Attachment A

Long Term System Assessment For the ERCOT Region

Part of a series of reports designed to study the need for increased transmission and generation capacity throughout the state, pursuant to Public Utility Regulatory Act 39.904 (k)

ERCOT
System Planning

December, 2006

LONG TERM SYSTEM ASSESSMENT FOR THE ERCOT REGION

EXECUTIVE SUMMARY

The need for new bulk transmission is driven in large part by installed-generation changes. With the restructuring of the electric industry in Texas, decisions about investing in and siting new generation resources are now made independently by merchant generation developers. Because of the competitive nature of this generation market, the developers' plans for adding or retiring generation capacity are closely guarded. This creates uncertainty in transmission planning, and in recent years transmission planning has tended to be more reactive and to operate with a horizon of no more than five years.

Even when load growth in an area causes the need for transmission-system improvements, the selection of which particular transmission project is preferable may be affected by new generation decisions. Depending on the type of technology, new generation can be added quickly – in the case of wind generation, in as little as six months. According to the public plans of at least one generation developer, even coal generation can be added in as little as 3-4 years. On the other hand, a transmission line addition requiring new right-of-way is typically placed into service no less than five years following the decision to construct the line.

It has become apparent to many stakeholders that a longer-term view of the needs of the Electric Reliability Council of Texas (ERCOT) power system could result in more efficient development of the transmission network, and ERCOT commends the Legislature for recognizing the significance of this issue. This Long Term System Assessment (LTSA) is intended to provide a longer-term view by:

- Analyzing different load growth scenarios;
- Developing an assessment of the type and general locations of the new generation that the market might build by 2016, based on an economic analysis, for several scenarios of key drivers of those decisions;
- Evaluating the need for new transmission under each of these load and generation scenarios; and,
- Identifying projects and general conclusions that are common across the different scenarios and can be used to provide guidance to nearer-term transmission plans.

It is important to note that this study uses available data to predict the type (i.e., coal, gas-fired, wind, etc.) and general location of new generation that the market may find economic to construct. Of course, ERCOT cannot control these decisions, but the estimation of market behavior provides a reasonable basis on which to assess longer-term transmission needs under a range of scenarios. It goes without saying that the specific new generation indicated through this analysis may not be what is ultimately constructed, and thus the exact transmission lines that are eventually built may vary from the specific lines indicated in this analysis. However, this approach serves its purpose by allowing the development of general guidance and transmission project concepts that can guide nearer-term decisions.

The LTSA, along with the annual Report on Constraints and Needs[1] and the Analysis of Transmission Alternatives for Competitive Renewable Energy Zones in Texas (CREZ Study),[2] is intended to meet the requirements of Public Utility Regulatory Act Section 39.904 (k) for ERCOT and the Public Utility Commission of Texas (PUCT) to study the need for increased transmission and generation capacity throughout this state and report to the Legislature the results of the study.

The LTSA is based upon a 10-year horizon instead of a longer 15- or 20-year timeframe because a longer view of the system may not provide useful guidance to nearer-term decisions due to uncertainties in future generation patterns and the variables that highly influence load growth, such as population, electricity price, economic activities, advancement of technology, and changes in weather patterns. It is increasingly difficult to incorporate those uncertainties with any level of confidence in a very-long-term horizon. Some stakeholders have suggested that the LTSA should include an even longer-term assessment of needs. This will be considered in future LTSAs, but such an evaluation would be in addition to the type of analysis contained in the present LTSA, and would, by necessity, be more conceptual and less quantitative in nature.

<u>Findings:</u>

- New generation and transmission infrastructure is essential to system reliability and to accommodate load growth in the ERCOT region and offset probable retirements of older units.
- At least one additional major 345kV bulk line will be needed into the Houston and DFW areas for reliability, and additional circuits may be economically justified.
- Significant additional upgrades of the 138 and 69 kV system and additional 345 kV support (particularly in DFW, Houston and along the I-35 cities from the west) or additional 345kV lines in lieu of some of these upgrades (if more economic) will be required in years 6-10 even with moderate 2% load growth.

[1] The Report on Constraints and Needs details the needs of the system for the next five years.
[2] The CREZ Study details the transmission needs associated with the development of additional wind generation.

- Installation of switching stations at points where existing 345 kV circuits intersect {at Singleton (east of Bryan), Zenith (northwest of Houston), Navarro (south of Dallas) and Paint Creek (north of Abilene)} may result in better distribution of power and increase transfer capacities utilizing existing lines.
- The total investment in lower voltage upgrades for the five year period between 2011 and 2016 is roughly estimated to be $2 billion and the investment in 345kV upgrades is expected to be $1 billion (not including CREZ-related lines), for a total of $3 billion. This is similar to the $3.1 billion currently expected for the five year period 2007-2011.
- Only one 765kV transmission corridor (in Central Texas) was determined to be cost effective and, at the same time, more expensive than 345kV alternatives. An even longer term look may result in a different result for the 765kV options. This will be investigated in future LTSAs.
- Due to the short lead time associated with new generation development decisions in a deregulated market, the assessment of the long term transmission needs of the system requires some assessment of the likely economic addition of new generation that may be added by market participants.
- Current generation interconnection requests in ERCOT reflect type and location of new fossil fuel generation indicated under all but the lowest natural gas price scenarios studied.
- If gas prices remain high, they will likely induce more coal and wind generation additions, which are likely to be built in areas at greater distances away from load centers in major metropolitan areas, requiring more bulk transmission lines to transfer power from generation to load.
- Low gas prices (e.g., $4/MMBtu) may result in marginally-adequate reserve margins, since there would be little economic incentive to overbuild; conversely, higher gas prices (e.g., $7 or $10/MMBtu) may result in higher reserve margins, as there is sufficient economic incentive to displace higher-priced gas generation with lower-cost solid-fueled generation.
- Load growth, natural gas prices and environmental regulations were considered by ERCOT and stakeholders to be the factors that fundamentally influence the type of new generation added.
- New nuclear power plant additions were not evaluated in this year’s LTSA due to the lengthy expected licensing and construction timeline. Based on recent announcements and generation interconnection requests, new nuclear plants are recommended for analysis in the 2008 LTSA.

Methodology:

Many of the factors driving the needs of the system for generation and transmission become increasingly uncertain with time. The longer one projects electric demand requirements, the higher the number of scenarios needed to be analyzed in order to plan those needs. ERCOT stakeholders regularly assess these uncertainties as a part of their ongoing business. ERCOT worked with these stakeholders, through the ERCOT Regional Planning Groups, to identify a set of key drivers of the system needs which could be used for the purposes of the LTSA, as well as a reasonable range for each driver. Table ES-1 shows the identified drivers and the ranges used for each.

Gas Prices	Load Growth	Environmental Regulations
High Price Case: Delivered gas price $10/MMBtu[3]	Base Case: Peak and Energy Growth of 2%/ year from 2006	Current: No change from regulations currently being implemented (CAIR, CAMR, Regional Haze)
Medium Price Case: Delivered gas price $7/MMBtu	High Growth Case: Peak and Energy Growth of 4%/year from 2006	Low Carbon Case: Current Case regulations plus $8.00/ton allowance cost for CO_2
Low Price Case: Delivered gas price $4/MMBtu	High Energy Case: Peak Growth of 2%/year from 2006 and Energy Growth of 3%/year from 2006	High Carbon Case: Current Case regulations plus $16.00/ton allowance cost for CO_2

Table ES-1

Since the needs of the system will vary according to the unknown future values of each of these variables, ERCOT used scenario analysis to evaluate the system needs that were common over a range of scenarios, as well as the needs that were dependent on a particular future outcome. Discrete scenarios were developed using combinations of the identified key drivers, as shown in Table ES-2. In order to assess the longer term transmission needs of the system, a reasonable set of new generation additions were developed for each scenario.

Table ES-2: LTSA study scenarios

Scenario	Gas Price	Load	Environmental Regulation
1	Low	Base	Low
2	High	High	Current
3	Medium	High Energy	High
4	Medium	Base	Current

An integrated transmission and generation dispatch model was used to simulate the dispatch of system generation to serve system load for each hour of 2016. The model was not able to optimize wind additions, so two scenarios were developed with 6,000MW and 12,000MW of installed wind generation. The transmission system was only allowed to constrain flows between a predefined set of regions within ERCOT; local constraints were ignored. This model was used to determine the type and regional location of generation additions that were most profitable given that scenario's set of input assumptions and the

[3] All dollar amounts are nominal.

existing transmission network. No attempt was made to determine specific siting for new generation within a region; specific siting would be dependent on factors (such as water and fuel handling availability) outside the scope of this analysis. The resulting set of generation additions for each scenario is shown in Table ES-3.

New Generation Additions (with 12,000MW installed wind)					
Scenario	**Coal**	**Combined Cycle Gas**	**Simple Cycle Gas**	**Total**	**Reserve Margin**
1		13,570	4,500	18,070	12.0%
2	30,000		8,700	38,700	14.2%
3	24,000		600	24,600	19.6%
4	18,000		2,700	20,700	15.1%

Table ES-3

The profitability of the existing generation that is included in the reserve margin calculation on Table ES-3, and thus its likelihood of retirement, was not assessed. However, it was noted that many older gas units run very little in scenarios 2, 3 and 4 and may be mothballed or retired by their owners.

In the next phase of the study, the need for transmission system improvements to meet the reliability and economic needs of the system were assessed, based on steady state analysis. All lines on the transmission system (and contingencies thereof), including planned additions through the year 2011 (based on the plans of transmission owners as of March 2006), were used to constrain flows on the system. Elements of the transmission system that must be upgraded in order to maintain the reliability of the network, given the expected load level in 2016, were identified for each generation scenario. Specific transmission system improvements were not identified to solve the portion of these upgrade needs that were due to elements at 138kV or below; it was assumed for the purposes of this LTSA that these elements, which are generally local in nature, could either be upgraded or an equivalent upgrade, including potential higher voltage solutions, could be implemented at the appropriate time. However, specific improvements were identified where 345kV elements were of concern, because these elements generally require a longer lead time to be implemented and are more likely to impact the selection of preferred, near-term upgrades.

Next, with all these reliability improvements modeled, a simulation of the hourly system dispatch was performed for 2016. The elements of the system which caused higher-cost generation to need to be run in order to maintain reliability were identified. Specific solutions were identified for any such elements that were 345kV and if the solution was lower in cost than continuing to run the higher cost generation to meet reliability requirements. Once all of this transmission analysis had been performed for all three scenarios (the 4% load growth scenario was dropped from the transmission analysis due to time limitations and the relative (un)likelihood of this scenario), common needs were identified across scenarios.

A list of 345kV transmission projects that were found to be either economic or reliability driven in one or multiple scenarios is included in table ES-4.

Table ES-4 345 kV projects by Scenario

Name	Type	S1	S3	S4
Reliability Projects				
Navarro Station	Substation	Yes	Yes	Yes
T House - Navarro	New Lines	Yes	Yes	Yes
Collin - Anna	New Lines	Yes	Yes	Yes
Singleton Station	Substation	Yes	Yes	Yes
Zenith Station	Substation	Yes	Yes	Yes
Fayette to O'Brien	New Lines	Yes	Yes	Yes
Lobo – Rio Bravo – Frontera – North Edinburg	New Lines		Yes	
Economic Projects				
Bosque Sw-Everman	New Lines		Yes	Yes
Lufkin-Cedar Bayou	New Lines	Yes	Yes	Yes
Big Brown-Lufkin	New Lines	Yes	Yes	Yes
Oasis-PH Robinson	Upgrades	Yes	Yes	Yes
Bellaire-Smithers/WA Parish	Upgrades	Yes	Yes	Yes
Killeen-Kendall	New Lines	Yes	Yes	Yes
TNP-Sandow	New Lines		Yes	Yes
Holman-Coleto	New Lines		Yes	Yes
Moses-Martin Lake	New Lines		Yes	

The ERCOT-region generation market is deregulated, and generation type and siting decisions are made in the marketplace. This LTSA is not an attempt to force these decisions; it is merely a set of reasonable generation assumptions that can be used to predict market decisions so that transmission needs can be estimated. Neither is the LTSA intended to provide recommendations on actual transmission projects that the system needs for the next ten years; these recommendations will come at the appropriate lead time, after thorough analysis in the annual Five-Year Plan development and specific review by the ERCOT Regional Planning groups. However, the LTSA, even in draft form, has already been found to be a useful tool in guiding near-term decisions on actual projects toward a consistent framework.

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

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I Introduction

A. Impetus for Study

In 2005, Senate Bill 20 (SB20) added new Section 39.904(k) to the Public Utility Regulatory Act (PURA). Section 39.904(k) requires the Public Utility Commission of Texas (PUCT) and the Electric Reliability Council of Texas, Inc. (ERCOT) to study the need for increased transmission and generation capacity throughout the state of Texas and report to the Legislature the results of the study and any recommendations for legislation. The report must be filed with the legislature not later than December 31, 2006. Three separate reports have been prepared to meet this requirement:

- **Annual Report on Constraints and Needs in the ERCOT Region** – this report provides an assessment of the need for increased transmission and generation capacity for the next five years (2007-2011) and provides a summary of the ERCOT 5-Year Plan to meet those needs.
- **Long Term System Assessment for the ERCOT Region** – this report provides an analysis of the system needs in the tenth year, in order to provide a longer term view to guide near-term decisions made in the 5-Year Plan
- **Analysis of Transmission Alternative for Competitive Renewable Energy Zones in Texas** – this report provides an assessment of the potential for wind generation development in Texas and the transmission necessary to economically provide a portion of this generation to loads in the ERCOT market.

In sum, these reports provide an overall assessment of the needs of the ERCOT System over the next ten years.

B. Stakeholder Involvement

Stakeholders and transmission owners have been actively involved throughout the study by way of regularly scheduled Regional Planning Meetings and through conversations with ERCOT staff. At the Regional Planning Meetings, ERCOT staff have presented the methodology of the study and their interim results to, and sought comments from, all participants of the three regional planning groups (RPG).

C. Relation of the LTSA to other ongoing planning studies

The Long Term System Assessment is intended to provide general guidance to nearer term planning and is not intended to provide actual recommendations for specific transmission projects that the system needs for the next ten years. The

LTSA study used projections of certain factors that drive decisions on generation investment and system needs, such as the price of natural gas, load growth, and environmental regulations. These projections drove the new generation units and sites that were assumed to be built to meet the projected increase in demand. The exact placement and size of these new generators together with the growth and location of the load has a significant effect on the transmission needs of the system. All projections are less certain the farther into the future they are made. Thus, any decisions to recommend specific transmission projects for implementation will be made through the 5-Year Plan process and Regional Planning Group review of specific projects.

With respect to transmission, the LTSA has primarily focused on the long term needs of the system outside the West Texas area that is the focus of significant analysis in the Competitive Renewable Energy Zones (CREZ) study. However, the designation of CREZs by the PUCT will also affect the LTSA. The CREZ process will identify areas with significant wind development potential and initiate associated transmission improvements. Since the PUCT has not yet defined the CREZs that are to be pursued, a proxy set of CREZs was assumed for the LTSA analysis in order to analyze other bulk transmission needs outside of the West Texas region. Thus, the LTSA generally takes into account the impact of significantly increased wind generation in West Texas on the needs of the system outside that region, but the exact CREZ designation determined by the PUCT may have an impact on the long term system transmission needs.

II Approach

A. Discussion

1. Process

Figure 1 illustrates the high-level process flow of the LTSA study. Key elements of this process were:

- Projections of load and generation level and electrical location are required to assess the needs for transmission through 2016.
- Scenarios were defined based on certain variables that were identified by the Regional Planning Group members as having the largest impact on the need for and type of new generation and transmission.
- A proxy set of new generation additions to serve the electric demand of the ERCOT system in 2016 was developed for each scenario based on the type, capacity and regional location of new generation based on the load level, simplified regional transmission system, new generation characteristic (size, type, capital cost etc), fuel price and environmental regulations of each scenario.

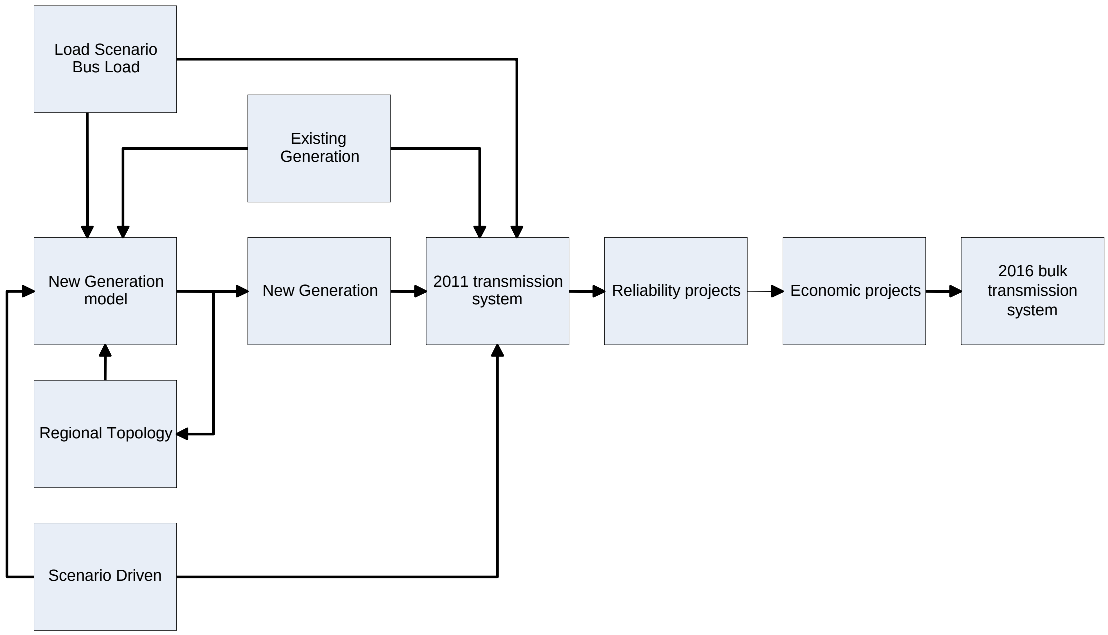


Figure 1: LTSA Process Chart

- The new generation additions, together with existing generation in the ERCOT system, the 2016 forecasted load, fuel prices, and environmental regulations for each scenario and the topology of the ERCOT transmission system expected for 2011 were used as inputs to an hourly security constrained unit commitment and economic dispatch model that was used to evaluate the transmission needs of the system.
- Due to the load growth expected by 2016, the transmission system currently planned for 2011 cannot serve the demand in 2016 even though there is a reasonable reserve margin with the new generation developed.

2. Focus on Bulk Transmission Needs

This study focuses on the bulk transmission needs at a ten year horizon, since the cost and lead time associated with such major transmission additions are precisely what warrant a longer-term assessment. However, as load grows over time, the underlying 69kV and 138kV lines used to distribute power locally to the load in growing areas will also need to be upgraded or additional injections of power from the bulk system into the area will need to be added. These lower voltage upgrades are typically lower in cost and do not require as much lead time. Since the focus of this study was on bulk transmission needs, specific upgrades of the underlying system were not studied. However, the lower voltage lines which need upgrades before 2016 have been identified and some conclusions may be drawn from the identified lines. Specific solutions to these lower voltage system issues will be identified through the Five-Year Plan at the appropriate horizon.

B. Long Term Planning Uncertainty in a Deregulated Market

The major role of a transmission system is securely transporting electric power from generation to load. In the long term, both load and generation (amount, type, and location) are changing and difficult to forecast. The difficulties and challenges facing the forecasting of long term load and generation (amount, type, and location) make long term transmission planning even more challenging and uncertain.

Long term load forecasting provides uncertainty for transmission planning. From a system standpoint, overall economic growth, technology improvement, energy consumption efficiency and weather all affect electricity consumption. Further, in transmission planning, the load at each substation (including new substations built in new areas of suburban growth) must be projected in order to develop a meaningful transmission plan.

In the deregulated market, forecasting future generation development provides another source of uncertainty in transmission planning. Transmission planners have to analyze transmission needs without knowing where, when and what type of generation is going to be built. Since the restructuring of the Texas wholesale electric market in 1999, transmission planners have generally adopted the approach of considering new generation in the transmission planning process only when an interconnection agreement is signed. New generation can be added to the system in as little as six months (for wind generation), while additional transmission lines requiring new right of way typically take about five years from the time a decision is made to build the line to the time it is placed into service. This has led to increasingly shorter planning horizons and uneconomic congestion being experienced on the system (or dependence on special protection systems) in the interim period between the completion of the generation and transmission. To some extent, this transmission-planning difficulty is unavoidable in a deregulated market; the flexibility in supply decisions that causes a market to be more efficient than regulated decision-making limits the information that is available for long term transmission planning.

The LTSA does not intend to impose generation type and siting decisions on the market, nor does it propose that transmission construction that may be influenced by specific generation siting decisions should be made in advance of firm siting decisions. It does, however, attempt to look proactively at the needs of the system by making a reasonable guess of what type, amount and location of the future generation may be built by the market, with the intent of guiding nearer-term decisions toward what are reasonably expected to be the longer term needs of the system and shortening the timeframe required to study the bulk transmission needs due to firm new generation by anticipating what those needs may be.

1. Key Drivers

This reasonable guess about new generation is based on an assessment of the key uncertainties that drive the decisions related to new generation and an evaluation of what those decisions might be under certain scenarios of the key uncertainties. In order to identify the key uncertainties driving the need for generation (and transmission), ERCOT worked with RPG stakeholders at the June 2 2006 RPG meeting to develop a consensus as to the drivers that should be considered in this study and the quantities that would make up each scenario. Through ERCOT's regional and open planning process, with active participation from RPG members, the following influence diagram was developed:

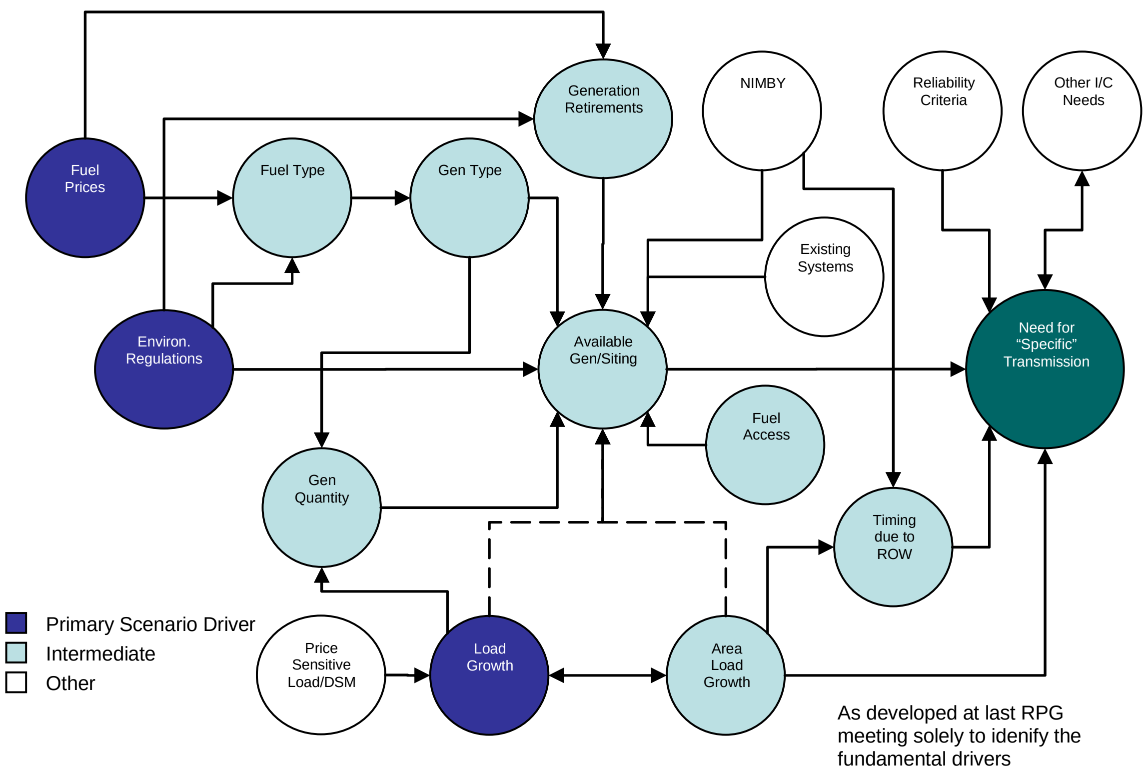


Figure 2: LTSA influence diagram

The concept was to develop a list of primary drivers that influence the need for new transmission and then develop scenarios based on these primary drivers. The need for new transmission is influenced by load growth and changes in generation. While load growth is a primary driver of the need for additional transmission, changes in generation is not a primary driver, because it is influenced by several more primary drivers: load growth, fuels prices (primarily natural gas) and environmental regulations. Thus the principal drivers upon which the scenario analysis for this study is based are load growth, fuel prices (primarily natural gas) and environmental regulations.

2. Range of Key Drivers

Again through stakeholder input, the following ranges were identified as describing a reasonable range for each of the primary drivers:

Gas Prices
- High Price Case: Delivered gas price $10/MMBtu[4]
- Medium Price Case: Delivered gas price $7/MMBtu
- Low Price Case: Delivered gas price $4/MMBtu

Load Growth
- Base Case: Peak and Energy Growth of 2%/ year from 2006
- High Growth Case: Peak and Energy Growth of 4%/year from 2006
- High Energy Case: Peak Growth of 2%/year from 2006 and Energy Growth of 3%/year from 2006

Environmental Regulations
- Current: No change from regulations currently being implemented (Clean Air Interstate Rule, Clean Air Mercury Rule, Regional Haze)
- Low Carbon Case: Current Case regulations plus $8.00/ton allowance cost for CO_2
- High Carbon Case: Current Case regulations plus $16.00/ton allowance cost for CO_2

3. Scenario definition

Because of the uncertainty in load and new generation forecasting, this study used the scenario analysis approach to evaluate specific combinations of future system states that reasonably covered the range of futures that should be considered in this study.

As a joint effort amongst ERCOT's staff and other RPG members, the following four scenarios were selected:

[4] All dollar amounts are nominal.

Table 1: LTSA study scenarios

Scenario	Gas Price	Load	Environmental Regulation
1	Low	Base	Low
2	High	High	Current
3	Medium	High Energy	High
4	Medium	Base	Current

III Generation Needs Analysis

A. Load

1. Load Scenarios.

As discussed in the previous sections, three load growth scenarios were developed: 2% peak and energy growth scenario, 4% peak and energy growth scenario, 2% peak and 3% energy growth scenario. These growth rates were used to forecast the ERCOT demand from 2007 to 2016. The starting peak load is the projected 2007 load in data set B of the ERCOT Steady State Working Group's (SSWG) power flow cases dated March 1, 2006. These peak loads are the estimates from each Transmission and Distribution Service Provider (TDSP).

The study uses a model that requires a load forecast for each hour of the year. An hourly load shape of a year was used to shape the peak hour load into each hour. The load shape used in this study was the normalized load shape derived through ERCOT's load forecasting process from the historical ERCOT load by weather zones, using econometric regression models.

2. Bus level load

Load grows at different rates in different regions and it grows at different rates at substations within the same region. Some substations may experience significantly higher growth than other substations because of business and /or residential developments in the area; some substations may have relatively slower growth. In addition, TDSPs have not generally identified locations for new distribution substations to serve expanding load in new areas beyond 2011. The following methodology was used to project the hourly load on each bus in the system consistent with the aggregated ERCOT system projected load in that hour.

Identify bus level growth rate: The SSWG cases have projected peak hour load for each bus on the system for each of the next five years. The imbedded growth rate in these five years of peak load is calculated and examined bus by bus. Some buses may show an extraordinary high growth because new subdivisions and/or new shopping and business centers are expected to be developed during the five year time frame. Some buses may show very little growth and even negative growth because of load shifting from one bus to other buses. This extreme high and low load growth buses were carefully examined by the respective transmission owners. Transmission owners examined the bus level load growth in their region and adjustments were made to ensure that the resulting growth rates for each bus from 2011 to 2016 were reasonable.

Distributing aggregated ERCOT total load to the bus level: After the bus level growth rates were developed, the bus level loads were then grown to the year modeled (2011 to 2016) according to their modified imbedded growth rate in the five year power-flow cases. Based on bus level load, bus load share percentages were then calculated. The aggregated total ERCOT load for each hour was then distributed to each bus according to these bus level load shares to produce an hourly forecast for each bus.

3. High load growth areas:

Figure 3 generally shows the areas expected to have high load growth from 2011 to 2016. Based on the growth rates anticipated by the TDSPs, the fastest growing areas are outside of the city centers. Large areas of growth are expected around the periphery of the Dallas-Fort Worth metroplex, north and west of Houston, around Austin and San Antonio into the Hill Country and along the lower Rio Grande valley.

4. Industrial load growth

In this study, it is assumed that the net large industrial load on the ERCOT grid will remain essentially constant. The rationale is that as industrial plant load increases, industrial plants will find it economic to build additional self-service generation to cover their load growth, as has been observed in recent history.

