

MAY 2012

Economic Impact of the Eagle Ford Shale



Prepared by:
Center for Community and Business Research
The University of Texas at San Antonio
Institute for Economic Development

Acknowledgements

This study was performed by The University of Texas at San Antonio Institute for Economic Development's Center for Community and Business Research. The project was supported with funding from America's Natural Gas Alliance. Any findings, conclusions or opinions are those of the authors and not necessarily those reflected by The University of Texas at San Antonio or America's Natural Gas Alliance.

Acknowledgments: This report was prepared by Thomas Tunstall, Javier Oyakawa, Christine Medina, Hisham Eid, Mark A. Green Jr., Iliana Sanchez, Racquel Rivera, John Lira, and David Morua, with special assistance from Carter Keairns and Alan Dutton. A special thanks to Adam Haynes and Chip Haass with Chesapeake Energy, David Blackmon with El Paso Corporation, as well as Sara Banaszak, Daniel Whitten and the entire ANGA organization for their support and assistance in collecting the data.

Table of Contents

Acknowledgements.....	2	Taxes	48
Table of Contents	3	Small Business	49
Executive Summary	4	Insight from a Small Business Owner:	
Introduction.....	9	Monica Contreras.....	50
Report Highlights	11	Insight from a Chamber of Commerce: Paula Seydel..	51
Current Activity (2011).....	14	Transportation.....	52
Total Impact Summary	14	Environment	53
Impacts outside of the Eagle Ford Shale drilling area.....	17	Insight from an Environmentalist: Dr. Susan Stuver ..	54
Impacts on Bexar County in 2011	17	Insight on Water: Warren Sumner	55
Impacts on Jim Wells, Uvalde, Victoria, Nueces, and San Patricio Counties in 2011	18	Housing	56
Wages	21	Impacts to Higher Education.....	57
Upstream Development	22	County Highlights	58
Drilling	22	Future Activity/Projections (2021)	66
Completion	22	Total Projected Impacts for 2021	66
Insight from the Energy Services Industry: Joe Foster ..	24	Detailed Combined Future Impacts:	
Drilling & Completion Impacts.....	25	Moderate Scenario	67
Insight from the Energy Sector: Rene Montalvo	26	Future Impacts in Additional Counties.....	70
Extraction.....	27	Projected Impacts in Bexar County, 2021.....	71
Production Summary.....	27	Projected Impacts in Jim Wells County, 2021.....	72
Extraction Impacts.....	31	Projected Impacts in Uvalde County, 2021.....	72
Insight from a Fracturing Company: Danny Jimenez..	32	Projected Impacts in Victoria County, 2021.....	72
Midstream Development.....	33	Projected Impacts in Nueces County, 2021.....	73
Insight from a Midstream Logistics Company:		Projected Impacts in San Patricio County, 2021	73
Curtis Anastasio	34	Forecast Methodology.....	74
Downstream Development.....	35	Closing discussion	76
Insight from an Oil Refining Company: Bill Day.....	36	Upside Implications for Low Natural Gas Prices.....	76
Land Leases	37	Replacing Coal as the Input for Electric	
Insight from a Petroleum Landman: Chris Johnson.....	38	Power Plants.....	76
Royalties	39	Use as a Feedstock for Chemical Manufacturers.....	76
Insight from a Royalty Owner: Terry Retzloff.....	40	Increased Use of Compressed	
Right-of-Way Payments	41	Natural Gas (CNG) Vehicles.....	77
Insight from a Land Owner: Jason Nelson.....	42	Further Research.....	78
Construction.....	43	Innovation Spillovers	79
Economic Development.....	44	Appendix A	80
Insight from the Eagle Ford Shale Consortium:		Appendix B	81
Leodoro Martinez, Jr.	46	Appendix C	85
Insight in Economic Development: Mario Hernandez..	47	About the Center for Community & Business Research	87

Executive Summary

The Eagle Ford Shale is a hydrocarbon producing formation that is a source rock for Austin Chalk which is approximately 4,000 to 14,000 feet below the surface. The core focus of this drilling activity is between 10,000 and 12,000 feet below surface. This discovery is of significant importance in that the formation contains both natural gas and oil deposits. The projections put forth in the initial study completed in February 2011 were conservative based on limited information available at the time. Since then, production conducted in 2010 has far exceeded the expectations outlined in the initial report due to rapidly evolving business activity.

Indeed, activity in the Eagle Ford Shale has expanded at an unprecedented rate, and the increase in production from 2010 to 2011 has been accompanied by equally significant increases in permitting, well drilling and completion, residential and commercial construction, pipeline construction, and numerous other support activities. This report serves to provide an overview of all activity related to the Eagle Ford Shale play and its economic impact.

This study will use 2011 as the baseline case for information on production, drilling, and related activities, to help interpret the rapid changes occurring in the region. This study also has been adjusted to focus specifically on the impacts of 14 producing counties that are of particular interest in the Eagle Ford Shale development area: Atascosa, Bee, DeWitt, Dimmit, Frio, Gonzales, Karnes, La Salle, Live Oak, Maverick, McMullen, Webb, Wilson, and Zavala. In addition, significant non-production activity is occurring in 6 peripheral counties and are included in the analysis: Bexar, Jim Wells, Nueces, San Patricio, Uvalde and Victoria.

Increase in Production

Production of oil, gas and condensate has increased dramatically from 2010 to 2011.

- Oil production increased by more than six times from 2010 to 2011, with 2011 production at 28,315,540 bbls (barrels).
- Gas production more than doubled from 2010 to 2011, with 2011 production at 271,831,688 mcf (thousand cubic feet).¹
- Condensate production tripled from 2010 to 2011, with 2011 production at 21,089,214 bbls.

2011 Total Impacts – Eagle Ford Shale Counties at the Regional Level (14-County Area)

Impacts were assessed for a 14-county region: Atascosa, Bee, DeWitt, Dimmit, Frio, Gonzales, Karnes, La Salle, Live Oak, Maverick, McMullen, Webb, Wilson, and Zavala.

The total economic output impact of the Eagle Ford Shale in 2011 in the county study region was just under **\$20 billion dollars**. Other impact highlights include:

- 38,000 full-time jobs supported
- \$2.6 billion in salaries and benefits paid to workers
- \$10.8 billion in gross regional product (value added)
- \$211 million in local government revenues
- \$312 million in state revenues, including \$120.4 million in severance taxes

¹ One thousand cubic feet are roughly equivalent to one million BTUs (British Thermal Units), an alternative unit of measure for natural gas spot prices.

2011 Total Impacts – Eagle Ford Shale Counties (20-County Area)

Impacts were also assessed for a 20-county region, which includes the 14 counties most actively producing as well as 6 counties that are experiencing substantial indirect and induced activity: Bexar, Jim Wells, Nueces, San Patricio, Uvalde and Victoria.² The remaining 10 counties not included in this year's baseline study due to limited production activity to date are Brazos, Burleson, Edwards, Fayette, Houston, Lavaca, Lee, Leon, Milam and Wood.

The total economic output impact of the Eagle Ford Shale in 2011 in the 20-county study region was over **\$25 billion dollars**. Other impact highlights include:

- 47,097 full-time jobs supported
- \$3.1 billion in salaries and benefits paid to workers
- \$12.63 billion in gross regional product (value added)
- \$257 million in local government revenues
- \$358 million in state revenues, including \$120.4 million in severance taxes

2011 Impacts Outside of the Eagle Ford Shale Drilling Area

The 6 counties that have close proximity to the Eagle Ford Shale region, but are not directly involved in drilling and extraction activities are important to note because of other activities occurring there such as headquartering, refining, construction, and renovation. Highlights of this activity include:

Bexar County Impact Summary:

- \$705 million in output impact (revenues)
- 4,290 full-time jobs supported
- \$423 million in gross county product impact (value added)
- \$186 million in salaries and benefits paid to workers

Jim Wells Impact Summary:

- \$47 million in output impact (revenues)
- 227 full-time jobs supported
- \$23 million in gross county product impact (value added)
- \$13 million in salaries and benefits paid to workers

Uvalde County Summary:

- \$13 million in output impact (revenues)
- 75 full-time jobs supported
- \$8 million in gross county product impact (value added)
- \$3 million in salaries and benefits paid to workers

² The February 2011 Preliminary Economic Impact Study did not examine the economic impacts of the Eagle Ford Shale on Nueces and San Patricio counties.

Victoria County Summary:

- \$23 million in output impact (revenues)
- 107 full-time jobs supported
- \$13 million in gross county product impact (value added)
- \$5 million in salaries and benefits paid to workers

Nueces County Summary:

- \$4.9 billion in output impact (revenues)
- 3,880 full-time jobs supported
- \$1.2 billion in gross county product impact (value added)
- \$225 million in salaries and benefits paid to workers

San Patricio County Summary:

- \$115 million in output impact (revenues)
- 517 full-time jobs supported
- \$65 million in gross county product impact (value added)
- \$23 million in salaries and benefits paid to workers

2011 Drilling and Completion Impacts for the Eagle Ford Shale at the Regional Level

Total output (revenues) economic impact for the 14-county Eagle Ford Shale region was **\$12.4 billion** in 2011.

Other impact highlights include:

- 23,409 full-time jobs supported
- \$7.0 billion in gross regional product impact (value added)
- \$1.8 billion in salaries and benefits paid to workers

2011 Extraction Impacts for the Eagle Ford Shale at the Regional Level

Total output (revenues) economic impact for the 14-county Eagle Ford Shale region was **\$5.2 billion** in 2011.

Other impact highlights include:

- 6,062 full-time jobs supported
- \$3.2 billion in gross regional product impact (value added)
- \$443 million in salaries and benefits paid to workers

2011 Pipeline Construction Impacts for the Eagle Ford Shale at the Regional Level

Total output (revenues) economic impact for the 14-county Eagle Ford Shale region was **\$1.1 billion** in 2011.

Other impact highlights include:

- 7,369 full-time jobs supported
- \$494 million in gross regional product impact (value added)
- \$309 million in salaries and benefits paid to workers

2011 Refinery Operations Impacts for the Eagle Ford Shale at the Regional Level

Total output (revenues) economic impact for the 14-county Eagle Ford Shale region was **\$992 million** in 2011.

