

## A TEXAS CASE STUDY:

---

*The effect of retail competition on the electric utility industry*

April 2017



# Contents

Executive Summary .....	ii
Introduction.....	1
Competition in the Texas Electric Power Market.....	2
Historical Overview .....	2
Current Status.....	2
Development of the Retail Electric Provider Industry.....	4
Growth in the Number of Establishments.....	4
Wage Improvement .....	4
Employment Growth .....	5
Synopsis .....	5
Economic Benefits of Retail Electric Providers.....	6
Total Industry Impact.....	6
Net Effects .....	6
Houston’s Retail Electric Utility Industry.....	9
Conclusion.....	13
Appendix A: About The Perryman Group .....	15
Appendix B: Methods Used .....	16
Texas Econometric Model.....	16
Overview .....	16
Model Logic and Structure .....	16
Model Simulation and Multi-Regional Structure .....	19
The Final Forecast .....	20
US Multi-Regional Impact Assessment System.....	21
Appendix C: Detailed Sectoral Results.....	25
Texas Effects.....	25
Houston Area Effects .....	27

## Executive Summary

- The **benefits of retail electric competition have been significant for the economy of Texas**, with better pricing and customer choice, as well as numerous innovations to meet consumer needs. In addition to these benefits (which are beyond the scope of this study), a new industry, retail electric providers,<sup>1</sup> has developed and is generating its own economic benefits.
- Since the introduction of competition, the **electric power distribution industry<sup>2</sup> has experienced significant growth in Texas**.
  - The number of establishments<sup>3</sup> (locations) providing distribution services in Texas increased from 180 in 2004 to 471 in 2015, which represents a growth rate of **161.7%**.
  - There are now well over 100 retail electric providers active in the state.
  - Average annual **wages** in the industry have increased dramatically and have surpassed those of the United States.
  - Overall employment in the larger electric utility sector<sup>4</sup> has declined by about 11% in the remainder of the United States since 2001, while growing in Texas. Specifically with regard to distribution, the rest of the country has seen growth since 2001 of 48.5%, while Texas saw expansion of **425.9%**.
- The Perryman Group estimates that operations of competitive retail electric providers in **Texas generate more than 16,800 ongoing jobs over and above what would be required for distribution under a regulated framework**. This activity adds significant value to consumers.
- In addition, the economic stimulus provided by the industry generates multiplier effects throughout the economy. When multiplier effects are included, retail electric

---

<sup>1</sup> The Public Utility Commission of Texas defines a retail electric provider as an entity that “sells electric energy to retail customers in the areas of Texas where the sale of electricity is open to retail competition. A REP buys wholesale electricity, delivery service, and related services, prices electricity for customers, and seeks customers to buy electricity at retail.”

<sup>2</sup> The Perryman Group used the North American Industry Classification System (NAICS, the standard used by Federal statistical agencies in classifying business establishments) industry 221122 - Electric power distribution, which the US Census Bureau defines as comprising “electric power establishments primarily engaged in either (1) operating electric power distribution systems (i.e., consisting of lines, poles, meters, and wiring) or (2) operating as electric power brokers or agents that arrange the sale of electricity via power distribution systems operated by others.”

<sup>3</sup> The US Bureau of Labor Statistics defines an establishment as “the physical location of a certain economic activity—for example, a factory, mine, store, or office. A single establishment generally produces a single good or provides a single service. An enterprise (a private firm, government, or nonprofit organization) can consist of a single establishment or multiple establishments.

<sup>4</sup> The electric utility sector includes electric power generation, transmission, and distribution.

competition and retail electric providers lead to almost **\$13.0 billion** in gross product per year as well as nearly **66,500** permanent jobs in Texas.

- The net annual impact (including multiplier effects) after adjusting for the shift from regulated utilities to the competitive retail electric providers following the introduction of the retail market is nearly **\$8.3 billion** in gross product and more than **42,320** permanent jobs in Texas.
- The fiscal effects of retail competition are also noteworthy; the State government enjoys annual revenues of about **\$327.6 million**, while various local governments see about **\$113.3 million** in yearly resources.
- These benefits are summarized in the table below.

Summary of Economic and Fiscal Benefits to Texas of Competition in the Retail Electric Power Industry*		
<b>Industry Growth Indicators</b>		
Businesses (Growth in number of establishments: 2004-15)		Up 161.7%
Employment (Growth in employment in electric distribution 2001-15)		Up 425.9%
Annual Wages (Growth in average annual wages 2001-15)		Up 130.4%
Incremental Direct Jobs due to Competition (The Perryman Group's estimate of ongoing Texas jobs in the retail electric power industry over and above what would be required under a regulated environment)		16,800
<b>Total Economic Benefits of Operations of Retail Electric Providers (Including Multiplier Effects)</b>		
	<b>Total Effect</b>	<b>Net Effect</b>
Annual Total Expenditures	\$46.933 billion	\$29.873 billion
Annual Gross Product	\$12.977 billion	\$8.260 billion
Annual Personal Income	\$6.425 billion	\$4.089 billion
Employment	66,491 jobs	42,322 jobs
<b>Annual Fiscal Benefits</b>		
State	\$413.7 million	\$327.6 million
Local Government Entities (Counties, Cities, and School Districts)	\$143.1 million	\$113.3 million
<p>*Economic benefits including multiplier effects are total annual impacts. Does not include the economic effects of lower electric power prices, greater innovation, and other benefits of the competitive market. Net impacts are adjusted for the conversion from regulated utilities to competitive retail electric providers following the introduction of the retail market. Fiscal benefits are based on net economic effects scenario. Dollar values are expressed in constant (2016) dollars. More detail is provided in the Appendices to this report. SOURCE: The Perryman Group</p>		

- The Perryman Group also specifically examined the Houston area and its emergence as a major center for the retail electric power market segment.
  - The number of **electric power distribution establishments** in the Houston-The Woodlands-Sugar Land Metropolitan Statistical Area (MSA) was 38 in 2004 and 107 in 2015, an increase of **181.6%** over the period.
  - The Houston area has experienced an increase in **wages** in the electric power distribution industry of **966.7%** since 2001.
  - For the **Houston-The Woodlands-Sugar Land MSA**, the operations of competitive retail electric providers contribute more than **6,600 direct jobs**.
  - When multiplier effects are considered, the total impact estimated at almost **\$4.9 billion** in gross product and more than **23,350 jobs**. (Results for Texas include those within the Houston area.)
  - The net annual impact (including multiplier effects) after adjusting for the shift from regulated utilities to the competitive retail electric providers following the introduction of the retail market is more than **\$3.8 billion** in gross product and some **18,490 jobs**.
  - The local governments in the greater Houston area experience gains of about **\$50.2 million** per annum.
- Clearly, **the introduction of competition and the resulting operations of retail electric providers has led to significant benefits to the Texas economy.**

## Introduction

About 15 years ago, competition was introduced into the retail electric power market in Texas.<sup>5</sup> Since that time, a healthy electric market has developed. Now, retail electric providers offer hundreds of plans to meet the needs of residential, commercial, and industrial customers.

The benefits of competition have been significant for the economy of Texas, with better pricing and customer choice than would exist without competition, as well as numerous innovations to meet consumer needs. In addition, a new industry, retail electric providers, has developed and is generating its own economic benefits.

The Perryman Group (TPG) was recently asked to assess the effects of competition on the electric utility industry and measure the economic benefits associated with the operations of retail electric providers. This report presents the results of TPG's analysis.

---

<sup>5</sup> Only the Electric Reliability Council of Texas (ERCOT) region is open to retail competition; some portions of the state are not yet open to competition. The ERCOT region accounts for approximately 90% of the state's electric load.