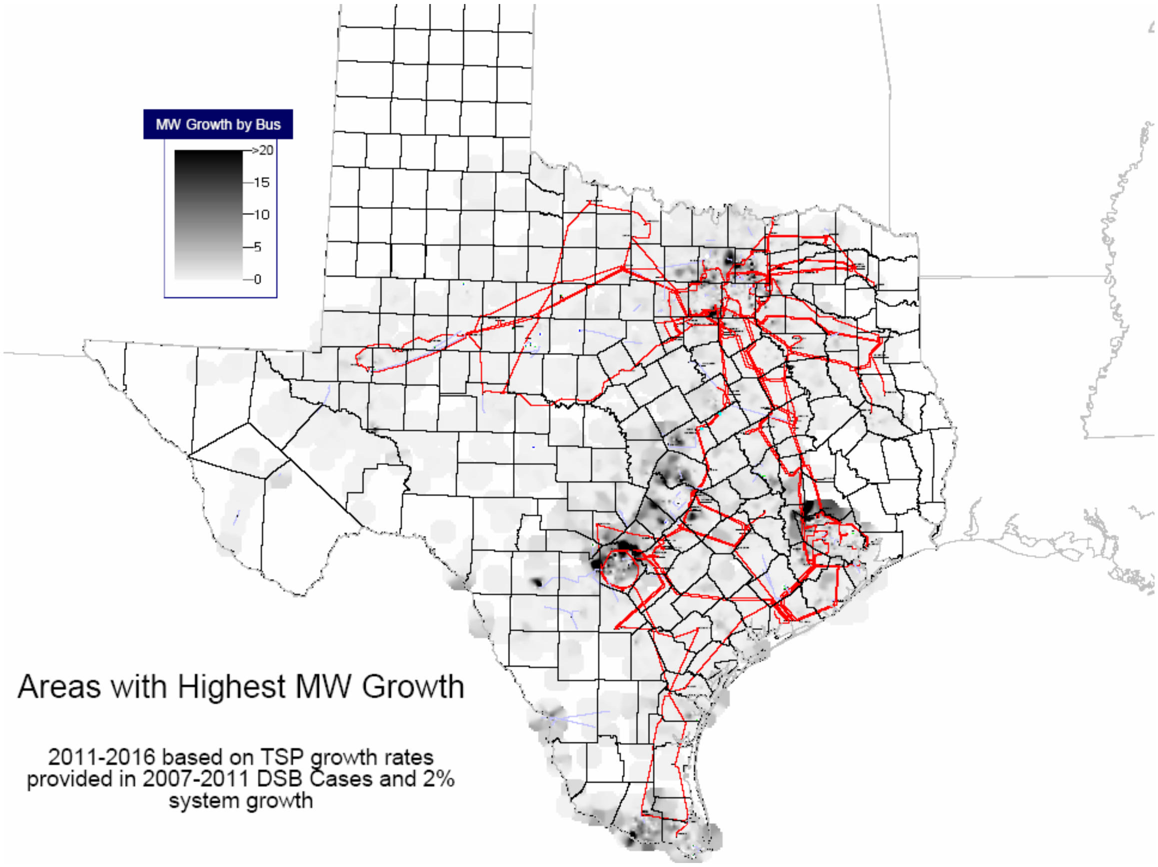


Figure 3: Areas with highest MW growth

B. Generation Additions

A significant amount of new generation will be needed to meet the demand projected for 2016 along with maintaining the 12.5% reserve margin that is needed to maintain system reliability, regardless of which load scenario is under consideration. In an efficient market, it should be profitable for merchant developers to develop the level of generation necessary to serve ERCOT load reliably. In the next phase of the study, a reasonable economic assessment of the types, amounts and locations of that new generation was developed

As described earlier in the report, load growth, fuel prices, and environmental regulations were identified by stakeholders as the primary drivers of generation development and ERCOT worked with stakeholders to develop a reasonable range of values for each of these drivers. Based on these primary drivers and values thereof, four generation scenarios have been developed. These scenarios are:

Table 2: Four generation scenarios

Scenario	Gas Price	Load	Environmental
1	$4	2%	$8
2	$10	4%	N/A
3	$7	2% peak; 3% energy	$16
4	$7	2%	N/A

In a deregulated market like ERCOT, profitability will be the main driving force for the quantity, the type, and the location of power plants to be built. Profitability of generation is determined by the fixed and variable costs of the power plants and the market price of power.

1. New Generation Parameters

In addition to wind generation, three types of fossil generation technologies were used as representative future generation in the study:

- Solid fuel (Coal, lignite) steam turbine generators
- Combined Cycle Gas Turbine generators
- Simple Cycle Gas Turbine generators.

The fixed and variable cost assumptions and other operating characteristics of the above three types of future generators are shown in the table 3. These assumptions were taken from the Texas Nodal cost/benefit study where available and reviewed with stakeholders through the RPG.

Table 3: List of new generation assumptions

Item	Unit	Solid Fuel	Combined-cycle	Combustion Turbine
Turn-Key Cost	$/kW	1,500	650	400
FOM	$/MW-Year	25	20	10
VOM	$/MWh	1.5	2.0	3.5
% of Debt	%	50	45	40
Interest Rate	%	8	8	8
Life	Years	30	30	30
Required Equity Return	%	12	16	18
Max Output	MW	750	590	150
Lowest Sustainable Level	%	51	24	90
Block 2	%	52	43	
Block 3	%	65	85	
Block 4	%	82	95	
Full Load	%	100	100	100
Seasonality (% of max)				
Spring	%	100	100	100
Summer	%	95	95	95
Fall	%	100	100	100
Winter	%	100	100	100
Heat Rate				
Lowest Sustainable Level	Btu/kW	9,940	7,786	10,000
Block 2	Btu/kW	8,404	5,102	
Block 3	Btu/kW	8,647	6,365	
Block 4	Btu/kW	9,067	7,980	
Block 5	Btu/kW	9,350	13,213	
Full Load		9,500	6,450	10,000
Emission rates				
NO_X	lb/mmbtu	0.10	0.03	0.03
SO_2	lb/mmbtu	0.50		
PAR	lb/mmbtu	0.04		
CO_2	lb/mmbtu	217	118	118
Min Uptime	Hours	168	8	1
Min Downtime	Hours	24	4	1
Expected Runtime	Hours	168	72	16
Cold Startup cost	$	30,000	22,000	5,300
Ramp Rate	MW/Hour	1,761	2,190	900
Average Maintenance	Days/Year	35	21	14
Forced Outage Rate	%	4	3	3

2. Regional modeling

For the generation expansion part of the LTSA, the ERCOT system was divided into twenty-five regions based on major transmission constraints, fuel availability, and geographic location. These regions were:

- Austin
- Bryan/College Station
- Fayette
- Hill Country
- Jewett
- San Antonio
- Temple/Waco
- DFW
- NW DFW
- South DFW
- East
- NE
- Houston
- STP
- Corpus
- Laredo
- Miguel/Victoria
- E. Valley
- W. Valley
- Abilene
- Del Rio
- McCamey
- Mid/Odessa
- Morgan Creek
- San Angelo

The regions are shown geographically on Figure 4.

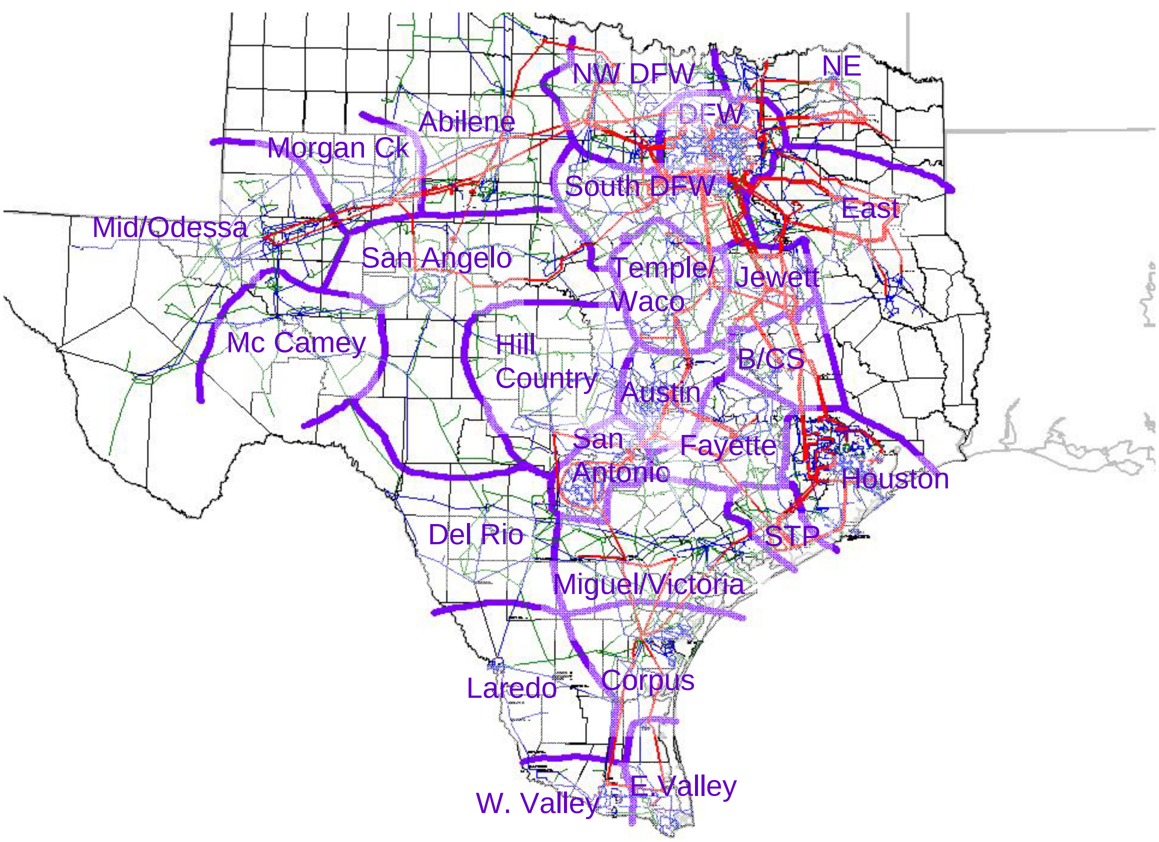


Figure 4: Regions for bulk generation and transmission analysis

In order to consider the economics and siting of new generation only on a regional basis, certain modeling techniques were used: All 345kV lines are modeled and fully monitored (rating A and B, contingencies, impedances), selected lower voltage tie lines between regions are fully monitored (rating A and B, contingencies, impedances). All the other lower voltage elements (lines and auto transformers) are modeled (contingencies, impedance) but their ratings are not monitored. The monitored lower voltage elements are in appendix D1.

The reason for this simplification is twofold. First, this study did not attempt to capture the impacts of many issues that profoundly affect the specific siting of generation within a region, such as water availability, fuel handling availability (gas pipelines and railways), local politics, etc. Second, future generation development will be affected more by the existing bulk transmission constraints rather than “local” constraints that are easier to upgrade in a timely manner.

3. Economic Evaluation of Proxy New Generation

A special New Generation Addition (NGA) model was used to develop the generation portfolio for each scenario. The inputs to the model consist of the following:

> **Load**: according to different scenario, as discussed in the previous section (section v, a), future year (2011-2016) bus level load was calculated and input into the model.
>
> **Existing generation and fuel cost**: Existing generation (MW, type, fuel, etc). Fuel (coal, gas, emission) prices assumptions was used according to each scenarios.
>
> **Regional Transmission topology**: simplified transmission topology discussed in the previous section (Regional Modeling)
>
> **New generation characteristics**: New generation assumptions (capital cost, size, heat rate, fuel type etc) discussed in the previous section (New generation characteristics).

The NGA model used the above assumptions and executed a multi-year optimization simulation that optimized the amount and type of generation additions from 2011 to 2016 based on the profitability of each new generator added. The model selected certain number of most profitable (highest price) locations to add the most profitable type of generators. After the first round of new generators being added, the model searched for the new highest price (most profitable) locations again, and added the most profitable type of generation to these highest price locations. The model iterated the process until no more new generation could be added profitably. This is a multiperiod (within a year) and multiyear optimization module. It uses financial Net Present Value (NPV) theory to calculate the overall profitability of new generation over all the years modeled. This optimization was repeated for each scenario after a proxy for the upgrade of the inter-regional transmission lines that appeared to be unreasonably binding on the solution was modeled.

The model used for this part of the analysis was unable to consider the economic addition of wind generation in the same manner it considered the addition of other generation technology types. Therefore, the analysis described above was performed on each of two levels of wind generation; a low wind case at 6000MW of total installed wind capacity (including existing wind generation) and a high wind case with 12,000 MW of total wind capacity. The proxy wind generation was placed in potential CREZ areas 2, 4, 5, and 6.[5] The selection of this set of potential CREZ areas was arbitrary and intended only to provide a reasonable expectation of the amount of wind generation in 2016 and the level of flows on the transmission network from that generation. Figure 5 shows the proxy wind generation capacity at different CREZs used in the study.

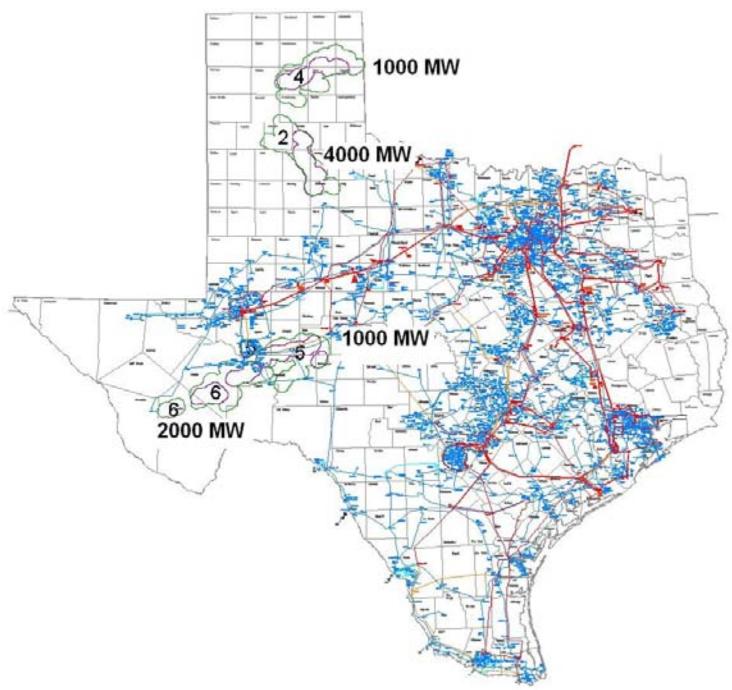


Figure 5: Proxy new wind generation capacity in potential CREZ areas 2, 4, 5, and 6

Although a set of generation was developed for each scenario based on both the low and high wind cases, only the high wind case was used for the transmission analysis portion of the LTSA study. By the time the transmission analysis portion of the study was begun, the RPG expected that at least 5000MW of wind

[5] The first round of CREZ designations will be made by the PUCT in the coming months.

generation would be installed in West Texas by the end of 2007. Therefore it did not seem reasonable that only an additional 1000MW would be added by 2016.

4. Proxy New Generation

Table 4 shows the results of new generation MW by type, by region of each scenario.

Table 4: New generation MW by type, region and scenario

	S1		S2		S3		S4	
Regions	**CT**	**CCGT**	**CT**	**CLLIG**	**CT**	**CLLIG**	**CT**	**CLLIG**
Abilene			600				300	
Austin	300		1500	750		750	900	750
Bryan		1180		2250		2250		1500
Corpus		590		750		1500		750
East	300	1180	600	3000		2250		3000
E.Valley	900						300	0
Fayette		1180		3000		2250		1500
Jewett		3540		5250		4500		3750
Laredo				750				
Northeast	300	1180	600	3000		3000	300	750
NW DFW	1500		1800		600		600	
San Angelo			900				300	
STP		3540	1800					
Temple	900			3750		3750		3000
Victoria	300	590		7500		3750		3000
W.Valley		590	900					

In scenario 1 (S1), the low gas price ($4 per MMBtu) resulted in the total cost of building and operating combustion turbines (CT) and combined-cycle gas turbine technology (CCGT) being more economical than coal and lignite (CLLIG).

In scenario 2 (S2), the high gas price ($10/MMBtu) makes the total cost of building and operating coal and lignite plants more economical than the gas technology. The total amount of new generation determined to be economic (38700MW) was due to the high load growth of 4%. Some CTs were indicated as needed by the model to meet the peak demand in areas that were transmission import constrained, not because they were necessarily economic.

In scenario 3 (S3), coal and lignite plants were predominantly the type of plants was determined to be economic by the model because of the relatively high gas prices ($7) and high energy growth (3%). The ratio of coal and lignite to CT is 40 to 1: that is for every 40 MW of CLLIG being built only 1 MW of CT were built. High energy case has a characteristic of flatter load curve comparing to the base and high load growth case. The flatter load curve means that more base load generation is required than peaking units. The $7 gas prices made the cost of operating CLLIG plants was considerably less than CTs. The $16/ton carbon tax was not enough to offset this cost advantage. Some CTs were indicated as needed by the model to meet the peak demand in areas that were transmission import constrained, not because they were necessarily economic.

In scenario 4 (S4), coal and lignite plants were predominantly the type of new generating unit that was determined to be economic by the model; however, in this scenario, the ratio of coal and lignite to CT is 7 to 1: that is for every 7 MW of CLLIG added, 1MW of CT was added.

Graphs of regions with gas, coal, and wind generation expansion potential can be found in appendix C1 and C2 respectively. Also, graphs of new generation of each of the scenarios can be found in appendix C3, C4, C5, and C6.

While it was reasonable to develop new generation assumptions on a regional basis, the more detailed transmission that followed in the next phase of the LTSA development required that each new generator be modeled on a specific electrical bus. As discussed earlier, the present analysis did not consider localized variables that typically guide the specific siting of generation within a region, such as water and fuel handling infrastructure availability. Since the market has already provided consideration of these variables that would be applicable to some portion of the proxy new generation in each scenario (in terms of actual plant site announcements), this information was used to model the connection of the first several units within each region on the specific buses to which the publicly announced plants would be connected. Any additional new proxy units in each region were modeled connected to one or more of the large 345kV substations in the region. These connections should provide a reasonable approximation of the impacts of the new proxy generation in each region upon the bulk transmission system for each scenario. Table 5 shows the specific buses upon which the proxy generation was modeled for each scenario.

Table 5: New generating unit by modeled powerflow bus name and scenario

S1		S2		S3		S4	
MW	**Modeled Location**	**MW**	**Modeled Location**	**MW**	**Modeled Location**	**MW**	**Modeled Location**
300	Valley	750	Valley	750	Valley	750	Valley
590	Hugo	750	Hugo	750	Hugo	750	Hugo
590	MOSES	750	MOSES	750	MOSES	750	MOSES
590	Martin lake	750	MOSES	750	MOSES	300	MOSES
300	STRYKER	300	MOSES	750	Martin lake	750	Martin lake
590	TRINDAD1	300	MOSES	750	SHAMBRGR	750	STRYKER
590	Big Brown	750	MARTINLK	750	TRINDAD1	750	Big Brown
590	Oak Grove	750	STRYKER	750	Big Brown	750	Oak Grove
590	Oak Grove	750	OAKGROVE	750	Oak Grove	750	Oak Grove
590	TNP	750	TRINDAD1	750	Oak Grove	750	TNP
590	Sand Creek	300	OAKGROVE	750	LIMEST 5	750	Sand Creek
590	LIMEST 5	300	SHAMBRGR	750	TNP	750	GIBCRK B
590	ROANS PR	750	Big Brown	750	Sand Creek	750	GIBCRK B
590	GIBCRK B	750	Oak Grove	750	GIBCRK B	750	T HOUSE
300	Lake Creek	750	Oak Grove	750	ROANS PR	750	T HOUSE
300	T HOUSE	750	TWIN OAK	750	GIBCRK B	750	LAKE CRK
300	T HOUSE	750	TNP	750	LAKE CRK	750	LAKE CRK
300	Sandow	750	Sand Creek	750	LAKE CRK	750	SANDOW
590	HOLMAN	750	LIMEST 5	750	T HOUSE	300	SANDOW
590	FAYETT34	750	GIBCRK B	750	T HOUSE	300	SANDOW
590	HILLJE 5	750	GIBCRK B	750	T HOUSE	300	LYTTON
590	HILLJE 5	750	ROANS PR	750	SANDOW	750	HOLMAN
590	HILLJE 5	750	Lake Creek	750	HOLMAN	750	FAYETT34
590	HILLJE 5	750	T HOUSE	750	HOLMAN	750	MIGUEL 5
590	HILLJE 5	750	T HOUSE	750	FAYETT34	750	MIGUEL 5
590	HILLJE 5	750	T HOUSE	750	MIGUEL 5	750	MIGUEL 5
590	VICTRA 4	750	T HOUSE	750	MIGUEL 5	750	VICTRA 4
300	COLETO 6	750	SANDOW	750	VICTRA 4	750	LNHILL 6
590	DAVIS 4	300	LYTTON	750	VICTRA 4	300	LAPALM 6
300	LAPALM 6	300	SANDOW	750	MIGUEL 5	300	PHATM W4
300	LAPALM 6	300	LYTTON	750	DAVIS 4	300	SAPS1 4
300	LAPALM 6	300	LYTTON	750	SHARPE6	300	BOWMAN
590	BATES 4	300	LYTTON	300	BOWMAN	300	GRAHAM
300	GRAHAM	750	FAYETT34	300	BOWMAN		
300	GRAHAM	750	HOLMAN				
300	GRAHAM	750	HOLMAN				
300	GRAHAM	750	FAYETT34				
300	GRAHAM	300	HILLJE 5				
		300	HILLJE 5				
		300	HILLJE 5				
		300	HILLJE 5				
		300	HILLJE 5				
		300	HILLJE 5				
		750	VICTRA 4				
		750	COLETO 6				
		750	MIGUEL 5				
		750	MIGUEL 5				
		750	MIGUEL 5				
		750	COLETO 6				
		750	COLETO 6				
		750	COLETO 6				
		750	COLETO 6				
		750	COLETO 6				
		750	LNHILL 6				
		300	BATES 4				
		300	BATES 4				
		300	EDNBRG 6				
		750	LARBTB				
		300	PHATM W4				
		300	PHATM W4				
		300	SAREDCK4				
		300	TWBT7				
		300	SAREDCK4				
		300	GRAHAM				
		300	GRAHAM				
		300	BOWMAN				
		300	BOWMAN				
		300	BOWMAN				
		300	GRAHAM				

Note:
- 750MW indicates coal unit
- 590MW indicates CCGT unit
- 300MW indicates CT unit

5. Reserve Margins

Table 6 shows the generation added of each type, by scenario, as well as the resulting reserve margin as calculated according to the current ERCOT methodology for each scenario. The reserve margin is the ratio by which the generating capacity that is expected to be available to meet the peak hourly load for the year exceeds that peak load. According to the current reserve margin calculation methodology, the 12,000 MW of installed wind capacity included in this analysis is counted at 2.6% of its nameplate value, or highest capacity, because wind is variable and does not tend to be strongest when electric load is at its highest; thus, wind adds 312MW toward the reserve margin.

The profitability of the existing generation included in the reserve margin calculation, and thus its likelihood of retirement, was not assessed. However, it was noted that many older gas units run very little in scenarios 2, 3 and 4 and therefore may become candidates for mothballing or retirement.

Table 6: New generation and reserve margin

New Generation Additions					
Scenario	**Coal**	**CCGT**	**CT**	**Total**	**Reserve Margin**
1		13,570	4,500	18,070	12.0%
2	30,000		8,700	38,700	14.2%
3	24,000		600	24,600	19.6%
4	18,000		2,700	20,700	15.1%

IV. Transmission Needs Analysis

While the regional generation development analysis, described above, had only considered inter-regional transmission constraints, the next phase of the analysis was intended to investigate the needs for transmission system improvements throughout the transmission grid.

The starting topology for analyzing transmission needs for the 2016 timeframe was the Steady State Working Group's 2006 Data Set B 2011 topology that was updated on March 1, 2006. Four cases, one for each of the scenarios, were developed by including the proxy new generation developed for the high wind case and the load level for that scenario into the 2011 case topology. In this way, an unimproved 2016 case was created for each scenario. Two additional changes were made to each of these cases. The portion of the 12,000MW of proxy wind generation that was included in potential CREZ areas 2 and 4 was modeled as connected to the system by a large capacity line into Northwest DFW. The portion of the 12,000MW that was included potential CREZ areas 5 and 6 were connected to the system by a large capacity line into the Hill Country area. The wind assumptions were uniform across all scenarios. While the exact amount and location of the wind generation and associated transmission selected by the PUCT through the CREZ process and built by developers is unknown at this time, the assumptions used in the present study should provide a sufficiently reasonable impact on the needs for transmission in the non-West Texas portions of the state as to allow those needs to be evaluated. As noted earlier, the transmission needs in West Texas will be primarily driven by the expected addition of significant new wind generation; these needs are primarily being studied in the CREZ analysis.

The analysis was conducted using an hourly security-constrained unit-commitment and economic-dispatch simulation model that can be used to forecast changes in system operations on an annual basis. The model uses a DC approximation of the steady state flows on the transmission network. Previously-identified dynamic limits (into Laredo, into and across the Rio Grande Valley) were modeled, but additional voltage and transient stability analyses were not performed for this screening study.

A. Identifying Reliability Needs

As expected, the simulation of the resulting system for 2016 resulted in a significant number of constraints, since at this point in the analysis the system consisted of 2016 loads and corresponding generation superimposed onto a transmission topology that had only been designed for loads through 2011.

Insecure energy was abundant, especially in the major metropolitan areas. Insecure energy is load at a given bus that cannot be securely served under any simultaneously feasible generation dispatch for a given hour.

For an example of what is meant by insecure energy, suppose the load on a particular bus is 198 MW in a certain hour. This bus is served by two transmission lines, each rated at 200MW. The system must be designed or operated in such a way that if one of those lines were to trip out of service (known as a contingency), the loading on the remaining line would be less than the line's rating. In this case, the loss of one of the lines would result in the entire 198MW of load on the bus being served by the other line. Since the other line is rated at 200MW, the load is able to be served securely. However, suppose the load on the bus rose to 205MW in the next hour. In this case, if one of the lines were to trip out of service, the remaining line would be loaded at 5 MW more than its 200 MW rating. This 5 MWh of energy above what can be securely served by the system is the amount of insecure energy on the bus in that hour.

A security constrained unit commitment and dispatch simulation was run on the 2016 case for each of the scenarios in UPlan and the contingency and overloaded transmission elements that caused insecure energy for every bus in the system were identified. The transmission elements that were overloaded causing insecure energy were given an increased rating and the simulation was re-run so that the next layer of insecure energy was exposed. This process of identifying elements that cause insecure energy and increasing their ratings was repeated until all the insecure energy was removed from the system. In other words, with the increased ratings on all of the identified elements, the system was able to reliably serve the load.

This process was performed for three of the four scenarios. There was not sufficient time and information to complete all of the required analysis for all four scenarios. The decision was made to complete the full analysis only on scenarios 1, 3 and 4. Scenario 2, which included a 4% annual load growth rate, would obviously require significantly more transmission upgrades to maintain a reliable system than the other scenarios, due to the higher total load. In some areas, all the lower voltage line ratings would need to be increased, some beyond the limits of current technology without upgrading some of the circuits to 345kV and adding additional distribution points. Due to the timing limitation, the scope of Scenario 2, and the relative (un)likelihood of Scenario 2, these upgrade needs were not studied further.

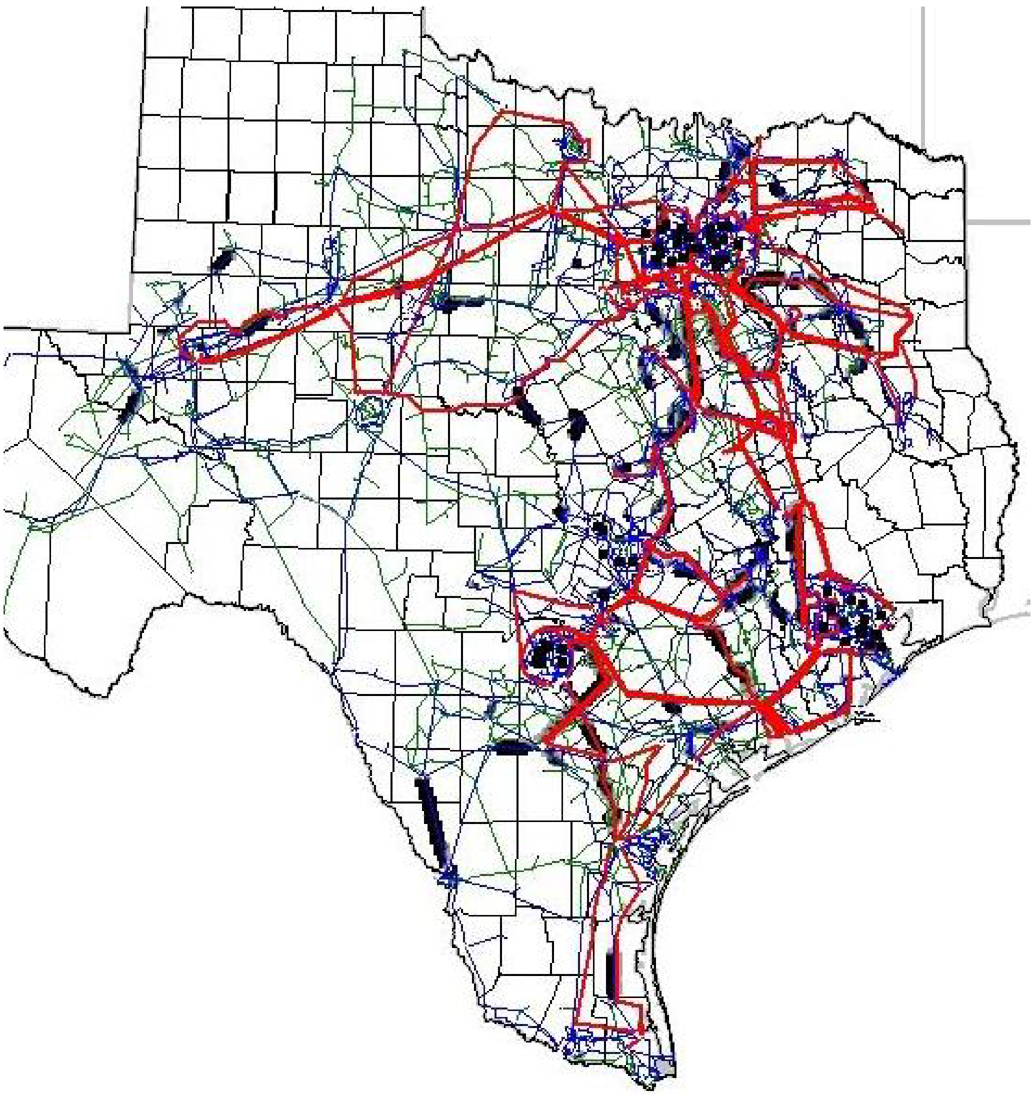
The list of all of the lines whose ratings had to be modeled as being increased in order to reliably serve all system load is included in appendix D2. Table 7 provides a summary of those results for each scenario.

