## CONFIGURATION #4

LOOP TOMBALL - KUYD - KING CKT.#74 INTO NEW PORTER 345KV SUBSTATION



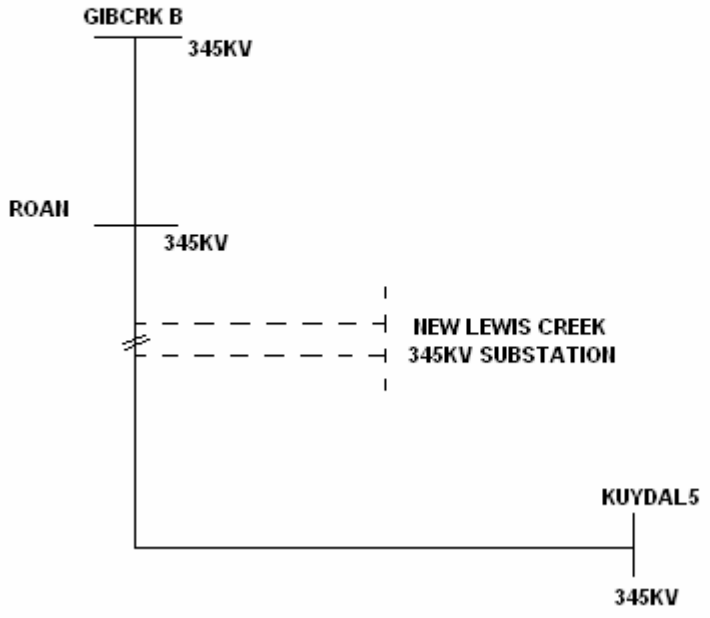

## CONFIGURATION #5

BUILD SINGLE 345KV LINE FROM ROANS PR - LEWIS CRK
OR
BUILD SINGLE 345KV LINE FROM GRIMES - LEWIS CRK



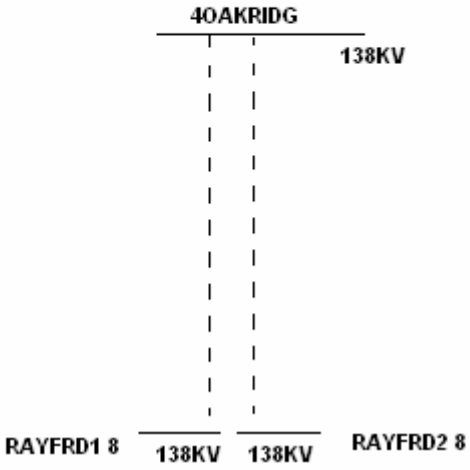
## CONFIGURATION #6

LOOP GIBBONS CREEK - KUYDAL CKT.#75 INTO NEW LEWIS CRK 345KV SUBSTATION



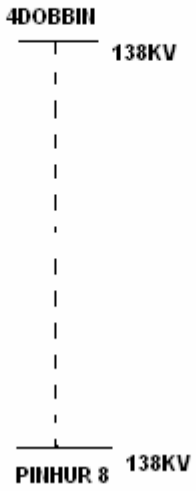

## CONFIGURATION #7

BUILD DOUBLE 138KV UNDERGROUND LINES FROM OAKRIDGE - RAYFORD DOUBLE TAP SUBSTATION



CONFIGURATION #8

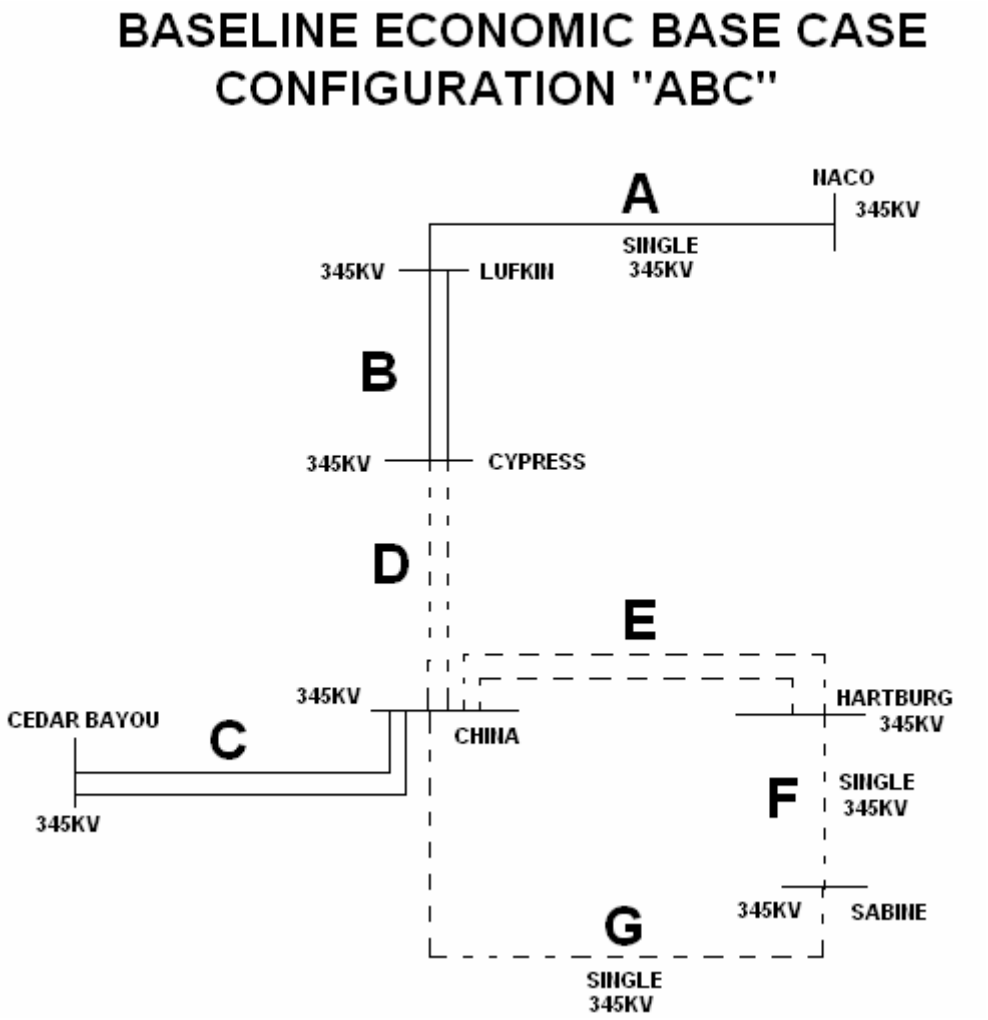
BUILD SINGLE 138KV LINE FROM PINEHURST - DOBBIN



# APPENDIX 2: COST ESTIMATE ASSUMPTIONS

| CONSTRUCTION COST ESTIMATES | M$ | |
|---|---|---|
| 500 KV COST/MILE | $1.50 | |
| 500KV DOUBLE CKT. COST/MILE | $1.88 | 25% Additional |
| 345KV COST/MILE | $1.00 | |
| 345KV DOUBLE CKT. COST/MILE | $1.25 | 25% Additional |
| 230KV COST/MILE | $0.75 | |
| 138KV COST/MILE | $0.50 | |
| 500 KV BREAKER | $3.00 | |
| 345KV BREAKER | $2.50 | |
| 230KV BREAKER | $1.80 | |
| 138KV BREAKER | $1.25 | |
| ASYNCHRONOUS TIE COSTS | $200/kW | |
| 500/345KV AUTOTRANSFORMER | $12.00 | 800 MVA |
| 345/230KV AUTOTRANSFORMER | $11.40 | 800 MVA |
| 345/138KV AUTOTRANSFORMER | $10.80 | 800 MVA |
| 230/138KV AUTOTRANSFORMER | $4.80 | 400 MVA |
| 138/69KV AUTOTRANSFORMER | $1.35 | 100 MVA |