## Competition in the Texas Electric Power Market

A brief historical overview and current status of competition in the electric power market in Texas are presented as a framework for this analysis.

### *Historical Overview*

---

In 1999, the passage of Senate Bill 7 by the 76<sup>th</sup> Texas Legislature opened the vast majority of the Texas retail electricity market to competition beginning in 2002. Prior to the bill's passage, the electric power market in Texas was regulated, with rates set by the Public Utility Commission of Texas (PUCT) to cover utility operating and investment costs as well as some level of profit.

After the passage of Senate Bill 7, the formerly vertically integrated utilities were required to separate their business into power generation companies, transmission and distribution utilities, and retail electric providers (REPs). The introduction of competition in retail electric power in Texas was carefully managed to allow time for a market to develop, with numerous companies entering the market offering a spectrum of options for consumers.

### *Current Status*

---

There are currently more than 100 retail electric providers offering more than 400 unique electric plans in Texas.<sup>6</sup> With the abundance of companies and plan choices, Texas widely recognized as one of the most competitive retail electricity markets in the United States.

The Annual Baseline Assessment of Choice in Canada and the United States (ABACCUS) has scored US states and Canadian provinces with respect to their efforts and achievements in the promotion of retail competition in the electric sector since 2007. Texas has been the competitive retail electricity market leader in the US and Canada for eight consecutive years.<sup>7</sup>

---

<sup>6</sup> Scope of Competition in Electric Markets in Texas, Report to the 85<sup>th</sup> Texas Legislature, Public Utility Commission of Texas, January 2017.

<sup>7</sup> Annual Baseline Assessment of Choice in Canada and the United States 2015, Distributed by Energy Financial Group, LLC, July 2015. Available at [www.energychoicematters.com/stories/ABACCUS2015.pdf](http://www.energychoicematters.com/stories/ABACCUS2015.pdf).  
(footnote continued)

In addition, common measures of the level of industry competition indicate a vibrant market. The Texas retail electricity market has a Herfindahl-Hirshman Index (HHI—a widely used indicator of market concentration) of 440, indicating a high level of competition with low market concentration.<sup>8</sup>

Consumer behavior provides yet more evidence of the health of competition. Since the beginning of retail competition in 2002, 92% of eligible residential customers have made at least one change in their electric provider.<sup>9</sup>

All of these indicators point to the fact that the Texas retail electricity market in Texas has become highly competitive.<sup>10</sup>

---

<sup>8</sup> Pointing, Stephen, A look at the world's most competitive retail electricity market, Lexology, August 20, 2015, <http://www.lexology.com/library/detail.aspx?g=9ad49e03-e782-4550-935a-32355d3ac5ca>.

<sup>9</sup> Supplemental Information Retail Electric Market, ERCOT, February 2016 – February 2017, [http://www.ercot.com/content/wcm/key\\_documents\\_lists/89277/Observed\\_Selection\\_of\\_Electric\\_Providers\\_February\\_2017.ppt.pptx](http://www.ercot.com/content/wcm/key_documents_lists/89277/Observed_Selection_of_Electric_Providers_February_2017.ppt.pptx).

<sup>10</sup> The transmission and distribution segments of the market remain regulated, but generation and the retail electric power market are not. Generation companies and retail electric providers are still required to be registered and/or certified by the PUCT.



## Development of the Retail Electric Provider Industry

The introduction of competition in the electric power market in Texas led to substantial changes in the industry structure. Among these was the development of retail electric providers. Over the years since competition was introduced, the number of businesses in the industry has grown substantially and wages have improved. These topics are explored in further detail below.

### *Growth in the Number of Establishments*

---

Since the introduction of competition, the number of establishments (locations) in electric power distribution (NAICS<sup>11</sup> 221122, which includes retail electric providers) has expanded substantially in Texas. According to data maintained by the US Bureau of Labor Statistics,<sup>12</sup> the number of private establishments in electric power distribution in the United States grew from 3,634 in 2004 to 5,062 in 2015, an increase of 39.3% over the period. In Texas, the number of establishments expanded from 180 in 2004 to 471 in 2015, which represents a growth rate of 161.7%. Many of these locations represent the offices of retail electric providers,

### *Wage Improvement*

---

**Since the retail electric market in Texas was opened to competition, average annual wages in the electric power distribution industry have increased dramatically and have surpassed those of the United States.** In 2001, the average annual pay in Texas was about \$42,600 compared to \$61,300 for the nation as a whole. By 2003, the year after electric competition began in Texas, the average annual pay in electric power distribution in Texas had risen to \$61,100, a 43.4% increase. In the United States, the average annual wage in the industry in 2003 was just under \$66,000, and had risen only 7.6% over the time period. By 2006, the average annual Texas wage in the industry had surpassed the US level, and by 2007, it was significantly higher at **\$86,350 in Texas** versus \$74,400 in the United States.<sup>13</sup> More recently, the wage gap between Texas and

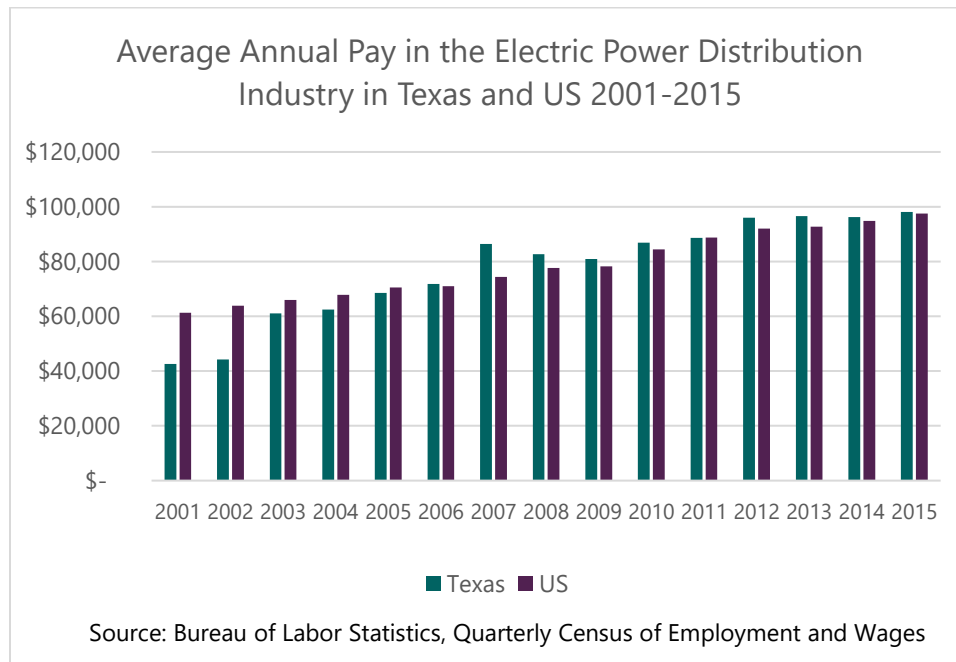
---

<sup>11</sup> The US Census Bureau defines the North American Industry Classification System (NAICS) as the standard used by Federal statistical agencies in classifying business establishments for the purpose of collecting, analyzing, and publishing statistical data related to the US business economy.

<sup>12</sup> United States Department of Labor, Bureau of Labor Statistics, Quarterly Census of Employment and Wages.

<sup>13</sup> United States Department of Labor, Bureau of Labor Statistics, Quarterly Census of Employment and Wages.

the United States has narrowed, but the introduction of competition to the retail electric market in Texas has led to a significant increase in annual pay for Texas workers in the industry.