Table 7: Summary of upgraded lines to remove insecure energy

	# of Lines	% of Total Lines Requiring Upgrade
Scenario 1		
138kV line	230	70%
Auto	47	14%
345kV line	51	16%
All of above	328	100%
Scenario 3		
138kV line	260	68%
Auto	60	16%
345kV line	61	16%
All of above	381	100%
Scenario 4		
138kV line	230	70.34%
Auto	55	16.82%
345kV line	42	12.84%
All of above	327	100.00%

A detailed listing of all 345kV, 138kV, and auto-transformer upgrades required to remove insecure energy could be found in appendix D2. Based on this listing, it can be estimated that approximately $1 billion (in 2006 dollars) will be required to upgrade the lower voltage 138kV lines to serve all the forecasted demand between 2011 and 2016. Graphical representation of all upgraded elements to resolve insecure energy of S1, S3, and S4 could be found in appendix C7, C8, and C9.

Figure 6 illustrates the geographic distribution of these upgrade needs. The primary areas with significant upgrades are in the DFW area, in Houston, and in the Central Texas cities along I-35 from Waco to San Antonio west of the existing 345kV infrastructure.



The black shaded areas indicate ugraded elements.

Figure 6: Upgrades of ERCOT transmission system to meet reliability needs (Scenario 4)

B. Bulk System Improvements to Meet Reliability Needs

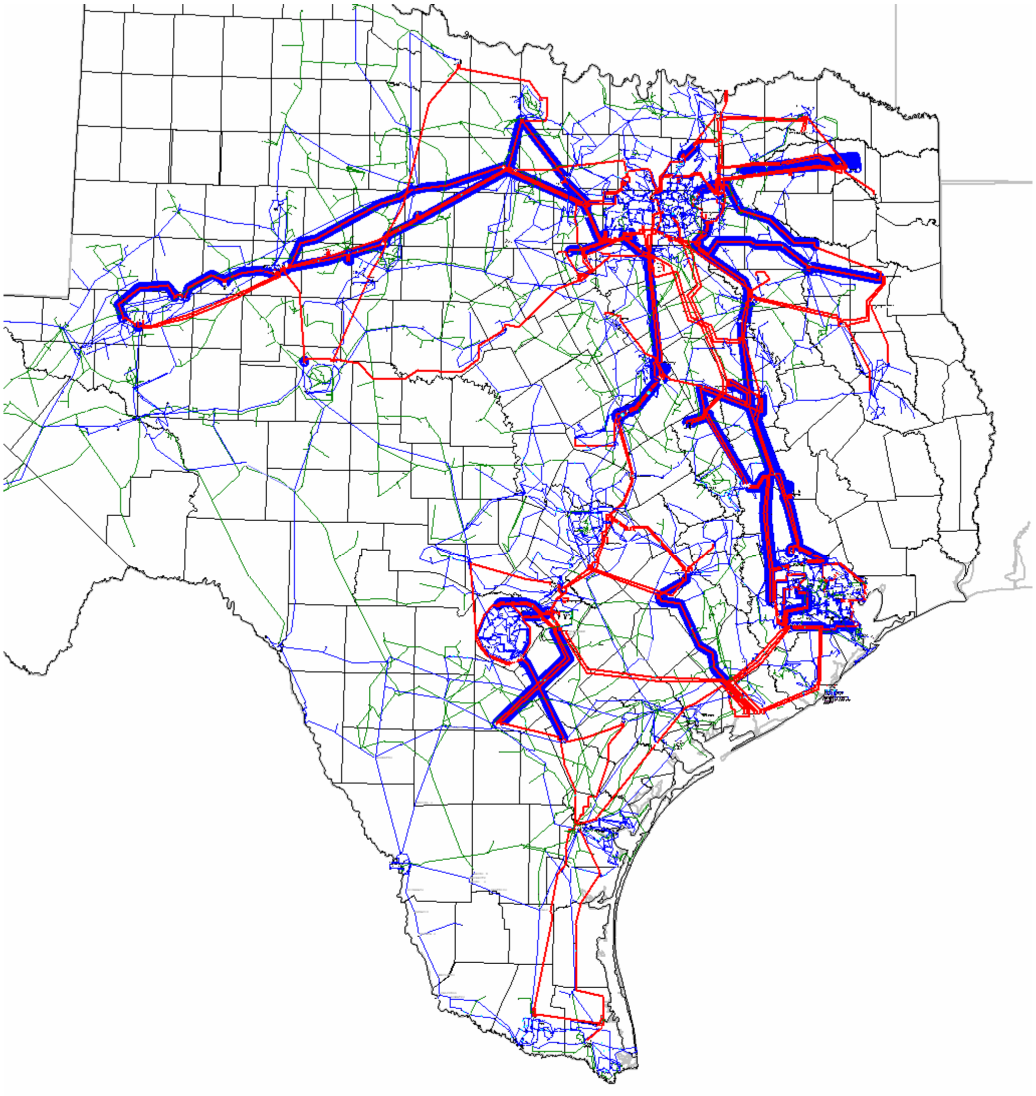
The focus of the transmission analysis portion of the LTSA was primarily on the need for new bulk transmission lines, which have a long lead time and greater effects on the need for other transmission projects. Since upgrades of lower voltage lines have a shorter lead time and generally more localized effects, it was not necessary to develop specific solutions for each of the 69kV and 138kV upgrade needs. However, specific transmission system improvements were evaluated for projected longer-term problems on the 345kV network, since information about which line concepts are preferred solutions to these problems will help to inform near-term transmission plans.

Figure 7, which uses scenario 4 data, shows the portion of the binding elements causing insecure energy (as identified previously) that are bulk transmission elements having a starting and ending voltage equal to or greater than 345kV.

Graphical representation of the most congested elements with all the reliability upgrades of all attempted scenarios (S1, S3, and S4) could be found in appendix C10, C11, and C12. Detail listing of those congested elements can be found in appendix D3.

By examining the map of the bulk system elements causing insecure energy, as well as the detailed model output of the buses which have insecure energy (over 90% of the insecure energy is from DFW and Houston areas), it is obvious that evaluating additional transfer capability into DFW and Houston is a high priority.

In order to investigate specific transmission projects that could relieve the insecure energy caused by these 345kV elements, the ratings of those elements were lowered in the model back to the rating currently planned for 2011 (as included in the original 2011 SSWG case). As expected, this caused insecure energy when the economic dispatch model was run. ERCOT worked with various transmission owners to identify potential transmission projects to solve the insecure energy caused by constraints on the 345kV transmission elements.



The blue shaded areas indicate
most congested elements (345 only)

Figure 7: Bulk system binding lines causing insecure energy (Scenario 4)

Projects selected in this phase of the study are the lowest capital cost solutions which also have the largest impact in reducing the amount of the insecure energy. The resulting projects are the minimum set of the reliability projects that may be needed to maintain reliability on the bulk system for 2016. These following projects and upgrades were the same in all generation scenarios:

1. Navarro switching station, which is positioned at the intersection of the Limestone – Watermill double circuit and the Big Brown – Venus double circuits. (Figure 8)

    - The addition of the Navarro switching station along with the Navarro – Tradinghouse 345kV double circuit line allow for greater flows into the southern part of the DFW area. The addition of the new substation reduces the contingency exposure from the lengthy lines coming from the Limestone and Big Brown stations going to the southern DFW area. The new double circuit line from Navarro – Tradinghouse will strengthen the corridor into southern DFW by tying together two major paths.

2. Tradinghouse – Navarro double circuit (Figure 8)

    - The new double circuit line from Navarro – Tradinghouse will strengthen the corridor into southern DFW by tying together two major paths.

3. Collin – Anna re-conductoring to get the rating to 1969 MVA (Figure 8)

    - Since this line is located in the major corridor that connects the Northeast to the northern DFW area and a second circuit cannot be added, an upgrade to the existing circuit or the addition of a parallel circuit (in order to avoid the expected high cost of a construction outage of the existing Collin-Anna line) is warranted as a reliability project by 2016.

4. Singleton switching station, which is located east of Bryan (Figure 9)

    - The addition of the Singleton substation will reduce the contingency exposure due to long transmission lines going into Houston. This will allow more flexibility when operating the system.

5. Zenith switching station which is located on the Northwest side of Houston (Figure 9)

- The addition of the Zenith substation will reduce the contingency exposure due to long transmission lines going into Houston. This will allow more flexibility when operating the system.

6. Gibbons Creek to Singleton upgrade (Figure 9)

   - This upgrade will allow power to flow up to the conductor rating. This will help increase the power import into Houston.

7. Fayette to O'Brien double circuit (Figure 9)

   - The addition of this double circuit line gives a new injection point into the Houston area. And since this line is coming from the Central Texas area, it will not congest the existing North and South corridors into Houston.

In the high energy scenario, scenario 3, an additional reliability element, Lobo – Rio Bravo – Frontera – North Edinburg, was needed to securely serve all the energy in 2016 (Figure 10). Also, in scenario 1, an additional line from Jewett to Singleton to Zenith is needed for reliability, but it may be replaced by approval of other economic projects.

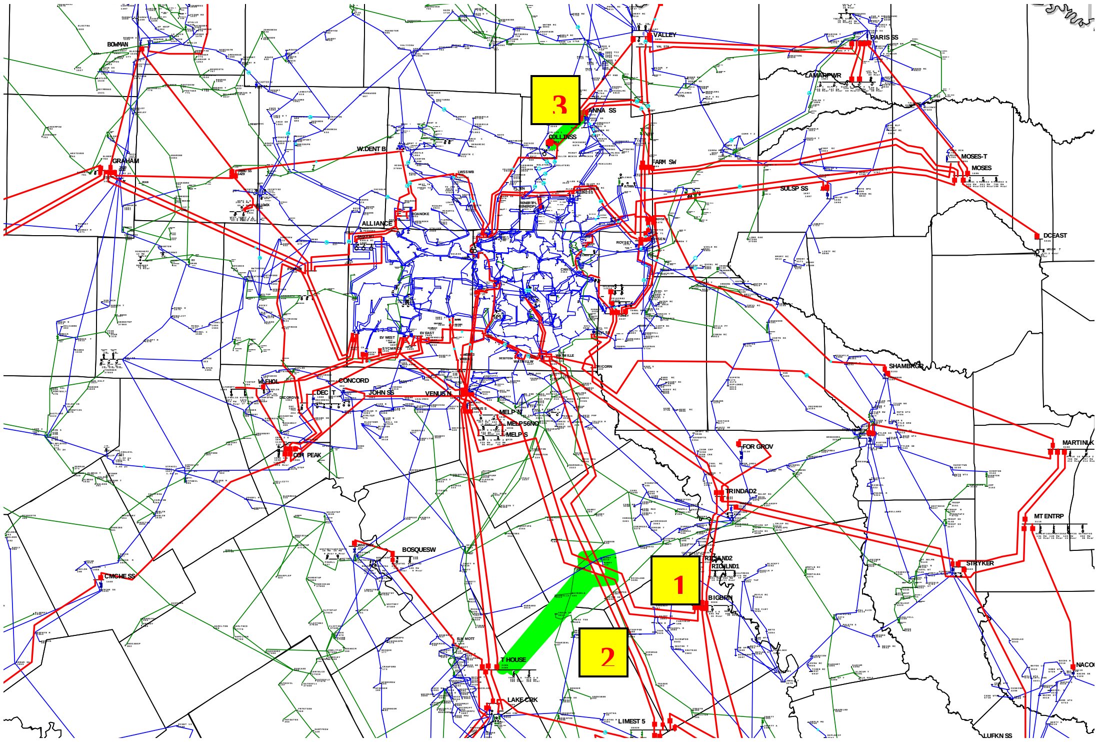


Figure 8: Map of DFW area reliability upgrades

1 – Navarro Switching Station
2 – Navarro-Tradinghouse
3 – Collin-Anna

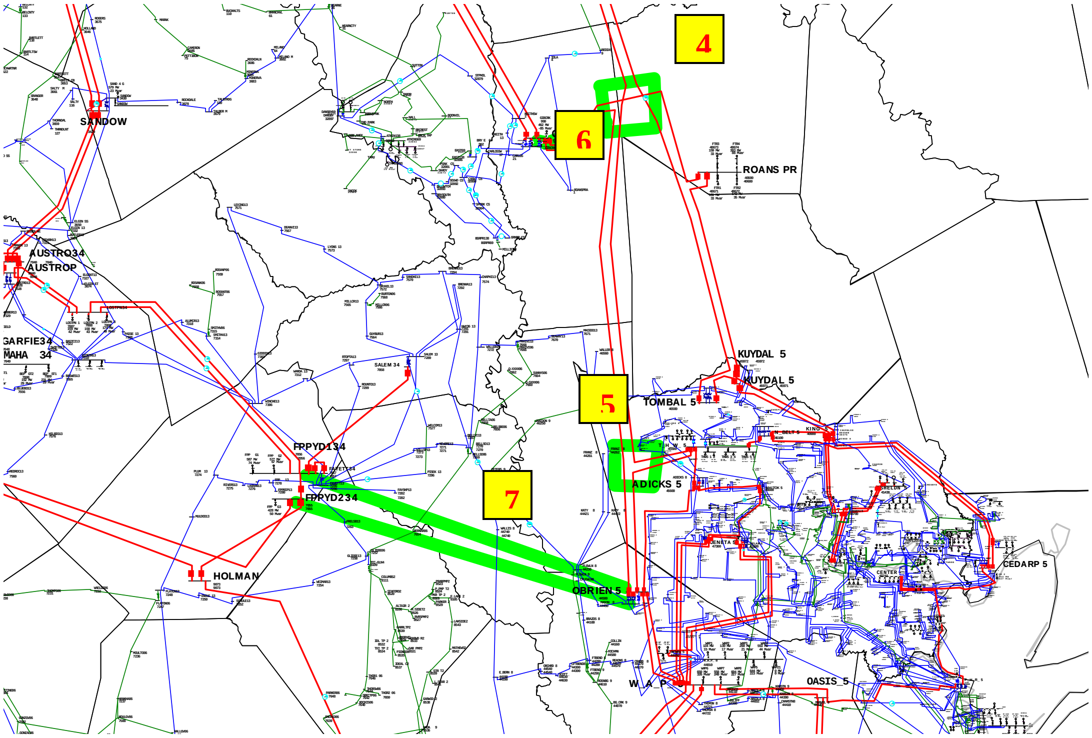


Figure 9: Map of Houston area reliability upgrades

4. Singleton substation
5. Zenith substation
6. Gibbons Ck. To Singleton
7. Fayette – O Brien

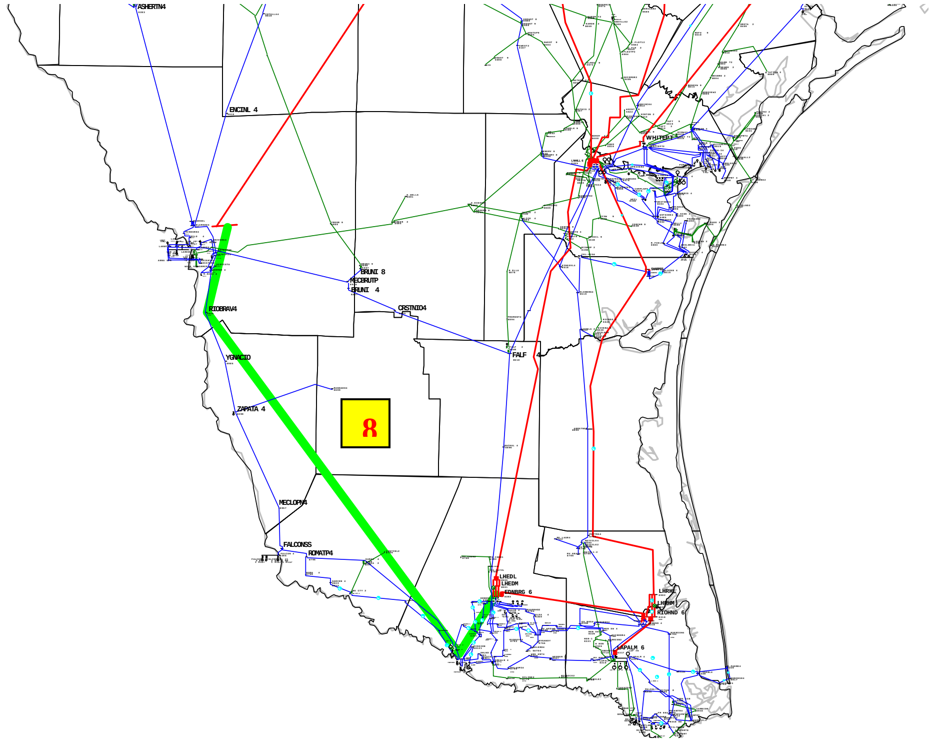


Figure 10: Map of Rio Grande Valley area reliability upgrades needed only in scenario 3
8. Lobo – Rio Bravo – Frontera - Edinburg

C. Bulk System Improvements to Improve Efficiency of the System

The list of reliability projects listed above, along with the lower voltage system improvements identified earlier for which specific transmission upgrades were not investigated, would be expected to allow the ERCOT system to operate reliably. However, significant uneconomic congestion would be experienced if these were the only improvements and upgrades that were implemented. The next phase of the analysis was performed in order to investigate which elements of the system were congested and to evaluate upgrades that would be economic in reducing the energy production cost for the system by relieving these congested elements.

For an example of what is meant by a congested element, suppose the load on a particular bus is 205 MW in a certain hour. This bus is served by two transmission lines, each rated at 200MW. A relatively inefficient generator is also connected to this bus. The cost of serving the load with this generator is $60 per MWh, whereas the marginal cost on the rest of the system is only $50/MWh. The system must be designed or operated in such a way that if one of those lines were to trip out of service (known as a contingency), the loading on the remaining line would be less than the line's rating. In this case, the loss of one of the lines would result in the entire 205MW of load on the bus being served by the other line (presuming the local generator was not on-line, due to its higher cost). Since the other line is rated at 200MW, the remaining line would be loaded at 5 MW more than its 200 MW rating. In this case, the 5MWh of energy would not be insecure, because the security constrained unit commitment and dispatch would cause the expensive generator on that bus to be brought on line and generate at 5MW output, so that if one of the lines were to trip, the remaining line would not overload in serving the load on the bus. The existing system is able to serve the load securely, but doing so costs an extra $50 {($60-$50) times the 5 MW} more than it would cost if the ratings of the two lines were increased to at least 205MW. If the production cost savings (the $50 of extra cost due to the constraint, in the one hour example above), over time, from increasing the ratings of the lines is greater than the capital cost of rebuilding the lines to the higher rating, then the upgrade of the transmission lines would be economic and should be initiated.

The process to identify the congested elements was similar to the process used to identify the constraints causing insecure energy. The security constrained unit commitment and economic dispatch model was run and the congested elements were reported. The ratings on the transmission elements that were highly congested were increased and the system was then simulated again so that the next layer of congested elements would be exposed. This process was repeated until a significant list of congested elements was populated. Figure 11 shows an example of the congested corridors in the S4. Graphical representation of the most congested elements with all the reliability upgrades of all attempted scenarios (S1, S3, and S4) could be found in appendix C13, C14, and C15. A detailed listing of the most-congested elements with all the reliability projects in place is found in appendix D4.

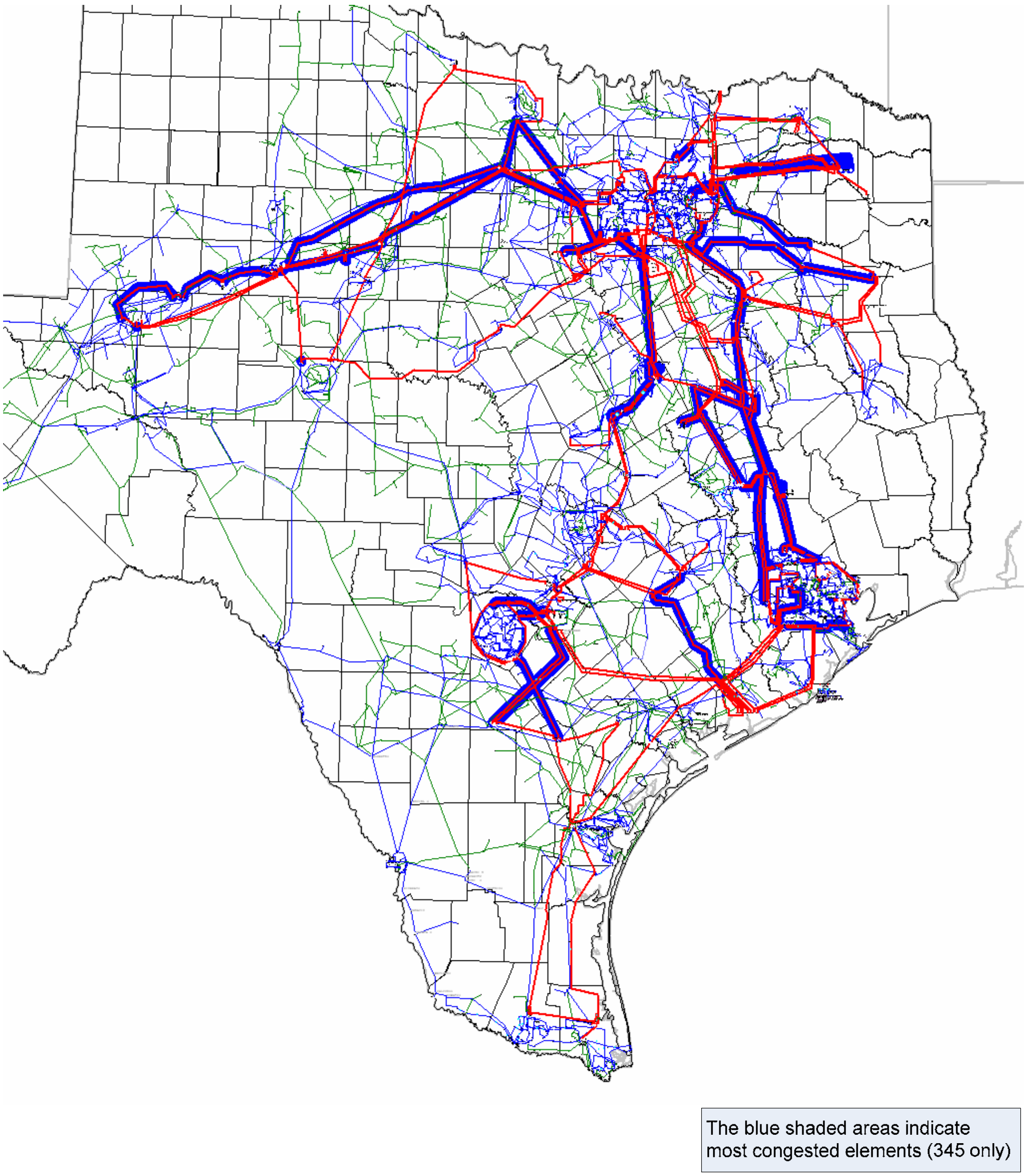


Figure 11: Most-congested elements with all reliability projects, 345 only (Scenario 4)

Since the LTSA is focused on the long term bulk transfer needs for the ERCOT system, specific transmission improvements were considered only to relieve the 345kV congested elements. If a lower voltage line was congested and received an increased rating in the previous step, that increased rating was kept for the remainder of the study. However, the ratings of the 345kV transmission elements that had received an increased rating were returned to the value from the 2011 SSWG case so that specific economic bulk transmission projects could be analyzed.

Multiple 345kV options were individually evaluated to relieve the loading on the congested 345kV elements and reduce the production cost to deliver power to the system. ERCOT worked with transmission owners to identify these options. Cost estimates were either provided by the transmission owners or estimated by ERCOT using the assumption of 130% of the straight line distance, $1 million per mile for a 345kV single circuit and $1.25 million for a 345kV double circuit, plus an estimate of substation costs. Table 8 summarizes the 345kV transmission projects that were found to be economic in one or multiple scenarios. A brief description of each transmission project is included below Table 8.

Table 8: Economic projects included in the LTSA, by scenario

Name	Note	S1	S3	S4
Bosque Sw-Everman	New Lines		Yes	Yes
Lufkin-Cedar Bayou	New Lines	Yes	Yes	Yes
Big Brown-Lufkin	New Lines	Yes	Yes	Yes
Oasis-PH Robinson	Upgrades	Yes	Yes	Yes
Bellaire-Smithers/WAP	Upgrades	Yes	Yes	Yes
Killeen-Kendall	New Lines	Yes	Yes	Yes
TNP-Sandow	New Lines		Yes	Yes
Holman-Coleto	New Lines		Yes	Yes
Moses-Martin Lake	New Lines		Yes	

Bosque Switch-Everman – This project provides another entry path into the south DFW area. The addition of this line also networks the Bosque 345kV circuit into the 345kV system.

Lufkin-Cedar Bayou – This double circuit 345kV line will connect the eastern portion of the ERCOT system with the Houston area. This project will also add another new corridor into Houston.

Big Brown-Lufkin – This double circuit 345kV project will strengthen the eastern ERCOT and Central ERCOT areas by allowing economic generation more avenues to load centers via existing and new transmission corridors.

Oasis-PH Robinson – This project upgrades the transmission line to allow operation at a higher conductor temperature and also replaces terminal equipment to achieve a higher segment rating.

Bellaire-Smithers/WAP – This project upgrades the transmission line to allow operation at a higher conductor temperature and also replaces terminal equipment to achieve a higher segment rating.

Killeen-Kendall – This transmission project will create a new pathway around the west side of Austin connecting the San Antonio area with the Killeen area.

TNP-Sandow – This double circuit project will connect and strengthen the Central Texas area to the Jewett area.

Holman-Coleto – This transmission project will create a 345kV switching station in the existing double circuit 345kV line from the South Texas Project – Elm Creek Switching Station. A new 345kV double circuit line from Holman through this new bus and continued to Coleto will be built to complete the project. This will help support the voltage north of the Corpus Christi area.

Monticello-Martin Lake – This transmission project will network the eastern area of the ERCOT grid to the northeastern area. This should help generation in these areas transmit power to the DFW area even under severe contingencies.

After the economic projects were tested individually to determine which ones produced an economic benefit to the system, all the projects that did produce enough of an economic benefit were run together to ensure that they were economic as a whole. Tests of the set of projects minus each of the projects were also run to evaluate whether each project was economic in the set. Each of the projects described above were also economic as a part of the set.

Once a package of projects had been identified that were economic as a whole, these projects were added to the model, and the resulting system was simulated through several iterations as before to determine the next layers of congested elements. Figures 12, 13 and 14 show where the remaining congested bulk transmission elements (S4) are located. The lines that are highlighted blue are the remaining congested elements. List of all the remaining most congested elements can be found in appendix table 4

Specific solutions (building new lines, reconductoring) were investigated for the remaining most congested elements. However, none of the solutions were found to be economic.