## APPENDIX 3: BASELINE DIAGRAM



# APPENDIX 4 ECONOMIC PROJECT COMPARISON

| Scenario | Total Cost (M$) | LC1 Costs (M$) | SAB Costs (M$) | | |
|---|---|---|---|---|---|
| LC1_SAB34_ETOLIE TIE | $236.98 | $130.10 | $106.88 | $236.98 | |

| | Total Cost (M$) | INCREMENTAL COST (M$) | PRODUCTION COST SAVINGS (M$) | 6 - YEAR SAVINGS (M$) | CC/PC RATIO |
|---|---|---|---|---|---|
| BASE: NACO-LUFKIN - CYPRESS; CHINA - CEDAR BAYOU | $483.63 | $246.65 | $41.79 | $250.74 | 0.983688283 |
| BASE: D | $514.88 | $277.90 | $63.44 | $380.64 | 0.730086171 |
| BASE: E | $578.63 | $341.65 | $59.67 | $358.02 | 0.954276297 |
| BASE: F | $551.91 | $314.93 | $60.43 | $362.58 | 0.868580727 |
| BASE: G | $511.63 | $274.65 | $44.38 | $266.28 | 1.031433078 |
| BASE: DE | $609.88 | $372.90 | $65.99 | $395.94 | 0.941809365 |
| BASE: DF | $583.16 | $346.18 | $71.92 | $431.52 | 0.802233964 |
| BASE: DG | $568.58 | $331.60 | $72.17 | $433.02 | 0.76578449 |
| BASE: EF | $646.91 | $409.93 | $68.83 | $412.98 | 0.992614654 |
| BASE: EG | $606.63 | $369.65 | $64.24 | $385.44 | 0.959033831 |
| BASE: FG | $579.91 | $342.93 | $62.32 | $373.92 | 0.917121309 |
| BASE: DEF | $678.16 | $441.18 | $71.56 | $429.36 | 1.027529346 |
| BASE: DEG | $637.88 | $400.90 | $71.69 | $430.14 | 0.932022132 |
| BASE: DFG | $611.16 | $374.18 | $71.13 | $426.78 | 0.876751488 |
| BASE: EFG | $674.91 | $437.93 | $68.79 | $412.74 | 1.061031158 |
| BASE: DEFG | $706.16 | $469.18 | $74.70 | $448.20 | 1.04680946 |

# APPENDIX 5: ADDITIONAL 600MW TIE REQUIREMENTS

## ECONOMIC RESULTS

| Scenario | Total Cost (M$) | LC1 Costs (M$) | SAB Costs (M$) |
|---|---|---|---|
| 450LC1_SAB41_900MW DC_ETOILE TIE @HARTBURG(600MW @230KV BUS, 300MW @500KV BUS) | $514.88 | $130.10 | $384.78 |

| | Total Cost (M$) | INCR COST (M$) | INCR PRODUCTION COST SAVINGS (M$) | 6 - YEAR SAVINGS (M$) | CC/PC RATIO |
|---|---|---|---|---|---|
| HARTBURG - CYPRESS SINGLE 500KV LINE | $560.63 | $45.75 | -$9.76 | -$58.56 | -0.781 |
| HARTBURG - CYPRESS SINGLE 500KV LINE & 500/345KV AUTO @CYPRESS | $578.13 | $63.25 | $0.28 | $1.68 | 37.649 |
| HARTBURG - CHINA SINGLE 345KV LINE & 500/345KV AUTO @HARTBURG | $576.63 | $61.75 | $3.70 | $22.20 | 2.782 |
| HARTBURG - CHINA SINGLE 345KV LINE & 2 - 500/345KV AUTOS @HARTBURG | $594.13 | $79.25 | $5.73 | $34.38 | 2.305 |
| HARTBURG - CHINA DOUBLE 345KV LINE & 500/345KV AUTO @HARTBURG | $591.63 | $76.75 | $2.72 | $16.32 | 4.703 |
| HARTBURG - CHINA DOUBLE 345KV LINE & 2 - 500/345KV AUTOS @HARTBURG | $609.13 | $94.25 | $3.99 | $23.94 | 3.937 |
| HARTBURG - SABINE SINGLE 345KV LINE & 500/345KV AUTO @HARTBURG & 345/230KV AUTO @SABINE | $582.41 | $67.53 | $9.48 | $56.88 | 1.187 |
| HARTBURG - SABINE - CHINA SINGLE 345KV LINE & 500/345KV AUTO @HARTBURG & 345/230KV AUTO @SABINE | $610.41 | $95.53 | $8.06 | $48.36 | 1.975 |
| **HARTBURG - SABINE SINGLE 230KV #2 LINE** | **$540.23** | **$25.35** | **$7.36** | **$44.16** | **0.574** |
| HARTBURG - CHINA 345KV SINGLE LINE & 2-500/345KV AUTOS @HARTBURG NO HARTBURG - SABINE 230KV LINES | $551.96 | $37.08 | -$40.54 | -$243.24 | -0.152 |
| HARTBURG - SABINE 345KV SINGLE LINE & 2-500/345KV AUTOS @HARTBURG NO HARTBURG - SABINE 230KV LINES | $541.96 | $27.08 | -$6.11 | -$36.66 | -0.739 |