Other impact highlights include:

- 463 full-time jobs supported
- \$143 million in gross regional product impact (value added)
- \$36 million in salaries and benefits paid to workers

2011 Land Lease Payments Impacts for the Eagle Ford Shale at the Regional Level

Total output (revenues) economic impact for the 14-county Eagle Ford Shale region was **\$5 million** in 2011.

Other impact highlights include:

- 40 full-time jobs supported
- \$3 million in gross regional product impact (value added)
- \$1 million in salaries and benefits paid to workers

2011 Royalties Payments Impacts for the Eagle Ford Shale at the Regional Level

Total output (revenues) economic impact for the 14-county Eagle Ford Shale region was **\$60 million** in 2011.

Other impact highlights include:

- 495 full-time jobs supported
- \$36 million in gross regional product impact (value added)
- \$15 million in salaries and benefits paid to workers

2011 Right-of-Way Payments Impacts for the Eagle Ford Shale at the Regional Level

Total output (revenues) economic impact for the 14-county Eagle Ford Shale region was **\$4 million** in 2011.

Other impact highlights include:

- 35 full-time jobs supported
- \$3 million in gross regional product impact (value added)
- \$1 million in salaries and benefits paid to workers

2011 Construction Impacts for the Eagle Ford Shale at the Regional Level

Total output (revenues) economic impact for the 14-county Eagle Ford Shale region was **\$18 million** in 2011.

Other impact highlights include:

- 127 full-time jobs supported
- \$9 million in gross regional product impact (value added)
- \$5 million in salaries and benefits paid to workers

2021 Projected Impacts for the Eagle Ford Shale at the Regional Level (14-County Area)

The economic impact of the Eagle Ford Shale was projected for 2021 in the Eagle Ford Shale 14-county study region in three scenarios for illustrative purposes: a low estimate, a moderate estimate, and a high estimate. There is opportunity for great variability in prices and other variables over the next ten years, so this approach is used to capture both a lower-price and higher-price scenario. It is expected that the true economic impact in 2021 will fall somewhere between the low and high estimate. The moderate estimate for total output (revenue) impact is **\$62.3 billion** dollars, with a low estimate of **\$26.1 billion** and a high estimate of **\$96.0 billion**. Other impact highlights include (for the moderate scenario):

- 82,645 full-time jobs supported
- \$6.0 billion in salaries and benefits paid to workers
- \$34.1 billion in gross regional product (value added)
- \$888 million in local government revenues
- \$1.6 billion in state revenues, including \$740.9 million in severance taxes

2021 Project Impacts for the Eagle Ford Shale Study Geography (20-County Area)

With the inclusion of the additional 6 counties not directly involved in production, the economic impacts under the moderate scenario are even more significant:

- 116,972 full-time jobs supported
- \$7.7 billion in salaries and benefits paid to workers
- \$42.0 billion in gross regional product (value added)
- \$1.09 billion in local government revenues
- \$1.76 billion in state revenues

Forecasted New Oil and Gas Wells (2011 – 2021)

The total new oil and gas wells were projected yearly for the next ten years in the same three-tiered projection approach as economic impacts, with low, medium, and high estimates. A total of **25,104** new oil and gas wells are projected to be built over the years 2012 to 2021 in the moderate scenario, with a low estimate of **13,537** and a high estimate of **34,039**.

Forecasted Production (2021)

In 2021, using the moderate price estimate to make projections, the 2021 production of gas, casinghead,³ oil, and condensate is projected at:

- Gas Production of 864,923,000 mcf
- Casinghead of 121,380,000 mcf
- Oil production of 168,956,000 bbls
- Condensate production 125,837,000 bbls

³ Casinghead is a natural gas produced along with crude oil from oil completions.

Introduction

In a region traditionally known for agriculture, the Western Gulf Basin of South Central Texas has recently become a major player in the oil and gas industry. The area is now known as the Eagle Ford Shale play and has experienced many changes since oil exploration began. The Eagle Ford Shale is a hydrocarbon producing formation that is a source rock for Austin Chalk which is approximately 4,000 to 14,000 feet below the surface. Its first well was drilled in 2008 by Petrohawk Energy Corporation in Hawkville Field of La Salle County.⁴ The core focus of this drilling activity is between 10,000 and 12,000 feet below surface. This discovery is of significant importance in that the formation contains both natural gas and oil deposits.

When the preliminary study, *Economic Impact of the Eagle Ford Shale*, was published by the Center for Community and Business Research in February 2011, much of the information about the shale play was new to those not only in the industry but also to the residents of the region. The 2011 study began to answer some of the questions about what the discovery means for communities located in this region and the importance of the discovery to the Texas economy.

The projections put forth in the initial study were conservative based on limited information available at the time. Since then, production has far exceeded the expectations outlined in the report due to rapidly evolving business activity. In light of this and in order to appropriately estimate the economic impact that Eagle Ford Shale activity is having and will continue to have, America's Natural Gas Alliance contracted once again with the Center for Community and Business Research (CCBR) at the University of Texas at San Antonio's Institute for Economic Development for an update to the original report. This study will provide both updates to the original impact estimates and a more comprehensive overview of Eagle Ford Shale activity and impacts. Part one of this study will use the actual production from the year 2011 as the baseline case for information and projections on production, drilling, and related activities. The second part of the study will focus on occupational and workforce impacts, and the final section will provide impacts at the county level.

This study will use 2011 as the baseline case for information on production, drilling, and related activities, to help interpret the rapid changes occurring in the region. This study also has been adjusted to focus specifically on the impacts of 14 producing counties that are of particular interest in the Eagle Ford Shale development area: Atascosa, Bee, DeWitt, Dimmit, Frio, Gonzales, Karnes, La Salle, Live Oak, Maverick, McMullen, Webb, Wilson, and Zavala. In addition, significant non-production activity is occurring in 6 additional counties and are included in the analysis: Bexar, Jim Wells, Nueces, San Patricio, Uvalde and Victoria. The remaining 10 counties that are typically referenced in the 24-county Eagle Ford Shale area, but are not included in this 2011 baseline study are Brazos, Burleson, Edwards, Fayette, Houston, Lavaca, Lee, Leon, Milam and Wood.

These counties are highlighted in a map on next page.

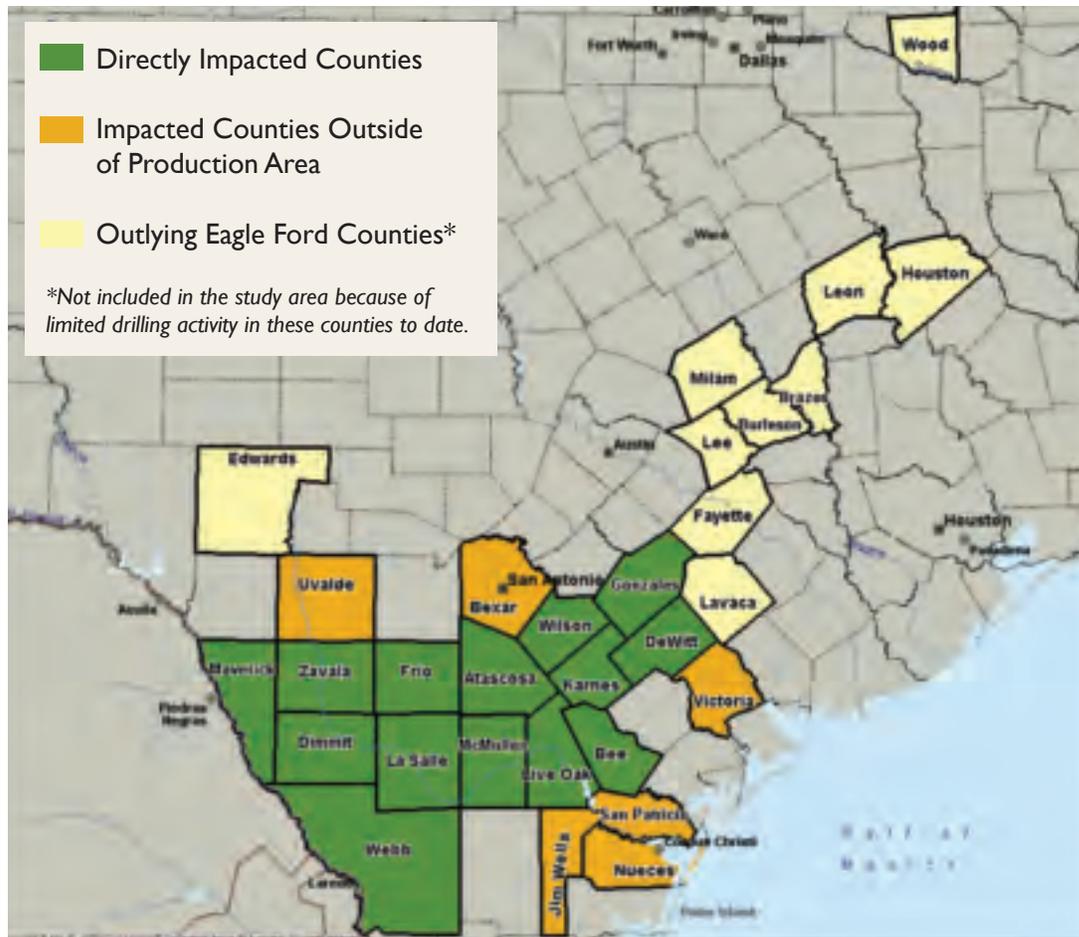
Typical well head
(also known as a
"Christmas tree") in a
deeper Eagle Ford well
in Live Oak County.
This well produces
both natural gas
and condensate.



Photograph by Terry Retzlaff.

⁴ *The Discovery, Reservoir Attributes, and Significance of the Hawkville Field and Eagle Ford Shale Trend*, Texas, Cusak et al. Gulf Coast Association of Geological Societies Transactions, v. 60, p. 165-179.

