



ERCOT Independent Review
Luminant & Oncor Tyler Autotransformer Addition and 138 kV
Line Upgrade Project
January 23, 2008

ERCOT Regional Planning

ERCOT Public Item 8 - Attachment 'B'	www.ercot.com	2705 West Lake Drive Taylor, Texas 76574 Tel: (512) 248-3000 Fax: (512) 248 6560
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Project Submitted

In September 2007, Luminant Energy submitted a project to accelerate the following from 2012 to May 2009:

1. Upgrade the Tyler Northeast – Tyler East 138 kV line (3.7 mi.) so that the Rate B is 326 MVA.
2. Upgrade the Tyler Grande (formerly known as Tyler Southeast) 345/138 kV autotransformer so that the Rate B is 600 MVA. Luminant had assumed that the autotransformer had already been through the Regional Planning Group review process and was approved. This turned out to be not the case as the autotransformer had merely been included in the SSWG base cases as a 493 MVA transformer without it being RPG approved.
3. Upgrade the Tyler Grande – Tyler South 138 kV line (4.1 mi.) so that the Rate B is 400 MVA.

Oncor Electric Delivery then studied Luminant's proposal and proposed the following, which is also illustrated in the one-line in Figure I:

1. Use a spare 493 MVA autotransformer at the Tyler Grande Switching Station and install four-ohm 138 kV switchable series reactors on the autotransformer.
2. Rebuild the Tyler Grande – Tyler South 138 kV line so that the Rate B is 326 MVA. The circuit will be rebuilt for double circuit operation with one circuit being the circuit from Tyler Grande to Elkton and the other circuit being a radial feed to Tyler South.
3. Upgrade the Tyler GE – Tyler Omen Road 138 kV line (2.4 mi.) so that the Rate B is 326 MVA

Oncor ED revised their previous statement that they would relocate the existing Tyler Southeast station to the Tyler Grande site if the 345/138 kV autotransformer project was to be approved. Regardless of the location chosen for the third 345/138 kV autotransformer in the area, they will relocate the 138 kV switching station from the Tyler Southeast site to the Tyler Grande site due to a road widening project. The estimated cost for this relocation is approximately \$10,672,000 and is not included as part of the capital cost needing to be justified by this review. The estimated costs of the project according to Oncor's proposal are:

Project Analysis

Base Case

For DC economic analysis, the most up-to-date Five Year Plan Study cases at the time of the study were used as the starting base case. These cases originated from the 2007 data set B case last updated in May 2007 and were modified to exclude major transmission projects that had yet to be RPG approved and include reliability projects necessary to eliminate unserved energy and projects that proved to be economic during work on the 2007 Five Year Plan. Information on these cases is available on <http://oldercot.ercot.com/tmaps/login.cfm> under the link [2007 5-year Study](#). The results of this study are in the 2007 Electric Reliability Council of Texas' Report on Existing and Potential Electric System Constraints and Needs document.

Oncor indicated that the Elkton to Tyler West 138 kV line was already upgraded in the SSWG base cases. Therefore, the Elkton to Tyler West 138 kV line upgrade was removed from the base case and modeled with these values: $R=0.003378$, $X=0.019217$, $B=0.005529$ and Rate A/B/C=214 MVA. However, ONCOR stated that their studies indicate that the Tyler Grande project as they proposed would delay the need for this upgrade for at least five years.

The Reliability base cases were modified to increase the load in the Tyler Area (Zone 144 in the SSWG base cases) to reflect a peak load of 745, 741, 746, 756 MW, respective to the 2009, 2010, 2011 and 2012 SSWG loads. Oncor's proposal stated a 745 MW load level for the Tyler Area in 2009; however for the subsequent years we used the load levels obtained from the latest updated SSWG base cases and that is the reason for the apparent load decrease from 2009 to 2010.

Alternative Description

Luminant and Oncor did not submit transmission alternatives, however Luminant indicated that generation re-dispatch of Stryker Creek, Martin Lake, and Tenaska Gateway could be used to control congestion on Tyler Northeast – Tyler East 138 kV line.

Reliability Analysis

The Tyler area is susceptible to low voltage problems when either of the following occurs:

- loss of the Shamburger 345/138 kV autotransformer
- loss of the Elkton 345/138 kV autotransformer
- loss of the Shamburger – Tyler Northeast 138 kV line
- loss of the Elkton – Forney and Elkton – Tricorner double circuit 345 kV line
- loss of the Martin Lake – Elkton 345 kV line along with the Elkton 345/138 kV autotransformer plus the Martin Lake – Tyler Grande 345 kV line

The unavailability of Stryker Creek 2 further exacerbates the low voltage problems in the Tyler area. Therefore all reliability analysis was performed with Stryker Creek 2 (500 MW) unavailable.

The contingency loss of the Shamburger to Tyler Northeast 138 kV line resulted in high reactive loading on the Elkton 345/138 kV autotransformer and low voltage on the 345 kV side of the transformer. To compensate for the high reactive loading on the Elkton autotransformer in UPLAN, which performs a DC analysis, the Elkton autotransformer rating was modified to have lower limits as shown in Appendix A.