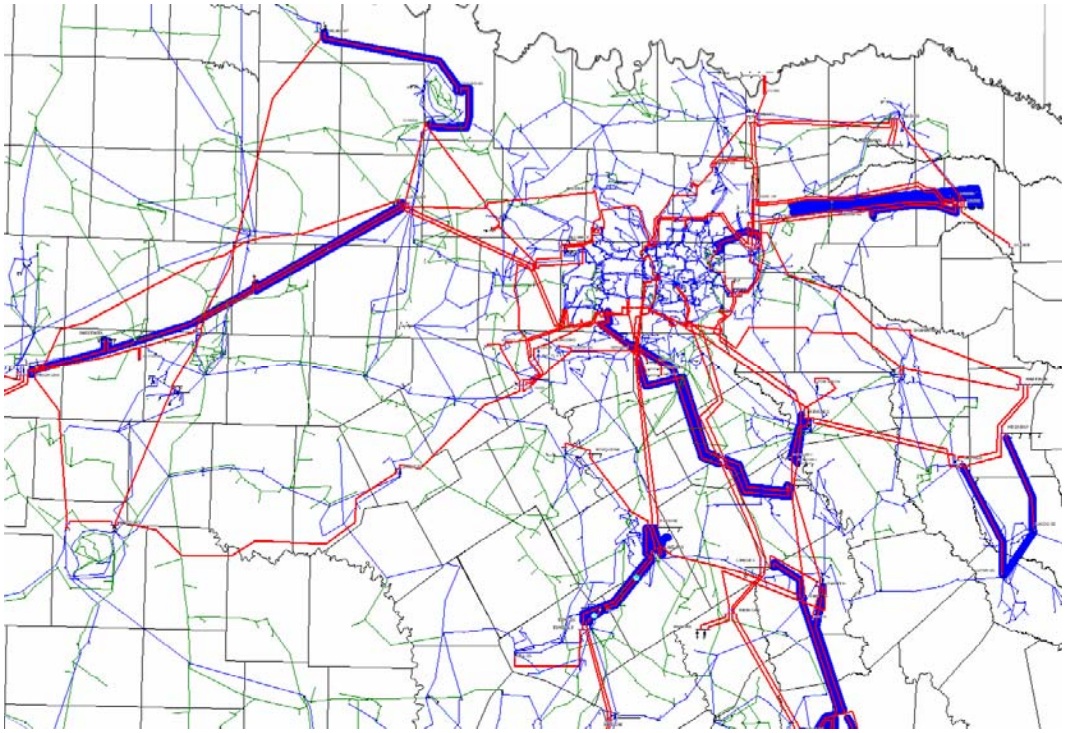


Figure 12: Remaining most congested elements in north Texas

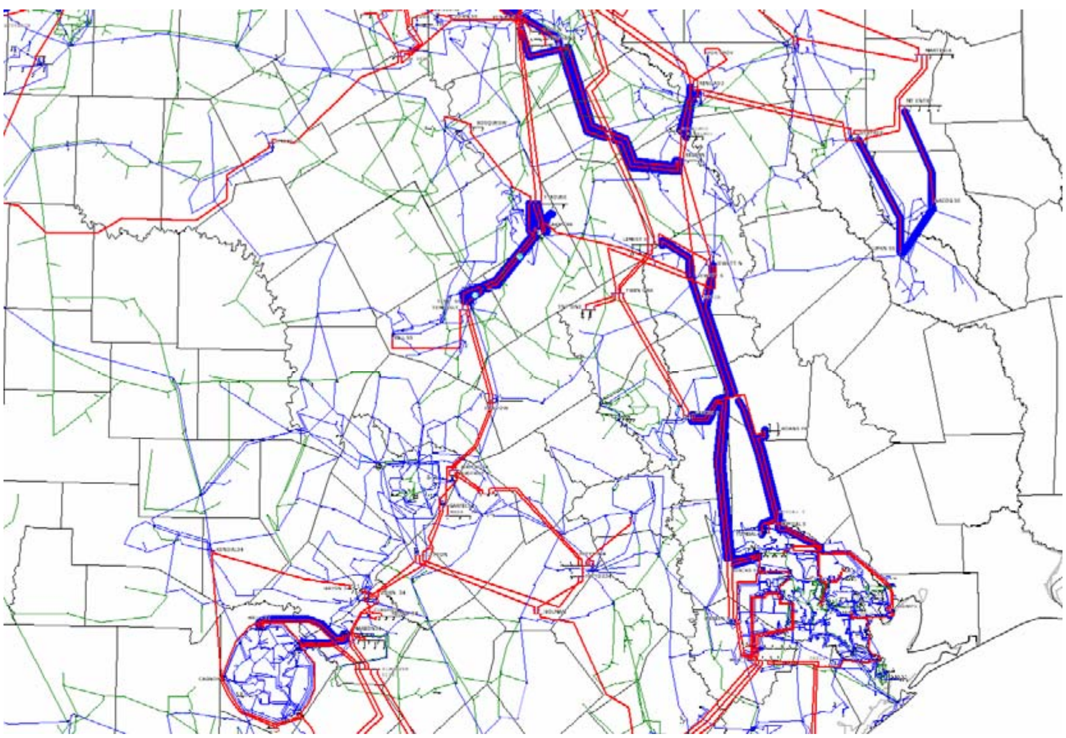


Figure 13: Remaining most congested elements in central Texas

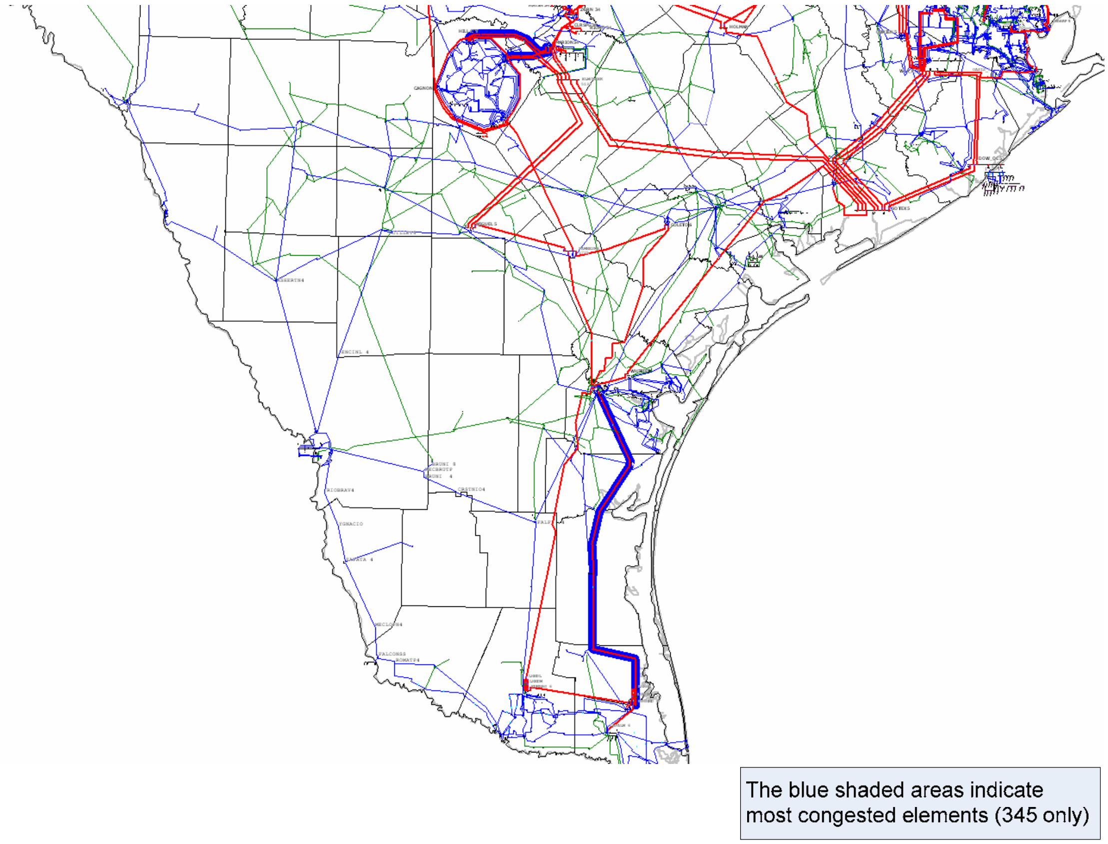


Figure 14: Remaining most congested elements in south Texas

Table 9 shows the summary of 345 system upgrade needed by scenario. In general, higher gas price scenarios (Scenario 3 and 4) may create more bulk transmission needs. Higher gas prices will likely induce more coal and wind generation additions, which can only be built in areas away from load centers in major metropolitan areas, requiring more bulk transmission lines to transfer power from generation to load.

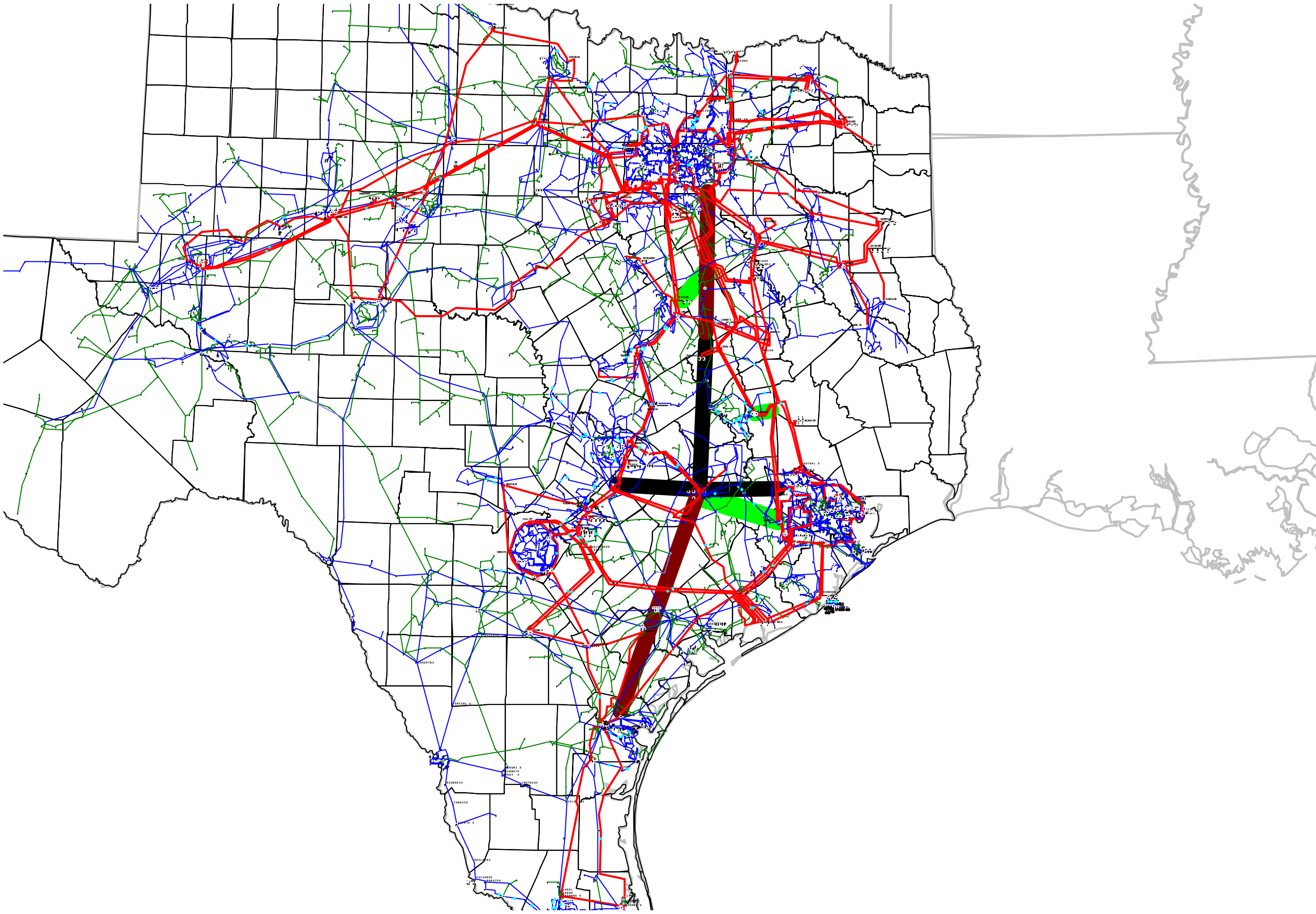
Table 9: Summary of bulk transmission needs by scenario

Scenario	Total Circuit-Miles	Representative Cost ($M)
1	867	794
3	1577	1372
4	1251	1087

D. Investigation of 765kV Options

Another bulk transmission option explored for the LTSA was the inclusion of new 765kV transmission lines. Currently, the highest voltage lines on the ERCOT System are 345kV lines. Single circuit 765kV lines have slightly more power-carrying capacity than a double circuit 345kV line with sufficient reactive support but, more importantly, also have the benefit of lower impedance. Thus, they are able to bring the generation and loads electrically closer together. A base cost of $50 Million for each terminating substation and $2 Million per circuit mile was assumed for new 765kV circuit, both of which are more expensive than the similarly rated 345kV equipment. All termination points include transformation down to 345kV and mileage for the 765kV line options was estimated as a straight line (actual lengths determined during routing would necessarily be longer) unless the line needs to traverse a major metropolitan area. In that case, a sufficient length was included so that the line would avoid highly populated areas.

Many different circuit options were analyzed, including a loop around the entire ERCOT system, with connections in each major load center. However, the potential 765kV corridor that proved to be most economical to the ERCOT system was the corridor that is shown below in figure 16. This potential 765kV corridor runs North and South from DFW to Corpus Christi and East and West from the Austin/San Antonio area to Houston. Several substations could be placed on this corridor to allow access to the major metropolitan area via a low impedance connection. Because of the high initial capital expenditure required by 765kV, this corridor as a whole was not found to be economic to the system, but smaller pieces of the corridor could be justified based upon economics. A 765kV section that runs from Twin Oaks South to Fayette and then East to Houston would cost approximately $400 Million to build, and would deliver an economic benefit to the system in the order of $100 Million per year. However, this same level of savings was found to be obtained at a lower capital cost by the portion of the set of 345kV economic projects which were similarly located. An even longer term look may result in a different result for the 765kV options. This will be investigated in future LTSAs.



The black shaded areas indicate potential 765kV corridor

Figure 15: Potential 765kV corridor

V. Conclusions:

- New generation and transmission infrastructure is essential to system reliability and to accommodate load growth in the ERCOT region and offset probable retirements of older units.
- At least one additional major 345kV bulk line will be needed into the Houston and DFW areas for reliability, and additional circuits may be economically justified.
- Significant additional upgrades of the 138 and 69 kV system and additional 345 kV support (particularly in DFW, Houston and along the I-35 cities from the west) or additional 345kV lines in lieu of some of these upgrades (if more economic) will be required in years 6-10 even with moderate 2% load growth.
- Installation of switching stations at points where existing 345 kV circuits intersect {at Singleton (east of Bryan), Zenith (northwest of Houston), Navarro (south of Dallas) and Paint Creek (north of Abilene)} may result in better distribution of power and increase transfer capacities utilizing existing lines.
- The total investment in lower voltage upgrades for the five year period between 2011 and 2016 is roughly estimated to be $2 billion and the investment in 345kV upgrades is expected to be $1billion (not including CREZ-related lines), for a total of $3 billion. This is similar to the $3.1 billion currently expected for the five year period 2007-2011.
- Only one 765kV transmission corridor (in Central Texas) was determined to be cost effective and, at the same time, more expensive than 345kV alternatives. An even longer term look may result in a different result for the 765kV options. This will be investigated in future LTSAs.
- Due to the short lead time associated with new generation development decisions in a deregulated market, the assessment of the long term transmission needs of the system requires some assessment of the likely economic addition of new generation that may be added by market participants.
- Current generation interconnection requests in ERCOT reflect type and location of new fossil fuel generation indicated under all but the lowest natural gas price scenarios studied.
- If gas prices remain high, they will likely induce more coal and wind generation additions, which are likely to be built in areas at greater distances away from load centers in major metropolitan areas, requiring more bulk transmission lines to transfer power from generation to load.
- Low gas prices (e.g., $4/MMBtu) may result in marginally-adequate reserve margins, since there would be little economic incentive to

overbuild; conversely, higher gas prices (e.g., $7 or $10/MMBtu) may result in higher reserve margins, as there is sufficient economic incentive to displace higher-priced gas generation with lower-cost solid-fueled generation.

- Load growth, natural gas prices and environmental regulations were considered by ERCOT and stakeholders to be the factors that fundamentally influence the type of new generation added.
- New nuclear power plant additions were not evaluated in this year's LTSA due to the lengthy expected licensing and construction timeline. Based on recent announcements and generation interconnection requests, new nuclear plants are recommended for analysis in the 2008 LTSA.

VI Appendix

A. Legislative Requirements

Section 39.904

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(g) The commission, after consultation with each appropriate independent organization, electric reliability council, or regional transmission organization:

(1) shall designate competitive renewable energy zones throughout this state in areas in which renewable energy resources and suitable land areas are sufficient to develop generating capacity from renewable energy technologies;

(2) shall develop a plan to construct transmission capacity necessary to deliver to electric customers, in a manner that is most beneficial and cost-effective to the customers, the electric output from renewable energy technologies in the competitive renewable energy zones; and

(3) shall consider the level of financial commitment by generators for each competitive renewable energy zone in determining whether to designate an area as a competitive renewable energy zone and whether to grant a certificate of convenience and necessity.

****

(j) The commission, after consultation with each appropriate independent organization, electric reliability council, or regional transmission organization, shall file a report with the legislature not later than December 31 of each even-numbered year. The report must include:

1. an evaluation of the commission's implementation of competitive renewable energy zones;
2. the estimated cost of transmission service improvements needed for each competitive renewable energy zone; and
3. an evaluation of the effects that additional renewable generation has on system reliability and on the cost of alternatives to mitigate the effects.

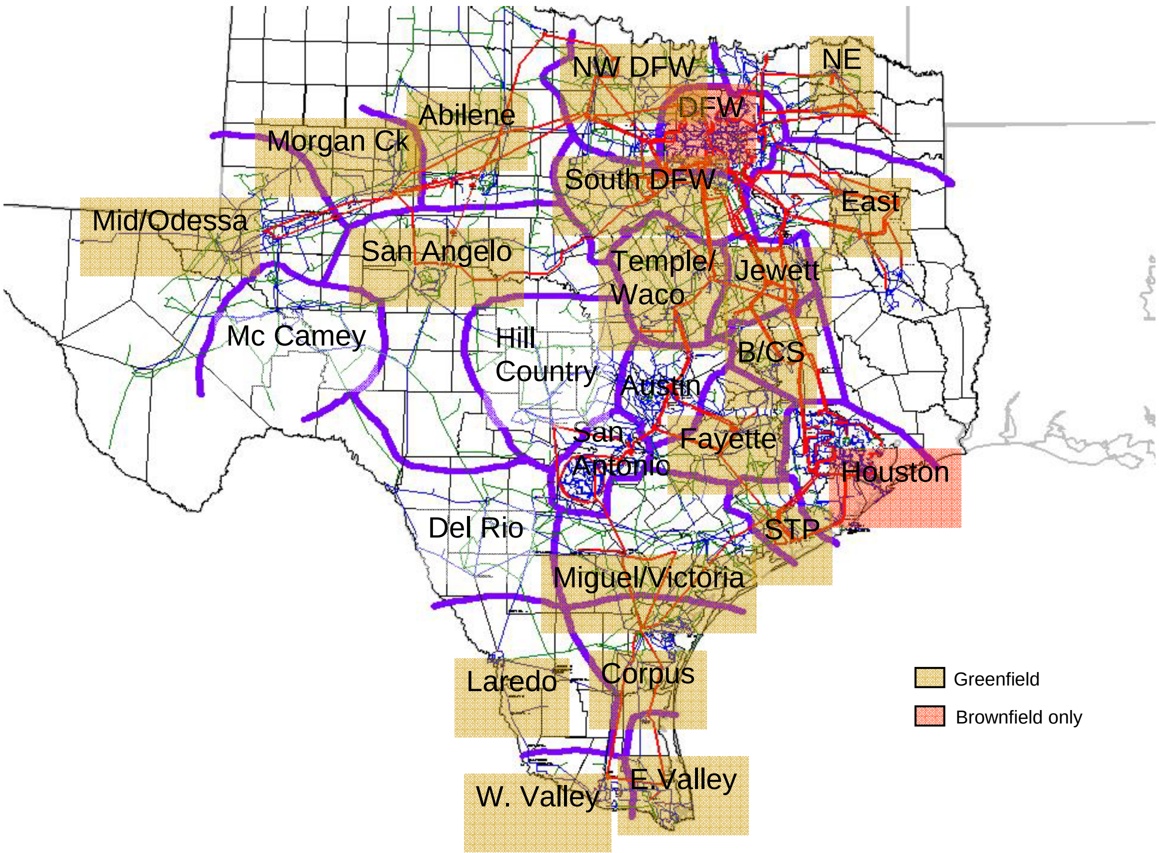
(k) The commission and the independent organization certified for ERCOT shall study the need for increased transmission and generation capacity throughout this state and report to the legislature the results of the study and any recommendations for legislation. The report must be filed with the legislature not later than December 31 of each even-numbered year and may be filed as a part of the report required by Subsection (j).

B. List of Key Drivers:

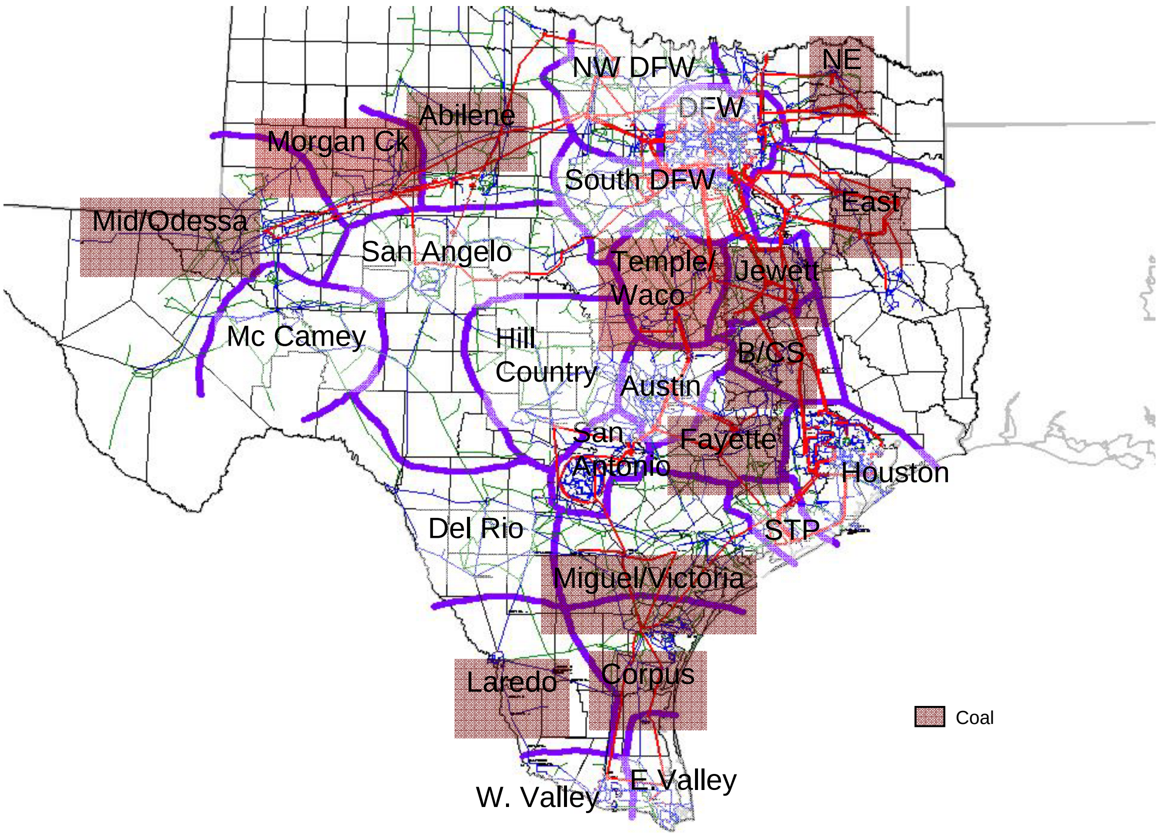
- Gas Prices (per MMBtu, delivered to generating plants)
  - Low: $4
  - Medium: $7
  - High: $10
- Load Growth
  - Base: Peak and Energy Grow at 2%/year from 2006
  - High Growth: Peak and Energy Grow at 4%/year from 2006
  - High Energy: Peak grows at 2%/year and energy grows at 3%/year
- Environmental Regulations
  - All cases have regulations currently being implemented
  - Current Case: No additional environmental regulations
  - Low Carbon Case: Current regulations plus $8/ton for CO2 emissions
  - High Carbon Case: Current regulations plus $16/ton for CO2 emissions