Eagle Ford Shale Counties



Impacts are also provided for the stages of production: upstream, midstream, and downstream.

- **Upstream** impacts are those related to the drilling, completion, and extraction of oil, gas and condensate.
- **Midstream** impacts are those related to the transportation of extracted products to the location of the refinery operation, and includes pipeline construction.
- **Downstream** impacts are those related to the refining and processing of the transported products.

Additionally, the study will find economic impacts in six other related counties involved as Eagle Ford Shale staging and administrative centers: Bexar, Jim Wells, Uvalde, Victoria, San Patricio, and Nueces.

Report Highlights

In addition to updates to the impact figures detailed in the 2011 Eagle Ford Shale Report, this report will include vignettes in which CCBR staff members interviewed individuals affected by the increased activity and production in the Eagle Ford Shale region. These vignettes serve to bring home the economic impacts from many different individual perspectives in terms of direct effects (drilling, transport, refining), indirect effects (construction and energy service companies) and induced effects (restaurants, hotels, stores, etc.).

Also included in this report are recommendations for improved governance, detailing strategies that communities may consider in order to develop in a sustainable and economically solid manner. These strategies are included in the discussions of the following topics:

- Revenue and investment strategies
- Medium and long-term planning – land use, capital outlays, sustainable infrastructure (medical facilities, improved aesthetics, elimination of blight, public attractions to build community desirability, etc.), and general livability
- Strong institutional management
- Engaged citizens
- Fiscal discipline
- Commitment to ongoing education/working smarter/learning from past mistakes
- Formation of linkages and alliances, and engagement of other Eagle Ford Shale communities and higher education institutions

Small business is an arena that has been particularly affected by the Eagle Ford Shale play. A small business section is included in this report to highlight the unique opportunities and challenges that small businesses, both previously existing and new, have and will encounter in the Eagle Ford Shale region.

The transportation section of this report will address the challenges in infrastructure and also will lay a foundation for future transportation studies in the region. Environment, water, housing, and public health and safety are also highlighted and discussed within this report.

In order to estimate the impacts, CCBR again used the input-output software IMPLAN.⁵ This software allows for the measurement of direct, indirect, and induced impacts from the operations of the firms in the Eagle Ford Shale. The direct impacts include the actual production and employment by the firms operating in the shale. The indirect impacts include the revenue and personnel expenses of the suppliers while the induced impacts include expenses of the workers. The software organizes the information based on data from the Bureau of Economic Analysis (BEA) and several other federal and state agencies. The IMPLAN model was adjusted to avoid double counting the impacts of several related industries in the same area.

⁵ From the Minnesota IMPLAN Group, Inc., IMPLAN System (data and software), 502 2nd Street, Suite 301, Hudson, WI 54016 www.implan.com.

Similar studies to this often utilize survey data to build new linkages between economic sectors in order to accommodate the fact that the IMPLAN database predates much of the shale gas drilling. However, our 2011 analysis relied on existing oil and gas sector linkages in the IMPLAN economic database, producing results which are more conservative.

To quantify the impact of the Eagle Ford Shale, we focused on four economic sectors where the oil and gas industries operate:⁶

1. Oil and Gas Extraction (NAICS 211)
2. Drilling Oil and Gas Wells (NAICS 213111)
3. Support Activities for Oil and Gas Operations (NAICS 213112)
4. Oil and Gas Pipeline and Related Structures Construction (NAICS 237120)
5. Oil Refineries (NAICS 324110)

It is worthwhile to note that the CCBR analysis uses a standard definition of direct impacts. These **direct** impacts consist primarily of the actual production and employment by the firms operating directly in the shale – those outlined in the five categories above. Yet, clearly jobs supported by the Eagle Ford Shale show up in other areas. **Indirect** impacts include the operational and personnel expenditures made by suppliers – the inter-industry transactions (or exchanges) that follow-on from the direct economic activity. The **induced** impacts include income flows created when workers spend money at stores, restaurants, and for housing in the impacted counties.

As an example, the multiregional analysis of the impacts on some of the counties studied shows little or no direct impacts. For instance, in Bexar County, the direct impact on jobs and output may appear muted. However, most of the direct activities associated with the Eagle Ford Shale occur inside the 14-county area – nonetheless, the indirect and induced effects are still captured across all of the counties in the study area. IMPLAN identifies and quantifies the relationships between the direct activities occurring primarily in that 14-county area on the one hand, and the supporting activities in counties such as Bexar, Jim Wells, Nueces, San Patricio, Uvalde and Victoria on the other.

Examples of sources of indirect jobs in the Eagle Ford area include regional headquarters (such as EOG, Chesapeake, Schlumberger, etc.), office jobs in the wholesale trade business (e.g., pipeline transportation services for firms such as NuStar), jobs in maintenance and repair (i.e., other work in pipeline construction or in drilling), jobs in employment services, as well as attorneys, CPAs, etc. that perform work for service or energy companies. As such, it is important to keep in mind the **total** impact on jobs and output supported in a given geography by the Eagle Ford Shale.

⁶ NAICS codes adapted from *The Economic Impact of the Oil and Gas Industry in Pennsylvania*, prepared by Pennsylvania Economy League of Southwestern Pennsylvania, LLC, November 2008, with the addition of pipeline construction activities, lease and royalty payments.

Additionally, we included the economic impacts of royalty, lease payments to households, and right of way agreements, as households in turn spend their money creating induced effects and supporting more jobs.⁷

To calculate the economic impact of the Eagle Ford Shale in 2011, we estimated the production of gas and oil for that year. We collected Eagle Ford related production information from the Railroad Commission of Texas up to December 2011, and used that information to project the final total for theyear.⁸ Using price information from the Energy Information Administration (EIA) we obtained estimation, in dollars, of revenues from oil and gas extraction for the year. This dollar-production amount was used with the software IMPLAN to obtain direct, indirect, and induced impacts in the area of analysis. Oil and Gas Extraction is the only sector related to this dollar value. Based on information about drilling and completion costs per well and by estimating the number of wells drilled and completed in 2011,⁹ we were able to obtain a total amount of drilling and completion costs. These costs were allocated to two different sectors in IMPLAN: Drilling Oil and Gas Wells (NAICS 213111) and Support Activities for Oil and Gas Operations (NAICS 213112).

Information on pipeline construction for 2011 relied on industry officials data and represent very conservative values. Unlike other studies that have assumed a 25 percent royalty payment, we recognize that not all the funds remain in the target area and hence assumed to use a more conservative estimate. For this study, royalties represent 20 percent of total revenues from oil and gas extraction, while lease payments were obtained from a group of companies currently working in the area.

Production estimates for the Eagle Ford Shale Play are a moving target; the area has proven capacity for extraction, and interest continues to grow on the part of oil companies, support businesses, and residents. This report seeks to capture the activity in measureable outcomes, specifically jobs and output, and to provide a guide to both short- and long-term planning for communities and stakeholders.

⁷ Methodology adapted from Timothy J. Considine in *The Economic Impacts of the Marcellus Shale: Implications for New York, Pennsylvania, and West Virginia*, July 14, 2010; and Anthony M. Zammerilli in *Projecting the Economic Impact of Marcellus Shale Gas Development in West Virginia: A Preliminary Analysis Using Publicly Available Data*, March 31, 2010; a report by the National Energy Technology Laboratory.

⁸ The conversion from output volumes of oil and gas to dollars is explained in Appendix A.

⁹ According to the HPDI, 1,649 wells were completed in 2011. Only 616 of these were producing in the same year, largely because the development of multi-well pads has become prevalent in the area. This has resulted in greater efficiency, allowing for the use of common gathering and completion features, but has led to the postponement of the production phase for all wells in a pad until the last well in the pad has been completed.

Current Activity (2011)

Total Impact Summary

In 2011, the 14-county Eagle Ford Shale region produced nearly \$20 billion and employed 38,000 workers in the following oil and gas related industries:

- Oil and Gas Extraction (NAICS 211)
- Drilling Oil and Gas Wells (NAICS 213111)
- Support Activities for Oil and Gas Operations (NAICS 213112)
- Oil and Gas Pipeline and Related Structures Construction (NAICS 237120)
- Oil Refineries (NAICS 324110)

The following table summarizes the 2011 impacts in the core 14-county area. Key highlights of this table are:

- Nearly \$20 billion in total economic output (revenues) impact
- Approximately 38,000 full-time jobs in the 14-county area
- Roughly \$2.6 billion in salaries and benefits paid to workers
- Close to \$11 billion in gross regional product (value added) impacts
- More than \$211 million in local government revenues
- More than \$310 million in state revenues, including \$120.4 million in severance taxes

Estimated Impacts for Eagle Ford Shale at the 14-County Regional Level (2011)

	Economic Impacts			Total
	Direct	Indirect	Induced	
Output	\$16,900,222,093	\$1,478,870,833	\$1,371,123,305	\$19,750,216,231
Employment	17,075	9,408	11,518	38,001
Payroll	\$1,903,916,876	\$365,770,566	\$342,354,445	\$2,612,041,887
	Fiscal Impacts			Total
	Direct	Indirect	Induced	
Gross Regional Product	\$9,215,755,576	\$816,656,284	\$817,323,679	\$10,849,735,540
Estimated Local Government Revenues				\$211,070,913
Estimated State Revenue, incl. severance taxes				\$312,280,400

2011 Total Impacts – Eagle Ford Shale Counties (20-County Area)

Impacts were also assessed for a 20-county region, which includes the 14 counties most actively producing, as well as 6 counties that are experiencing substantial indirect and induced activity: Bexar, Jim Wells, Nueces, San Patricio, Uvalde and Victoria.¹⁰ The remaining 10 counties not included in this 2011 baseline study are Brazos, Burleson, Edwards, Fayette, Houston, Lavaca, Lee, Leon, Milam and Wood.