## Employment Growth

Electric competition has led to notable positive effects in terms of jobs as well. Since 2001, the overall employment in the electric utility sector has declined by about 11% in the remainder of the United States, while growing in Texas. Specifically with regard to distribution, the rest of the country has seen growth since 2001 of 48.5%. Over the same period, Texas saw expansion of 425.9%; in other words, growth in the state was 8.8 times that of the nation.<sup>14</sup>

## Synopsis

Clearly, since the advent of retail competition in Texas, retail electric providers have become a major force in the Texas economy. Establishments have increased impressively, while jobs and salaries have seen notable gains.

<sup>14</sup> United States Department of Labor, Bureau of Labor Statistics, Quarterly Census of Employment and Wages; United States Department of Commerce, Census Bureau, County Business Patterns; The Perryman Group.

## Economic Benefits of Retail Electric Providers

As noted, a competitive market leads to economic benefits across the economy such as greater consumer choice and better pricing compared to the regulated situation. (These substantial benefits are beyond the scope of this study.) In addition, it has allowed for the development of the retail electric provider industry.

The Perryman Group measured the total economic benefits (including multiplier effects) for

- the total current industry impact of retail electric provider operations as a whole, and
- the net industry effects adjusted for the employment effects of the conversion from the regulated environment in order to reflect the incremental benefits of competition.

The methods used are briefly described on page 12, with additional detail in the Appendices.

### *Total Industry Impact*

---

The operations of competitive retail electric providers in Texas generate more than 16,800 ongoing jobs over and above the level that would be required for distribution under a regulated framework. This activity adds significant value to consumers and provides Texas with additional high-paying jobs.

These additional jobs also involve multiplier effects through the economy. When multiplier effects are included, retail electric competition leads to almost **\$13.0 billion** in gross product per year as well as nearly **66,500** permanent jobs.

### *Net Effects*

---

In order to isolate the economic benefits of the introduction of competition to the retail electric power market, The Perryman Group adjusted the overall economic benefits of current operations of retail electric providers to reflect the shift in jobs relative to the prior regulated environment. This analysis provides an estimate of the “net” benefits associated with competition.

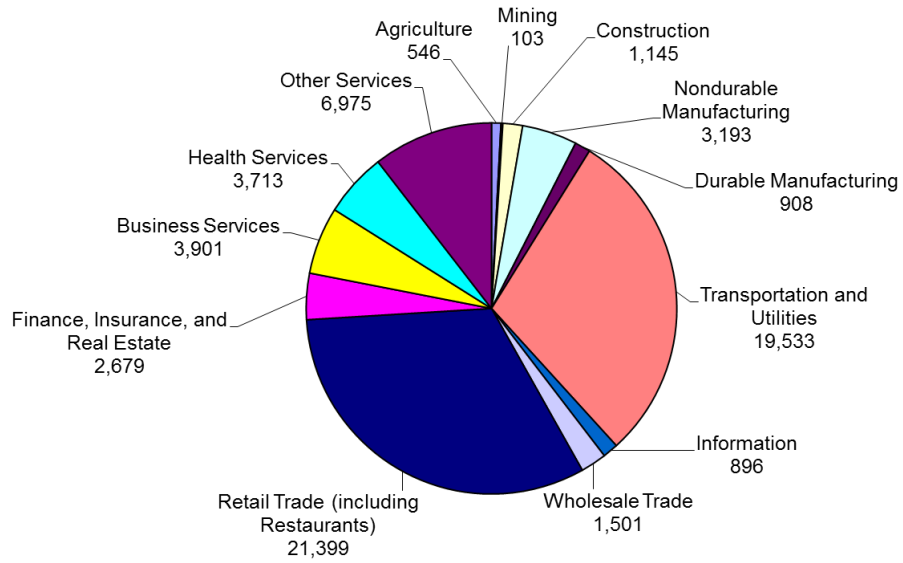
The net annual impact (including multiplier effects) after adjusting for the shift from regulated utilities to the competitive retail electric providers following the introduction of the retail market is nearly **\$8.3 billion** in gross product and more than **42,320** permanent jobs in Texas.

The **net fiscal effects** of retail competition are also worthy of note. The State government enjoys annual revenues of about **\$327.6 million**, while various local governments see about **\$113.3 million** in yearly resources.

The Economic Benefits (including Multiplier Effects) of Operations of Competitive Retail Electric Providers on Business Activity in Texas*		
(Monetary Values in Billions of 2016 Dollars)		
	Total Effect	Net Effect
Total Expenditures	\$46.933	\$29.873
Gross Product	\$12.977	\$8.260
Personal Income	\$6.425	\$4.089
Employment (Permanent Jobs)	66,491	42,322
<p>*Total annual economic effects when multiplier effects are considered. Does not include the economic effects of lower electric power prices, greater innovation, and other benefits of the competitive market. Net impacts are adjusted for the shift from regulated utilities to competitive retail electric providers following the introduction of the retail market. Values are expressed in constant (2016) dollars. More detail is provided in the Appendices to this report.</p> <p>SOURCE: The Perryman Group</p>		

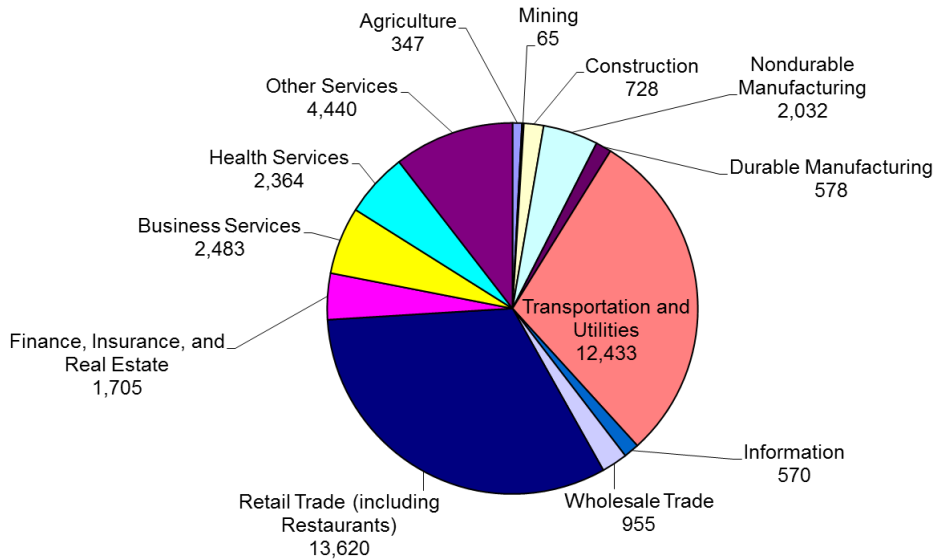
These economic benefits involve all industry sectors, as noted in the graphs below (with further detail in the Appendices).