# Appendix 6
# Natural Gas Fuel Price Assumption in 2009

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **5$ Annual Average** | 5.28 | 4.80 | 4.73 | 4.71 | 4.76 | 4.78 | 4.72 | 4.71 | 4.72 | 4.95 | 5.19 | 5.44 |
| **7$ Annual Average** | 7.55 | 6.87 | 6.77 | 6.73 | 6.81 | 6.83 | 6.75 | 6.73 | 6.75 | 7.07 | 7.41 | 7.78 |

# Appendix 7

## ERCOT and Entergy EGSI-TX Integration Study
## Generation Data at $7.00 Average Natural Gas Price

| | | | Minimum Reliability (450 MW Async. ties) | | Minimum Reliability (1050 MW Async. ties) | | Economic Case (450 MW Async. ties) | | Economic Case (1050 MW Async. ties) | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Unit Name | Unit Size (MW) | Capacity Factor(%) | Generation (GWh) | Capacity Factor(%) | Generation (GWh) | Capacity Factor(%) | Generation (GWh) | Capacity Factor(%) | Generation (GWh) |
| **Entergy EGSI-TX Units** | G1LEWIS _1 | 260 | 28.10 | 639.98 | 25.23 | 574.75 | 11.97 | 272.60 | 9.58 | 218.13 |
| | G2LEWIS _1 | 260 | 15.54 | 353.92 | 16.30 | 371.15 | 7.59 | 172.88 | 4.88 | 111.23 |
| | G3SABIN _1 | 420 | 1.96 | 71.96 | - | - | 0.58 | 21.35 | 0.10 | 3.64 |
| | G4SABIN _1 | 530 | 33.60 | 1,559.94 | 13.53 | 628.05 | 6.01 | 279.25 | 0.03 | 1.33 |
| | G5SABIN _1 | 470 | 1.46 | 60.08 | 0.22 | 8.96 | 0.89 | 36.80 | - | - |
| | G1SABIN _1 | 212 | 10.31 | 191.47 | 6.00 | 111.43 | 3.09 | 57.45 | 1.48 | 27.47 |
| | G2SABIN _1 | 212 | 10.31 | 191.53 | 5.14 | 95.40 | 2.46 | 45.66 | 0.45 | 8.30 |
| **EGSI-TX and SPP Async ties** | HARTBURG_300MW DC | 300 | 61.04 | 1,604.09 | 61.04 | 1,604.09 | 61.04 | 1,604.09 | 61.04 | 1,604.09 |
| | QUARRY_DC | 150 | 61.03 | 801.98 | 61.03 | 801.98 | 61.03 | 801.98 | 61.04 | 802.03 |
| | HARTBURG_600MW DC | 600 | | | 97.88 | 5,144.66 | | | 98.05 | 5,153.66 |
| **Aggregrated rest of Entergy EGSI-TX Units** | | | | **16,488.23** | | **13,831.34** | | **12,730.89** | | **8,790.67** |
| **Aggregrated rest of ERCOT units (including existing async ties)** | | | | **381,739.02** | | **380,556.91** | | **387,498.86** | | **386,748.45** |

**Net Annual Production Cost Savings**

95.15 (M$)