C. Graphs

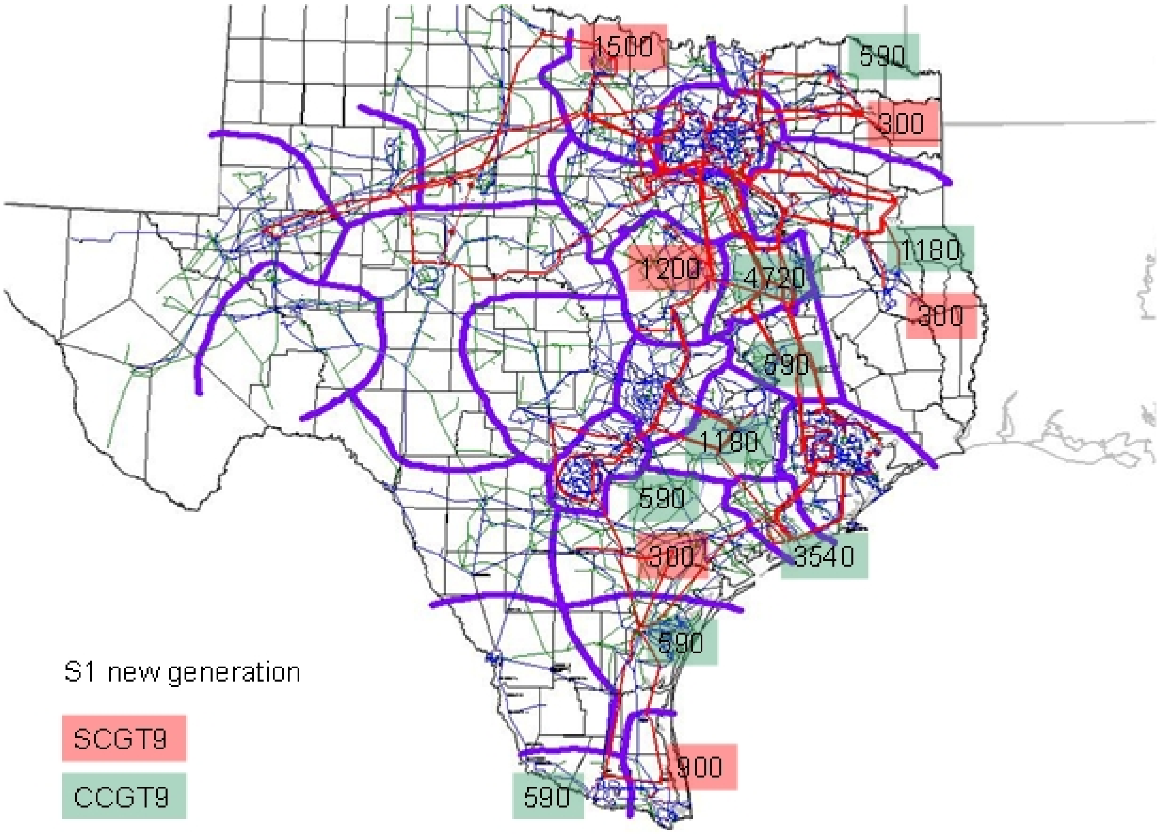
1. Regions with allowed gas expansion



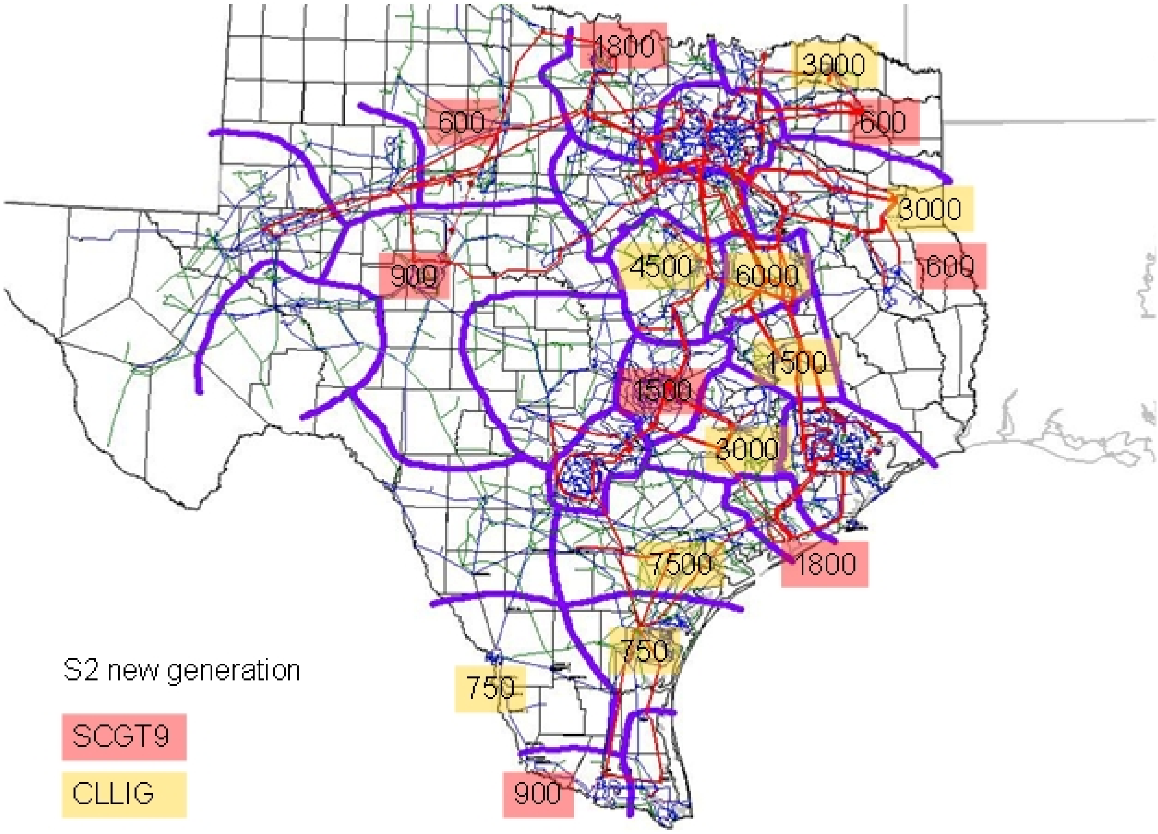
2. Regions with allowed coal expansion



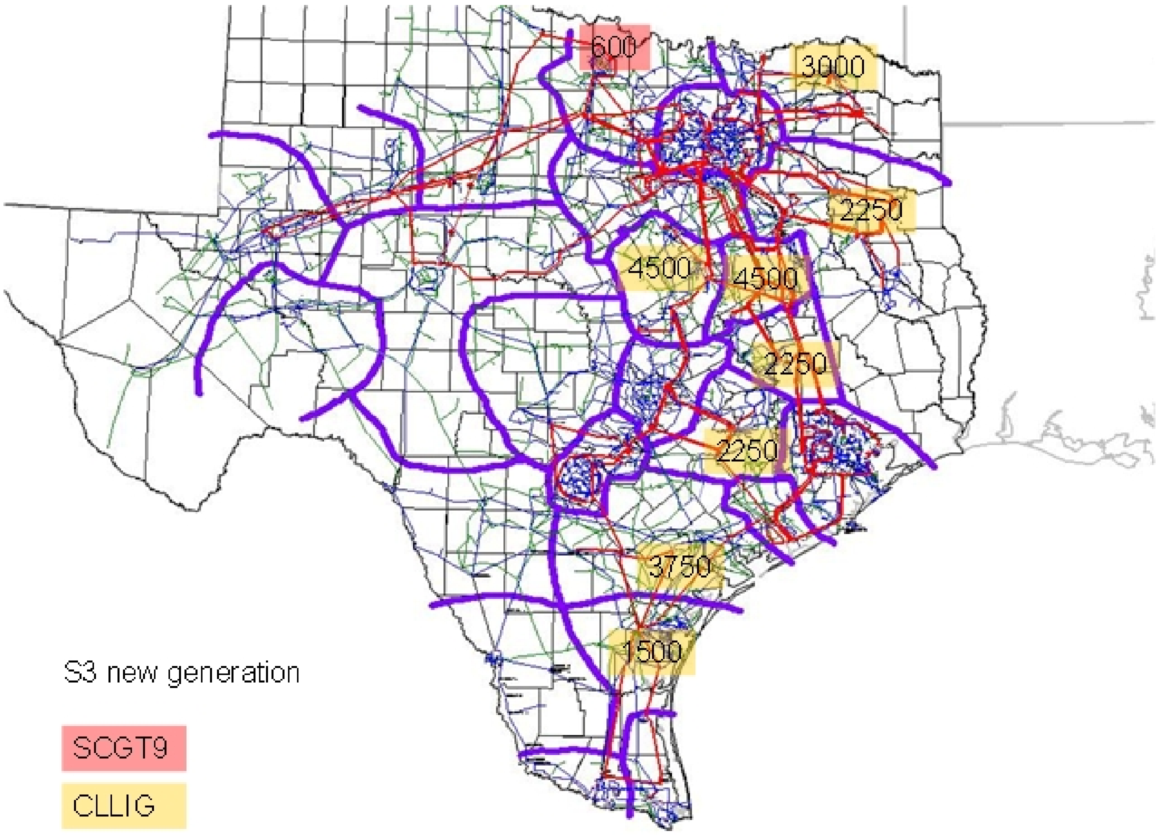
3. S1 new generation



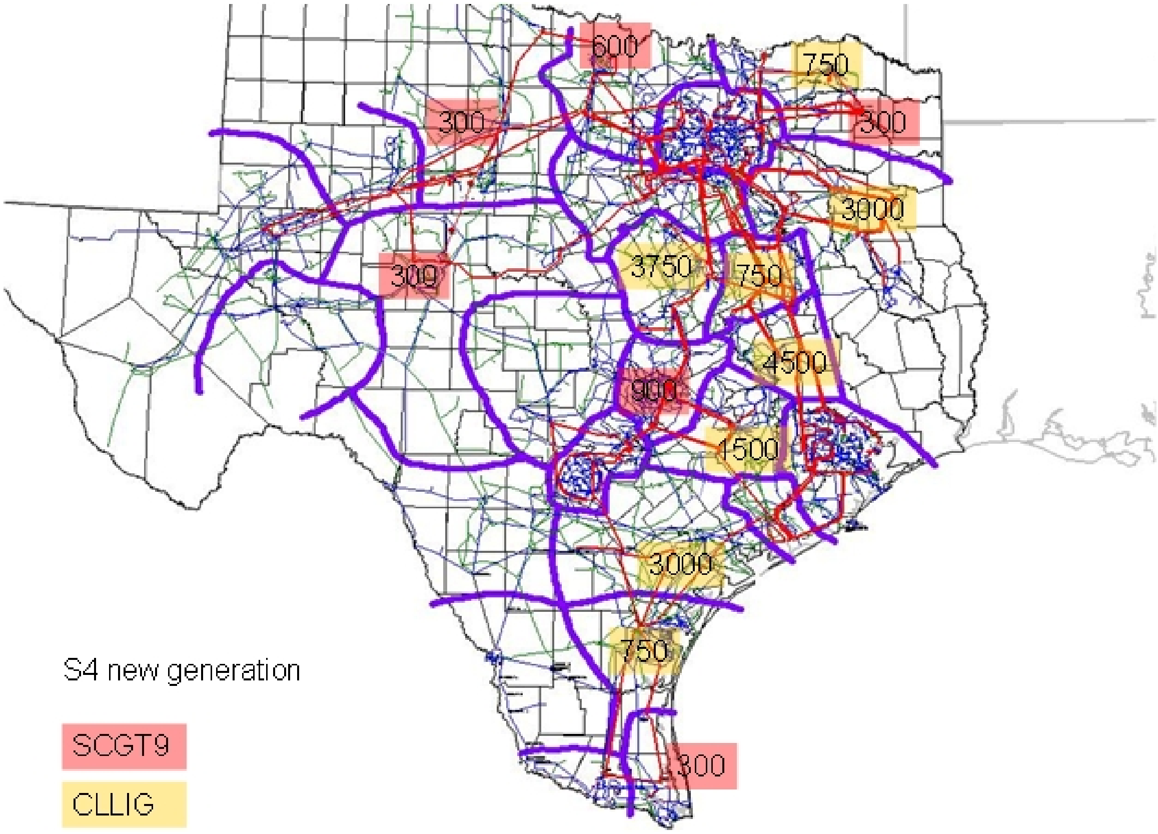
4. S2 new generation



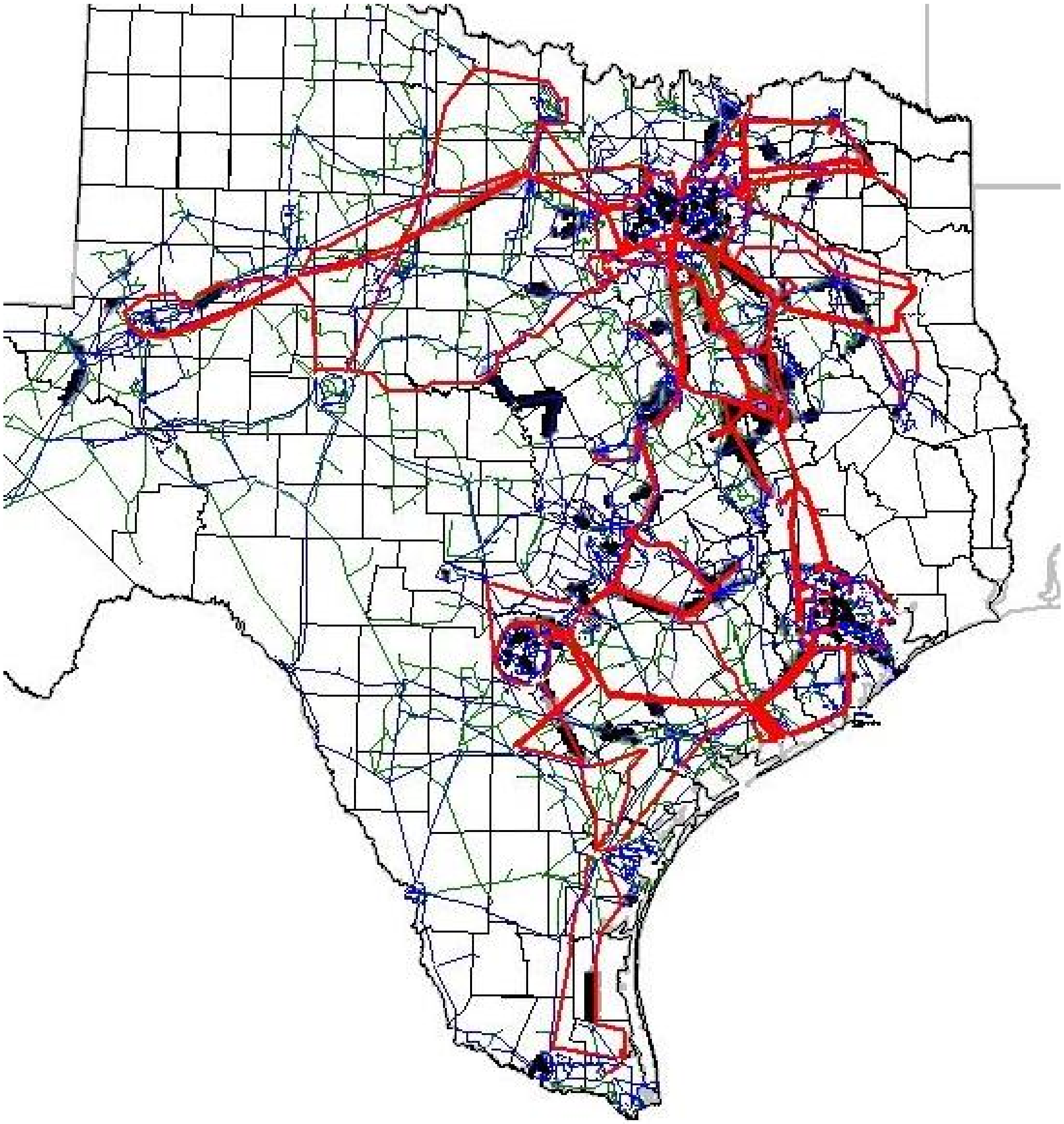
5. S3 new generation



6. S4 new generation

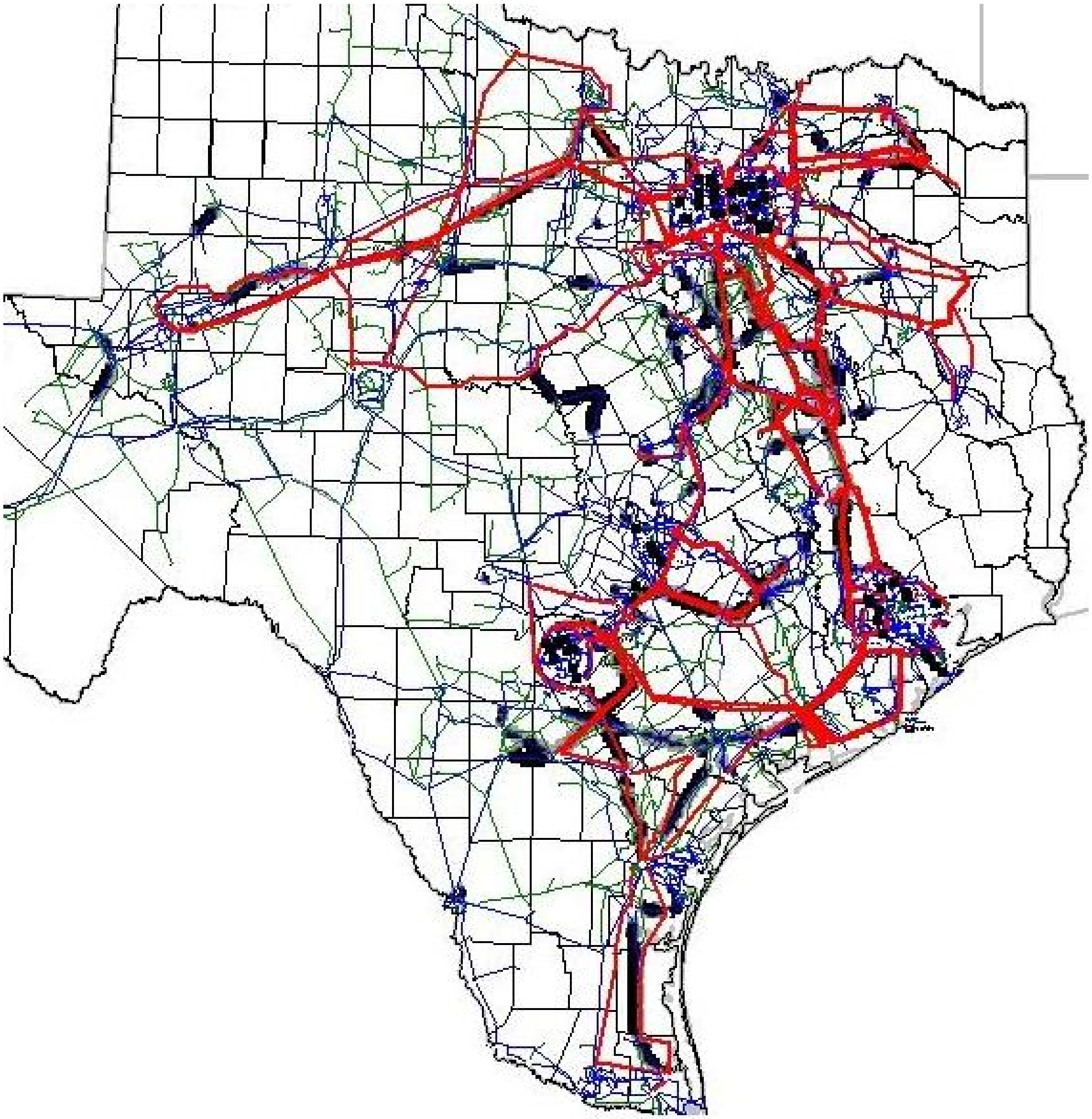


7. S1 Upgraded elements to resolve insecure energy



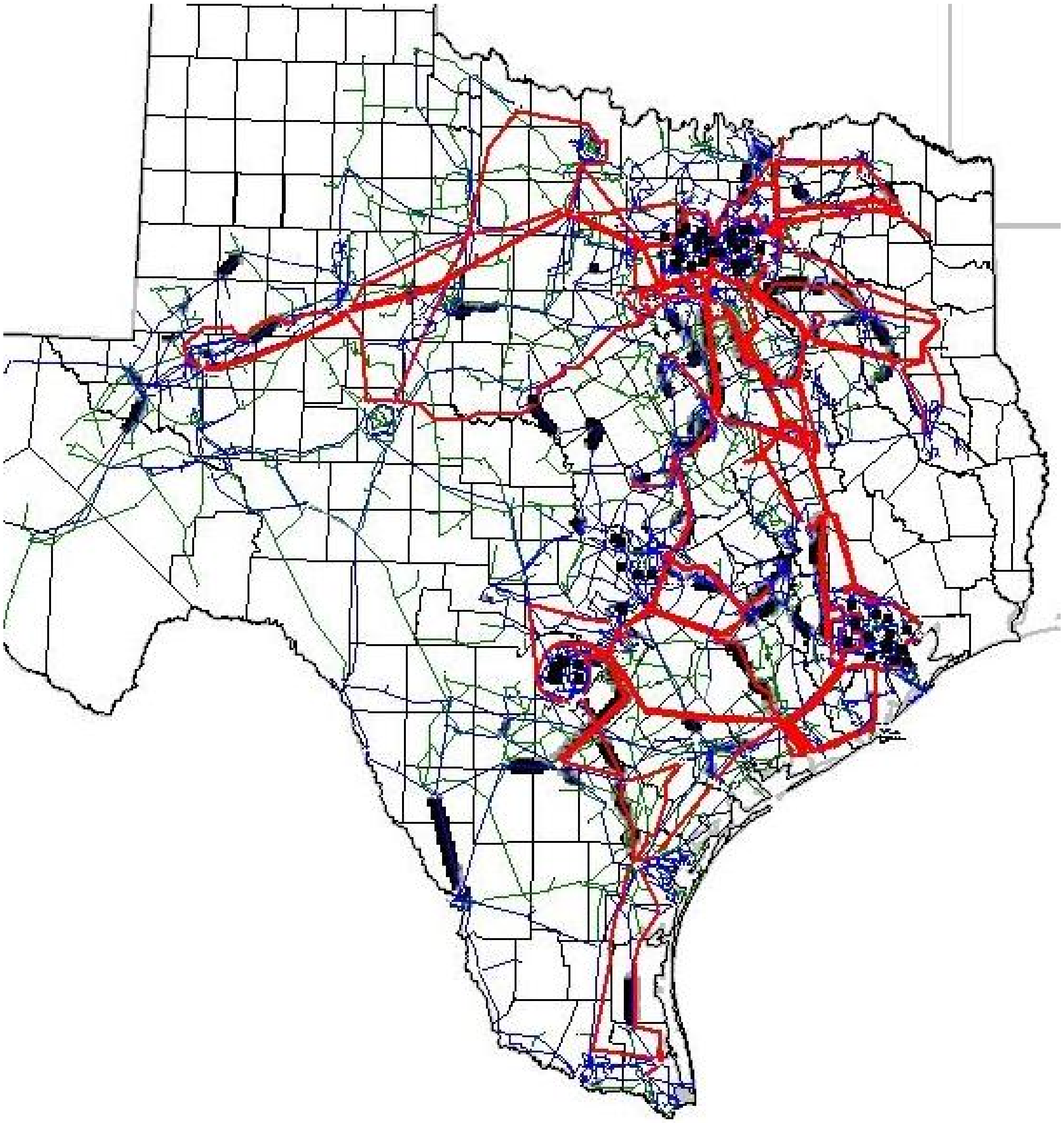
The black shaded areas indicate upgraded elements.

8. S3 Upgraded elements to resolve insecure energy



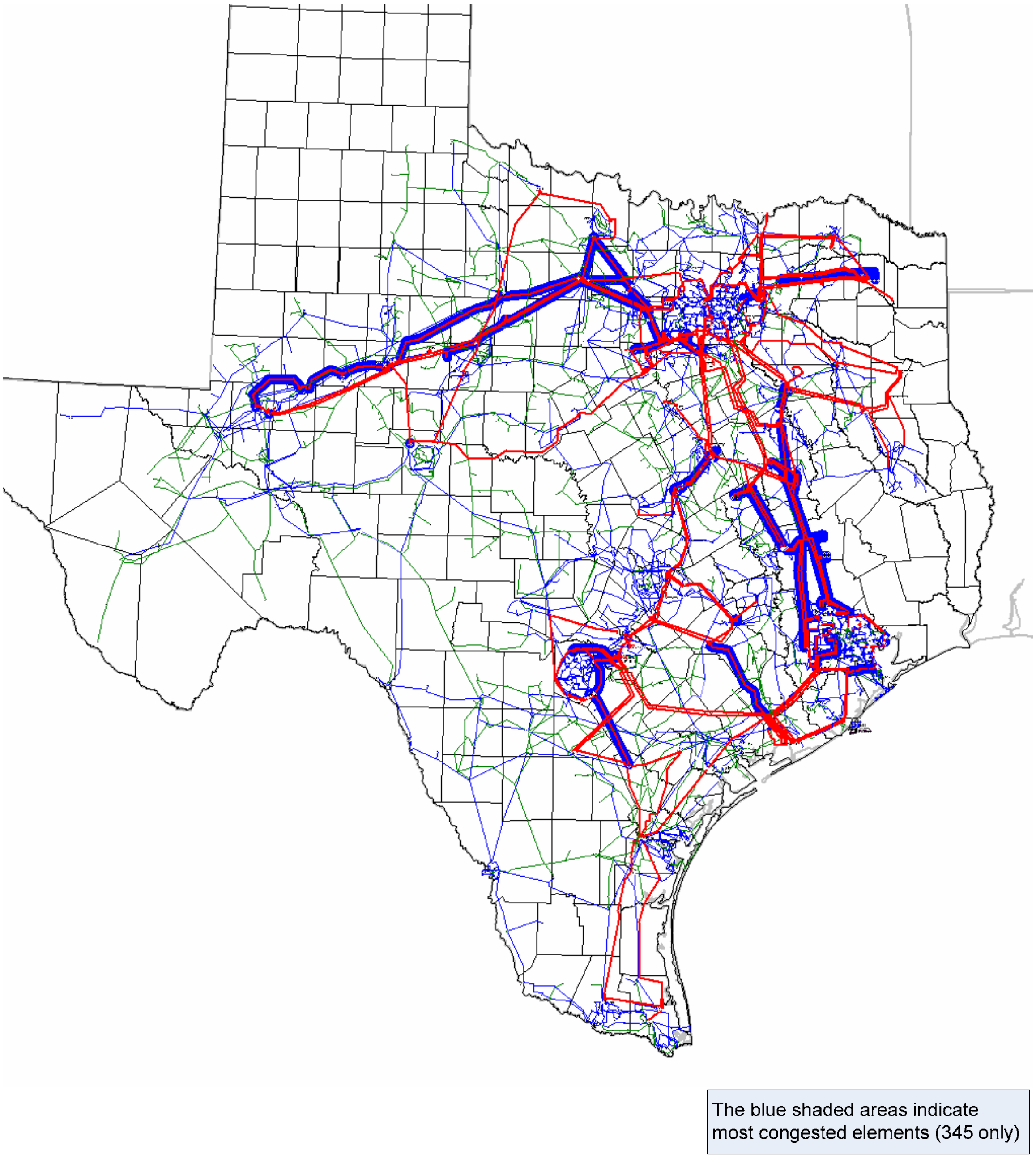
The black shaded areas indicate upgraded elements.

9. S4 Upgraded elements to resolve insecure energy

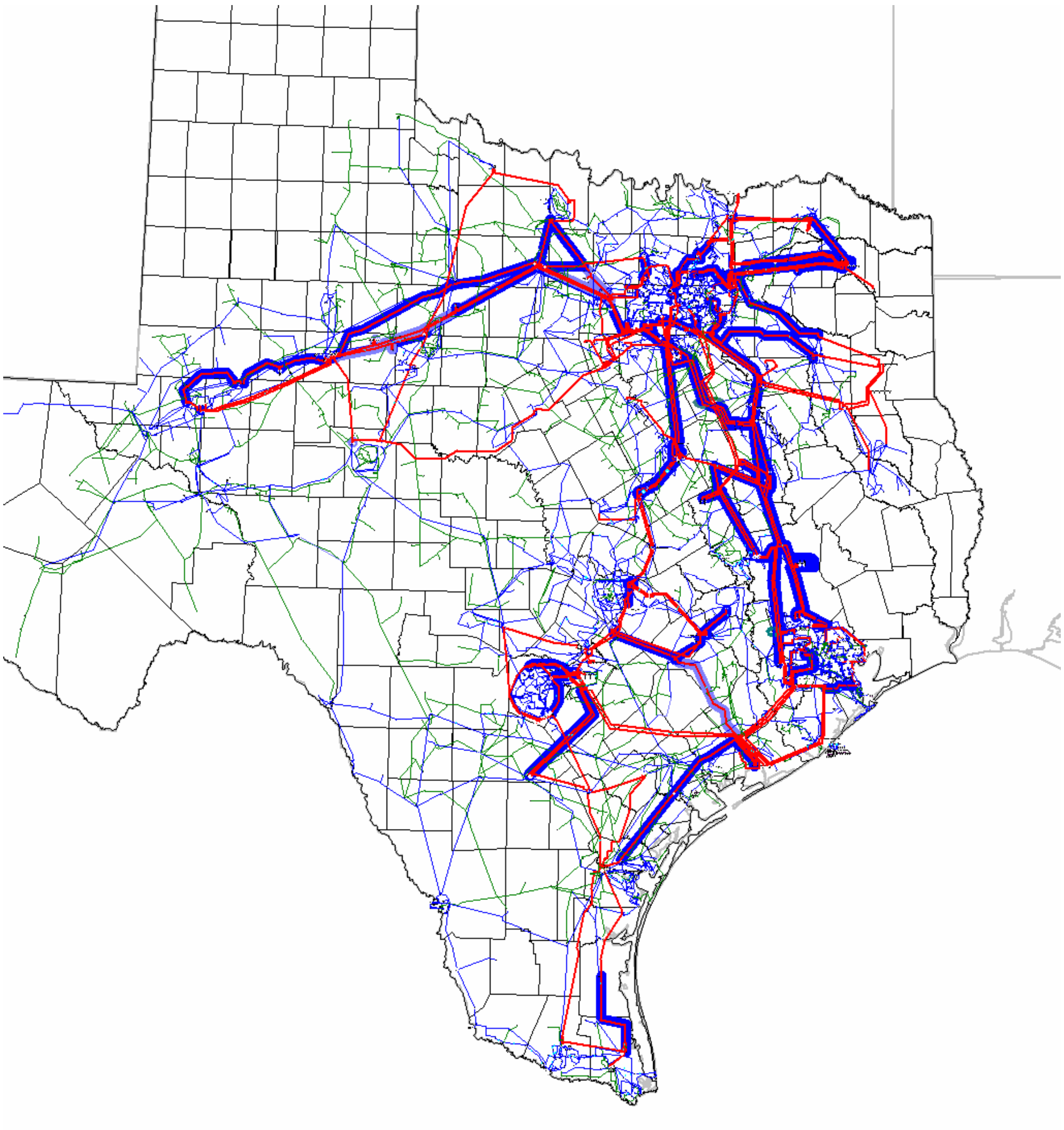


The black shaded areas indicate upgraded elements.