When Stryker Creek 2 was unavailable and the rating modifications due to MVar loading and voltage to the Elkton 345/138 kV autotransformer were made, the 2009 – 2012 UPLAN results show unserved energy at the Tyler Bullard 138 kV bus. This unserved energy was caused by an overload on the Elkton to Tyler Bullard 138 kV line due to the contingency outage of the Shamburger to Tyler Northeast 138 kV line. To eliminate all the overloads causing unserved energy using this direct approach, two other projects were identified as being needed. This alternative set of projects was compared to using part of the proposed project to eliminate the unserved energy to see which set of project had the lowest capital cost in 2009:

Part of Proposed project

Addition of a 345/138 kV autotransformer using the 493 MVA autotransformer that was replaced at Shamburger.	\$ 3,665,000
Rebuild of the Tyler Grande to Tyler South 138 kV line	\$ 2,750,000
Total Cost	\$ 6,415,000

Alternative Project (direct approach method)

Add a second Elkton 345/138 kV 600 MVA autotransformer	\$ 11,165,000
Upgrade the Elkton – Tyler West 138 kV line for Rate B = 326 MVA	\$ 3,670,000
Upgrade the Elkton – Tyler Bullard 138 kV line for Rate B = 478 MVA	\$ 1,718,000
Total Cost	\$ 16,553,000

Oncor indicated that if a second 345/138 kV autotransformer is installed at Elkton, it would be more reliable and beneficial to connect it to the Martin Lake – Tricorner 345 kV line so that both autos would not be connected to the same 345 kV bus. This is the reason for the second Elkton autotransformer's capital cost. However, the capital cost of the alternative project is significantly higher than using part of the proposed Tyler Grande project to eliminate the unserved energy. Therefore the installation of the 345/138 kV auto at the Tyler Grande substation and the upgrade of the Tyler Grande to Tyler South 138 kV line are recommended as reliability projects.

On a separate note, UPLAN identified unserved energy at the Brownsboro 69 kV bus caused by the overload on the Tyler Northwest 138/69 kV autotransformer due to the contingency outage of the Tyler West 138/69 kV autotransformer. However, the Tyler Northwest 138/69 kV autotransformer was determined to not have a significant impact on the study area but is included for informational purposes. For this study its capacity was increased to have an emergency rating of at least 60 MVA to eliminate the unserved energy.

Economic Analysis

After the reliability projects were identified and added to the base cases, the proposed upgrades were then analyzed to determine their economic benefits. The three upgrades were

each added individually to the base cases and the economic benefit of each by itself was determined. The different combinations of upgrades were then added to the base case and the results of this analysis for the years 2009 through 2012 can be found in Table 1.

Upgrade	Capital Cost (\$M)	Incremental Savings (\$M)				Total Savings
		2009	2010	2011	2012	
Tyler Northeast - Tyler East 138 kV line	1.90	10.83	7.24	10.03	4.53	32.63
Tyler GE - Tyler Omen Road 138 kV line	1.30	4.05	3.16	2.12	2.81	12.14
138 kV Switchable Series Reactors at Tyler Grande	1.50	-0.74	0.02	0.47	0.02	-0.23
Tyler GE - Tyler Omen Road 138 kV line & 138 kV Switchable Series Reactors at Tyler Grande	2.80	-0.30	1.00	-0.02	-0.10	0.58
Tyler Northeast - Tyler East 138 kV line & 138 kV Switchable Series Reactors at Tyler Grande	3.40	0.92	2.61	1.45	0.95	5.93
Tyler Northeast - Tyler East 138 kV line & Tyler GE - Tyler Omen Road 138 kV line	3.20	11.11	8.06	10.87	4.58	34.62
Tyler Northeast - Tyler East 138 kV line & 138 kV Switchable Series Reactors at Tyler Grande & Tyler GE - Tyler Omen Road 138 kV line	4.70	12.23	9.62	11.61	4.50	37.96

Table I: Production Cost Savings Summary from Tyler Area Upgrades

As a project, the upgrades of the Tyler Northeast to Tyler East and Tyler GE to Tyler Omen Road 138 kV lines and the addition of the 138 kV switchable series reactors on the Tyler Grande autotransformer proved to be the most economic providing production cost savings of \$37,960,000 from 2009 through 2012. With capital costs of \$4,700,000, this satisfies ERCOT's economic criteria.

Summary

The Tyler Grande switching station will be built to replace the Tyler Southeast station due to a local road widening project. ERCOT recommends the addition of a 493 MVA 345/138 kV autotransformer to the Tyler Grande switching station, the rebuild of the Tyler Grande to Tyler South 138 kV line to 326 MVA, and the upgrade of the Tyler Northwest 69/138 kV autotransformer to at least 60 MVA to be completed by 2009 to reliably serve the ERCOT system.

ERCOT also recommends the upgrade of the Tyler Northeast to Tyler East 138 kV line so that the Rate B is 326 MVA, the upgrade of the Tyler GE to Tyler Omen Road 138 kV line so that the Rate B is 326 MVA, and the addition of the four-ohm series reactors on the Tyler Grande autotransformer by 2009 as they should provide economic benefits to the ERCOT system.

Designated Providers of Transmission Facilities

In accordance with ERCOT's Power System Planning Charter and Processes, ERCOT staff is to designate transmission providers for projects reviewed in the regional planning groups. These providers can agree to provide or delegate the new facilities or inform ERCOT they do

not elect to provide them. For the project scope recommended in this report, Oncor Electric Delivery is the designated provider for this project.

Appendix A	 TylerAdditionalTable. xls
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