119.95 (M$)

193.66 (M$)

# APPENDIX 8

## ERCOT Estimated Cost & Timeline for Supporting Entergy Companies to be Qualified and Integrated into the ERCOT Power Region

Overview: ERCOT's estimated cost for supporting, qualifying and integrating Entergy's prospective new Market Participants (QSE, TSP, LSE and Resources) into the ERCOT's competitive power region, wholesale and retail markets is $400,000 - $500,000. This cost range reflects the estimated ERCOT employee time and labor cost for performing specific ERCOT responsibilities associated with Entergy's Market Participant qualification and integration. The critical path timelines for supporting Entergy's Market Participant qualification ranges from five-months (Resources) to approximately two-years (TSP).

Assumptions: ERCOT's cost and critical path timeline assumes Entergy diligently works in cooperation with ERCOT to meet qualification requirements by a date certain. Specific critical path tasks must be timely performed in sequence for each of Entergy's prospective QSE, TSP, LSE and Resources. ERCOT includes a step-by-step roadmap for Entergy's consideration and use in meeting its ERCOT cutover date.

QSE (Qualified Scheduling Entity): ERCOT's cost is estimated to be $33,000 for supporting Entergy's QSE to become qualified for scheduling a generation portfolio and for bidding its generation into ERCOT's markets. Approximately seven-months will be needed for ERCOT to work with Entergy's QSE for successful qualification as a generation scheduling QSE. Examples of critical path milestones for this qualification process include registration, telemetry testing, telecommunications, credit, network modeling, scheduling, bidding and deployments.

TSP (Transmission & Distribution Service Provider): Two critical paths are required for successful TSP qualification. One critical path reflects Entergy's requirements to become qualified as a TSP in wholesale power transmission connectivity, communications, network modeling, metering and data aggregation. The other critical path reflects Entergy's TDSP requirements for successful load profiling, retail testing, ESIID data and submittals.

ERCOT's cost for supporting Entergy's wholesale TSP requirements is estimated to be $184,000. Approximately nine-months are estimated to be needed for ERCOT to support Entergy's TSP meet its wholesale related requirements. ICCP telemetry, settlement metering and are the primary TSP wholesale related areas for required qualification.

ERCOT's cost for supporting Entergy's retail TDSP qualification is estimated to be $123,000. Approximately twenty-nine months will require ERCOT's load profiling, Texas Test Plan and Retail Customer Choice groups to support Entergy's TDSP's retail related requirements.

LSE (Load Serving Entity): ERCOT's cost for supporting Entergy's LSE preparedness and qualification is estimated to be $42,000. Six-months are estimated for ERCOT's Texas Test Plan and Retail Customer Choice areas to help Entergy's LSE meet its critical path timeline and associated requirements.

Resources: ERCOT's cost for supporting Entergy's Resource registrations and systems preparedness is estimated to be $38,000. Five-months is estimated to be needed by ERCOT to support Entergy's Resources register and coordinate the information needed to correctly set-up each resource in ERCOT's Network Model and Data Aggregation systems.

Municipal Electric Utilities & Electric Cooperatives (Non Opt-In Entity): ERCOT's integration support estimates include cost and time to register, test and integrate Electric Cooperative meter points into ERCOT's metering, data aggregation and settlement systems.

Pilot Program: ERCOT's estimated cost and implementation timeline does not include estimates for supporting a pilot program. ERCOT's analysis assumes Entergy's QSE, TSP, LSE and Resources qualify in advance of its "cutover" or grid integration date.