The total economic output impact of the Eagle Ford Shale in 2011 in the 20-county study region was over **\$25 billion dollars**. Other impact highlights include:

- 47,097 full-time jobs supported
- \$3.1 billion in salaries and benefits paid to workers
- \$12.63 billion in gross regional product (value added)
- \$257 million in local government revenues
- \$358 million in state revenues

Estimated Impacts for Eagle Ford Shale – 20 County Study Area (2011)

	Economic Impacts			Total
	Direct	Indirect	Induced	
Output	\$21,385,221,912	\$2,367,819,971	\$1,812,572,555	\$25,565,614,428
Employment	18,339	13,993	14,767	47,097
Payroll	\$2,019,674,803	\$584,369,738	\$463,210,978	\$3,067,255,518
	Fiscal Impacts			
	Direct	Indirect	Induced	Total
Gross Regional Product	\$10,169,420,700	\$1,330,109,122	\$1,095,159,095	\$12,594,688,918
Estimated Local Government Revenues				\$257,879,161
Estimated State Revenue, incl. severance taxes				\$358,009,810

¹⁰ The February 2011 Preliminary Economic Impact Study did not examine the economic impacts of the Eagle Ford Shale on Nueces and San Patricio counties.

These direct impacts are combined impacts from the activity in the industries listed above. In addition to these activities, the royalty, lease and right-of-way payments to landowners created additional induced impacts in the area. Also, the construction activities for pipelines and the refining operations of some firms located in the area contributed to these outcomes.

The industries most impacted by the Eagle Ford Shale activity in terms of employment, gross regional product, and output are shown in the three following tables. The first table shows the top ten industries impacted in terms of employment.

Industry	Employment
Drilling oil and gas wells	7,581
Construction of other new nonresidential structures	5,099
Extraction of oil and natural gas	2,407
Support activities for oil and gas operations	2,169
Food services and drinking places	1,759
Transport by truck	1,050
Non-depository credit intermediation and related activities	879
Legal services	858
Wholesale trade businesses	817
Maintenance and repair construction of nonresidential structures	776

This table shows the top ten impacted industries in terms of gross regional product (value added).

Industry	Gross State Product (Value added)
Drilling oil and gas wells	\$5,367,023,166
Extraction of oil and natural gas	\$2,840,389,195
Support activities for oil and gas operations	\$575,231,359
Construction of other new nonresidential structures	\$316,642,709
Imputed rental activity for owner-occupied dwellings	\$194,248,764
Wholesale trade businesses	\$128,239,373
Real estate establishments	\$112,629,672
Petroleum refineries	\$111,351,488
Legal services	\$100,785,010
Monetary authorities and depository credit intermediation activities	\$94,480,929

Finally, this table shows the top ten industries impacted in terms of output (revenues).

Industry	Output
Drilling oil and gas wells	\$9,477,856,302
Extraction of oil and natural gas	\$4,665,285,933
Support activities for oil and gas operations	\$1,053,600,317
Petroleum refineries	\$936,075,483
Construction of other new nonresidential structures	\$755,065,186
Imputed rental activity for owner-occupied dwellings	\$229,664,090
Monetary authorities and depository credit intermediation activities	\$221,769,207
Wholesale trade businesses	\$187,695,203
Legal services	\$155,514,780
Real estate establishments	\$144,525,819

Impacts outside of the Eagle Ford Shale drilling area

In addition to the impacts on the 14-county Eagle Ford Shale drilling region, several counties outside of the area of drilling sites have also been heavily impacted by Eagle Ford Shale activity. These are discussed here.

Impacts on Bexar County in 2011

Given San Antonio's proximity to the shale play sites, Bexar County is likely to have a significant role in staging exploration, production and other related activities.¹¹ The following table shows the estimated impacts of the shale activity on Bexar County. In 2011, it is estimated that a total of 4,290 Bexar County jobs were supported by the Eagle Ford shale, in addition to \$705 million in output and more than \$422 million in gross county product.

Several companies relocating to or expanding offices in San Antonio have invested millions of dollars into the construction of new facilities. Examples of this are Schlumberger and Weatherford. For the purposes of this study, it was assumed that nearly \$30 million was invested into building these new facilities. Another company, NuStar, is currently renovating a refinery in the city and constructing new pipelines for transporting oil. This company is estimated to have invested close to \$35 million for these activities in 2011. The total amount of construction activity for 2011 was estimated at \$65 million in Bexar County, and these activities are captured as direct impacts in Bexar County. Other facilities, such as Halliburton's new offices in southeast Bexar County, will have impacts in 2012 and will be important sources of jobs in the area. Several companies already have offices in Bexar County with several hundred employees working in response to the needs of firms drilling or extracting oil and gas from the Eagle Ford Shale. Those employees are counted as indirect jobs in the analysis, and in this case indirect jobs in Bexar County. These workers spend their incomes in the area and generate induced impacts.

Estimated Impacts of the Eagle Ford Shale on Bexar County (2011)

	Economic Impacts			Total
	Direct	Indirect	Induced	
Output	\$65,000,000	\$407,328,329	\$232,832,329	\$705,160,654
Employment	486	2,164	1,640	4,290
Gross County Product	\$26,379,099	\$247,404,249	\$148,828,055	\$422,611,403
Payroll	\$17,669,885	\$103,074,365	\$65,418,478	\$186,162,729



¹¹ Based on information from HPDI, in the year ending on September 31, 2010, more than 94 percent of the liquids produced in the shale came from counties closer to Bexar than to other larger economic areas (for example, Austin or Houston). Furthermore, more than 99 percent of the gas extracted came from counties located closer to Bexar than to other major cities.

Impacts on Jim Wells, Uvalde, Victoria, Nueces, and San Patricio Counties in 2011

Five additional counties are understood to be heavily impacted by the Eagle Ford Shale activity due to their proximity to the Eagle Ford Shale and the activities, such as satellite facility construction and renovation that are taking place in these areas. The impacts for Jim Wells, Uvalde, Victoria, Nueces, and San Patricio Counties are detailed in the following tables. The benefits these counties enjoy of companies drilling and extracting oil in the Eagle Ford Shale are counted as indirect jobs for the counties, and further induced impacts are produced as those employees spend their income.

Estimated Impacts of the Eagle Ford Shale Jim Wells County Level (2011)

	Economic Impacts			Total
	Direct	Indirect	Induced	
Output	\$0	\$39,483,530	\$7,586,689	\$47,070,219
Employment	0	162	66	227
Gross County Product	\$0	\$18,805,194	\$4,509,356	\$23,314,551
Payroll	\$0	\$11,127,588	\$1,869,590	\$12,997,177

Estimated Impacts of the Eagle Ford Shale Uvalde County Level (2011)

	Economic Impacts			Total
	Direct	Indirect	Induced	
Output	\$0	\$10,565,655	\$2,476,922	\$13,042,577
Employment	0	55	20	75
Gross County Product	\$0	\$6,624,689	\$1,507,418	\$8,132,106
Payroll	\$0	\$2,242,704	\$556,788	\$2,799,492

Estimated Impacts of the Eagle Ford Shale Victoria County Level (2011)

	Economic Impacts			Total
	Direct	Indirect	Induced	
Output	\$0	\$17,838,358	\$5,137,787	\$22,976,145
Employment	0	71	36	107
Gross County Product	\$0	\$9,742,591	\$3,246,664	\$12,989,255
Payroll	\$0	\$3,673,711	\$1,297,815	\$4,971,526

In Nueces County, companies like Baker Hughes and Martin Midstream Partners planned to spend close to \$45 million in new facilities. For this study, it was assumed that \$30 million was spent in 2011, according to plans made by these two companies. These expenditures are considered direct output for the county.

Another source of direct impacts in the area is the activity of the Flint Hills Refinery. In 2011, the refinery was processing close to 100,000 barrels of oil per day from the Eagle Ford Shale. These activities will also have impacts in neighboring San Patricio County.

Nueces County, like Bexar and other counties near the shale, has also had important indirect impacts as companies have expanded and hired additional employees to meet the needs of those companies located in the Eagle Ford Shale production counties.

Estimated Impacts of the Eagle Ford Shale Nueces County Level (2011)

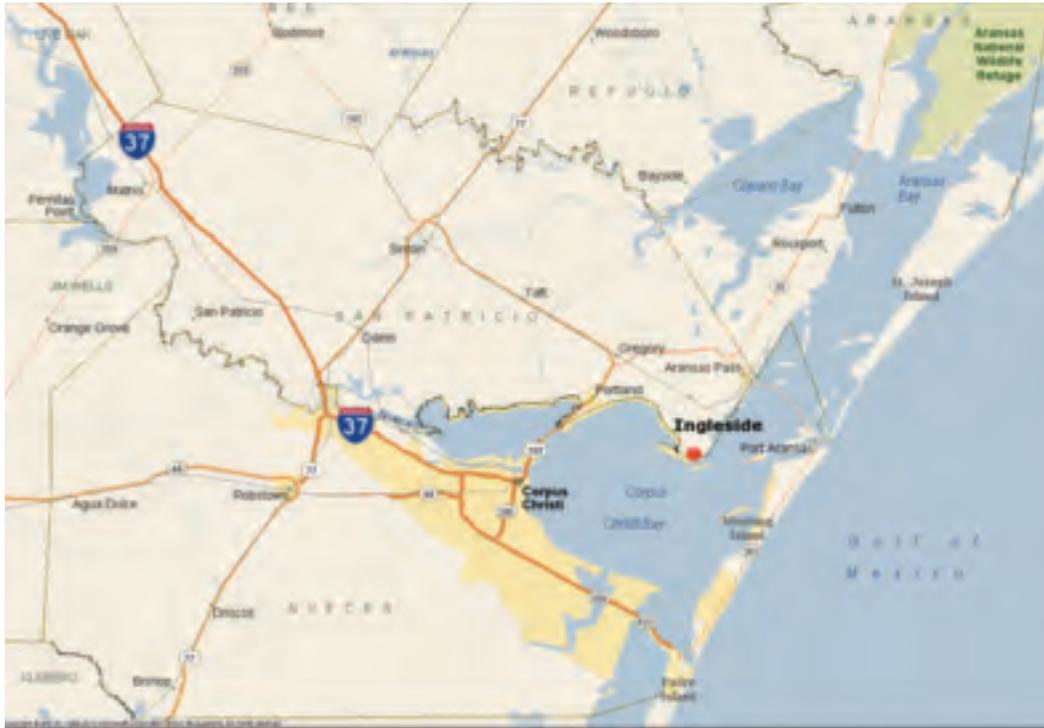
	Economic Impacts			Total
	Direct	Indirect	Induced	
Output	\$4,409,999,819	\$321,200,422	\$180,496,665	\$4,911,696,901
Employment	713	1,788	1,380	3,880
Gross County Product	\$922,511,488	\$178,121,334	\$112,148,366	\$1,212,781,188
Payroll	\$94,001,448	\$82,177,284	\$48,804,351	\$224,983,082

Horizontal separator and coriolis meter (the stainless steel device) in middle. The coriolis meter is used by several operators to measure oil or condensate before it leaves the lease / well site area. The coriolis meter in essence replaces a traditional tank battery and helps minimize truck traffic on leases.