10. S1 most congested elements with reliability projects

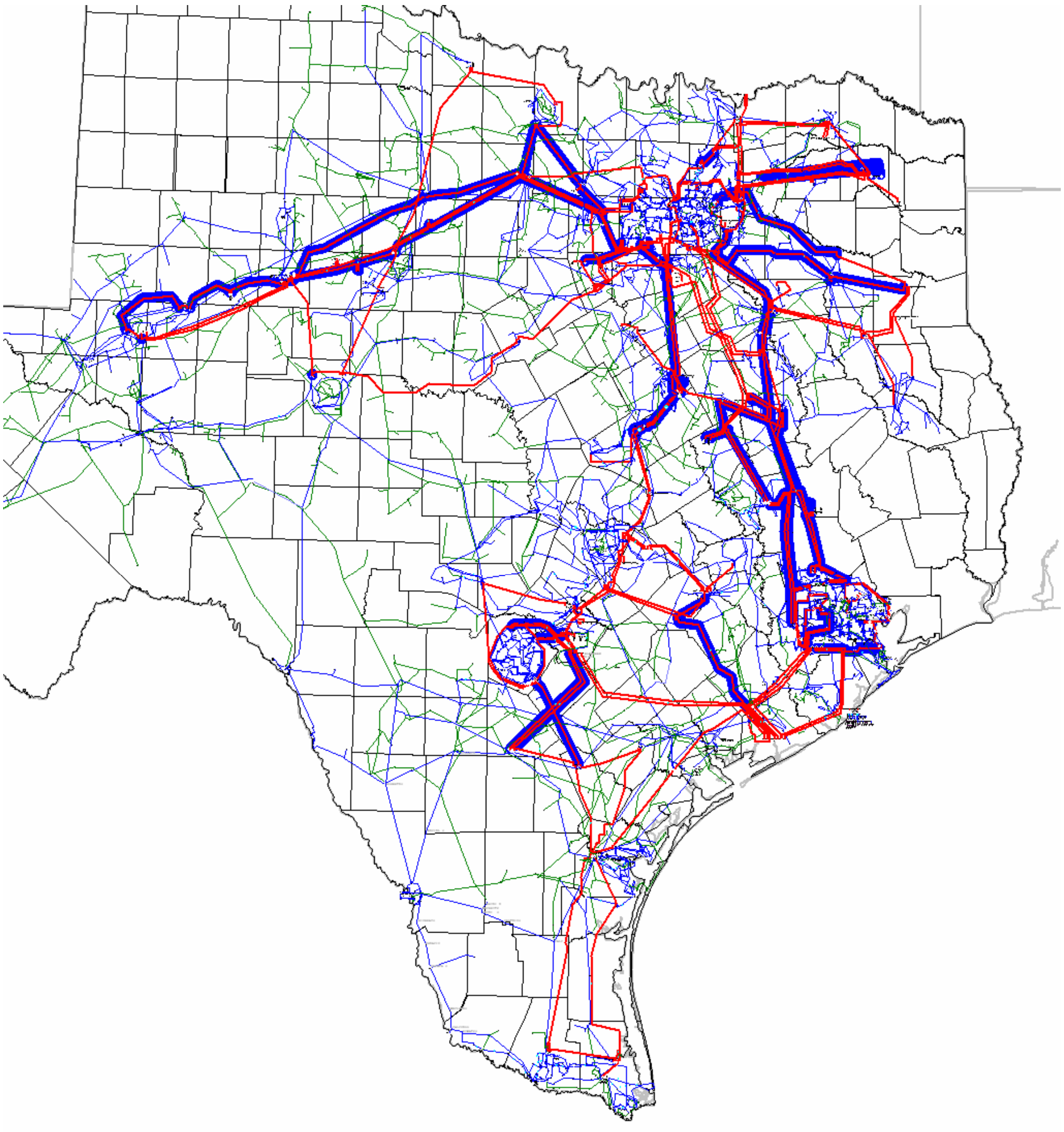


11. S3 most congested elements with reliability projects (345kV lines only)



The blue shaded areas indicate most congested elements (345 only)

12. S4 most congested elements with reliability projects (345kV lines only)



The blue shaded areas indicate most congested elements (345 only)

D. Tables

1. Monitored lower voltage regional tie-lines

Start Bus	Start Bus #	End Bus	End Bus #	Voltage
BARCLAY	69	SEATON	131	69
BARNSLEY	1203	EXN JC T	1204	69
BRNHRTP2	6003	MERTZNR2	6526	69
EDEN 2	6372	CRMW1TP2	6376	69
FALF 2	8508	PREMONT2	8894	69
FREER 2	8505	S.DIEGOX	8890	69
GETTY	1233	PGASUS T	1234	69
LULNG M4	8199	HOCH.TP2	8577	69
MOULTO06	7236	HANKHA06	7237	69
SONORAT2	6511	CROCKHT2	6552	69
UTOPIA06	7428	TARPLE06	7440	69
UVALDE 2	8231	CMPWOOD2	8633	69
ADAMSV13	7066	EVANT 13	7068	138
AIRCO 4	8144	RINCON 4	8418	138
ALHUB TU	1757	CELINASE	2350	138
AURORA	572	RHOME	576	138
BLANCO13	7482	DEVIHI13	7493	138
Blessing4	8121	Lolita 4	8125	138
BLF CRK	6216	BRADSHW4	60331	138
BLF CRK	6216	OAKCK1 4	6335	138
CAGNON	5055	CASTRVLL	5083	138
CAGNON	5055	MEDILA13	7432	138
CALHNTP	6229	OAKCK1 4	6335	138
CANEY_	44130	E_BERN 8	44190	138
CASTRVLL	5083	LYTLE	5290	138
CHINAGRV	1318	RADIUM M	1398	138
COPPERCV	3630	COPPCV13	7061	138
COTULLA4	8610	ENCINL 4	8619	138
DECATUR	1566	RHOME	1570	138
E_BERN 8	44190	ORCHRD 8	44540	138
EL CAMP4	8102	GANADO 4	8117	138
EVANAL	1751	ANNASS1T	2528	138
FAIRVIEW	470	ALEDO	527	138
FALF 4	8510	KRGP	80228	138
FALLSCTY	5145	STCKDALE	5412	138
FLEWLN 8	44230	PETERS 8	46220	138
FORSAN T	1335	CRMWD7 T	1337	138
FRKCMP8	5568	SEAWAY	43220	138
GRAHAM P	1431	BRECK T	1613	138
HALLET13	7246	FLATON13	7248	138
HAMIL_P4	8257	CORTHAN4	8259	138
HASSE M	1649	CMCHE T	1650	138
HELOTES	5200	HICOTP13	7663	138
HGN SW 4	8327	MERCDES	8358	138

JOHNVL M	1645	WALNUTSP	1646	138
JORDAN	722	SEWHTBOR	1724	138
KRUM T	1986	VAL VIEW	1988	138
LAKE CRK	3410	GROESPOD	3597	138
LAKEVIEW	3278	LONGLK T	3279	138
LAMESA	1163	PAUL D T	1168	138
LAMPOST	236	WHITNEY	241	138
LEON	5260	PLESTN 4	8203	138
LEON	1624	PUTNAM 4	6309	138
LULING13	7224	GONZAL13	7245	138
LYTLE	5290	PEARSON8	5813	138
MACEDO13	7671	HOCKLY 8	45880	138
MECLOPN4	8957	FALCONSS	80106	138
MENARD 4	6375	SAPS1 4	6480	138
MIDLND E	1023	BIG SPGW	1324	138
MRGN CRK	1032	SWTRDT T	1341	138
MURRAY M	1371	PTCRK2 4	6169	138
MV.COOK4	8787	RACHAL 4	8896	138
MVBURNS4	8763	MV.HBRG4	8765	138
NEWBER13	7612	WILSGO13	7613	138
NSANGER	680	SPRING	684	138
ODES EHV	1027	ARCO C T	1199	138
ORNGRV 8	5660	GWEST2	8167	138
PLESTN 4	8203	BIGFOOT4	8221	138
ROBERTSN	32	MILANO M	3682	138
SANDOW	3430	ROGERS	3675	138
SCURRYSW	729	SALTCREK	743	138
SMDB 8	5706	PRS1388	5895	138
SMIGL 8	5704	DILYSW 4	8212	138
SONORA 4	6515	FDRAN 4	6562	138
SUTHRLND	5418	LAVERN13	7614	138
TELICO M	2332	MONTFTSS	3454	138
TWBT4	6011	BIGLAKE4	6535	138
UPTON	1212	LCRANE	6615	138
VAN AL	1754	ANNA SS	2374	138
WESMER 4	8347	MV.RNGR	8747	138
WRBRTN4	8907	MEDIOCK4	8912	138
WSTWTHFD	340	FOX	477	138
ZORN 13	7181	LULING13	7224	138

2. Upgraded transmission elements to remove insecure energy

Start Bus	Start Bus #	End Bus	End Bus #	Voltage	S1	S3	S4
AUSTRO34	7040	GARFIE34	7048	345	Y	Y	Y
BEN DV B	970	ROYSE S	2478	345	Y	Y	Y
BIGBRN	3380	JEWETT N	3391	345	Y	Y	Y
BIGBRN	3380	JEWETT S	3390	345	Y	Y	Y
BITTERCK	1050	ABMULCW7	6235	345	N	Y	N
BOWMAN	1422	GRAHAM	1430	345	N	Y	N
BOWMAN	1422	JXBRO SS	1429	345	N	Y	N
C HILL	2420	WATMILLE	2428	345	Y	Y	Y
COLLINSS	2372	ANNA SS	2373	345	Y	Y	Y
ELMCREEK	5133	MIGUEL 5	5901	345	N	Y	N
EV EAST	1886	KENNDLE1	1932	345	Y	Y	Y
EV EAST	1886	VENUS N	1907	345	Y	Y	Y
EV WEST	1882	VENUS S	1906	345	Y	Y	Y
FORNEY	2437	ELKTON	3105	345	N	N	N
FPPYD134	7056	FAYETT34	7057	345	N	N	N
FPPYD234	7055	FPPYD134	7056	345	Y	Y	Y
FPPYD234	7055	HOLMAN	9073	345	Y	Y	Y
FPPYD234	7055	LYTTON	9074	345	N	Y	N
FPPYD134	7056	SALEM 34	7058	345	Y	Y	Y
FS COGEN	1025	MRGN CRK	1030	345	N	Y	N
GIBCRK B	967	TWIN OAK	3400	345	Y	N	Y
GIBCRK B	967	OBRIEN 5	44500	345	N	Y	N
GIBCRK B	967	ROAN	45973	345	Y	Y	Y
GRAHAM	1430	MESQUITE	1435	345	Y	Y	Y
HACKBRY	2387	IV VR	2389	345	N	Y	N
HILL CTY	5211	MARION34	7044	345	Y	Y	Y
HOLMAN	9073	HILLJE 5	44200	345	N	N	N
HOLMAN	9073	LYTTON	9074	345	Y	Y	Y
JEWETT N	3391	LIMEST 5	46020	345	Y	Y	Y
JEWETT S	3390	LIMEST 5	46020	345	Y	Y	Y
JEWETT S	3390	SANDYCRK	3399	345	Y	Y	Y
JEWETT S	3390	T_H_W_ 5	45500	345	N	Y	N
JEWETT N	3391	TWIN OAK	3400	345	Y	Y	Y
KING 5	40900	KUYDAL 5	45972	345	N	Y	N
LAKE CRK	3409	TEMP SS	3414	345	Y	Y	Y
LCRK LS	3402	LAKE CRK	3409	345	Y	Y	Y
LCRK LS	3402	T HOUSE	3405	345	Y	Y	Y
LHRHL	8902	LHRHM	8903	345	N	Y	N
LHRHL	8902	ARMSTRNG	80076	345	N	Y	N
MOSES	1695	SULSP SS	1697	345	N	Y	N
NORWOODT	2410	C HILL	2420	345	Y	Y	Y
ODES EHV	1026	ODEHV 1T	1028	345	N	Y	N
P_H_R_ 5	42000	OASIS_5	43035	345	Y	N	Y

PARIS SS	1692	MOSES	1695	345	N	Y	N
PAWNESW6	5725	LNHILL 6	8455	345	N	Y	N
RICHLND2	3134	BIGBRN	3380	345	Y	N	Y
RICHLND1	3133	BIGBRN	3380	345	Y	N	Y
RIOHND 6	8318	LHRHM	8903	345	N	Y	N
ROAN	45973	KUYDAL 5	45972	345	N	Y	N
ROANS PR	40600	TOMBAL 5	46500	345	N	Y	N
SANDYCRK	3399	LCRK LS	3402	345	Y	Y	Y
SKYLINE	5371	MARION34	7044	345	Y	Y	Y
SMTHRS 5	44650	BELAIR 5	47000	345	Y	N	Y
SO TEX 5	5915	HILLJE 5	44200	345	Y	N	Y
SPRUCE	5400	PAWNESW6	5725	345	Y	Y	Y
T HOUSE	3405	ELM MOTT	3406	345	N	Y	N
T HOUSE	3405	TEMP PEC	3412	345	Y	Y	Y
TEMP PEC	3412	TEMP SS	3414	345	Y	Y	Y
TRICORN	2432	TRINDAD2	3124	345	Y	Y	Y
TRINDAD2	3124	RICHLND2	3134	345	Y	Y	Y
TRINDAD1	3123	RICHLND1	3133	345	Y	Y	Y
TWBT7	6009	TWBT4STR	6012	345	N	Y	N
TWIN OAK	3400	LIMEST 5	46020	345	Y	N	Y
TWIN OAK	3400	LIMEST 5	46020	345	Y	N	Y
VENUS N	1907	BIGBRN	3380	345	Y	Y	Y
VENUS N	1907	T HOUSE	3405	345	N	Y	N
VENUS S	1906	BIGBRN	3380	345	Y	Y	Y
VENUS S	1906	T HOUSE	3405	345	Y	Y	Y
W.DENT B	988	ROANOKE1	1851	345	Y	Y	Y
W_A_P_ 5	44000	HILLJE 5	44200	345	Y	N	Y
W_A_P_ 5	44000	OBRIEN 5	44500	345	Y	N	Y
W_A_P_ 5	44000	BELAIR 5	47000	345	Y	N	Y
W_A_P_ 5	44000	HILLJE 5	44200	345	Y	N	Y
W_A_P_ 5	44000	OBRIEN 5	44500	345	Y	N	Y
WATMILLW	2427	SARGT SS	2946	345	Y	N	Y
WATMILLW	2427	TRINDAD1	3123	345	Y	N	Y
ZORN 34	7042	LYTTON	9074	345	N	Y	N
800/9002	2809	DRAGON 2	2857	138	Y	N	Y
800/9001	2808	DRAGON 1	2858	138	Y	N	Y
ABSOUTH4	6260	POTOSITP	6313	138	N	Y	N
ADAMSV13	7066	EVANT 13	7068	138	Y	Y	Y
AIRLINE4	8490	CABINES4	8882	138	N	Y	N
ALAZAN 4	8515	SHARPE4	85002	138	N	Y	N
ALHUB TU	1757	CELINASE	2350	138	Y	N	Y
ALHUB TU	1757	PAYNE	1758	138	Y	N	Y
AMELIA 1	2815	REAGAN 1	2819	138	Y	Y	Y
AMELIA 1	2815	UTSW MC1	2823	138	Y	Y	Y
ANGLTN 8	42110	LIVRPL 8	42870	138	Y	Y	Y
APOLLO C	802	RICH E	2690	138	Y	Y	Y
ARGYLE	1984	HIGHL TN	37050	138	N	Y	N
AROHD M	1478	RATHGBER	1480	138	Y	N	Y

ASHERTN4	8283	NLARSSL	88909	138	N	N	N
ATM T2	1997	HACKBRY	2388	138	Y	Y	Y
ATM T1	1996	HACKBRY	2388	138	Y	Y	Y
AUSTIN	5005	TUTTLE	5435	138	Y	Y	Y
AUSTRO13	7328	DUNLAP	9194	138	Y	Y	Y
AUSTIN-2	5006	KIRBY-2	5249	138	Y	Y	Y
AUSTIN	5005	TUTTLE	5435	138	Y	Y	Y
BALL PRK	5011	JT DEELY	5110	138	Y	N	Y
BANDERA	5020	BROADVEW	5040	138	Y	Y	Y
BARTON	9158	PATTON	9253	138	Y	Y	Y
BATES 4	8392	FRONT	8980	138	Y	N	Y
BAYTWN 8	40170	HANEY 8	40790	138	Y	Y	Y
BCHSPG T	2776	LAWSON	2779	138	N	Y	N
BELLSO13	7270	NEWBRE13	7271	138	Y	Y	Y
BELLSO13	7270	PETERS 8	46220	138	N	N	N
BELLCTYM	3425	SALADO	3640	138	Y	Y	Y
BELTON	3610	TEMP S	3611	138	N	Y	N
BEN DV C	968	BEN DSTR	997	138	Y	Y	Y
BEN DV C	968	ELM GRVE	2705	138	N	Y	N
BEN DV C	968	PL JUP	2687	138	Y	Y	Y
BIG 3 4	8146	BLCBAYU4	8911	138	N	Y	N
BLANTONM	3521	HILLBR	3522	138	N	Y	N
BLESSNG4	8121	LOLITA 4	8125	138	N	Y	N
BLOGET89	47521	GARROT 8	47660	138	Y	N	Y
BLUM	3518	BLANTONM	3521	138	N	Y	N
BOSQUE	177	CAYOTE	181	138	N	Y	N
BOSQUESW	252	LKWHITNY	37410	138	N	Y	N
BRAUNIG	5025	HIGHLAND	5205	138	N	N	N
BRAZOS 8	44100	CFLEWLN8	44231	138	Y	N	Y
BRAZOS 8	44100	FTBEND 8	44280	138	Y	Y	Y
BRENNO13	7294	CHAPHI13	7574	138	N	Y	N
BRNWD SS	1655	GOLDTH13	7070	138	Y	Y	Y
BROADVEW	5040	FRED RD	5170	138	N	Y	N
BUDA 13	7498	TURNER13	7500	138	Y	Y	Y
BUTLER M	3283	JEWETT	3392	138	Y	Y	Y
CAGNON	5055	MARBACH	5295	138	Y	Y	Y
CAGNON	5055	MARBACH	5295	138	Y	Y	Y
CALMONT	1955	WHILL 24	2088	138	Y	Y	Y
CAPEDUM3	42862	TIKIIS 8	43355	138	Y	Y	Y
CAPEDUM3	42862	WEBSTR 8	43500	138	Y	Y	Y
CAYOTE	181	WHITNEY	241	138	N	Y	N
CEDR CRK	3262	SEVENPTS	3264	138	N	Y	N
CELINASE	2350	WLSNCRKM	2366	138	Y	N	Y
CEL-BIS4	8516	SHARPE4	85001	138	N	Y	N
CENEXP 2	2648	BANDRA1T	2651	138	Y	N	Y
CENEXP 1	2647	BANDRA2T	2652	138	Y	N	Y
CHAPINST	8375	HEC 4	8963	138	Y	Y	Y
CHATT M	3516	HILLBR	3522	138	Y	Y	Y

CHILLTPL	3053	CHCLRDT1	3055	138	Y	Y	Y
CIBOLO13	7608	SCHERT13	7610	138	Y	Y	Y
CNVIL E	2450	GARLDPL1	2919	138	Y	Y	Y
CNVIL W	2439	GARLDPL2	2920	138	Y	Y	Y
COLETO 4	8162	COLETSTR	8165	138	N	Y	N
COLETO 4	8162	VICTRA 4	8172	138	N	Y	N
COLETO 4	8162	KENDYSW4	8186	138	Y	Y	Y
COLETO 4	8162	VICTRA 4	8172	138	N	Y	N
CRAWFORD	173	BOSQUE	177	138	N	Y	N
CROCKETT	3354	GRPLMG T	3355	138	Y	Y	Y
DAVIS 4	8458	ALAZAN 4	8515	138	Y	Y	Y
DAVIS 4	8458	R.FIELD4	8883	138	N	Y	N
DECK MB1	9187	DUNLAP	9194	138	Y	Y	Y
DEL MAR4	8645	UNIVERS4	8647	138	N	Y	N
DENTON C	982	CORINTH	1985	138	N	N	N
DFW SW	2009	EULESS	2016	138	N	Y	N
DINGDONG	115	CEDARVAL	117	138	N	Y	N
DUPSW-V4	8143	VICTRA 4	8172	138	N	N	N
DUPSW-V4	8143	BIG 3 4	8146	138	Y	Y	Y
DUPSW-V4	8143	VICTRA 4	8172	138	N	Y	N
E SIDE2T	2771	MSQT	2775	138	N	Y	N
EDNBRG 4	8380	HEC 4	8963	138	N	Y	N
EDNBRG 4	8380	HEC 4	8963	138	N	Y	N
EDNBRG 4	8380	MOORE F	80117	138	Y	N	Y
EDNBRG 4	8380	MV.WEDN4	8771	138	N	Y	N
ELKTON	3106	ATHENS T	3247	138	Y	Y	Y
ELKTON	3106	TYLR BUL	3219	138	Y	Y	Y
ELM MOTT	3407	NCREST T	3575	138	Y	Y	Y
ELM MOTT	3407	THOUSE T	3555	138	N	Y	N
ELSA 4	8360	MVADRHD2	8754	138	N	Y	N
EMORY	3170	EMORY N	3171	138	Y	N	Y
EULESS	2016	GV BALL	2021	138	Y	Y	Y
EVANT 13	7068	GOLDTH13	7070	138	Y	Y	Y
EVERMN B	1884	OAK H 2T	2225	138	Y	Y	Y
EVERMN A	1883	OAK H 1T	2224	138	N	Y	N
FAIROK 2	2928	FORSTV2T	2929	138	Y	Y	Y
FAIRDL C	805	LAWLER D	820	138	Y	Y	Y
FALCREEK	377	WAPLES	467	138	N	Y	N
FALLSCTY	5145	KENDYSW4	8186	138	N	Y	N
FAYETT13	7286	PISEK 13	7296	138	N	N	N
FAYETT13	7286	WINCHE13	7306	138	Y	Y	Y
FISHRDSS	1426	FISHR RD	1427	138	Y	Y	Y
FISHRDSS	1426	CITYVIEW	1483	138	N	N	N
FISHR RD	1427	WFALLS	1448	138	Y	Y	Y
FLEWLN 8	44230	PETERS 8	46220	138	N	N	N
FOR GROV	3131	MALAKOFF	3276	138	Y	Y	Y
FORMOSA4	8126	JOSLIN 4	8140	138	Y	N	Y
FORNEY	2438	FORNYW M	2712	138	Y	N	Y

FORNEY	2438	MSQT E	2756	138	Y	N	Y
FRELSB13	7263	FAYETT13	7286	138	Y	Y	Y
FREMAN 8	45770	HOCKLY 8	45880	138	N	N	N
FTWRTH C	919	W.DENT C	986	138	Y	Y	Y
GALVES 8	42670	TIKIIS 8	43355	138	Y	Y	Y
GARLDPL2	2920	PLANO 2	2922	138	Y	Y	Y
GARLDPL1	2919	PLANO 1	2921	138	Y	Y	Y
GATETPW4	8650	NLARSWW4	8909	138	N	Y	N
GEMINI 1	2049	RICHLN 1	2099	138	Y	Y	Y
GEORGE13	7343	CHIEBR13	7366	138	Y	N	Y
GIBCRK C	964	BGRPR138	32878	138	Y	Y	Y
GIDEON13	7310	AUSTRO13	7328	138	N	N	N
GPWEST	2265	DALWORTH	2274	138	Y	Y	Y
GRAHAMSS	1596	GRAHAM E	1601	138	Y	N	Y
GRNPR CS	32003	BRYSOUTH	32880	138	N	Y	N
GRPLMG T	3355	PLSNTSPG	3357	138	Y	Y	Y
H_O_C_ 8	47150	KNIGHT 8	47331	138	Y	N	Y
HALBRG M	3554	THOUSE T	3555	138	N	Y	N
HAMILTON	5187	MED CTR	5300	138	Y	Y	Y
HANDLEYD	1951	RANDL WT	2103	138	Y	N	Y
HANDLEYD	1951	WHITE 1T	2109	138	Y	Y	Y
HANDLEYD	1951	LAKEWD 2	2246	138	N	Y	N
HANDLEYC	1950	LAKEWD 1	2245	138	Y	Y	Y
HANDLEYC	1950	WHITE 2T	2110	138	Y	Y	Y
HANEY M	3514	HUBBARD	3515	138	N	Y	N
HILLTO13	7190	STRAHA13	7193	138	Y	Y	Y
HILLBR	3522	WHITNYON	3546	138	Y	Y	Y
HOCKLY 8	45880	TOMBALT8	46511	138	Y	Y	Y
HOLLY 4	8486	R.FIELD4	8883	138	N	Y	N
HOLT SS	1141	AM GLDSM	1145	138	Y	N	Y
HOWARD13	7335	GILLEL13	7336	138	Y	Y	Y
HWY36 13	7291	BRENNO13	7294	138	N	N	N
IRVING	2054	NORWOD 1	2408	138	Y	Y	Y
IV NORTH	2001	IV BLT T	2002	138	Y	Y	Y
JMCSTL C	916	N DENT C	985	138	Y	Y	Y
JMCSTL C	916	W.DENT C	986	138	Y	Y	Y
JUPITR D	806	LAWLER D	820	138	Y	Y	Y
KAUFMAN	2724	KAUF S	2728	138	N	Y	N
KEMP S	2726	SEVENPTS	3264	138	N	Y	N
KENDYSW4	8186	PLESTN 4	8203	138	N	Y	N
KIRBY 8	47320	GARROT 8	47660	138	Y	N	Y
KIRBY-2	5249	KIRBY	5250	138	Y	Y	Y
KIRKTIE2	2459	FAIROK 1	2927	138	Y	Y	Y
KIRKTIE1	2458	FAIROK 2	2928	138	Y	Y	Y
KLEBERG4	8519	LOYOLA 4	8887	138	N	Y	N
KRKLD W	2457	CENEXP 1	2647	138	N	Y	N
KRKLD E	2456	CENEXP 2	2648	138	N	Y	N
L HLDS1T	2923	FAIROK 1	2927	138	Y	Y	Y

L HLDS2T	2924	FORSTV2T	2929	138	Y	Y	Y
L-463	5680	VICTRA 4	8172	138	Y	Y	Y
LAGOVI13	7352	MARSFO13	7356	138	Y	Y	Y
LAKE CRK	3410	TEMP PEC	3420	138	Y	Y	Y
LAKE CRK	3410	GROESPOD	3597	138	N	Y	N
LAKE CRK	3410	HALBRG M	3554	138	N	Y	N
LAKEWD 1	2245	PANTEGO	2247	138	Y	Y	Y
LAMESA	1163	PAUL D T	1168	138	N	Y	N
LAMPAS13	7064	ADAMSV13	7066	138	Y	Y	Y
LAPALM 4	8314	LAPALSTR	8324	138	Y	N	Y
LAREDO 4	8293	DEL MAR4	8645	138	Y	Y	Y
LEWSVLSW	645	TU JNS M	1972	138	N	N	N
LIGNORTH	1922	ATM T1	1996	138	Y	Y	Y
LIGNORTH	1922	DFW SW	2009	138	Y	Y	Y
LIGSOUTH	1924	IV VAL V	2006	138	Y	Y	Y
LIVRPL 8	42870	PETSON	43070	138	Y	N	Y
LNGLVL M	1640	CLIP TAP	1642	138	Y	N	Y
LNGLVL M	1640	STPHVIL	1641	138	Y	Y	Y
LOLITA 4	8125	FORMOSA4	8126	138	N	N	N
LOLITA 4	8125	VICTRA 4	8172	138	N	Y	N
LOYOLA 4	8887	ARMSTNG4	8899	138	N	Y	N
LUFKN SS	3118	TX FND T	3333	138	Y	N	Y
MARION13	7178	CIBOLO13	7608	138	Y	Y	Y
MARKLEY	1476	RICE	1477	138	Y	N	Y
MAYFD NT	1912	C HILL N	2422	138	Y	Y	Y
MAYFD NT	1912	GPWEST	2265	138	Y	Y	Y
MCCALA13	7184	REDWOO13	7188	138	N	Y	N
MCCALA13	7182	RNRD1213	7186	138	Y	Y	Y
MCGREG T	3594	TELMC SS	13662	138	Y	Y	Y
MCNEILN	9079	SUMMITN	9279	138	N	N	N
MIDLND E	1023	BIG SPGW	1324	138	Y	Y	Y
MILLCR13	7565	GAYHIL13	7572	138	N	N	N
MILO 4	8918	LARBTB	80013	138	N	Y	N
MINESRD4	8643	MILO 4	8918	138	N	Y	N
MINWLJCT	1576	MINWL 2	1577	138	Y	Y	Y
MINWL 1	1580	MINWL E	1584	138	Y	N	Y
MOORE138	5827	PRS1388	5895	138	N	Y	N
MOSE MIN	1791	MOSES T	1794	138	Y	Y	Y
MOSE MIN	1791	MOSES	1795	138	Y	Y	Y
MRGN CRK	1032	CHINAGRV	1318	138	N	N	N
MRGN CRK	1032	FORSAN T	1335	138	N	Y	N
MSQT E	2756	E SIDE2T	2771	138	Y	Y	Y
MSQT	2775	BCHSPG T	2776	138	Y	Y	Y
MT CRK E	2412	TRA 1	2804	138	Y	Y	Y
MVABRTP4	8759	MV.PHAR4	8762	138	N	Y	N
MVECCANT	8779	CITCTY	80123	138	Y	N	Y
MVECCANT	8779	MOORE F	80117	138	Y	N	Y
MV-MCRIS	8708	HEC 4	8963	138	Y	Y	Y

MV-MCRIS	8708	MVADRHD2	8754	138	Y	Y	Y
MVYTRA4	8702	ARMSTNG4	8899	138	Y	Y	Y
N ANDREW	1159	EXMEAN T	1165	138	Y	Y	Y
N ANDREW	1159	UN PKRBK	1161	138	Y	N	Y
N PRK 1	2564	PVLGCRK1	2566	138	Y	N	Y
NACDCH	5315	SKYLIN-S	5370	138	N	Y	N
NEWBRE13	7271	WILLSP13	7273	138	Y	Y	Y
NIPAK T	3260	CEDR CRK	3262	138	N	Y	N
NMCALN 4	8368	EDNBRG 4	8380	138	N	Y	N
NORWDPLW	2405	E LEVEEW	2481	138	Y	Y	Y
NORWDPLE	2407	REG RW 1	2800	138	Y	Y	Y
OAKGROVE	2725	KAUF S	2728	138	N	Y	N
OAKGROVE	2725	KEMP S	2726	138	N	Y	N
ODESSA N	1122	ODESSA 2	1126	138	Y	N	Y
ODES EHV	1027	BIG3OD T	1111	138	Y	Y	Y
OLFN/SHL	1054	NYLON T	1055	138	Y	N	Y
OLINGR C	818	ELM GRVE	2705	138	Y	Y	Y
ORAN	1571	GRAHAMSS	1596	138	Y	Y	Y
ORAN	1571	WTHFRD	1592	138	Y	N	Y
PAIGE 13	7308	GIDEON13	7310	138	N	N	N
PALMVW 4	8387	BATES 4	8392	138	Y	N	Y
PALMVW 4	8387	PLMHSTT1	80107	138	Y	N	Y
PALOPNTO	1574	MINWLJCT	1576	138	N	Y	N
PALOPNTO	1574	PALOPT M	1578	138	Y	Y	Y
PANTEGO	2247	BOWEN 1T	2250	138	Y	Y	Y
PARIS SS	1693	PARIS	1777	138	Y	Y	Y
PAYNE	1758	PINKHILM	1763	138	Y	N	Y
PERMIANB	1010	HCKBRYTP	6656	138	Y	Y	Y
PERMIANB	1010	WINK SS	1074	138	Y	Y	Y
PISEK 13	7296	WELCOM13	7577	138	N	N	N
PL JUP	2687	PL SHIL	2691	138	N	Y	N
PLANO 2	2922	L HLDS2T	2924	138	Y	Y	Y
PLANO 1	2921	L HLDS1T	2923	138	Y	Y	Y
PLMHSTT1	80107	CITCTY	80123	138	Y	N	Y
PLSNTSPG	3357	CENTVILL	3358	138	Y	Y	Y
POCKRUSC	917	DENTON C	982	138	Y	N	Y
POCKRUSC	917	TEASLY C	918	138	Y	Y	Y
POTOSITP	6313	PCANBYU4	6773	138	N	Y	N
PPG	1484	ACROCH	1485	138	Y	N	Y
PPG	1484	HEMMERD	1487	138	Y	N	Y
QUANAB	41310	S_R_B_E8	41400	138	N	Y	N
RAYBRN 8	5502	L-463	5680	138	Y	Y	Y
RAYVILE4	8302	MVYTRA4	8702	138	Y	Y	Y
RAYVILE4	8302	RIOHND 4	8319	138	N	Y	N
REC CR 1	2813	UTSW MC1	2823	138	N	Y	N
RICH SC	2689	RICH E	2690	138	N	N	N
RIMROC13	7143	TURTCR13	7442	138	Y	Y	Y
RKWL S	2711	FORNYW M	2712	138	N	N	N