# APPENDIX 9 – page1 of 5

| QSE: Project 32217 ERCOT as Entergy Gulf States Applicable Power Region | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Task No. | ERCOT Area | QSE tasks | ERCOT Cost | Month 1 | Month 2 | Month 3 | Month 4 | Month 5 | Month 6 | Cutover Month 7 |
| 1 | Registration | Application to register as a QSE, Service Filing, Second Partial Service Filing, Standard Form Agreement (incl. $500 fee) | $585 | | | | | | | |
| 2 | Siebel | Siebel system setup as Market Participant | $585 | | | | | | | |
| 3 | Client Relations | Initial communications between Wholesale Account Manager (Entergy's primary point of contact with ERCOT on QSE issues) and Entergy's designated Authorized Representative | $585 | | | | | | | |
| 4 | Credit | Credit Application, financial contact & security posting (consistent with information provided in Entergy's Second Partial Service Filing). | $585 | | | | | | | |
| 5 | Digital Certificate | Creation & delivery of test digital certificate to Company's User Security Administrator (USA) | $585 | | | | | | | |
| 6 | Operations Support | Review of Documentation in Lieu of Site Visit | $520 | | | | | | | |
| 7 | Credit Requirements | Verify Credit posted in accordance with Second Partial Service Filing | $520 | | | | | | | |
| 8 | Telco - Connectivity | Entergy returns WAN (Wide Area Network) appendix forms and signed "WAN Connection Agreement". ERCOT provides frame relay cost estimate. Upon approving ERCOT's install cost estimate, ERCOT has 60 days for the install & frame relay test. Point-to-point installation & voice (OPX & Hotline) testing will also be required for "generation" QSEs. Communication testing includes ERCOT Taylor & Austin control centers, QSE's primary & back-up sites. Typically 30 days. | $9,360 | | | | | | | |
| 9 | Network Modeling (Informational-see Resource Entity) | Network model data input & displays for generation sites in Generation Asset Registration Form (submitted by Resource Entity). ERCOT recommends Entergy synchronize the timing for submitting its Generation Asset Registration forms with timing its QSE Connectivity & telemetry efforts in the QSE timeline (see Resource Entity for ERCOT costs) | N/A | | | | | | | |
| 10 | Web Support | Confirm API (Automated Programmatic Interface) URL & set-up in LDAP. | $2,730 | | | | | | | |
| 11 | Market Operations / IT Departments | API / XML / MOS Connectivity & Functional Qualificaton Test. QSE submits resource plans, schedules, bids, receive instructions. | $1,040 | | | | | | | |
| 12 | EMMS Production | ICCP Technical test | $780 | | | | | | | |
| 13 | EMMS Production | ICCP Resource Specific testing of data quality and generation status scada data points (real-time telemetry communications test after real time generation data points set-up under Entergy's QSE) | $2,730 | | | | | | | |
| 14 | Digital Certificate | Creation & delivery of production digital certificate to Company's User Security Administrator (USA) | $650 | | | | | | | |
| 15 | Client Relations | Issuance of QSE Level 3 Qualification Letter | $390 | | | | | | | |
| 16 | Operatons Support | Outage Scheduler Support - outage coordination requirements according to ERCOT Operating Guide & Protocols | $1,040 | | | | | | | |
| 17 | Operator Training | EMS Operator Training | $780 | | | | | | | |
| 18 | Operations Support / Client Relations | QSE Synchronization Checklist | $1,430 | | | | | | | |
| 19 | Operations Support | Ancillary Services Qualification | $1,170 | | | | | | | |
| 20 | Operations Support | Regulation Service | $1,690 | | | | | | | |
| 21 | Operations Support | Responsive Reserve Service | $1,690 | | | | | | | |
| 22 | Operations Support | Non-Spinning Reserve Service | $1,690 | | | | | | | |
| 23 | Operations Support | Balancing Energy Service | $1,690 | | | | | | | |

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| Resource: Project 32217 ERCOT as Entergy Gulf States Applicable Power Region | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Task No. | ERCOT Area | Resource Entity Tasks | ERCOT Cost | Month 1 | Month 2 | Month 3 | Month 4 | Cutover Month 5 |
| 1 | Registration | 1) Resource Application; 2) Standard Form Agreement; 3) Generation Asset Registration Form; 4) QSE Acknowledgment; 5) PUCT Certification form processing & verification | $650 | | | | | |
| 2 | Siebel | Siebel system setup as Market Participant | $585 | | | | | |
| 3 | Client Relations | Initial & ongoing communications as ERCOT primary point of contact client representative with Company's Authorized Rep. | $10,920 | | | | | |
| 4 | Digital Certificate | Creation & delivery of of test digital certificate to Company's User Security Administrator (USA) | $650 | | | | | |
| 5 | ERCOT Settlement Metering | EPS Metering Design Proposal site Approval (certification). Synchronize Generation Asset Registration Form submittals with TDSP Meter Design submittal(s) | n/a | | | | | |
| 6 | Network Modeling | Input Generation Asset Registration Form site data and displays into Network Model (17 gen sites) | $19,500 | | | | | |
| 7 | Data Aggregation | Input Generation Sites into Lodestar | $4,290 | | | | | |
| 8 | Operatons Support | Outage Scheduler Support - outage coordination requirements according to ERCOT Operating Guide & Protocols | $1,040 | | | | | |
| | | **Summary** | $37,635 | | | | | |