**Total Impact (including Multiplier Effects) of Operations of Competitive Retail Electric Providers on Employment by Industry in Texas**



SOURCE: US Multi-Regional Impact Assessment System, The Perryman Group

**Impact (including Multiplier Effects) of Operations of Competitive Retail Electric Providers on Employment by Industry in Texas Adjusted for the Shift from Regulated Utilities**



SOURCE: US Multi-Regional Impact Assessment System, The Perryman Group

## Houston's Retail Electric Utility Industry

The **Houston area has emerged as a major center** of the retail electric market segment, expanding even faster than the state as a whole. The number of electric power distribution establishments in the Houston-The Woodlands-Sugar Land Metropolitan Statistical Area (MSA--Austin, Brazoria, Chambers, Fort Bend, Galveston, Harris, Liberty, Montgomery, and Waller Counties) was 38 in 2004 and 107 in 2015, an increase of **181.6%** over the period. Moreover, of the 109 REPs operating in Texas, over 50% provide plans in the Centerpoint transmission region (the Houston area). In addition, there are **eight distribution operations in the Houston area with more than 250 employees, representing one-half of all large operations in the state.**<sup>15</sup>

In addition, the Houston area has experienced an increase in employment in the electric distribution industry of **966.7% since 2001. The Houston-area rate of employments gain was 19.9 times the national average.**<sup>16</sup>

For the Houston-The Woodlands-Sugar Land MSA, The Perryman Group estimates that the total industry effects of operations of competitive retail electric providers contribute more than 6,600 direct jobs.

The total impact (including multiplier effects) estimated to be almost **\$4.9 billion** in gross product and more than **23,350 jobs**. (Results for Texas previously described include those within the Houston area.)

When adjusted for the conversion from a regulated industry environment, the net annual impact is more than **\$3.8 billion** in gross product and some **18,490 jobs**. (Again, Texas results include effects within the Houston area.)

---

<sup>15</sup> Scope of Competition in Electric Markets in Texas, Report to the 85<sup>th</sup> Texas Legislature, Public Utility Commission of Texas, January 2017.

<sup>16</sup> United States Department of Labor, Bureau of Labor Statistics, Quarterly Census of Employment and Wages; United States Department of Commerce, Census Bureau, County Business Patterns; The Perryman Group.

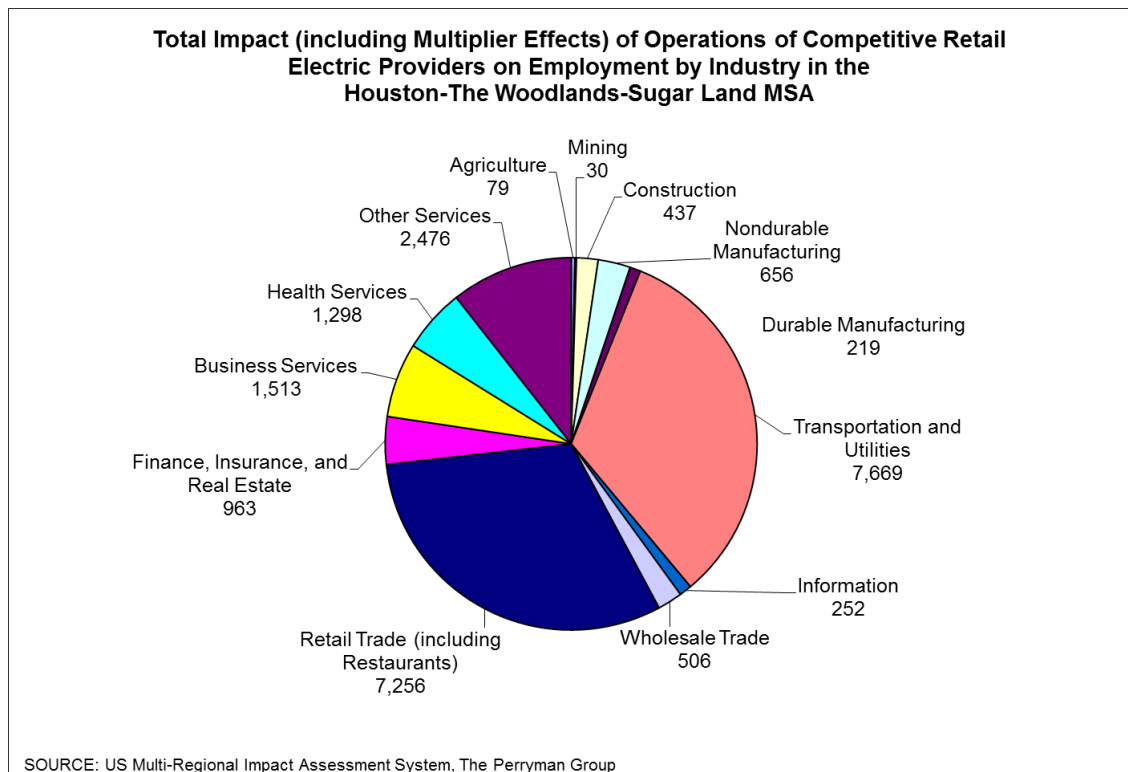
**The Economic Benefits (including Multiplier Effects) of Operations of Competitive Retail Electric Providers on Business Activity in the Houston Area Adjusted for the Shift from Regulated Utilities\***  
(Monetary Values in Billions of 2016 Dollars)

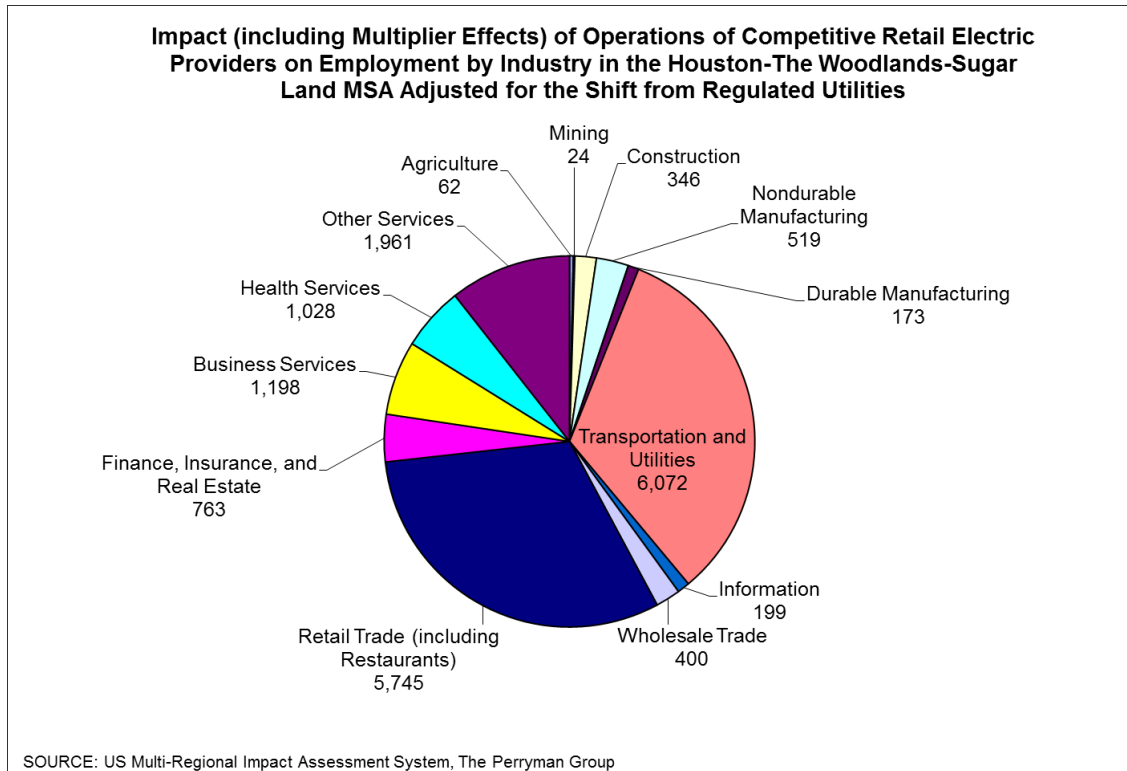
	<b>Total Effect</b>	<b>Net Effect</b>
Total Expenditures	\$17.920	\$14.188
Gross Product	\$4.681	\$3.849
Personal Income	\$2.387	\$1.890
Employment (Permanent Jobs)	23,353	18,490

\* Total annual economic effects when multiplier effects are considered. Net impacts are adjusted for the shift from regulated utilities to competitive retail electric providers following the introduction of the retail market. Values are expressed in constant (2016) dollars. The "Houston Area" is the Houston-The Woodlands-Sugar Land Metropolitan Statistical Area (MSA--Austin, Brazoria, Chambers, Fort Bend, Galveston, Harris, Liberty, Montgomery, and Waller Counties). Results for Texas previously described include these effects within the Houston Area. More detail is provided in the Appendices to this report.