Photograph by Terry Retzlaff.

In San Patricio County, Flint Hills has also begun to renovate sections of the area vacated in the Ingleside Navy military base closure in order to build shipment areas for future crude oil transportation by sea. Out of the \$40 million planned for the construction renovations, the study assumed \$10 million were spent in 2011. This construction generated direct impacts and jobs in 2011.



Eagle Ford Shale activities have also required goods and services from San Patricio County, producing indirect impacts and jobs. Similarly, the refining activities by Flint Hills in Nueces County have also produced additional indirect impacts and jobs in San Patricio County.

Estimated Impacts of the Eagle Ford Shale San Patricio County Level (2011)

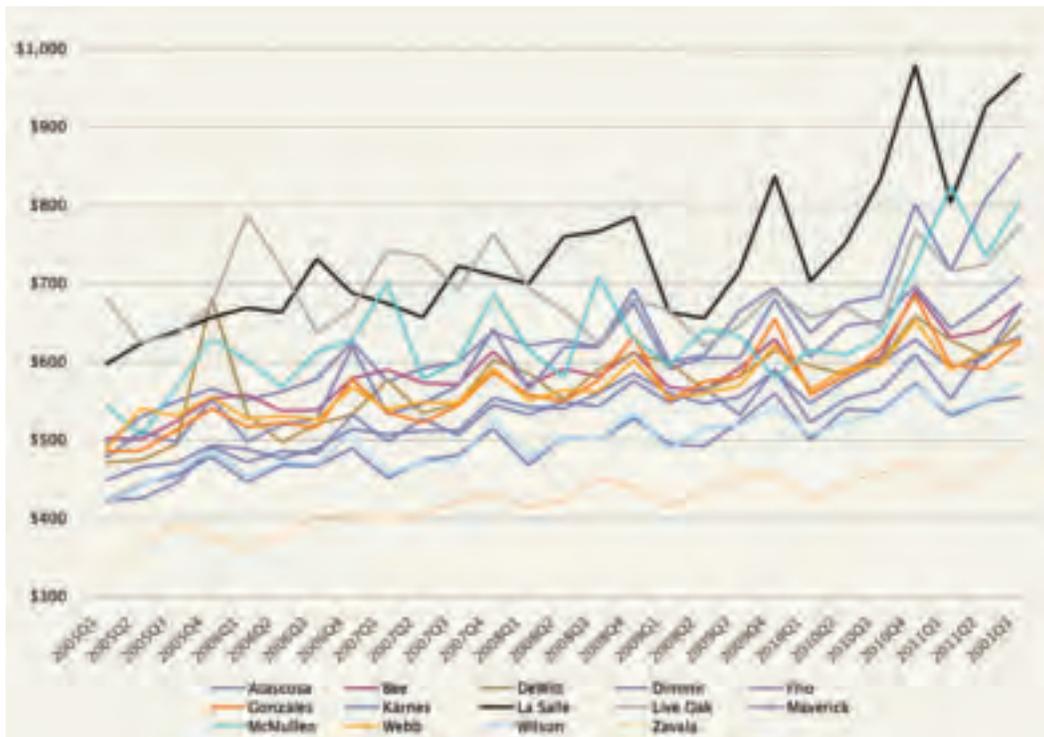
	Economic Impacts			Total
	Direct	Indirect	Induced	
Output	\$10,000,000	\$92,532,844	\$12,918,858	\$115,451,701
Employment	65	345	107	517
Gross County Product	\$4,774,537	\$52,754,781	\$7,595,557	\$65,124,875
Payroll	\$4,086,594	\$16,303,520	\$2,909,511	\$23,299,625

Wages

Initially, it is expected that some skilled workers will be imported from other areas of the state. However, in areas where the local workforce is matched to the qualifications necessary for the additional jobs added in the local area, there will be important employment opportunities for area residents.

It is clear from wage trends in the 14-county Eagle Ford Shale area that the activity in the region is having a positive impact on wages. As the graph below shows, all of the Eagle Ford Shale counties have experienced a trend of upward average weekly wage growth since 2005.¹² Zavala County, which had the lowest wages in all cases, grew from an average weekly wage of \$332 in the first quarter of 2005 (just over \$17,000 annual wage) to an average weekly wage of \$489 in the third quarter of 2011 (more than a \$25,000 annual wage). Most of the counties trended around \$450 to \$550 in average weekly wages in 2005 and rose to between \$600 and \$700 in average weekly wages.

Average Weekly Wage Trends for Eagle Ford Shale Counties



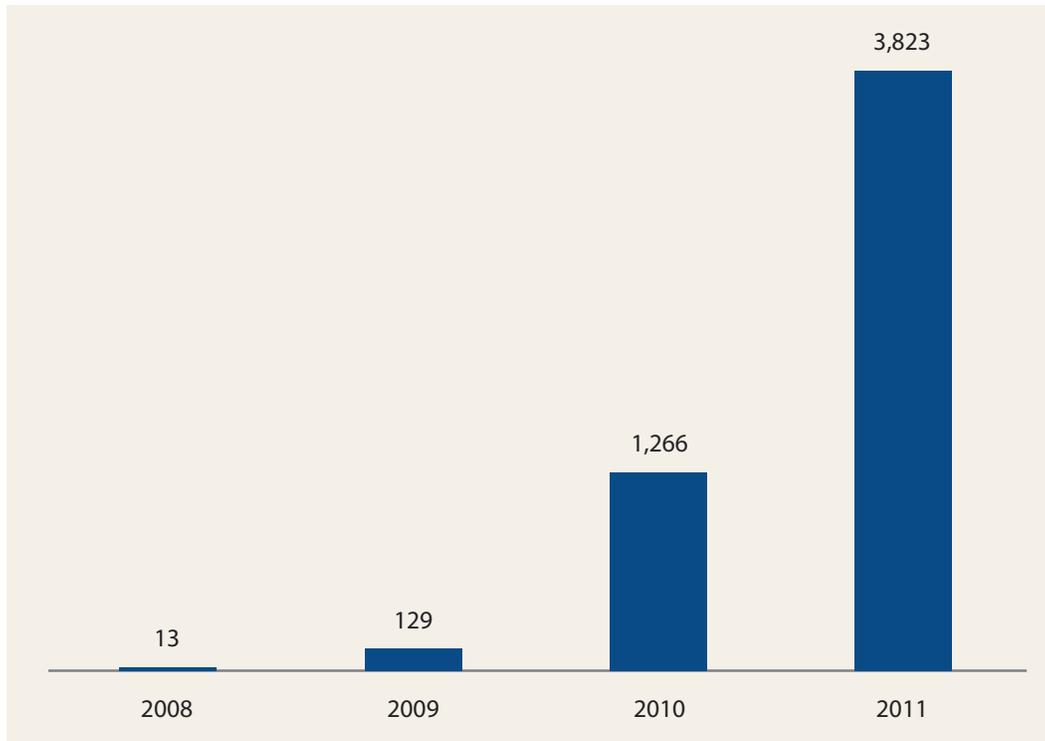
¹² Wage information is from the Texas Workforce Commission.

Upstream Development

Drilling

There has been a significant upturn in permitting and completion, and production in the Eagle Ford Shale region since 2008. By all appearances, the escalation of this activity is continuing into 2012. The increase in drilling permits issued is depicted in the graph below, with drilling permits **tripling** between 2010 and 2011, with a total of 3,823 permits issued in the fourteen-county region in 2011.¹³

Drilling Permits Issued in 14 Eagle Ford Shale Counties



Completion

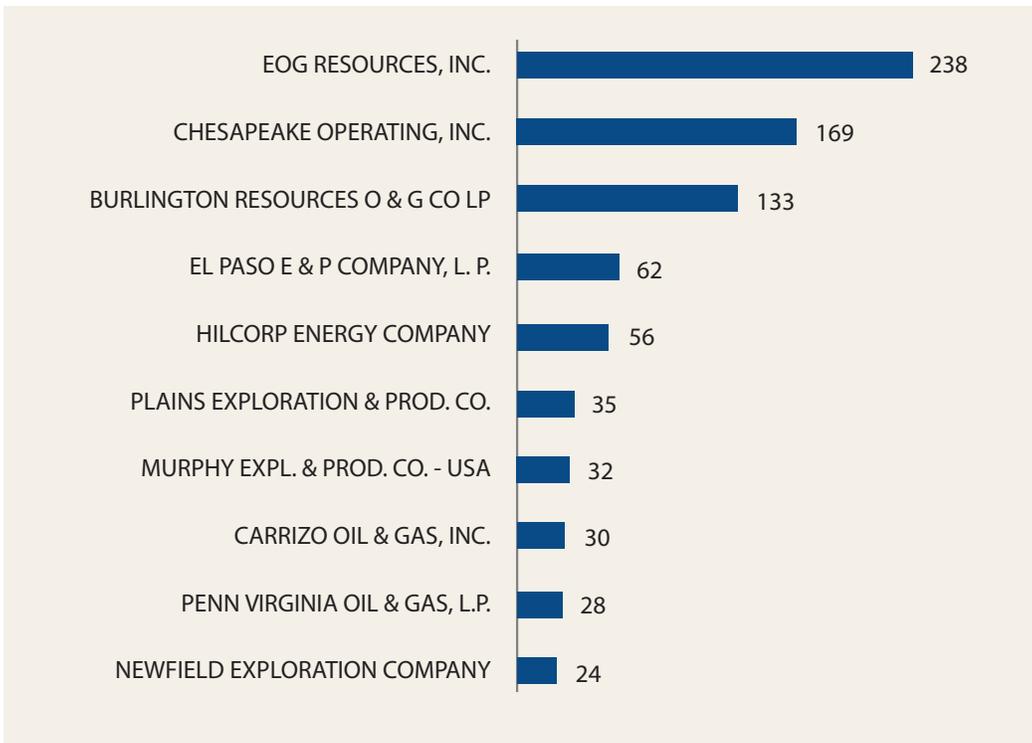
In 2011, there were an estimated 1,649 wells completed in the fourteen Eagle Ford Shale counties highlighted in this study, most of them horizontal. These wells were managed by approximately 50 companies. The ten largest operators in terms of wells completed in 2011 are highlighted below, both for gas and oil wells. In the arena of completed gas wells, Anadarko completed the greatest number in 2011, with 184 completions. Anadarko also completed 20 oil wells. The top oil well operator was EOG Resources, Inc, with 238 completions of oil wells. This company operated specifically in oil well completion, with no gas well completion activity.