RNDRK	3668	CHIEBR13	7366	138	Y	Y	Y
RNDRK	3668	RNDRK NE	3670	138	N	Y	N
RNKETP11	1848	ROANOKE2	1852	138	Y	Y	Y
RNKETP12	1850	ROANOKE2	1852	138	N	Y	N
RNRD1213	7186	HILLTO13	7190	138	Y	Y	Y
RNRTPL W	2352	PVLGCRK1	2566	138	Y	Y	Y
ROANOKE	1854	MCPHER M	1857	138	Y	N	Y
ROBERTSN	32	WATSONCP	33	138	Y	Y	Y
ROBINSON	3567	ROBSONNW	3568	138	Y	Y	Y
ROSEHILL	2723	KAUFMAN	2724	138	N	Y	N
S WFALLS	1464	AROHD M	1478	138	Y	Y	Y
S WFALLS	1464	SCOTLD M	1474	138	Y	N	Y
SAGINAW	1957	GEMINI 1	2049	138	Y	Y	Y
SAGINAW	1957	AM MFG T	2146	138	N	N	N
SAGINAW	1957	GEMINI 2	2048	138	Y	Y	Y
SALEM 13	7289	BRENHA13	7292	138	N	N	N
SALEM 13	7289	HWY36 13	7291	138	N	N	N
SANDOW	3430	ELGIN SS	3650	138	Y	N	Y
SANDOW	3430	SALTY M	3661	138	Y	Y	Y
SANMAR13	7192	CANYON13	7200	138	Y	Y	Y
SANMAR13	7192	STRAHA13	7193	138	Y	N	Y
SCHERT13	7610	PARKWA13	7611	138	Y	Y	Y
SCOTLD M	1474	WINDTHOR	1475	138	Y	N	Y
SE EDNB4	8374	CHAPINST	8375	138	Y	Y	Y
SE EDNB4	8374	MV.PHAR4	8762	138	N	Y	N
SEGUIN13	7228	SEGUWE13	7229	138	Y	Y	Y
SEGUWE13	7229	S-XXXX13	7602	138	Y	Y	Y
SGVL SS	2434	LAWSON	2779	138	N	Y	N
SGVL SS	2434	MARSHL M	2732	138	Y	N	Y
SHAMBRGR	3104	TYLER NW	3141	138	N	Y	N
SHARPE4	85002	SHARPE4	85001	138	Y	Y	Y
SHERSH13	7102	FERGUS13	7126	138	N	N	N
SHILOH C	830	MCCREE C	834	138	Y	Y	Y
SHLND 4	8391	FRONT	8980	138	Y	N	Y
SHLND 4	8391	SLUTALR4	8821	138	Y	N	Y
SMCALN 4	8371	MVLASMI4	8758	138	Y	N	Y
SMDB 8	5706	PRS1388	5895	138	N	Y	N
SMDB 8	5706	SIGMOR 4	8404	138	N	N	N
SMIGL 8	5704	DILYSW 4	8212	138	N	Y	N
SMIGL 8	5704	MIGUEL 8	5902	138	N	Y	N
SPGVAL M	3593	MCGREG T	3594	138	Y	Y	Y
STRYKER	3110	DIALVILL	3160	138	Y	N	Y
STRYKER	3110	TROUP SS	3147	138	Y	N	Y
SULSP SS	1698	LIBERTY	1723	138	Y	Y	Y
T.I. T	1137	SPRABERY	1329	138	Y	Y	Y
T_H_W_D8	45512	GEARS 8	45782	138	N	N	N
TAYLOR	3658	THORNDAL	3659	138	Y	Y	Y
TEASLY C	918	FTWRTH C	919	138	Y	Y	Y

TEMP SS	3415	TEMP PEC	3420	138	Y	Y	Y
TEMP SS	3415	BELLCTYM	3425	138	Y	Y	Y
THOMSTN4	8183	C.LCRA 4	8192	138	Y	Y	Y
THOMSTN4	8183	MGRUDR4	8194	138	Y	Y	Y
THORNDAL	3659	SALTY M	3661	138	Y	Y	Y
TOMBAL 8	46510	TOMBALT8	46511	138	Y	Y	Y
TRA 1	2804	IVHNT 2T	2805	138	N	Y	N
TRIMMIER	136	KILL SS	3423	138	Y	Y	Y
TRINIDAD	3127	MALAKOFF	3276	138	Y	N	Y
TRINIDAD	3127	NIPAK T	3260	138	N	Y	N
TRNTYSW	2096	RICHLN 2	2100	138	Y	Y	Y
TRNTYSW	2096	RANDL ET	2104	138	Y	Y	Y
TRNTYSW	2096	RICHLN 1	2099	138	Y	Y	Y
TRNTYSW	2096	TRINITY1	2113	138	Y	Y	Y
TROUP SS	3147	WHITEHSE	3227	138	Y	N	Y
TYLER SE	3143	TYLER S	3218	138	Y	Y	Y
TYLER SE	3143	WHITEHSE	3227	138	Y	N	Y
VALLEY	1691	PAYNE	1758	138	Y	Y	Y
VALLEY	1691	PINKHILM	1763	138	Y	Y	Y
VICTRA 4	8172	MGRUDR4	8194	138	N	Y	N
VISTRON4	8145	BLCBAYU4	8911	138	N	Y	N
WACO W	3436	WACOMM2T	3565	138	Y	Y	Y
WACO W	3436	WACOWOOD	3591	138	Y	Y	Y
WACOWOOD	3591	WACOATCO	3592	138	Y	Y	Y
WACOMM2T	3565	ROBSONNW	3568	138	N	Y	N
WACOATCO	3592	SPGVAL M	3593	138	Y	Y	Y
WALLER13	7272	CHAPHI13	7574	138	N	Y	N
WALNT 1T	2607	SCHDR 2	2637	138	Y	N	Y
WALNUTSP	1646	WHITNYON	3546	138	N	Y	N
WATSONCP	33	JEWETT	3392	138	Y	N	Y
WHITE 2T	2110	TRINITY1	2113	138	Y	Y	Y
WHITES13	7529	BUTTER13	7531	138	Y	Y	Y
WHITNYON	3546	LKWHITNY	37410	138	N	Y	N
WILLSP13	7273	FAYETT13	7286	138	Y	Y	N
WINCHE13	7306	GIDEON13	7310	138	N	N	N
WIRTZ 13	7104	FERGUS13	7126	138	N	Y	N
WLEVEE W	2400	DRAGON 1	2858	138	Y	Y	N
WLEVEE E	2399	DRAGON 2	2857	138	Y	Y	N
WOLF CTY	1809	COMM SS	1816	138	Y	Y	N
WORMSR 4	8295	GATETPW4	8650	138	N	Y	N
WRBRTN4	8907	MEDIOCK4	8912	138	N	Y	N
WSTSIDE4	8485	CABINES4	8882	138	N	Y	N
WSTWTHFD	340	MINWL E	1584	138	Y	N	N
WSTWTHFD	340	NWTHRFRD	512	138	Y	N	N
ZORN 13	7180	MCCALA13	7182	138	Y	Y	N
ZORN 13	7180	SEGUIN13	7228	138	Y	Y	N
ALLEN1SS	2511	ALLEN1SS	2513	Auto	Y	Y	Y
ALLEN2SS	2512	ALLEN2SS	2514	Auto	Y	Y	Y

ANNA SS	2373	ANNA SS	2374	Auto	Y	Y	Y
ANNA SS	2373	ANNA SS	2374	Auto	Y	Y	Y
AUSTRO13	7328	AUSTROP	9040	Auto	Y	Y	Y
AUSTRO13	7328	AUSTROP	9040	Auto	Y	Y	Y
BEN DV B	970	BEN DSTR	997	Auto	Y	Y	Y
BENB A T	1869	BENBRK A	1874	Auto	Y	Y	Y
BENB B T	1870	BENBRK B	1875	Auto	Y	Y	Y
C HILL	2420	C HILL S	2421	Auto	Y	Y	Y
CAGNON	5056	CAGNON	5055	Auto	Y	Y	Y
CAGNON	5056	CAGNON	5055	Auto	Y	Y	Y
CLT NW	2361	CLT NW T	2360	Auto	N	Y	N
CNVIL	2453	CNVIL W	2439	Auto	Y	Y	Y
COLETO 6	8164	COLETSTR	8165	Auto	N	Y	N
COLLINSS	2372	COLLIN	2370	Auto	Y	Y	Y
EAGLE MT	1859	EAGLE MT	1860	Auto	Y	Y	Y
ELKTON	3105	ELKTON	3106	Auto	Y	Y	Y
FAYETT34	7057	FAYETT13	7286	Auto	Y	Y	Y
FOR GROV	3130	FOR GROV	3131	Auto	Y	N	Y
FORNEY	2437	FORNEY	2438	Auto	Y	N	Y
GILLE138	9054	GILLE345	9053	Auto	N	Y	N
GRNBYU 5	40700	GRNBYUE8	40710	Auto	Y	Y	Y
HILL CTY	5211	HILLCTYE	5209	Auto	Y	Y	Y
HILL CTY	5211	HILLCTYE	5209	Auto	Y	Y	Y
HILL CTY	5211	HILLCTYW	5210	Auto	Y	Y	Y
JEWETT N	3391	JEWETT	3392	Auto	Y	Y	Y
KILL SS	3422	KILL SS	3423	Auto	Y	Y	Y
LAKE CRK	3409	LAKE CRK	3410	Auto	N	Y	N
LAPALM 6	8317	LAPALSTR	8324	Auto	Y	N	Y
LCRK LS	3402	LAKE CRK	3410	Auto	Y	Y	Y
LIGRING	1927	LIGAUTO2	1925	Auto	Y	Y	Y
LIGRING	1926	LIGAUTO1	1923	Auto	Y	Y	Y
LYTTON	9075	LYTTON	9074	Auto	N	Y	N
LYTTON	9075	LYTTON	9074	Auto	Y	Y	Y
MARION34	7044	MARION13	7178	Auto	N	Y	N
MIGUEL 5	5901	MIGUEL 8	5902	Auto	N	Y	N
MIGUEL 5	5901	MIGUEL 8	5902	Auto	N	Y	N
NORWOODT	2410	NORWDTIE	2404	Auto	Y	Y	Y
NORWD	2406	NRWDTPLT	2423	Auto	Y	Y	Y
ODEHV 2T	1029	ODES EHV	1027	Auto	Y	N	Y
PAWNESW6	5725	PAWNESW8	5727	Auto	N	Y	N
ROANOKE1	1851	RNKETP12	1850	Auto	Y	Y	Y
ROANOKE	1853	RNKETP11	1848	Auto	N	Y	N
ROYSETIE	2483	ROYSE T1	2460	Auto	Y	Y	Y
ROYSE T	2474	ROYSE T2	2473	Auto	Y	Y	Y
SALEM 34	7058	SALEM 13	7289	Auto	Y	Y	Y
SARGT SS	2946	SARGT S	2948	Auto	Y	Y	Y
SGVL SS	2433	SGVL SS	2434	Auto	Y	Y	Y
SHAMBRGR	3103	SHAMBRGR	3104	Auto	Y	N	Y

SKYLINE	5371	SKYLIN-S	5370	Auto	N	Y	N
SKYLINE	5371	SKYLIN-S	5370	Auto	N	Y	N
STRYKER	3109	STRYKER	3110	Auto	N	N	N
T_H_W_ 5	45500	T_H_W_E8	45510	Auto	N	N	N
TEMP PEC	3412	TEMP PEC	3420	Auto	Y	Y	Y
TEMP SS	3414	TEMP SS	3415	Auto	N	Y	N
TOMBAL 5	46500	TOMBAL 8	46510	Auto	Y	Y	Y
TOMBAL 5	46500	TOMBAL 8	46510	Auto	N	Y	N
VENUS N	1907	VENUS	1908	Auto	N	Y	N
W LEVEE	2398	WLEVEE2T	2480	Auto	Y	Y	Y
W LEVEE	2398	WLEVEE T	2479	Auto	Y	Y	Y
WATMILLW	2427	WATMLL W	2430	Auto	Y	Y	Y
WHITNEY	240	WHITNEY	241	Auto	N	Y	N
WHITNEY	240	WHITNEY	241	Auto	N	Y	N
ZORN 34	7042	ZORN 13	7180	Auto	Y	Y	Y
ZORN 34	7045	ZORN 13	7180	Auto	Y	Y	Y

3. Most congested elements of all attempted scenarios without economic projects

Start Bus	Start Bus #	End Bus	End Bus #	Voltage	S1	S3	S4
AUSTRO34	7040	GARFIE34	7048	345	N	Y	N
BEN DV B	970	ROYSE S	2478	345	Y	N	Y
BIGBRN	3380	JEWETT N	3391	345	N	Y	N
BIGBRN	3380	JEWETT S	3390	345	Y	Y	Y
BIGBRN	3380	NavarroS	13405	345	N	Y	Y
BIGBRN	3380	NavarroS	13405	345	N	Y	Y
BITTERCK	1050	ABMULCW7	6235	345	Y	Y	Y
BOWMAN	1422	GRAHAM	1430	345	Y	Y	Y
BOWMAN	1422	JXBRO SS	1429	345	Y	Y	Y
C HILL	2420	WATMILLE	2428	345	N	Y	N
CEDARP 5	40000	CHAMBR 5	40255	345	Y	N	N
CLT NW	2361	COLLINSS	2372	345	N	Y	N
COLLINSS	2372	ANNA SS	2373	345	N	Y	Y
COURTLND	1931	C HILL	2420	345	N	Y	N
ELMCREEK	5133	MIGUEL 5	5901	345	N	Y	Y
ELMCREEK	5133	MIGUEL 5	5901	345	N	Y	Y
EV EAST	1886	KENNDLE1	1932	345	Y	N	N
EV EAST	1886	VENUS N	1907	345	Y	Y	Y
EV WEST	1882	VENUS S	1906	345	N	Y	Y
FORNEY	2437	CNVIL	2453	345	N	Y	N
FORNEY	2437	ELKTON	3105	345	N	Y	Y
FPPYD134	7056	FAYETT34	7057	345	Y	Y	N
FPPYD234	7055	FPPYD134	7056	345	N	Y	N
FPPYD234	7055	HOLMAN	9073	345	N	Y	Y
FPPYD134	7056	SALEM 34	7058	345	N	Y	N
FS COGEN	1025	MRGN CRK	1030	345	Y	Y	Y
GIBCRK B	967	TWIN OAK	3400	345	Y	Y	Y
GIBCRK B	967	OBRIEN 5	44500	345	Y	Y	Y
GIBCRK B	967	ROAN	45973	345	Y	Y	Y
GIBCRK B	967	TWIN OAK	3400	345	Y	Y	N
GRAHAM	1430	BENBRK	1873	345	Y	Y	Y
GRAHAM	1430	MESQUITE	1435	345	Y	Y	Y
GRAHAM	1430	PARKER	1436	345	Y	Y	Y
HACKBRY	2387	IV VR	2389	345	N	Y	N
HILL CTY	5211	MARION34	7044	345	Y	Y	Y
HOLMAN	9073	HILLJE 5	44200	345	Y	Y	Y
HOLMAN	9073	LYTTON	9074	345	N	Y	N
JEWETT S	3390	LIMEST 5	46020	345	Y	Y	Y
JEWETT N	3391	ROANS PR	40600	345	Y	Y	Y
JEWETT S	3390	T_H_W_ 5	45500	345	Y	Y	Y
JEWETT N	3391	TWIN OAK	3400	345	N	Y	Y
JXBRO SS	1429	GRAHAM	1430	345	Y	Y	N
KING 5	40900	KUYDAL 5	45972	345	Y	Y	Y

LAKE CRK	3409	T HOUSE	3405	345	N	Y	Y
LAKE CRK	3409	TEMP SS	3414	345	Y	Y	Y
LCRK LS	3402	LAKE CRK	3409	345	Y	N	Y
MARTINLK	3100	ELKTON	3105	345	N	N	Y
MESQUITE	1435	ABMULCE7	6230	345	Y	Y	Y
MIDL E T	1021	FS COGEN	1025	345	Y	Y	Y
MOSES-T	1696	ALLEN2SS	2514	345	N	Y	N
MOSES	1695	SULSP SS	1697	345	N	Y	N
MOSS	1018	MIDLND E	1022	345	Y	Y	Y
MRGN CRK	1030	BITTERCK	1050	345	Y	Y	Y
MRGN CRK	1030	GRAHAM	1430	345	Y	Y	Y
MRGN CRK	1030	SWEETWTR	1420	345	N	Y	N
NavarroS	13405	VENUS N	1907	345	N	Y	Y
NavarroS	13405	VENUS S	1906	345	N	Y	Y
ODES EHV	1026	ODEHV 1T	1028	345	Y	Y	Y
P_H_R_ 5	42000	OASIS_5	43035	345	Y	Y	Y
PARIS SS	1692	MOSES	1695	345	N	Y	N
RENERTPL	2355	ALLEN1SS	2513	345	N	Y	N
RICHLND2	3134	BIGBRN	3380	345	N	Y	Y
RICHLND1	3133	BIGBRN	3380	345	N	Y	N
RIOHND 6	8319	ARMSTRNG	80076	345	N	Y	N
ROAN	45973	KUYDAL 5	45972	345	Y	Y	Y
ROANS PR	40600	TOMBAL 5	46500	345	Y	Y	Y
ROYSE N	2461	ALLEN1SS	2513	345	N	Y	N
ROYSE S	2478	SHAMBRGR	3103	345	N	Y	Y
SANDYCRK	3399	LCRK LS	3402	345	Y	Y	Y
SKYLINE	5371	SPRUCE	5400	345	N	Y	N
SKYLINE	5371	MARION34	7044	345	Y	Y	Y
SKYLINE	5371	SPRUCE	5400	345	Y	Y	N
SMTHRS 5	44650	BELAIR 5	47000	345	Y	Y	Y
SO TEX 5	5915	WHITEPT	8956	345	N	Y	N
SPRUCE	5400	PAWNESW6	5725	345	Y	N	Y
SWEETWTR	1420	GRAHAM	1430	345	N	Y	N
T HOUSE	3405	TEMP PEC	3412	345	N	Y	Y
TEMP PEC	3412	TEMP SS	3414	345	Y	Y	Y
TRICORN	2432	TRINDAD2	3124	345	N	Y	Y
TRINDAD2	3124	RICHLND2	3134	345	Y	Y	Y
TRINDAD1	3123	RICHLND1	3133	345	N	Y	Y
TWBT7	6009	TWBT4STR	6012	345	Y	Y	Y
TWIN OAK	3400	TNP ONE	39950	345	Y	Y	Y
TWIN OAK	3400	TNP ONE	39950	345	Y	Y	Y
VALLEY	1690	VAL STH	1729	345	N	Y	N
VENUS N	1907	T HOUSE	3405	345	N	Y	Y
VENUS S	1906	T HOUSE	3405	345	N	Y	N
W.DENT B	988	ROANOKE1	1851	345	N	Y	N
W_A_P_ 5	44000	BELAIR 5	47000	345	Y	Y	Y
WATMILLW	2427	SARGT SS	2946	345	N	Y	N
WILLOWCK	1421	JXBRO SS	1429	345	Y	Y	Y

WILLOWCK	1421	PARKER	1436	345	Y	Y	Y
WLFHOL	1876	ROCKY CK	1880	345	Y	N	Y
800/9002	2809	DRAGON 2	2857	138	N	Y	N
800/9001	2808	DRAGON 1	2858	138	N	Y	N
ABSOUTH4	6260	POTOSITP	6313	138	Y	N	N
AGNESSW	511	WTHFRD	1592	138	Y	N	N
AIRCO 4	8144	CARB-SD4	8152	138	Y	Y	Y
AIRCO 4	8144	RINCON 4	8418	138	Y	Y	Y
AIRLINE4	8490	CABINES4	8882	138	Y	Y	N
AIRLIN 8	45630	WHITOKN8	46610	138	Y	N	Y
ALAZAN 4	8515	SHARPE4	85002	138	N	Y	N
ALHUB TU	1757	PAYNE	1758	138	N	Y	N
ALLENSSE	2510	PL CUST2	2526	138	N	Y	N
AMAC1	80078	AMAC1	80082	138	Y	Y	Y
AMAC1	80078	ARMSTSTR	80077	138	Y	Y	Y
ANGLTN 8	42110	CW_COL_8	42330	138	Y	Y	Y
ARCO C T	1199	LCRANE	6615	138	Y	Y	Y
AROHD M	1478	RATHGBER	1480	138	N	Y	Y
AROWHEAD	1468	NEWPRT M	1470	138	Y	Y	Y
ATHENS T	3247	ATHNS NW	3248	138	N	Y	Y
AUSTIN	5005	AUSTIN-2	5006	138	N	Y	N
AUSTIN-2	5006	KIRBY-2	5249	138	N	N	Y
BALL PRK	5011	FERN	5147	138	Y	Y	N
BALL PRK	5011	JT DEELY	5110	138	N	Y	Y
BALNGR 4	6340	IVEYPTP4	6360	138	Y	Y	Y
BANDERA	5020	HAMILTON	5187	138	Y	Y	Y
BARRILA4	6655	HCKBRYTP	6656	138	N	Y	N
BATES 4	8392	GARZA 4	8399	138	Y	N	N
BAYTWN 8	40170	EXXON_	40570	138	Y	N	Y
BELAIRN8	47010	BRAYS 8	47050	138	Y	Y	Y
BELLSO13	7270	BELLVI13	7287	138	N	N	Y
BELLVI13	7287	HWY36 13	7291	138	N	N	Y
BELLSO13	7270	PETERS 8	46220	138	Y	Y	N
BELTNBEC	139	BELTON	3610	138	Y	N	N
BELTNBEC	139	MOFFAT	141	138	Y	N	N
BIG 3 4	8146	BLCBAYU4	8911	138	N	N	Y
BIGBRN T	3505	WINKLR M	3508	138	N	Y	N
BIGLAKE4	6535	NMC_STH	60032	138	Y	Y	Y
BLESSNG4	8121	LOLITA 4	8125	138	N	N	Y
BLOGET89	47521	GARROT 8	47660	138	N	Y	N
BOSQUESW	252	LKWHITNY	37410	138	Y	N	N
BRAYS 8	47050	H_O_C_ 8	47150	138	Y	Y	Y
BRDGTAP	626	AUDBONSW	634	138	Y	N	N
BRDGPORT	1565	DECATUR	1566	138	Y	N	N
BRECK T	1613	CADDO	1618	138	Y	N	N
BRITMR 8	44120	ADICKS 8	45610	138	Y	Y	Y
BRNWD S	1656	CAMPBO13	7386	138	N	Y	Y
BRNWD S	1656	BRNWD	1661	138	Y	N	N

BRNWD SS	1655	CAMPBO13	7386	138	N	Y	Y
BROADVEW	5040	FRED RD	5170	138	N	N	Y
BRY E C	962	GIBCRK C	964	138	N	Y	N
BRYSOUTH	32880	BRSSWTCH	32893	138	Y	Y	N
BUTLER13	7324	ELGIN 13	7332	138	N	Y	Y
BUTLER M	3283	JEWETT	3392	138	N	N	Y
C HILL N	2422	FSHCRK	2491	138	Y	Y	N
C_BELAIR	47016	KIRBY 8	47320	138	Y	Y	Y
CEDARVAL	117	TRIMMIER	136	138	Y	Y	Y
CEL-BIS4	8516	KLEBERG4	8519	138	Y	Y	Y
CEL-BIS4	8516	SHARPE4	85001	138	Y	N	N
CFTBEND8	44300	SCOTT_	44630	138	Y	Y	Y
CHILLTPL	3053	CHCLRDT1	3055	138	N	Y	Y
CHINAGRV	1318	RADIUM M	1398	138	N	Y	Y
CHISOLM	585	ROANOKE	640	138	Y	N	N
CKRELL 1	3014	HMPTON 1	3016	138	Y	N	N
CLT NW E	2362	LAKEPNTE	37010	138	N	Y	Y
CLTHEBRN	2384	CLT FK	2519	138	N	Y	N
CMCHE SS	1441	CMCHE T	1650	138	N	Y	N
COLETO 4	8162	VICTRA 4	8172	138	Y	N	Y
COLETAP4	6347	IVEYPTP4	6360	138	N	Y	N
COLETO 4	8162	KENDYSW4	8186	138	N	N	Y
COLETAP4	6347	SANANNA4	6355	138	N	Y	N
COLETO 4	8162	VICTRA 4	8172	138	Y	N	Y
COLNY CK	1619	LEON	1624	138	Y	N	N
COMFOR13	7155	RAYBAR13	7158	138	Y	Y	Y
CROCKETT	3354	GRPLMG T	3355	138	N	N	Y
CUERO 13	7244	GONZAL13	7245	138	N	Y	N
CUSHING	3299	CUSH SE	3300	138	Y	N	N
CUSH SE	3300	NACGDCHS	3303	138	Y	N	N
DAVIS 4	8458	R.FIELD4	8883	138	Y	N	N
DECATUR	1566	RHOME	1570	138	Y	Y	Y
DENTON C	982	CORINTH	1985	138	N	Y	N
DEPORT	1768	PARISE T	1769	138	Y	N	N
DEPORT	1768	RCST	1780	138	Y	N	N
DINGDONG	115	CEDARVAL	117	138	N	N	Y
DVIL S	3052	CHCLRDT1	3055	138	N	Y	Y
E LEVEEW	2481	W DAL 2T	2832	138	Y	N	N
E_BERN 8	44190	ORCHRD 8	44540	138	Y	Y	N
EAGLE MT	1860	AZLE	2062	138	Y	N	N
EDGCLF 2	2191	ROGERS 2	2193	138	Y	Y	N
EDNA 4	8118	VICTRA 4	8172	138	N	Y	N
EDNBRG 4	8380	EDNBRSTR	8384	138	N	Y	N
EDNBRG 4	8380	MV.WEDN4	8771	138	N	N	Y
EGL FD 2	3049	SORCEY 1	3050	138	Y	N	N
ELGIN 13	7332	GILLEL13	7336	138	N	Y	N
ELKTON	3106	TYLER SS	3197	138	N	Y	N
ELKTON	3106	TYLER W	3139	138	N	Y	N

ELM MOTT	3407	THOUSE T	3555	138	N	Y	N
ELSA 4	8360	MVADRHD2	8754	138	Y	N	N
EVANT 13	7068	GOLDTH13	7070	138	N	N	Y
EVERMN A	1883	OAK H 1T	2224	138	Y	N	N
FALLSCTY	5145	KENDYSW4	8186	138	Y	N	Y
FAYETT13	7286	PISEK 13	7296	138	Y	Y	N
FAYETT13	7286	WINCHE13	7306	138	N	N	Y
FISHRDSS	1426	CITYVIEW	1483	138	N	Y	N
FIVE PTS	5150	WESTSIDE	5490	138	N	Y	N
FLEWLN 8	44230	PETERS 8	46220	138	Y	Y	N
FONDRN 8	47100	WESTWD 8	47462	138	Y	N	N
FORMOSA4	8126	JOSLIN 4	8140	138	N	Y	Y
FORNEY	2438	E SIDE1T	2769	138	N	Y	N
FORNEY	2438	MSQT E	2756	138	N	Y	Y
FORSAN T	1335	CRMWD7 T	1337	138	N	Y	N
FRATT	5165	PARKWA13	7611	138	Y	Y	N
FREMAN 8	45770	HOCKLY 8	45880	138	Y	Y	N
FRISCO	681	COLLIN	2370	138	N	Y	N
GANADO 4	8117	EDNA 4	8118	138	N	Y	N
GARFIELD	9071	HICRSMB2	9147	138	Y	Y	Y
GARFIELD	9071	ONION CK	9251	138	N	Y	Y
GARROT 8	47660	MIDTWN 8	47705	138	Y	Y	Y
GEN RUBR	1053	OLFN/SHL	1054	138	Y	N	N
GIDEON13	7310	AUSTRO13	7328	138	Y	Y	N
GIDEON13	7310	SWIFTE13	7326	138	N	Y	N
GLIDDE13	7258	FRELSB13	7263	138	N	N	Y
GOODWIN4	8355	LAGRULA4	8798	138	Y	N	N
GRAHAMSS	1596	GRAHAM E	1601	138	N	Y	N
GRAHAM P	1431	BRECK T	1613	138	Y	N	N
GRAHAM P	1431	RICE	1477	138	Y	N	N
GRD PRIE	2262	C HILL S	2421	138	N	Y	Y
GRNPR CS	32003	BRYSOUTH	32880	138	Y	N	Y
GRPLMG T	3355	PLSNTSPG	3357	138	N	N	Y
H_O_C_ 8	47150	KNIGHT 8	47331	138	N	Y	N
HALBRG M	3554	THOUSE T	3555	138	N	N	Y
HALLET13	7246	FLATON13	7248	138	N	Y	N
HAMILTN4	8255	HAMIL_P4	8257	138	Y	Y	Y
HAMIL_P4	8257	CORTHAN4	8259	138	Y	Y	Y
HANEY M	3514	HUBBARD	3515	138	N	N	Y
HASSE M	1649	CMCHE T	1650	138	N	Y	Y
HEARNE	35	DANSBY	32897	138	Y	Y	Y
HEBRN SS	2376	AUSRNCH1	2377	138	N	Y	Y
HEMPHILL	2164	MIST 34	2173	138	N	N	Y
HENNE 13	7172	COMAL 13	7176	138	N	Y	N
HIGHL TN	37050	WEST TN	37060	138	Y	N	N
HILLCTYE	5209	LASIERRA	5257	138	Y	Y	N
HMPTON 2	3017	POLK 2T	3019	138	Y	N	N
HMPTON 2	3017	LVBRD 2T	3032	138	Y	N	N