SOURCE: The Perryman Group

Effects by industry are depicted in the following graphics, with additional detail in the Appendices to this report.





The local governments in the greater Houston area experience gains of about **\$50.2 million** per annum due to development of the retail electric provider industry.



## Measuring Economic and Fiscal Impacts

Any economic stimulus, whether positive or negative, generates multiplier effects throughout the economy. In this instance, the direct effects were estimated based on patterns in employment and establishments in the electric power distribution industry.

Once the direct effects were quantified, the associated multiplier or spinoff activity was measured using The Perryman Group's input-output assessment model (the US Multi-Regional Impact Assessment System, which is described in further detail in the Appendices to this report) developed by the firm more than 30 years ago and consistently maintained and updated since that time. The model has been used in hundreds of analyses for clients ranging from major corporations to government agencies. It uses a variety of data (from surveys, industry information, and other sources) to describe the various goods and services (known as resources or inputs) required to produce another good/service. This process allows for estimation of the total economic impact (including multiplier effects) of the direct stimulus resulting from the development of the retail electric provider industry. The models used in the current analysis reflect the specific industrial composition and characteristics of the Texas and Houston-The Woodlands-Sugar Land economies.

These total economic effects are quantified for key measures of business activity:

- **Total expenditures** (or total spending) measure the dollars changing hands as a result of the economic stimulus.
- **Gross product** (or output) is production of goods and services that will come about in each area as a result of the activity. This measure is parallel to the gross domestic product numbers commonly reported by various media outlets and is a subset of total expenditures.
- **Personal income** is dollars that end up in the hands of people in the area; the vast majority of this aggregate derives from the earnings of employees, but payments such as interest and rents are also included.
- **Job gains** are expressed as permanent jobs because the study is evaluating ongoing effects.

Increases in economic activity generate additional fiscal revenues such as retail sales taxes, income tax, property tax, franchise tax, and other levies. The Perryman Group has developed a model linking increases in economic activity to incremental taxes; in this case, the fiscal benefits were measured for (1) the state of Texas and (2) local government entities as a group (cities, counties, school districts, and special districts). Monetary values were quantified on a constant (2016) basis. See the Appendices to this report for additional information regarding the methods and assumptions used in this analysis.

## Conclusion

The introduction of competition in the Texas power market not only provided economic benefits in terms of pricing, innovation, and consumer choice, but also led to the development of retail electric provider businesses. These firms provide quality jobs for thousands of Texans. In addition, the conversion from a regulated environment to one of competition resulted in a significant increase in industry wages.

The Perryman Group measured the total economic benefits of operations of retail electric providers and found that they generate almost **\$13.0 billion** in gross product per year as well as nearly **66,500** permanent jobs (including multiplier effects) in Texas. In order to isolate the effects of the introduction of competition, The Perryman Group also measured the “net” annual impact (including multiplier effects) by adjusting for the shift from regulated utilities. The net impact of retail electric providers was found to be nearly **\$8.3 billion** in gross product and more than **42,320** permanent jobs in Texas.

In the Houston area, the total economic benefits of retail electric provider operations lead to gains of almost **\$4.9 billion** in gross product and more than **23,350** jobs (including multiplier effects), while the net impact includes an estimated **\$3.8 billion** in gross product and some **18,490** jobs.

Clearly, the introduction of competition and the resulting operations of retail electric providers has led to significant benefits to the Texas economy.

# Appendices



## Appendix A: About The Perryman Group

The Perryman Group (TPG) is an economic research and analysis firm based in Waco, Texas. The firm has more than 30 years of experience in assessing the economic impact of corporate expansions, regulatory changes, real estate developments, public policy initiatives, and myriad other factors affecting business activity. TPG has conducted hundreds of impact analyses for local areas, regions, and states throughout the United States. Impact studies have been performed for hundreds of clients including many of the largest corporations in the world, governmental entities at all levels, educational institutions, major health care systems, utilities, and economic development organizations.

Dr. M. Ray Perryman, founder and President of the firm, developed the US Multi-Regional Impact Assessment System (USMRIAS—used in this study) in the early 1980s and has consistently maintained, expanded, and updated it since that time. The model has been used in hundreds of diverse applications and has an excellent reputation for reliability. The Perryman Group has analyzed the economic and fiscal aspects of a broad range of corporate locations, infrastructure projects, mixed-use real estate developments, and regulatory changes.

The firm also has extensive expertise in analysis of the electric power industry and has performed numerous studies including, among others, rate analysis, impact assessments of potential additions to generation capacity (gas, wind, coal, and nuclear) and transmission infrastructure, demand forecasts, price forecasts, fuel diversity analysis, usage analysis, and major policy studies. In particular, TPG has analyzed the effects of competition in the electric power industry on multiple occasions, including major studies before, during, and after the introduction of competition in Texas and played a key role in the introduction of wholesale and retail competition into the state. Dr. M. Ray Perryman, founder and president of the firm, has testified before the US Department of Energy, the US Department of Agriculture, the Public Utility Commission of Texas, the Oklahoma Corporation Commission, the Texas Railroad Commission, the Texas Legislature (House and Senate), and numerous other legislative and regulatory bodies on electric industry matters. He has also spoken to major industry conferences on dozens of occasions.

## Appendix B: Methods Used

### *Texas Econometric Model*

---

#### Overview

The Texas Econometric Model was developed by Dr. M. Ray Perryman, President and CEO of The Perryman Group (TPG), more than 30 years ago and has been consistently maintained, expanded, and updated since that time. It is formulated in an internally consistent manner and is designed to permit the integration of relevant global, national, state, and local factors into the projection process. It is the result of more than three decades of continuing research in econometrics, economic theory, statistical methods, and key policy issues and behavioral patterns, as well as intensive, ongoing study of all aspects of the global, US, Texas, and Texas metropolitan area economies. It is extensively used by scores of federal and State governmental entities on an ongoing basis, as well as hundreds of major corporations. It is employed in the current analysis to simulate the expected performance of the electric power sector in the absence of retail electric competition.

This section describes the forecasting process in a comprehensive manner, focusing on both the modeling and the supplemental analysis. The overall methodology, while certainly not ensuring perfect foresight, permits an enormous body of relevant information to impact the economic outlook in a systematic manner.

#### Model Logic and Structure

The Texas Econometric Model revolves around a core system which projects output (real and nominal), income (real and nominal), and employment by industry in a simultaneous manner. For purposes of illustration, it is useful to initially consider the employment functions. Essentially, employment within the system is a derived demand relationship obtained from a neo-Classical production function. The expressions are augmented to include dynamic temporal adjustments to changes in relative factor input costs, output and (implicitly) productivity, and technological progress over time. Thus, the typical equation includes output, the relative real cost of labor and capital, dynamic lag structures, and a technological adjustment parameter. The functional form is logarithmic, thus preserving the theoretical consistency with the neo-Classical formulation.