¹³ Data for permits and completions was gathered from HDPI, March 2012.

2011 Completed Gas Wells for Top Ten Operators



2011 Completed Oil Wells for Top Ten Operators





Insight from the Energy Services Industry: Joe Foster

Photo courtesy of Halliburton.

Halliburton has been operating in South Texas for over 80 years, providing solutions that include drilling services, hydraulic fracturing, wireline and perforating, cementing, and fluid services. As Eagle Ford Shale activity has escalated in recent years, Halliburton has had the advantage of a strong existing base of activity in South Texas to build from. “Our company has really invested in South Texas and will continue to invest as the growth of production activity in the Eagle Ford continues,” says Joe Foster, Vice President of the South Texas Area for Halliburton.

Halliburton has begun construction on a 400,000 square foot facility in south San Antonio’s Loop 1604 and Interstate 37 area. The \$50 million state-of-the-art facility is expected to be fully functional by summer 2013 and will house 1,500 employees, with an estimated 1,100 to be hired from the San Antonio area. Halliburton plans to work with local colleges and universities to provide training and education for current and future employees. “One of the things that really attracted us to the San Antonio area was a strong workforce in excess of two million people,” says Foster. “When you look at the Metropolitan area, you find a diverse pool of talent with the veteran population and their transferrable skills and with the graduates from some of the top Texas universities in the surrounding areas. There’s also the local support and infrastructure that are already in place. We are very excited to be in Bexar County.”

One of the challenges faced by many of the larger corporations in the Eagle Ford is staffing, as competition for employees occurs between companies. “We currently have 2,600 employees in our South Texas operations, and last year alone we hired around 900 employees here,” says Foster. “When you look at just keeping up with the growth in the Eagle Ford, many of the other service companies are looking for employees as well. This is a very competitive business after all. So we need to do all that we can to be able to attract and retain the best and the brightest talent. This includes developing our people and putting critical infrastructure in place to facilitate this growth. This is why we are attracted to the area and investing in our facility in San Antonio.” Halliburton is a leader in technology and innovation. Among those innovations are the CleanSuite™ technologies, which are used with hydraulic fracturing. There are three elements to this technology suite. The first, CleanStim®, is a hydraulic fracturing fluid. “It’s basically a hydraulic fracturing fluid made up of ingredients that are sourced from the food industry, such as ingredients that are found in fruit juices, baby wash, body lotion, and toothpaste,” explains Foster. The second process, CleanStream®, uses ultraviolet light to control bacteria in the water, which reduces the use of biocides needed to control bacteria growth. The third process, CleanWave,™ enables the recycling of flowback and produced water so that it can be used again, reducing the need for freshwater.

Drilling & Completion Impacts

To estimate the impacts of drilling and completion activities in the Eagle Ford Shale region, two industries were analyzed: Drilling Oil and Gas Wells (NAICS 213111)¹⁴ and Support Activities for Oil and Gas Operations (NAICS 213112). In order to assess the impacts of these activities, the total amount input into all Drilling and Completion activities was divided between the two industries based on the assumption that an estimated 90 percent of costs are allocated to drilling activities and 10 percent to support activities for oil and gas.¹⁵ Accordingly, in the study it was assumed that \$6.75 million were spent on drilling and completion activities and \$750,000 were allocated to support activities for oil and gas operations.

Based on information from HPDI and the RRC of Texas, we estimated 1,649 completed wells were drilled in 2011, almost all horizontal wells. Drilling and completion costs were therefore assumed to be \$7.5 million for the first well and decreased for the following wells.¹⁶

Drilling and completion activities had an estimated total impact of nearly \$12.5 billion in output (revenues) in 2011 and more than \$7 billion in gross regional product (value added), and supported roughly 23,400 full-time jobs.

Estimated Drilling and Completion Impact for Eagle Ford Shale at the Regional Level (2011)

	Economic Impacts			Total
	Direct	Indirect	Induced	
Output	\$10,530,950,717	\$1,000,433,665	\$892,353,018	\$12,423,737,400
Employment	9,615	6,295	7,499	23,409
Gross Regional Product	\$5,941,978,360	\$538,490,037	\$531,857,779	\$7,012,326,176
Payroll	\$1,340,419,198	\$238,870,863	\$222,961,752	\$1,802,251,814

¹⁴ These sectors have code 28 and 29 in IMPLAN.

¹⁵ Based on a study by Marcellus State Education & Training Center, *Pennsylvania Marcellus Shale Economic Impact Study*. Summer 2011. Here, the percentages were applied to costs of drilling and support activities for oil and gas.

¹⁶ Based on both the Marcellus State Education & Training Center study and *The Economic Impact of the Value Chain of the Marcellus Shale Well*, by the Joseph M. Katz Graduate School of Business from the University of Pittsburgh, August 2011. These costs are confirmed to be in a reasonable range by Hart Energy reports on firms operating in the local area.



Insight from the Energy Sector: Rene Montalvo

Chesapeake Energy is the most active driller in the Eagle Ford Shale. Their Eagle Ford Shale drilling footprint includes oil and condensate with operations spanning from support staff in Austin and San Antonio to Carrizo Springs and Pearsall. The company operates 35 rigs on nearly 700,000 acres of leased land in the Eagle Ford Shale area and expects that this figure will increase in 2012, according to Rene Montalvo, the local Manager of Community Development for Chesapeake Energy. “We are going to be busy for a very long time. We plan to drill here for 20 to 25 years, just for the initial effort. Of course, after the drilling comes the production process which is probably another 30 to 40 years.”

The Eagle Ford Shale is still very new to the surrounding communities. Once lightly-traveled rural roads now provide a different kind of commute for local residents. “As the need for drilling increases in the area, so does the amount of equipment needed in the process. Our equipment is very heavy, so when we move in, county roads do experience some wear and tear,” says Montalvo. “It is up to each company to work closely with county commissioners and county judges to try and make sure we do our part to alleviate any concerns. Many times, we work closely with the county commissioners and we will donate materials and they will donate the equipment and manpower to fix county roads,” says Montalvo.



The Eagle Ford Shale has the potential to be an abundant opportunity for all parties not only in the region, but nationally. “When you start looking at us making a dent in the dependency on foreign countries for oil,” Montalvo emphasizes, “the more natural gas and oil [that is] found here domestically, the more independent we can become as a nation.”

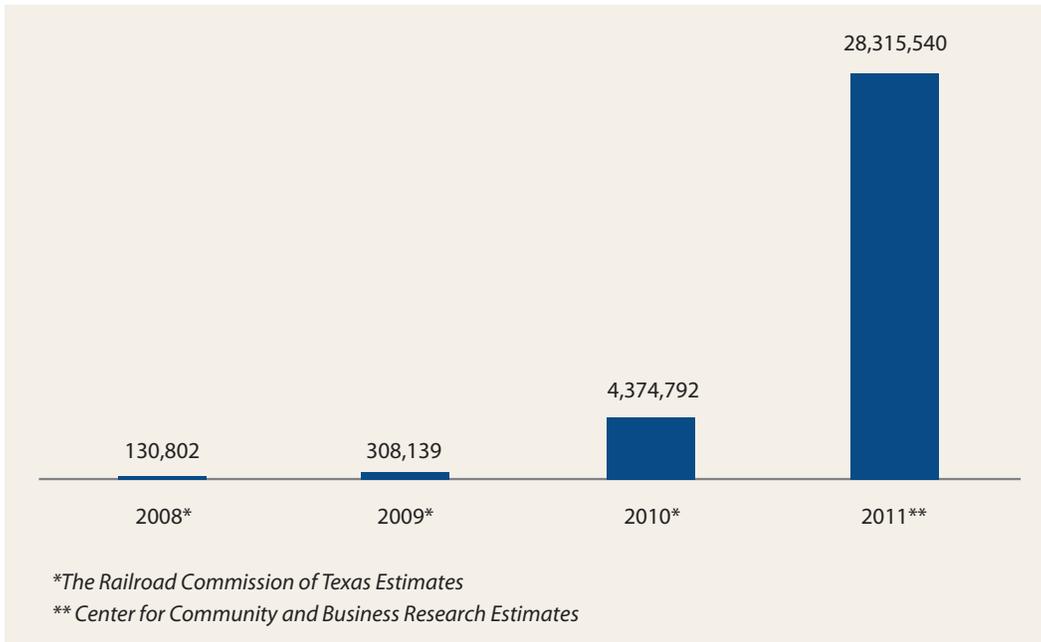
Chesapeake and other drilling companies seek to be involved where possible in local communities, joining efforts with local fire departments and EMS workers, those involved in local economic development strategies, and others. In 2011, Chesapeake Energy donated more than \$265,000 to 67 different entities in the Eagle Ford Shale area. Developing in a sustainable way is possible, especially for the local communities that take advantage of resources like the Eagle Ford Consortium and have a well-defined strategic plan. Montalvo suggests that to be successful, communities must, “have a game plan in place that they implement and stick to by showing a lot of patience.”