HMPTON 1	3016	POLK 1T	3018	138	Y	N	N
HNC1388	5819	MOORE138	5827	138	N	Y	N
HOLLY 4	8486	R.FIELD4	8883	138	Y	N	N
HUNTSMAN	1051	REXALL	1052	138	Y	Y	Y
HUTTO SS	3666	RNDRK NE	3670	138	N	Y	N
HWY36 13	7291	BRENNO13	7294	138	Y	Y	N
HWY36 13	7291	BRENHA13	7292	138	N	N	Y
JARRELLE	3688	GABRIE13	7346	138	Y	N	N
JEFFERSN	41240	CS_CHAN8	41371	138	N	N	Y
JENETA 8	47310	WESTWD 8	47462	138	Y	Y	Y
KEMP S	2726	SEVENPTS	3264	138	N	N	Y
KENDYSW4	8186	PLESTN 4	8203	138	Y	N	N
KILELMR2	3427	KILLTAFD	3616	138	N	Y	N
KINGSVL4	8518	KLEBERG4	8519	138	Y	Y	Y
KIRBY 8	47320	GARROT 8	47660	138	N	Y	Y
KLEBERG4	8519	LOYOLA 4	8887	138	Y	N	Y
KLEBRG T	3077	SSWWT2T	3079	138	N	Y	N
KLUGE 8	45952	PINHUR 8	46240	138	Y	N	N
LAKE CRK	3410	TEMP PEC	3420	138	N	N	Y
LAMPAS13	7064	ADAMSV13	7066	138	N	N	Y
LCRANE	6615	KM WTP4	6635	138	Y	Y	Y
LEON	1624	CLIP TAP	1642	138	Y	Y	Y
LEON	1624	LNGLVL M	1640	138	Y	Y	Y
LEON	1624	PUTNAM 4	6309	138	Y	Y	Y
LEWSVLSW	645	HIGHL ME	1970	138	N	Y	N
LEWSVLSW	645	HIGHLAND	664	138	N	Y	N
LEWSVLSW	645	TU JNS M	1972	138	N	Y	N
LIBERTY	1723	EMORY N	3171	138	Y	N	N
LIVRPL 8	42870	PETSON	43070	138	N	Y	N
LK WICH	1446	S WFALLS	1464	138	Y	N	N
LNGLVL M	1640	CLIP TAP	1642	138	N	Y	Y
LNGLVL M	1640	STPHVIL	1641	138	N	N	Y
LNHILL 4	8452	MEDIOCK4	8912	138	N	Y	N
LOLITA 4	8125	FORMOSA4	8126	138	Y	N	N
LOLITA 4	8125	VICTRA 4	8172	138	Y	N	N
LONGLK T	3279	BUTLER M	3283	138	N	Y	N
LOYOLA 4	8887	ARMSTNG4	8899	138	Y	Y	Y
LUFKN SS	3118	LUFKIN	3340	138	Y	N	N
LUFKN SS	3118	TX FND T	3333	138	N	N	Y
LYTTON	9075	PILOT KB	9259	138	Y	Y	N
LYTTON	9075	RINARDCK	9262	138	N	Y	Y
MASON4	6390	GILLES13	7132	138	Y	Y	N
MCCALA13	7184	REDWOO13	7188	138	N	N	Y
MCGREGOR	161	WINDSRSW	165	138	Y	N	N
MECLOPN4	8957	FALCONSS	80106	138	Y	N	N
MENARD 4	6375	MASON4	6390	138	Y	Y	Y
MENARD 4	6375	SAPS1 4	6480	138	Y	Y	Y
MIDLND E	1023	MIDL DWN	1132	138	N	Y	N

MIDROPN8	47706	POLK 8	47730	138	Y	Y	Y
MIDTWN 8	47705	MIDROPN8	47706	138	Y	N	Y
MILLCR13	7565	GAYHIL13	7572	138	Y	Y	N
MINWL W	1575	MINWLJCT	1576	138	Y	N	N
MONSAN	42940	PETSON	43070	138	Y	N	Y
MOODY	137	MCGREGOR	161	138	Y	N	N
MOODY	137	MOFFAT	141	138	Y	N	N
MOSE MIN	1791	MOSES	1795	138	N	N	Y
MOSES T	1794	SUL BLF	1796	138	N	Y	Y
MOSS	1019	ODESA SW	1113	138	Y	Y	Y
MRGN CRK	1032	CHINAGRV	1318	138	Y	Y	N
MRGN CRK	1032	CHINAGRV	1318	138	Y	Y	Y
MRGN CRK	1032	FORSAN T	1335	138	Y	N	Y
MSQT E	2756	E SIDE2T	2771	138	N	N	Y
MSQT E	2756	E SIDE1T	2769	138	N	Y	N
MURRAY M	1371	GRAHAM P	1431	138	Y	N	N
MURRAY M	1371	PTCRK2 4	6169	138	Y	N	N
MV.WEDN4	8771	MV.ALTON	8772	138	N	Y	N
MVABRTP4	8759	MV.PHAR4	8762	138	Y	N	N
MVBURNS4	8763	MVSHAR4	8776	138	N	Y	N
MVLASMI4	8758	STEWART4	8951	138	Y	N	N
MVYTRA4	8702	ARMSTNG4	8899	138	N	Y	Y
N PRK 1	2564	PVLGCRK1	2566	138	N	Y	Y
NACDCH	5315	TUTTLE	5435	138	N	Y	N
NACGDCHS	3303	NACOG SW	3305	138	Y	N	Y
NACOG SE	3120	NACOG S	3315	138	Y	Y	Y
NACOG SW	3305	NACOG N	3310	138	Y	N	Y
NACOG S.	3314	NACOG S	3315	138	Y	Y	Y
NACOG S.	3314	NACOG ST	3316	138	Y	N	N
NACOG N	3310	NAC SFA	3311	138	Y	Y	Y
NACOG SE	3120	HERTY N	3319	138	Y	Y	N
NACOG ST	3316	LUFKIN	3340	138	Y	Y	Y
NACOG SE	3120	NAC SFA	3311	138	Y	Y	Y
NAVYK SS	1472	WINDTHOR	1475	138	Y	N	N
NEWGLF 8	43011	PLEDGR 8	43120	138	N	Y	N
NEWGLF 8	43011	TEXGLF	43340	138	N	Y	N
NEWPRT M	1470	CARTER M	1471	138	N	Y	N
NMC_NRTH	6595	KM WTP4	6635	138	Y	Y	Y
NMCALN 4	8368	EDNBRG 4	8380	138	N	Y	N
NORWDPLW	2405	EP CNT2T	2797	138	Y	N	N
OAKGROVE	2725	KEMP S	2726	138	N	N	Y
ODES EHV	1027	ARCO C T	1199	138	N	Y	Y
ORAN	1571	MINWL W	1575	138	Y	N	N
ORCHRD 8	44540	SCOTT_	44630	138	Y	Y	Y
PAIGE 13	7308	GIDEON13	7310	138	N	Y	N
PISEK 13	7296	WELCOM13	7577	138	Y	Y	N
PLEDGR 8	43120	W_COL_ 8	43380	138	N	Y	N
POCKRUSC	917	DENTON C	982	138	N	Y	N

POTOSITP	6313	PCANBYU4	6773	138	Y	N	N
POTTERTP	6317	MCELMUR	6319	138	N	Y	N
PPG	1484	ACROCH	1485	138	N	Y	Y
PPG	1484	HEMMERD	1487	138	N	Y	N
PUTNAM 4	6309	PCANBYU4	6773	138	Y	Y	Y
RAYBRN 8	5502	VAND 8	5584	138	N	Y	Y
RAYFRD 8	46262	TOMBALT8	46512	138	Y	Y	N
RAYFRD 8	46261	TOMBAL 8	46510	138	Y	Y	Y
RAYVILE4	8302	MVYTRA4	8702	138	N	Y	N
RAYVILE4	8302	RIOHND 4	8319	138	Y	N	Y
RCST	1780	TALCOPOD	1793	138	Y	N	N
RED OAK	2328	DESOTO	2424	138	Y	N	N
RG CTY 4	8793	LAGRULA4	8798	138	Y	N	N
RINARDCK	9262	HC_TAP	9292	138	N	Y	N
RIOHND 4	8319	MVERIOH4	8764	138	N	Y	N
RIOHND 4	8319	MVSHAR4	8776	138	Y	Y	N
RIOPEC14	6601	LCRANE	6615	138	Y	Y	Y
RKWELL T	1797	MRTN SPG	1800	138	Y	N	Y
RNDRK	3668	RNDRK NE	3670	138	Y	N	Y
ROBERTSN	32	HEARNE	35	138	N	Y	Y
ROBERTSN	32	WATSONCP	33	138	N	N	Y
ROMATP4	8795	FALCONSS	80106	138	Y	N	N
S WFALLS	1464	AROHD M	1478	138	N	N	Y
SAGINAW	1957	AM MFG T	2146	138	Y	N	N
SALADO	3640	JARRELLE	3688	138	Y	Y	N
SALEM 13	7289	BRENHA13	7292	138	Y	Y	N
SALEM 13	7289	HWY36 13	7291	138	Y	Y	Y
SALEM 13	7289	WELCOM13	7577	138	Y	Y	N
SANDOW	3430	ELGIN SS	3650	138	N	Y	N
SANDHI13	7570	GAYHIL13	7572	138	Y	N	N
SANMAR13	7192	STRAHA13	7193	138	N	Y	N
SCHKADE	6320	SAPS1 4	6480	138	N	Y	N
SEALY 8	44640	PETERS 8	46220	138	N	N	Y
SEGUWE13	7229	S-XXXX13	7602	138	N	N	Y
SGVL SS	2434	SGVL	3076	138	N	Y	N
SGVL	3076	KLEBRG T	3077	138	N	Y	Y
SHAMBRGR	3104	TYLER NE	3210	138	N	Y	N
SHAMBRGR	3104	LINDALE	3201	138	N	Y	N
SHAMBRGR	3104	TYLER NW	3141	138	Y	N	N
SHARPE4	85002	SHARPE4	85001	138	N	Y	N
SHILOH C	830	MARQUIS	848	138	N	Y	N
SMCALN 4	8371	H.ACRES4	8760	138	Y	N	N
SMCALN 4	8371	MVLASMI4	8758	138	N	Y	N
SMCALN 4	8371	SLUTALR4	8821	138	Y	N	N
SMDB 8	5706	PRS1388	5895	138	N	N	Y
SMIGL 8	5704	MIGUEL 8	5902	138	Y	N	N
SONORA 4	6515	CORTHAN4	8259	138	Y	Y	Y
SONORA 4	6515	FDRAN 4	6562	138	Y	Y	Y

SPGVAL M	3593	MCGREG T	3594	138	N	N	Y
SPRABERY	1329	CRMWD7 T	1337	138	Y	Y	Y
SUL BLF	1796	RKWELL T	1797	138	N	Y	Y
SULSP SS	1698	LIBERTY	1723	138	N	N	Y
SULSP SS	1698	MRTN SPG	1800	138	Y	N	Y
SUNSET	1469	CARTER M	1471	138	N	Y	N
SWAN 2	3202	LNDALE T	3203	138	N	Y	N
SWHOME13	7235	HALLET13	7246	138	N	Y	N
SWHOME13	7235	YOAKUM13	7242	138	N	Y	N
TALCOPOD	1793	MOSES T	1794	138	Y	N	Y
TATE E T	2221	OAK H 2T	2225	138	N	Y	Y
TATE W T	2220	OAK H 1T	2224	138	N	N	Y
TECO__	47430	BLOGET89	47521	138	Y	N	Y
TOMBAL 8	46510	TOMBALT8	46512	138	Y	Y	N
TRSWIG 8	46550	CWESFLD8	46571	138	Y	Y	Y
TU JNS M	1972	LAKEPNTE	37010	138	N	Y	Y
TWBT4	6011	SCHKADE	6320	138	Y	Y	Y
TYLER W	3139	TYLER NW	3141	138	N	Y	N
TYLER NE	3210	TYLER E	3211	138	N	Y	N
TYLER E	3211	TYLR OMN	3212	138	N	Y	N
TYLER NW	3141	SWAN 2	3202	138	N	Y	N
TYLR OMN	3212	TYLER GE	3213	138	N	Y	N
UTSA	5460	UTSA-BTP	5462	138	Y	Y	N
VALLEY	1691	BRKSTNTP	1833	138	N	Y	N
VERDCR13	7146	RAYBAR13	7158	138	Y	Y	Y
VERDCR13	7146	TURTCR13	7442	138	Y	Y	Y
VICTRA 4	8172	MGRUDR4	8194	138	N	Y	N
VICTRA 4	8172	WRBRTN4	8907	138	N	Y	N
VISTRON4	8145	BLCBAYU4	8911	138	N	N	Y
VISTRON4	8145	CARB-SD4	8152	138	N	Y	N
WALLER13	7272	CHAPHI13	7574	138	Y	N	N
WATSONCP	33	HLTOPLKS	47	138	N	Y	N
WATSONCP	33	JEWETT	3392	138	N	Y	Y
WDGWD NT	2184	EDGCLF 2	2191	138	Y	Y	Y
WES UNT4	8348	STEWART4	8951	138	Y	N	N
WHITNYON	3546	LKWHITNY	37410	138	Y	N	Y
WINCHE13	7306	SMITHV13	7314	138	N	Y	N
WINDSRSW	165	CRAWFORD	173	138	N	Y	N
WINDTHOR	1475	MARKLEY	1476	138	Y	N	N
WINDWOOD	1116	MIDLND W	1117	138	Y	Y	Y
WLEVEE W	2400	DEALEY1	2842	138	N	Y	N
WSTSIDE4	8485	CABINES4	8882	138	Y	Y	N
YOAKUM13	7242	CUERO 13	7244	138	N	Y	N
ZAPATA 4	8299	MECLOPN4	8957	138	Y	N	N
ZEPHYR M	1654	BRNWD SS	1655	138	Y	N	N
ALLEN2SS	2512	ALLEN2SS	2514	Auto	N	Y	Y
ANNA SS	2373	ANNA SS	2374	Auto	N	N	Y
ARMSTRNG	80076	ARMSTSTR	80077	Auto	Y	Y	Y

AUSTRO13	7328	AUSTROP	9040	Auto	N	Y	Y
AUSTRO13	7328	AUSTROP	9040	Auto	N	Y	Y
BELAIRN8	47010	BELAIR 5	47000	Auto	Y	Y	Y
BOWMAN	1422	BOWMAN B	1424	Auto	N	Y	Y
BOWMAN	1422	BOWMAN A	1423	Auto	N	Y	N
CAGNON	5056	CAGNON	5055	Auto	N	Y	Y
CAGNON	5056	CAGNON	5055	Auto	N	Y	Y
CLRSPG13	7680	CLRSPG34	7050	Auto	Y	Y	Y
CNVIL	2453	CNVIL E	2450	Auto	N	Y	Y
COLLINSS	2372	COLLIN	2370	Auto	N	Y	Y
COLLINSS	2372	COLLIN	2370	Auto	N	N	Y
CONCORD	393	CONCORD	394	Auto	N	Y	N
CONCORD	393	CONCORD	394	Auto	N	Y	N
DOW_OC 5	42500	DOW138 8	42510	Auto	Y	N	Y
EV EAST	1886	EVERMN B	1884	Auto	N	Y	Y
EV EAST	1886	EVERMN B	1884	Auto	N	Y	Y
FAYETT34	7057	FAYETT13	7286	Auto	N	Y	N
FOR GROV	3130	FOR GROV	3131	Auto	N	Y	N
FORNEY	2437	FORNEY	2438	Auto	N	N	Y
FS COGEN	1025	FS COGEN	1024	Auto	Y	Y	Y
FS COGEN	1025	FS COGEN	1024	Auto	Y	Y	Y
GARFIE34	7048	GARFIELD	9071	Auto	N	Y	Y
GARFIE34	7048	GARFIELD	9071	Auto	Y	Y	Y
GRAHAM	1430	GRAHAM P	1431	Auto	Y	N	N
GRNBYU 5	40700	GBCENT 8	40716	Auto	Y	Y	Y
GRNBYU 5	40700	GRNBYUE8	40710	Auto	N	Y	N
HILL CTY	5211	HILLCTYE	5209	Auto	N	Y	N
HILL CTY	5211	HILLCTYE	5209	Auto	N	Y	N
HILL CTY	5211	HILLCTYW	5210	Auto	N	Y	Y
HUTTO SS	3696	HUTTO SS	3666	Auto	N	Y	N
JEWETT N	3391	JEWETT	3392	Auto	N	N	Y
LAPALM 6	8317	LAPALSTR	8324	Auto	N	N	Y
LYTTON	9075	LYTTON	9074	Auto	Y	Y	Y
MARION34	7044	MARION13	7178	Auto	N	N	Y
MIDL E T	1021	MIDLND E	1023	Auto	Y	Y	Y
MOSES-T	1696	MOSES	1795	Auto	Y	N	N
NACOG SE	3119	NACOG SE	3120	Auto	Y	Y	Y
ODEHV 2T	1029	ODES EHV	1027	Auto	N	Y	Y
ODEHV 1T	1028	ODES EHV	1027	Auto	Y	Y	Y
SALEM 34	7058	SALEM 13	7289	Auto	N	Y	Y
SANDOW	3429	SANDOW	3430	Auto	N	Y	Y
SHAMBRGR	3103	SHAMBRGR	3104	Auto	N	Y	Y
SKYLINE	5371	SKYLIN-S	5370	Auto	N	N	Y
SKYLINE	5371	SKYLIN-S	5370	Auto	N	N	Y
SKYLINE	5371	SKYLIN-N	5369	Auto	N	Y	N
T_H_W_ 5	45500	T_H_W_E8	45510	Auto	Y	N	N
TEMP SS	3414	TEMP SS	3415	Auto	Y	N	N
TWBT4	6011	TWBT4STR	6012	Auto	Y	Y	Y

VALLEY	1690	VALLEY	1691	Auto	N	Y	N
WHITEPT	8956	WHITEPT2	8961	Auto	N	Y	N

4. Remaining most congested elements of all attempted scenarios with all passed economic and reliability projects

Start Bus	Start Bus #	End Bus	End Bus #	Voltage	S1	S3	S4
ARMSTRNG	80076	SHARPE6	85000	345	N	N	N
BEN DV B	970	ROYSE S	2478	345	Y	Y	Y
BIGBRN	3380	NavarroS	13405	345	N	N	N
BIGBRN	3380	NavarroS	13405	345	N	N	N
BOWMAN	1422	FISHRDSS	1425	345	Y	Y	Y
BOWMAN	1422	JXBRO SS	1429	345	N	N	N
COM PEAK	1900	JOHN SS	1902	345	Y	N	Y
EV EAST	1886	KENNDLE1	1932	345	Y	N	Y
EV EAST	1886	VENUS N	1907	345	Y	Y	Y
EV WEST	1882	VENUS S	1906	345	Y	Y	Y
FISHRDSS	1425	OKLAEHV7	6100	345	N	N	N
FLOYD	95020	TURKEY3	63453	345	N	Y	N
FPPYD234	7055	HOLMAN	9073	345	N	Y	N
FS COGEN	1025	MRGN CRK	1030	345	N	N	N
GIBCRK B	967	Singleton	46000	345	N	Y	N
GIBCRK B	967	Singleton	46000	345	N	Y	N
GRAHAM	1430	MESQUITE	1435	345	N	Y	N
HILL CTY	5211	MARION34	7044	345	Y	Y	Y
LAKE CRK	3409	T HOUSE	3405	345	N	N	N
LAKE CRK	3409	TEMP SS	3414	345	N	Y	N
LCRK LS	3402	T HOUSE	3405	345	N	Y	N
RIOHND 6	8318	ARMSTRNG	80076	345	Y	N	Y
LNHILL 6	8455	SHARPE6	85000	345	N	N	N
LUFKN SS	3117	NACOG SE	3119	345	N	N	N
MARTINLK	3100	ELKTON	3105	345	N	N	N
MOSES	1695	SULSP SS	1697	345	N	Y	N
MRGN CRK	1030	SWEETWTR	1420	345	N	N	N
MT ENTRP	3116	NACOG SE	3119	345	Y	Y	Y
NavarroS	13405	VENUS N	1907	345	N	Y	N
NavarroS	13405	VENUS S	1906	345	N	Y	N
OBRIEN 5	44500	ADICKS 5	45600	345	N	Y	N
P_H_R_ 5	42000	OASIS_5	43035	345	N	N	N
ROANS PR	40600	KUYDAL 5	45972	345	N	Y	N
SANDYCRK	3399	LCRK LS	3402	345	Y	Y	Y
SGVL SS	2433	FORNEY	2437	345	Y	N	Y
SKYLINE	5371	SPRUCE	5400	345	Y	N	Y
SKYLINE	5371	MARION34	7044	345	Y	Y	Y
SPRUCE	5400	PAWNESW6	5725	345	Y	N	Y
STRYKER	3109	LUFKN SS	3117	345	N	Y	N
SWEETWTR	1420	GRAHAM	1430	345	N	N	N
T HOUSE	3405	ELM MOTT	3406	345	N	Y	N
T HOUSE	3405	LAKE CRK	3409	345	N	Y	N

T HOUSE	3405	TEMP PEC	3412	345	N	Y	N
T_H_W_ 5	45500	ADICKS 5	45600	345	Y	N	Y
TEMP PEC	3412	TEMP SS	3414	345	Y	N	Y
Zenith	44900	T_H_W_ 5	45500	345	Y	N	Y
Zenith	44900	T_H_W_ 5	45500	345	Y	N	Y
TOMBAL 5	46500	Singleton	46000	345	N	Y	N
TRICORN	2432	TRINDAD2	3124	345	N	N	N
TRINDAD2	3124	RICHLND2	3134	345	Y	Y	Y
TWBT7	6009	TWBT4STR	6012	345	Y	N	Y
VENUS N	1907	T HOUSE	3405	345	N	Y	N
WILLOWCK	1421	PARKER	1436	345	Y	N	Y
Zenith	44900	Singleton	46000	345	N	Y	N
Zenith	44900	Singleton	46000	345	Y	Y	Y
Zenith	44900	T_H_W_ 5	45500	345	N	Y	N
Zenith	44900	T_H_W_ 5	45500	345	N	Y	N
ZORN 34	7042	HAYSN 34	7043	345	Y	N	Y
ZORN 34	7042	HAYSN 34	7043	345	Y	N	Y
ABILNW14	6228	CALHNTP	6229	138	N	Y	N
AGNESSW	511	WTHFRD	1592	138	Y	N	Y
AIRLIN 8	45630	WHITOKN8	46610	138	N	Y	N
ALAZAN 4	8515	SHARPE4	85002	138	Y	N	Y
AUSTIN-2	5006	KIRBY-2	5249	138	N	Y	N
AUSTIN	5005	AUSTIN-2	5006	138	Y	N	Y
BALL PRK	5011	FERN	5147	138	N	N	N
BALNGR 4	6340	IVEYPTP4	6360	138	Y	N	Y
BASTCI13	7322	WEBBER13	7329	138	N	Y	N
BAYTWN 8	40170	CBAYTWN8	40171	138	N	Y	N
BLF CRK	6216	ABSOUTH4	6260	138	Y	Y	Y
BRAUNIG	5025	HIGHLAND	5205	138	Y	N	Y
BRY E C	962	GIBCRK C	964	138	Y	N	Y
CAGNON	5055	MARBACH	5295	138	Y	N	Y
CEDARW	40015	CBAYTWN8	40171	138	Y	Y	Y
CICO 13	7151	COMFOR13	7155	138	Y	Y	Y
CMCHE SS	1441	CMCHE T	1650	138	N	N	N
COLETO 4	8162	COLETSTR	8168	138	N	Y	N
COLETAP4	6347	IVEYPTP4	6360	138	N	N	N
CUSHING	3299	CUSH SE	3300	138	N	N	N
DAVIS 4	8458	ALAZAN 4	8515	138	N	N	N
DECKER	40430	CAPEDUM1	40431	138	Y	N	Y
DECKER	40430	EXXON_	40570	138	Y	N	Y
DEPORT	1768	PARISE T	1769	138	N	N	N
DEPORT	1768	RCST	1780	138	N	N	N
EAGLE MT	1860	BLUE MD1	2071	138	N	Y	N
EAGLE MT	1860	EMCS	2065	138	N	N	N
EAGLE MT	1860	ROSEN 2T	2067	138	Y	Y	Y
EDGCLF 2	2191	ROGERS 2	2193	138	Y	Y	Y
EDNBRG 4	8380	EDNBRSTR	8384	138	Y	N	Y
ELSA 4	8360	MVADRHD2	8754	138	N	N	N

EMORY	3170	EMORY N	3171	138	N	N	N
FIVE PTS	5150	WESTSIDE	5490	138	Y	N	Y
FONDRN 8	47100	WESTWD 8	47462	138	Y	Y	Y
FRATT	5165	PARKWA13	7611	138	N	N	N
FREMAN 8	45770	HOCKLY 8	45880	138	N	Y	N
FRONT	8980	PLMHSTT2	80108	138	Y	N	Y
GARFIELD	9071	ONION CK	9251	138	Y	N	Y
HENNE 13	7172	COMAL 13	7176	138	Y	N	Y
HILLCTYE	5209	LASIERRA	5257	138	N	N	N
HOCKLY 8	45880	TOMBALT8	46511	138	N	N	N
IRONBR T	3168	EMORY	3170	138	Y	N	Y
JEFFERSN	41240	CS_CHAN8	41371	138	Y	N	Y
JENETA 8	47310	WESTWD 8	47462	138	N	Y	N
KENDCT13	7147	KENDAL13	7152	138	N	Y	N
KENDCT13	7147	MOUNTO13	7148	138	N	Y	N
LIBERTY	1723	EMORY N	3171	138	N	N	N
LNHILL 4	8452	KINGSVL4	8518	138	N	N	N
LOLITA 4	8125	FORMOSA4	8126	138	N	Y	N
MARION13	7178	SHERPO13	7460	138	N	Y	N
MASON4	6390	GILLES13	7132	138	N	Y	N
MOORE138	5827	PRS1388	5895	138	Y	N	Y
OLNEY	787	RICE	1477	138	Y	N	Y
POLK 1T	3018	S OKCF 1	3023	138	Y	N	Y
RCST	1780	TALCOPOD	1793	138	N	N	N
S_CHAN 8	41370	SHELL_	41450	138	Y	N	Y
SPRABERY	1329	CRMWD7 T	1337	138	Y	N	Y
T_H_W_D8	45512	GEARS 8	45782	138	Y	N	Y
TYLER E	3211	TYLR OMN	3212	138	Y	N	Y
VERDCR13	7146	BANDER13	7438	138	N	Y	N
WESLCSW4	8354	MV.WESL4	8768	138	Y	N	Y
WIRTZ 13	7104	FLATRO13	7111	138	N	N	N
WORMSR 4	8295	S.NINO 4	8653	138	N	Y	N
ZAPATA 4	8299	YGNACIO	8985	138	Y	N	Y
ADICKS 5	45600	ADICKS 8	45610	Auto	N	N	N
AUSTRO13	7328	AUSTROP	9040	Auto	N	Y	N
AUSTRO13	7328	AUSTROP	9040	Auto	N	Y	N
BELAIRN8	47010	BELAIR 5	47000	Auto	N	Y	N
CLT NW	2361	CLT NW T	2360	Auto	N	N	N
COLETO 6	8164	COLETSTR	8168	Auto	N	Y	N
CONCORD	393	CONCORD	394	Auto	N	Y	N
HILL CTY	5211	HILLCTYE	5209	Auto	Y	N	Y
KENDALL	67663	KENDAL34	7046	Auto	Y	Y	Y
KENDALL	67663	KENDAL34	7046	Auto	Y	Y	Y
KENDAL34	7046	KENDAL13	7152	Auto	N	Y	N
KENDAL34	7046	KENDAL13	7150	Auto	N	Y	N
KIOWAV	67655	VALLEY	1690	Auto	Y	Y	Y
MOSES-T	1696	MOSES	1795	Auto	N	N	N
OBRIEN 5	44500	OBRIEN 8	44510	Auto	Y	Y	Y

OBRIEN 5	44500	OBRIEN 8	44510	Auto	N	Y	N
SKYLINE	5371	SKYLIN-N	5369	Auto	N	Y	N
T_H_W_ 5	45500	T_H_W_W8	45515	Auto	N	Y	N
T_H_W_ 5	45500	T_H_W_E8	45510	Auto	N	N	N
TURKEY	67658	TURKEY3	63453	Auto	N	Y	N
TURKEY	67658	TURKEY3	63453	Auto	Y	Y	Y
TURKEY	67658	TURKEY3	63453	Auto	Y	N	Y