The income segment of the model is divided into wage and non-wage components. The wage equations, like their employment counterparts, are individually estimated at the 3-digit North American Industry Classification System (NAICS) level of aggregation. Hence, income by place of work is measured for approximately 90 production categories. The wage equations measure real compensation, with the form of the variable structure differing between “basic” and “non-basic.”

The basic industries, comprised primarily of the various components of Mining, Agriculture, and Manufacturing, are export-oriented, i.e., they bring external dollars into the area and form the core of the economy. The production of these sectors typically flows into national and international markets; hence, the labor markets are influenced by conditions in areas beyond the borders of the particular region. Thus, real (inflation-adjusted) wages in the basic industry are expressed as a function of the corresponding national rates, as well as measures of local labor market conditions (the reciprocal of the unemployment rate), dynamic adjustment parameters, and ongoing trends.

The “non-basic” sectors are somewhat different in nature, as the strength of their labor markets is linked to the health of the local export sectors. Consequently, wages in these industries are related to those in the basic segment of the economy. The relationship also includes the local labor market measures contained in the basic wage equations.

Note that compensation rates in the export or “basic” sectors provide a key element of the interaction of the regional economies with national and international market phenomena, while the “non-basic” or local industries are strongly impacted by area production levels. Given the wage and employment equations, multiplicative identities in each industry provide expressions for total compensation; these totals may then be aggregated to determine aggregate wage and salary income. Simple linkage equations are then estimated for the calculation of personal income by place of work.

The non-labor aspects of personal income are modeled at the regional level using straightforward empirical expressions relating to national performance, dynamic responses, and evolving temporal patterns. In some instances (such as dividends, rents, and others) national variables (for example, interest rates) directly enter the forecasting system. These factors have numerous other implicit linkages into the system resulting from their simultaneous interaction with other phenomena in national and international markets which are explicitly included in various expressions.

The output or gross area product expressions are also developed at the 3-digit NAICS level. Regional output for basic industries is linked to national performance in the relevant industries, local and national production in key related sectors, relative area and national labor costs in the industry, dynamic adjustment parameters, and ongoing changes in industrial interrelationships (driven by technological changes in production processes).

Output in the non-basic sectors is modeled as a function of basic production levels, output in related local support industries (if applicable), dynamic temporal adjustments, and ongoing patterns. The inter-industry linkages are obtained from the input-output (impact assessment) system which is part of the overall integrated modeling structure maintained by The Perryman Group. Note that the dominant component of the econometric system involves the simultaneous estimation and projection of output (real and nominal), income (real and nominal), and employment at a disaggregated industrial level. This process, of necessity, also produces projections of regional price deflators by industry. These values are affected by both national pricing patterns and local cost variations and permit changes in prices to impact other aspects of economic behavior. Income is converted from real to nominal terms using Texas Consumer Price Index, which fluctuates in response to national pricing patterns and unique local phenomena.

Several other components of the model are critical to the forecasting process. The demographic module includes (1) a linkage equation between wage and salary (establishment) employment and household employment, (2) a labor force participation rate function, and (3) a complete population system with endogenous migration. Given household employment, labor force participation (which is a function of economic conditions and evolving patterns of worker preferences), and the working age population, the unemployment rate and level become identities.

The population system uses Census information, fertility rates, and life tables to determine the “natural” changes in population by age group. Migration, the most difficult segment of population dynamics to track, is estimated in relation to relative regional and extra-regional economic conditions over time. Because evolving economic conditions determine migration in the system, population changes are allowed to interact simultaneously with overall economic conditions. Through this process, migration is treated as endogenous to the system, thus allowing population to vary in accordance with relative business performance (particularly employment).

Real retail sales is related to income, interest rates, dynamic adjustments, and patterns in consumer behavior on a store group basis. It is expressed on an inflation-

adjusted basis. Inflation at the state level relates to national patterns, indicators of relative economic conditions, and ongoing trends. As noted earlier, prices are endogenous to the system.

A final significant segment of the forecasting system relates to real estate absorption and activity. The short-term demand for various types of property is determined by underlying economic and demographic factors, with short-term adjustments to reflect the current status of the pertinent building cycle. In some instances, this portion of the forecast requires integration with the Multi-Regional Industry-Occupation System which is maintained by The Perryman Group. This system also allows any employment simulation or forecast from the econometric model to be translated into a highly detailed occupational profile.

The overall Texas Econometric Model contains numerous additional specifications, and individual expressions are modified to reflect alternative lag structures, empirical properties of the estimates, simulation requirements, and similar phenomena. Moreover, it is updated on an ongoing basis as new data releases become available. Nonetheless, the above synopsis offers a basic understanding of the overall structure and underlying logic of the system.

### **Model Simulation and Multi-Regional Structure**

The initial phase of the simulation process is the execution of a standard non-linear algorithm for the state system and that of each of the individual sub-areas. The external assumptions are derived from scenarios developed through national and international models and extensive analysis by The Perryman Group. The US model, which follows the basic structure outlined above, was used to some extent in the current analysis to define the demand for domestically produced goods on a per capita basis.

Once the initial simulations are completed, they are merged into a single system with additive constraints and interregional flows. Using information on minimum regional requirements, import needs, export potential, and locations, it becomes possible to balance the various forecasts into a mathematically consistent set of results. This process is, in effect, a disciplining exercise with regard to the individual regional (including metropolitan and rural) systems. By compelling equilibrium across all regions and sectors, the algorithm ensures that the patterns in state activity are reasonable in light of smaller area dynamics and, conversely, that the regional outlooks are within plausible performance levels for the state as a whole.



The iterative simulation process has the additional property of imposing a global convergence criterion across the entire multi-regional system, with balance being achieved simultaneously on both a sectoral and a geographic basis. This approach is particularly critical on non-linear dynamic systems, as independent simulations of individual systems often yield unstable, non-convergent outcomes.

It should be noted that the underlying data for the modeling and simulation process are frequently updated and revised by the various public and private entities compiling them. Whenever those modifications to the database occur, they bring corresponding changes to the structural parameter estimates of the various systems and the solutions to the simulation and forecasting system. The multi-regional version of the Texas Econometric Model is re-estimated and simulated with each such data release, thus providing a constantly evolving and current assessment of state and local business activity.

### The Final Forecast

The process described above is followed to produce an initial set of projections. Through the comprehensive multi-regional modeling and simulation process, a systematic analysis is generated which accounts for both historical patterns in economic performance and inter-relationships and best available information on the future course of pertinent external factors. While the best available techniques and data are employed in this effort, they are not capable of directly capturing “street sense,” i.e., the contemporaneous and often non-quantifiable information that can materially affect economic outcomes. In order to provide a comprehensive approach to the prediction of business conditions, it is necessary to compile and assimilate extensive material regarding current events and factors both across the state of Texas and elsewhere.

This critical aspect of the forecasting methodology includes activities such as (1) daily review of hundreds of financial and business publications and electronic information sites; (2) review of major newspapers and online news sources in the state on a daily basis; (3) dozens of hours of direct telephone interviews with key business and political leaders in all parts of the state; (4) face-to-face discussions with representatives of major industry groups; and (5) frequent site visits to the various regions of the state. The insights arising from this “fact finding” are analyzed and evaluated for their effects on the likely course of the future activity.

Another vital information resource stems from the firm’s ongoing interaction with key players in the international, domestic, and state economic scenes. Such activities include visiting with corporate groups on a regular basis and being regularly

involved in the policy process at all levels. The firm is also an active participant in many major corporate relocations, economic development initiatives, and regulatory proceedings.