Extraction

Production Summary

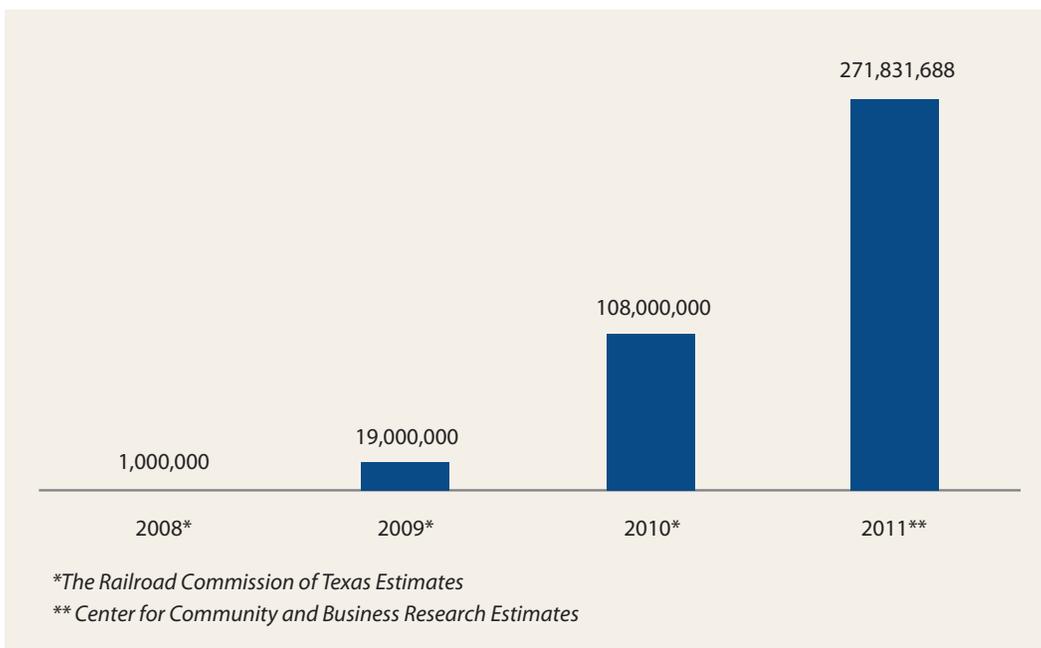
Production in the Eagle Ford Shale region virtually exploded in 2011. Oil production increased more than six-fold over 2010.

Oil Production (In bbls)



Similarly, gas production skyrocketed, more than doubling from 2010 to 2011.

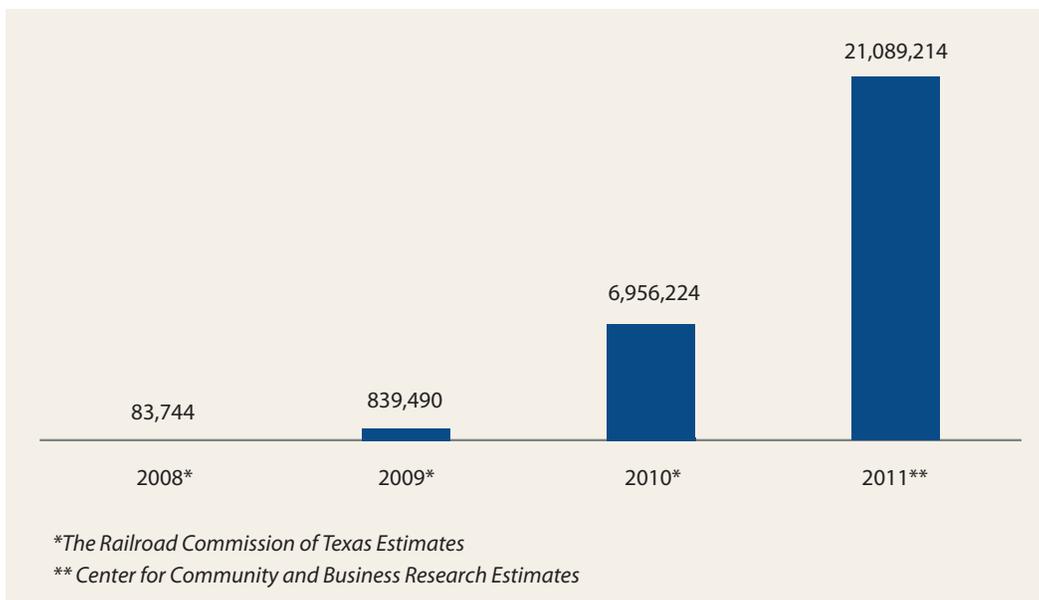
Gas Production (In mcf)



Lastly, condensate is another major product of the Eagle Ford Shale activity. Condensate resembles petroleum in appearance and is similar in composition to some volatile¹⁷ light crude oils, which are technically defined as having an API (American Petroleum Institute) gravity greater than 30 degrees (West Texas Intermediate has an API gravity of approximately 40). Light crude oil is liquid petroleum that has a low density, flows freely at room temperature, has a low viscosity, low specific gravity and high API gravity due to the presence of a high proportion of light hydrocarbon fractions. Condensate has an API gravity between 50 and 120 degrees.

From an economic standpoint, both condensate and crude oil are measured in barrels and priced similarly.¹⁸ The production of condensate in the Eagle Ford area increased significantly, tripling from 2010 to 2011.

Condensate Production (In bbls)



¹⁷ Volatility is the tendency of a liquid to vaporize due to a lower boiling point.

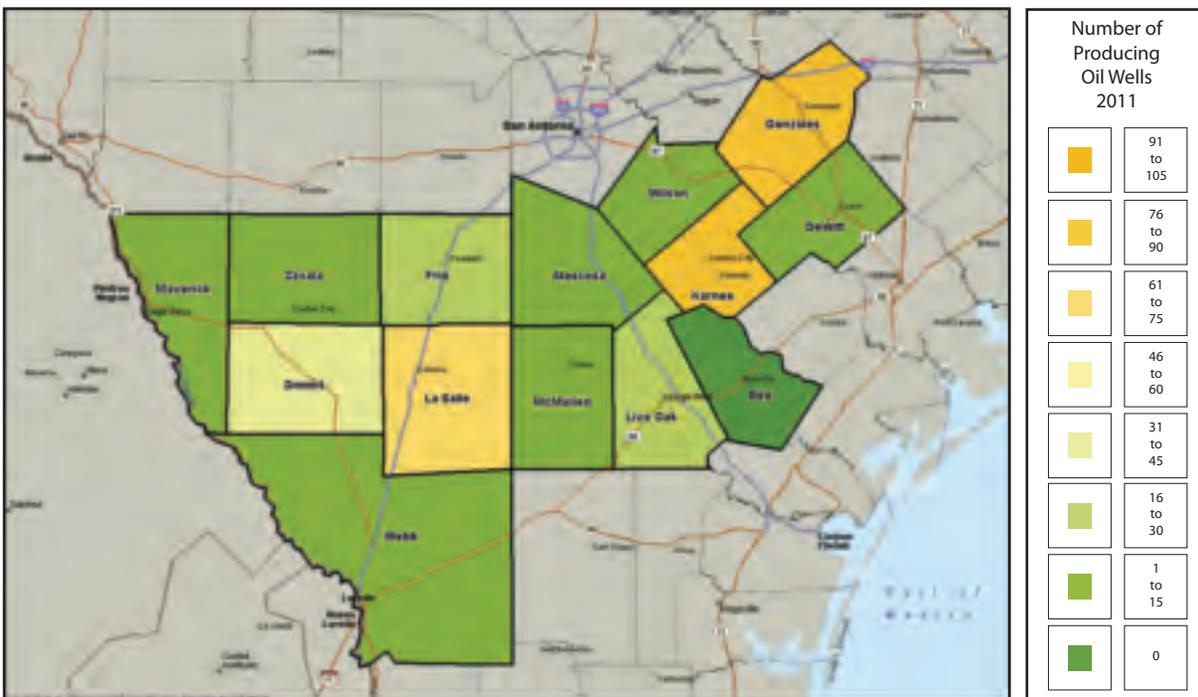
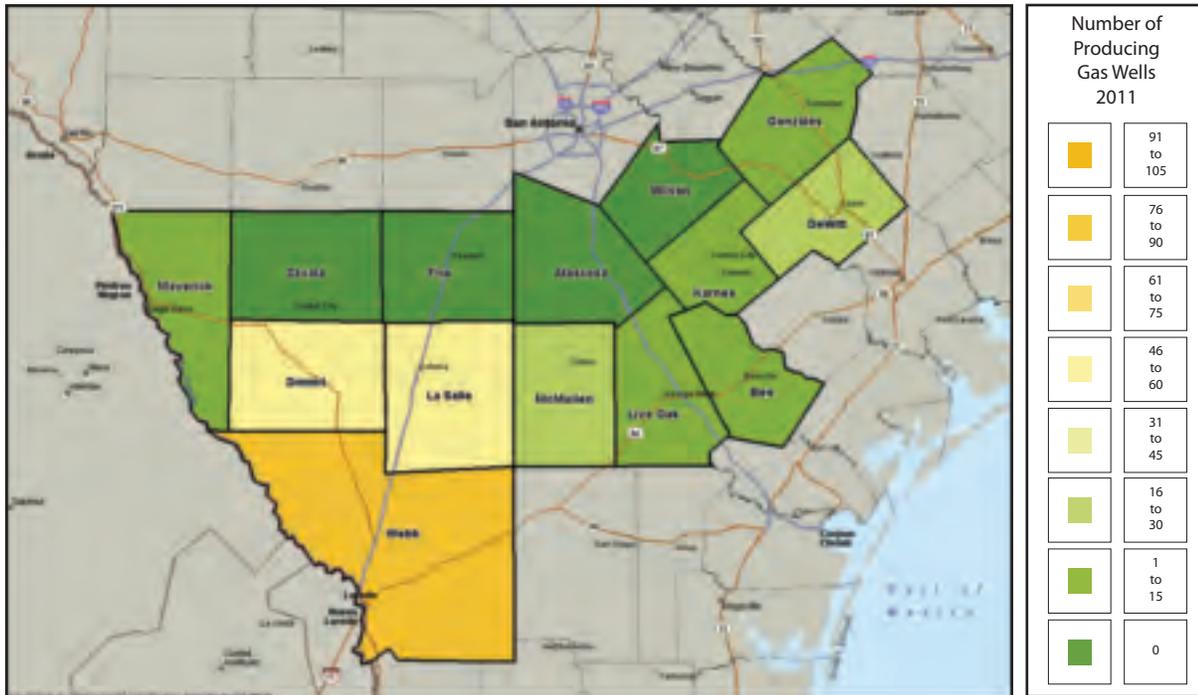
¹⁸ For purposes of forecasting and economic impacts, CCBR's analysis assumes a more conservative price for condensate (57 percent that of oil).