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| TSP: Wholesale: Project 32217 ERCOT as Entergy Gulf States Applicable Power Region | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Task No. | ERCOT Area | TSP-Wholesale tasks | ERCOT Cost | Month 1 | Month 2 | Month 3 | Month 4 | Month 5 | Month 6 | Month 7 | Month 8 | Cutover Month 9 |
| 1 | Registration | Applications & agreement processing | $650 | | | | | | | | | |
| 2 | Siebel | Siebel system setup as Market Participant | $585 | | | | | | | | | |
| 3 | Client Relations | Communications initiating primary point of contact account management support with Company's Authorized Rep. | $585 | | | | | | | | | |
| 4 | Digital Certificate | Creation & delivery of of test digital certificate to Company's User Security Administrator (USA) | $650 | | | | | | | | | |
| 5 | Telco - Connectivity | Entergy returns WAN (Wide Area Network) appendix forms and signed "WAN Connection Agreement", ERCOT provides frame relay cost estimate. Upon approving ERCOT's install cost estimate, ERCOT has 60 days for the install & frame relay test. Point-to-point installation & voice (OPX & Hotline) testing will be required for "generation" QSEs. Communication testing includes ERCOT Taylor & Austin control centers, QSE's primary & back-up sites. Typically 30 days. | $9,360 | | | | | | | | | |
| 6 | Network Modeling | Input, set-up & test data and displays for transmission substations, buses, ties and transformers. | $87,100 | | | | | | | | | |
| 7 | Web Support | Confirm API (Automated Programmatic Interface) URL & set-up in LDAP. | $2,730 | | | | | | | | | |
| 8 | Market Operations / IT Departments | API / XML / MOS Connectivity & Functional Qualificaton Test. QSE submits resource plans, schedules, bids, receive instructions. | $1,040 | | | | | | | | | |
| 9 | EMMS Production | ICCP Technical test | $1,040 | | | | | | | | | |
| 10 | EMMS Production | Data-base input of scada points, testing, scaling | $2,600 | | | | | | | | | |
| 11 | EMMS Production | ICCP Resource Specific testing of data quality and real-time telemetry communications | $1,040 | | | | | | | | | |
| 12 | Operatons Support | Outage Scheduler Support - test outage coordination & requirements in MOTE (Operating Guide & Protocols) | $1,040 | | | | | | | | | |
| 13 | Operator Training | EMS Operator Training | $780 | | | | | | | | | |
| 14 | ERCOT Settlement Metering | EPS Generation & TSP Metering Design Proposal Approval (certification) per site | $28,860 | | | | | | | | | |
| 15 | Data Aggregation | Input TSP installed Generation Site Metering Points into Lodestar (See Resource Entity regarding input to Lodestar of Generation units scheduled by QSE) | $4,225 | | | | | | | | | |
| 16 | Data Aggregation | Input NOIE Metering Points into Lodestar (See NOIE Cost & Timeline tab) | $3,965 | | | | | | | | | |
| 17 | ERCOT Settlement Metering | Initial meter point setup in the data acquistion system-MV90 | $8,580 | | | | | | | | | |
| 18 | ERCOT Settlement Metering | EPS Generation & TSP Metering Facility Documentation review, approval per meter point | $25,220 | | | | | | | | | |
| 19 | Distribution Loss Factor | Distribution Loss Factor Methodology review, approval and posting | $4,181 | | | | | | | | | |
| 20 | Company Prerequisite | EPS meter inspector training | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a |
| | | **Summary** | $184,231 | | | | | | | | | |