Once organized, this information is carefully assessed and, when appropriate, independently verified. The impact on specific communities and sectors that is distinct from what is captured by the econometric system is then factored into the forecast analysis. For example, the opening or closing of a major facility, particularly in a relatively small area, can cause a sudden change in business performance that will not be accounted for by either a modeling system based on historical relationships or expected (primarily national and international) factors.

The final step in the forecasting process is the integration of this material into the results in a logical and mathematically consistent manner. In some instances, this task is accomplished through “constant adjustment factors” which augment relevant equations. In other cases, anticipated changes in industrial structure or regulatory parameters are initially simulated within the context of the Multi-Regional Impact Assessment System to estimate their ultimate effects by sector. Those findings are then factored into the simulation as constant adjustments on a distributed temporal basis. Once this scenario is formulated, the extended system is again balanced across regions and sectors through an iterative simulation algorithm analogous to that described in the preceding section.

### *US Multi-Regional Impact Assessment System*

---

In order to estimate the total economic effects of competition in the retail electric power industry, The Perryman Group utilized its US Multi-Regional Impact Assessment System (USMRIAS).

The basic modeling technique used in this segment of the analysis is known as dynamic input-output analysis. This methodology essentially uses extensive survey data, industry information, and a variety of corroborative source materials to create a matrix describing the various goods and services (known as resources or inputs) required to produce one unit (a dollar’s worth) of output for a given sector. Once the base information is compiled, it can be mathematically simulated to generate evaluations of the magnitude of successive rounds of activity involved in the overall production process.

There are two essential steps in conducting an input-output analysis once the system is operational. The first major endeavor is to accurately define the levels of direct activity to be evaluated. In this instance, The Perryman Group utilized various

sources of employment data and the Texas Econometric Model to derive estimates of direct employment in the electric power sector and its various components, including retail distribution.

The second major phase of the analysis is the simulation of the input-output system to measure overall economic effects of the projects facilitated by the sales tax for economic development. The present study was conducted within the context of the USMRIAS which was developed and is maintained by The Perryman Group. This model has been used in hundreds of diverse applications across the country and has an excellent reputation for accuracy and credibility. The systems used in the current simulations reflect the unique industrial structures and characteristics of the Houston-The Woodlands-Sugar Land Metropolitan Statistical Area and Texas.

The USMRIAS is somewhat similar in format to the Input-Output Model of the United States and the Regional Input-Output Modeling System, both of which are maintained by the US Department of Commerce. The model developed by TPG, however, incorporates several important enhancements and refinements. Specifically, the expanded system includes (1) comprehensive 500-sector coverage for any county, multi-county, or urban region; (2) calculation of both total expenditures and value-added by industry and region; (3) direct estimation of expenditures for multiple basic input choices (expenditures, output, income, or employment); (4) extensive parameter localization; (5) price adjustments for real and nominal assessments by sectors and areas; (6) measurement of the induced impacts associated with payrolls and consumer spending; (7) embedded modules to estimate multi-sectoral direct spending effects; (8) estimation of retail spending activity by consumers; and (9) comprehensive linkage and integration capabilities with a wide variety of econometric, real estate, occupational, and fiscal impact models. Moreover, the model uses specific local taxing patterns to estimate the fiscal effects of activity on a detailed sectoral basis. The models used for the present investigation have been thoroughly tested for reasonableness and historical reliability.

The impact assessment (input-output) process essentially estimates the amounts of all types of goods and services required to produce one unit (a dollar's worth) of a specific type of output. For purposes of illustrating the nature of the system, it is useful to think of inputs and outputs in dollar (rather than physical) terms. As an example, the construction of a new building will require specific dollar amounts of lumber, glass, concrete, hand tools, architectural services, interior design services, paint, plumbing, and numerous other elements. Each of these suppliers must, in turn, purchase additional dollar amounts of inputs. This process continues through multiple rounds of production, thus generating subsequent increments to business

activity. The initial process of building the facility is known as the *direct effect*. The ensuing transactions in the output chain constitute the *indirect effect*.

Another pattern that arises in response to any direct economic activity comes from the payroll dollars received by employees at each stage of the production cycle. As workers are compensated, they use some of their income for taxes, savings, and purchases from external markets. A substantial portion, however, is spent locally on food, clothing, health care services, utilities, housing, recreation, and other items. Typical purchasing patterns in the relevant areas are obtained from the ACCRA *Cost of Living Index*, a privately compiled inter-regional measure which has been widely used for several decades, and the *Consumer Expenditure Survey* of the US Department of Labor. These initial outlays by area residents generate further secondary activity as local providers acquire inputs to meet this consumer demand. These consumer spending impacts are known as the *induced effect*. The USMRIAS is designed to provide realistic, yet conservative, estimates of these phenomena.

Sources for information used in this process include the Bureau of the Census, the Bureau of Labor Statistics, the Regional Economic Information System of the US Department of Commerce, and other public and private sources. The pricing data are compiled from the US Department of Labor and the US Department of Commerce. The verification and testing procedures make use of extensive public and private sources.

Impacts were measured in constant 2016 dollars to eliminate the effects of inflation. Note that totals may not add due to rounding.

The USMRIAS generates estimates of the effect on several measures of business activity. The most comprehensive measure of economic activity used in this study is **Total Expenditures**. This measure incorporates every dollar that changes hands in any transaction. For example, suppose a farmer sells wheat to a miller for \$0.50; the miller then sells flour to a baker for \$0.75; the baker, in turn, sells bread to a customer for \$1.25. The Total Expenditures recorded in this instance would be \$2.50, that is,  $\$0.50 + \$0.75 + \$1.25$ . This measure is quite broad, but is useful in that (1) it reflects the overall interplay of all industries in the economy, and (2) some key fiscal variables such as sales taxes are linked to aggregate spending.

A second measure of business activity frequently employed in this analysis is that of **Gross Product**. This indicator represents the regional equivalent of Gross Domestic Product, the most commonly reported statistic regarding national economic performance. In other words, the Gross Product of Texas is the amount of US output that is produced in that state; it is defined as the value of all final goods produced in

a given region for a specific period of time. Stated differently, it captures the amount of value-added (gross area product) over intermediate goods and services at each stage of the production process, that is, it eliminates the double counting in the Total Expenditures concept. Using the example above, the Gross Product is \$1.25 (the value of the bread) rather than \$2.50. Alternatively, it may be viewed as the sum of the value-added by the farmer, \$0.50; the miller, \$0.25 ( $\$0.75 - \$0.50$ ); and the baker, \$0.50 ( $\$1.25 - \$0.75$ ). The total value-added is, therefore, \$1.25, which is equivalent to the final value of the bread. In many industries, the primary component of value-added is the wage and salary payments to employees.

The third gauge of economic activity used in this evaluation is **Personal Income**. As the name implies, Personal Income is simply the income received by individuals, whether in the form of wages, salaries, interest, dividends, proprietors' profits, or other sources. It may thus be viewed as the segment of overall impacts which flows directly to the citizenry.

The fourth measure, **Retail Sales**, represents the component of Total Expenditures which occurs in retail outlets (general merchandise stores, automobile dealers and service stations, building materials stores, food stores, drugstores, restaurants, and so forth). Retail Sales is a commonly used measure of consumer activity.

The final aggregates used are **Permanent Jobs and Person-Years of Employment**. The Person-Years of Employment measure reveals the full-time equivalent jobs generated by an activity. It should be noted that, unlike the dollar values described above, Permanent Jobs is a "stock" rather than a "flow." In other words, if an area produces \$1 million in output in 2014 and \$1 million in 2015, it is appropriate to say that \$2 million was achieved in the 2014-2015 period. If the same area has 100 people working in 2014 and 100 in 2015, it only has 100 Permanent Jobs. When a flow of jobs is measured, such as in a construction project or a cumulative assessment over multiple years, it is appropriate to measure employment in Person-Years (a person working for a year). This concept is distinct from Permanent Jobs, which anticipates that the relevant positions will be maintained on a continuing basis.

## Appendix C: Detailed Sectoral Results

### *Texas Effects*

The Total Annual Impact Associated with Operations of Competitive Retail Electric Providers on Business Activity in Texas				
Category	Total Expenditures (2016 Dollars)	Gross Product (2016 Dollars)	Personal Income (2016 Dollars)	Employment (Permanent Jobs)
Agriculture	\$184,141,298	\$51,617,632	\$34,070,232	546
Mining	\$133,888,777	\$31,199,021	\$17,361,047	103
Construction	\$184,133,849	\$97,424,127	\$80,283,549	1,145
Nondurable Manufacturing	\$1,139,897,988	\$341,028,795	\$183,154,762	3,193
Durable Manufacturing	\$256,299,814	\$100,045,307	\$64,833,411	908
Transportation and Utilities	\$39,322,128,659	\$9,131,574,385	\$4,045,731,023	19,533
Information	\$356,469,479	\$219,517,219	\$94,534,383	896
Wholesale Trade	\$334,074,589	\$225,906,049	\$130,259,442	1,501
Retail Trade (including Restaurants)	\$1,575,874,471	\$1,179,158,426	\$684,954,937	21,399
FIRE	\$1,752,550,579	\$592,258,926	\$266,514,932	2,679
Business Services	\$627,917,957	\$387,342,699	\$315,972,391	3,901
Health Services	\$374,476,109	\$262,032,412	\$221,550,829	3,713
Other Services	\$690,859,872	\$358,167,480	\$285,725,310	6,975
<b>TOTAL</b>	<b>\$46,932,713,439</b>	<b>\$12,977,272,478</b>	<b>\$6,424,946,248</b>	<b>66,491</b>

SOURCE: US Multi-Regional Impact Assessment System, The Perryman Group

<b>The Net Annual Impact Associated with Operations of Competitive Retail Electric Providers on Business Activity in Texas</b>				
<b>Category</b>	<b>Total Expenditures (2016 Dollars)</b>	<b>Gross Product (2016 Dollars)</b>	<b>Personal Income (2016 Dollars)</b>	<b>Employment (Permanent Jobs)</b>
Agriculture	\$117,206,512	\$32,854,784	\$21,685,809	347
Mining	\$85,220,625	\$19,858,274	\$11,050,361	65
Construction	\$117,201,770	\$62,010,761	\$51,100,730	728
Nondurable Manufacturing	\$725,548,632	\$217,065,894	\$116,578,579	2,032
Durable Manufacturing	\$163,135,632	\$63,679,151	\$41,266,668	578
Transportation and Utilities	\$25,028,657,785	\$5,812,275,635	\$2,575,120,440	12,433
Information	\$226,893,937	\$139,723,396	\$60,171,430	570
Wholesale Trade	\$212,639,520	\$143,789,906	\$82,910,542	955
Retail Trade (including Restaurants)	\$1,003,049,026	\$750,538,024	\$435,975,958	13,620
FIRE	\$1,115,503,921	\$376,974,657	\$169,637,587	1,705
Business Services	\$399,671,742	\$246,544,839	\$201,117,414	2,483
Health Services	\$238,355,214	\$166,784,449	\$141,017,795	2,364
Other Services	\$439,734,468	\$227,974,720	\$181,865,053	4,440
<b>TOTAL</b>	<b>\$29,872,818,783</b>	<b>\$8,260,074,490</b>	<b>\$4,089,498,367</b>	<b>42,322</b>
NOTE: Adjusted for the conversion from regulated utilities to competitive retail electric providers following the introduction of competition in the retail market.				
SOURCE: US Multi-Regional Impact Assessment System, The Perryman Group				

*Houston Area Effects*

<b>The Total Annual Impact Associated with Operations of Competitive Retail Electric Providers on Business Activity in the Houston-The Woodlands-Sugar Land Metropolitan Statistical Area</b>				
<b>Category</b>	<b>Total Expenditures (2016 Dollars)</b>	<b>Gross Product (2016 Dollars)</b>	<b>Personal Income (2016 Dollars)</b>	<b>Employment (Permanent Jobs)</b>
Agriculture	\$26,448,840	\$7,577,026	\$4,933,249	79
Mining	\$46,984,139	\$10,676,716	\$5,376,571	30
Construction	\$70,210,682	\$37,185,781	\$30,643,399	437
Nondurable Manufacturing	\$294,819,782	\$77,767,964	\$41,986,274	656
Durable Manufacturing	\$58,602,887	\$22,764,295	\$15,001,098	219
Transportation and Utilities	\$15,425,319,588	\$3,582,942,874	\$1,587,088,863	7,669
Information	\$98,973,528	\$60,939,234	\$26,300,285	252
Wholesale Trade	\$112,581,078	\$76,127,681	\$43,895,898	506
Retail Trade (including Restaurants)	\$534,409,997	\$399,978,387	\$232,359,933	7,256
FIRE	\$628,475,266	\$214,300,783	\$96,938,255	963
Business Services	\$243,349,691	\$150,222,232	\$122,542,845	1,513
Health Services	\$130,861,167	\$91,617,924	\$77,463,806	1,298
Other Services	\$248,701,144	\$129,098,041	\$102,926,217	2,476
<b>TOTAL</b>	<b>\$17,919,737,789</b>	<b>\$4,861,198,938</b>	<b>\$2,387,456,694</b>	<b>23,353</b>

SOURCE: US Multi-Regional Impact Assessment System, The Perryman Group



### The Net Annual Impact Associated with Operations of Competitive Retail Electric Providers on Business Activity in the Houston-The Woodlands-Sugar Land Metropolitan Statistical Area

Category	Total Expenditures (2016 Dollars)	Gross Product (2016 Dollars)	Personal Income (2016 Dollars)	Employment (Permanent Jobs)
Agriculture	\$20,941,584	\$5,999,316	\$3,906,034	62
Mining	\$37,200,963	\$8,453,578	\$4,257,046	24
Construction	\$55,591,206	\$29,442,847	\$24,262,740	346
Nondurable Manufacturing	\$233,431,534	\$61,574,888	\$33,243,768	519
Durable Manufacturing	\$46,400,420	\$18,024,246	\$11,877,525	173
Transportation and Utilities	\$12,213,413,857	\$2,836,891,897	\$1,256,620,519	6,072
Information	\$78,364,967	\$48,250,286	\$20,823,962	199
Wholesale Trade	\$89,139,113	\$60,276,150	\$34,755,764	400
Retail Trade (including Restaurants)	\$423,133,565	\$316,693,703	\$183,977,260	5,745
FIRE	\$497,612,284	\$169,678,440	\$76,753,484	763
Business Services	\$192,678,698	\$118,942,514	\$97,026,611	1,198
Health Services	\$103,612,867	\$72,540,969	\$61,334,063	1,028
Other Services	\$196,915,855	\$102,216,864	\$81,494,615	1,961
<b>TOTAL</b>	<b>\$14,188,436,912</b>	<b>\$3,848,985,697</b>	<b>\$1,890,333,390</b>	<b>18,490</b>

NOTE: Adjusted for the shift from regulated utilities to competitive retail electric providers following the introduction of the retail market.  
SOURCE: US Multi-Regional Impact Assessment System, The Perryman Group