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**TDSP Retail: Project 32217 ERCOT as Entergy Gulf States Applicable Power Region**

| Task No. | ERCOT Area | TDSP-Retail tasks | ERCOT Cost | Month 1 | Month 2 | Month 3 | Month 4 | Month 5 | Month 6 | Month 7 | Month 8 | Month 9 | Month 10 | Month 11 | Month 12 | Month 13 | Month 14 | Month 15 | Month 16 | Month 17 | Month 18 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Retail Client Relations | Ongoing Client Relations support: Monthly weekly conference calls, help coordinate Market Participant testing | $ 16,900 | ' | ' | ' | ' | ' | ' | ' | ' | ' | ' | ' | ' | ' | ' | ' | ' | ' | ' |
| 2 | Registration | TDSP Applications & agreement processing | $ 650 | | | | | | | | | | | | | | | | | | |
| 3 | Siebel | Siebel system setup as TDSP Market Participant | $ 585 | | | | | | | | | | | | | | | | | | |
| 4 | Client Relations | Communications initiating primary point of contact account management support with TDSP's Authorized Rep. | $ 585 | | | | | | | | | | | | | | | | | | |
| 5 | Digital Certificate | Creation & delivery of of test digital certificate to TDSP's User Security Administrator (USA) | $ 650 | | | | | | | | | | | | | | | | | | |
| 6 | Load Profiling | Work with PWG to determine Weather Zone and get approval | $ 16,250 | | | | | | | | | | | | | | | | | | |
| 7 | Load Profiling | Update Profile Decision Tree and get approval | $ 5,200 | | | | | | | | | | | | | | | | | | |
| 8 | Load Profiling | Complete and verify Profile ID assignments | $ 13,000 | | | | | | | | | | | | | | | | | | |
| 9 | Load Profiling | Design and implement LRS sample | $ 10,400 | | | | | | | | | | | | | | | | | | |
| 10 | Load Profiling | Update templates for Switcher Report, Profile Counts Report, etc. | $ 2,600 | | | | | | | | | | | | | | | | | | |
| 11 | Texas Test Plan | ERCOT Retail Market Testing (TDSP & CR) | $ 10,920 | | | | | | | | | | | | | | | | | | |
| 12 | Retail Customer Choice | Service Delivery Point registration: Monitor receipt of transactions | $ 11,440 | | | | | | | | | | | | | | | | | | |
| 13 | Lodestar - Billing | Set-up ESIIDs in Lodestar, receipt of 18 months of usages | $ 17,420 | | | | | | | | | | | | | | | | | | |
| 14 | Retail Customer Choice | Initial meter read monitoring - completion of move-ins | $ 16,120 | | | | | | | | | | | | | | | | | | |
| | | **Summary** | $122,720 | | | | | | | | | | | | | | | | | | |

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| LSE: Project 32217 ERCOT as Entergy Gulf States Applicable Power Region | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Task No.** | **ERCOT Area** | **LSE tasks** | **ERCOT Cost** | **Month 1** | **Month 2** | **Month 3** | **Month 4** | **Month 5** | **Cutover Month 6** |
| 1 | Retail Client Relations | Ongoing Client Relations support: Monthly weekly conference calls, help coordinate Market Participant testing | $16,900 | ' | ' | ' | ' | ' | ' |
| 2 | Registration | LSE Applications & agreement processing | $650 | | | | | | |
| 3 | Siebel | Siebel system setup as LSE Market Participant | $585 | | | | | | |
| 4 | Client Relations | Communications initiating primary point of contact account management support with LSE's Authorized Rep. | $585 | | | | | | |
| 5 | Digital Certificate | Creation & delivery of of test digital certificate to LSE's User Security Administrator (USA) | $650 | | | | | | |
| 6 | Texas Test Plan | ERCOT Retail Market Testing | $10,920 | | | | | | |
| 7 | Retail Customer Choice | Monitor receipt of CR transactions | $11,440 | | | | | | |
| | | **Summary** | $ 41,730 | | | | | | |