Not every permit translates directly into a completed well – there were 1,649 wells completed in 2011, but only 616 wells were actively producing during the same year.

Number of Wells Completed in 2011			
	Gas	Oil	Total
Atascosa	1	54	55
Bee	2	0	2
DeWitt	105	35	140
Dimmit	170	134	304
Frio	0	31	31
Gonzales	1	143	144
Karnes	42	230	272
La Salle	51	163	214
Live Oak	26	58	84
Maverick	8	9	17
McMullen	52	80	132
Webb	198	3	201
Wilson	0	29	29
Zavala	0	24	24
Total	656	993	1,649

Number of Wells Completed and First Producing in 2011			
	Gas	Oil	Total
Atascosa	0	9	9
Bee	2	0	2
DeWitt	24	13	37
Dimmit	60	43	103
Frio	0	21	21
Gonzales	1	78	79
Karnes	13	83	96
La Salle	34	67	101
Live Oak	14	17	31
Maverick	1	2	3
McMullen	17	11	28
Webb	87	1	88
Wilson	0	11	11
Zavala	0	7	7
Total	253	363	616

The producing gas wells are currently somewhat more concentrated in the southwestern counties of the Eagle Ford Shale Region. Zavala, Frio, Atascosa, and Wilson Counties did not have gas producing wells as of 2011. Meanwhile, the producing oil wells are most highly concentrated in the northeastern portion of the Eagle Ford Shale play, especially Gonzales and Karnes County. Bee County had no producing oil wells in 2011.



Extraction Impacts

To estimate the impacts of the extraction activities of oil and gas, the sector with NAICS code 211, Oil and Gas Extraction was chosen.¹⁹ This industry code includes Crude Petroleum and Natural Gas Extraction, as well as Natural Gas Liquid Extraction. In 2011, the oil and gas extraction firms in the 14 counties included in the study had an estimated \$5.2 billion total impact in output (revenues) and a gross regional product (value added) total impact close to \$3.2 billion. These activities supported a total of approximately 6,000 full-time jobs.²⁰

Estimated Extraction Operations Impact for Eagle Ford Shale at the Regional Level (2011)

	Economic Impacts			Total
	Direct	Indirect	Induced	
Output	\$4,665,206,357	\$314,664,629	\$208,905,143	\$5,188,776,129
Employment	2,374	1,933	1,755	6,062
Gross Regional Product	\$2,840,340,369	\$185,836,107	\$124,450,339	\$3,150,626,815
Payroll	\$305,782,329	\$84,674,155	\$52,207,056	\$442,663,541

While activity in the Eagle Ford area has been ramping up significantly over the past year (and continues to do so), the influx of workers and capital will level off over time. How long before a slowdown in the growth activity occurs remains an open question that is dependent on issues such as energy prices, as well as other factors affecting economics including technical and operational advances.

¹⁹ This sector has code 20 in IMPLAN.

²⁰ The methodology to obtain these results is explained in Appendix A.



Insight from a Fracturing Company: Danny Jimenez

Photos courtesy of Sanjel Inc.

Sanjel (USA) Inc., based in Canada, began providing hydraulic fracturing and other support services in the Eagle Ford Shale area in June of 2011. Sanjel obtained a facility in Cibolo, Texas, near enough to the shale to maintain operations, and a handful of employees were hired. The new location now employs around 350 and plans to increase that number to close to 500 workers. This is great news for Guadalupe County, as many jobs are becoming available.

Technology is a major factor in the oil and gas industry. It is important to reduce costs for the producer and the consumer, as well as reduce environmental effects. “Today, technology is the only way you are going to be able to access the reserves in places like the Eagle Ford,” says Danny Jimenez, Vice President of Sanjel (USA) Inc. “Today’s technology are geared more towards operational efficiencies at all levels including completions techniques, completions tools, et cetera. All efforts aim to reduce time on location, volumes pumped, and to bring reserves to market a lot quicker. These efforts have a positive impact on safety and the environment.” He stresses the importance of proper training and education, especially on-the-job training from employers, in order to help Eagle Ford Shale workers stay on top of the latest technology and regulations. Oil and gas companies are striving for complete transparency with the public and are abiding by closely monitored safety and training regulations that are in place.



“In an effort to make [safety] more personal,” Jimenez says, “we came up with the idea of having a Safety Fair where we shut down our facility for the day, we stop operations and we invite the community to come into our place. It’s an open house and it’s really nice to see kids and their dads talking about a pump and talking about how we do things. Anywhere from fire departments, to police departments, to railroad people - our own Sanjel safety personnel are there with the community. It’s a really good way to connect. It’s a way to tell the people, ‘Hey, come look, there is nothing to hide’. There is a lot to learn. There is a lot to share.” Sanjel continues to serve as a leader in employee safety and training as employment increases.

Midstream Development

Midstream development companies have spent hundreds of millions of dollars in developing the pipeline needed to move the products produced in the Eagle Ford Shale region to the refineries and processing plants located in close areas. Based on the information available from surveying these companies, an estimated \$755.1 million was spent in 2011 on this pipeline development and construction. These construction activities resulted in close to \$1.1 billion in total output impact and more than \$494 million in total gross regional product impact. These activities also supported approximately 7,400 full-time jobs. The impact of midstream development will likely have a limited lifespan once the new supporting pipeline infrastructure is built out.

Estimated Pipeline Construction Impact for Eagle Ford Shale at the Regional Level (2011)

	Economic Impacts			Total
	Direct	Indirect	Induced	
Output	\$755,065,080	\$124,085,944	\$180,139,648	\$1,059,290,672
Employment	4,929	924	1,516	7,369
Gross Regional Product	\$316,642,691	\$70,061,873	\$107,505,947	\$494,210,511
Payroll	\$230,969,724	\$32,589,991	\$44,972,548	\$308,532,263



Insight from a Midstream Logistics Company: Curtis Anastasio

NuStar Energy has been involved with the Eagle Ford Shale since the very beginning of its production, and was the first company to move Eagle Ford crude oil through pipeline. “The reason we’ve been an early mover on this,” says Curt Anastasio, President and CEO of NuStar Energy L.P., “is because we had a critical mass of excess pipelines being underutilized in South Texas that can be filled up with the Eagle Ford liquids production.” Anastasio also noted that NuStar is aggressively expanding its South Texas pipeline network to further increase the delivery of Eagle Ford crude from the field to South Texas refineries where it can be processed, or to South Texas ports where it can then be moved to other markets for refining. As one of the primary midstream providers in the Eagle Ford Shale region, NuStar Energy provides midstream services, including infrastructure, pipeline, storage tanks, breakout facilities, and blending facilities. “This is the biggest onshore oil and gas play in the country and it’s right on our door step in San Antonio,” says Anastasio. “This is all made in America - this is American technology to develop American natural resources benefiting American jobs. So it’s a tremendous story, not just for our region but for the country.”

The Eagle Ford activity is having a major economic impact in San Antonio. “San Antonio is the hub for the Eagle Ford development,” says Anastasio. “Houston is still the center of the oil and gas industry in the United States. But what San Antonio has done is attract Houston and Oklahoma companies to open important offices and facilities in San Antonio because we are strategically located and we have the largest and most diverse workforce available to fill the jobs that they are going to have available.”

One of the most vital issues for the Eagle Ford Shale area is sustainability. Communities must plan to take into consideration that the shale activity will not be around forever and plan accordingly. The real challenge will be using this economic impact to promote long-term growth in South Texas. “I think the Eagle Ford is only positive. It’s positive for our region, our state, and even for the country,” says Anastasio. “All of this wealth creation needs to be invested wisely in things that are of sustainable value to the communities. Whether it be preserving our water resources, improving education, improving infrastructure, whatever it may be that the local authorities decide. It is important that we not squander this golden opportunity that nature has given us. That’s part of the responsibility of everyone working in this. If you’re called upon by local or regional authorities to help plan long term economic benefit to the region then people need to step up and be a part of that. It’s not about making money in the short term; it’s about making sure we protect the long term value of this event.” NuStar has experienced significant growth over the past few years, and has been building a new headquarters in San Antonio to help accommodate its expanded workforce. The company is investing \$100 million in a 300,000 square foot new facility in Northwest San Antonio. This state-of-the-art location has created construction jobs and is set to be in operation by the third quarter of 2012.

Downstream Development

Because of oil refining operations, the Eagle Ford Shale region enjoyed over \$990 million in total output impact and \$143 million in total gross regional product impact. These payments also supported 463 full-time jobs.

Estimated Refinery Operations Impact for Eagle Ford Shale at the Regional Level (2011)

	Economic Impacts			Total
	Direct	Indirect	Induced	
Output	\$935,999,940	\$37,550,200	\$18,084,770	\$991,634,910
Employment	71	240	152	463
Gross Regional Product	\$111,342,502	\$21,062,007	\$10,777,142	\$143,181,651
Payroll	\$22,769,006	\$9,074,453	\$4,516,495	\$36,359,954



Insight from an Oil Refining Company: Bill Day

Photos courtesy of Valero Energy Corporation.

Valero Energy Corporation, one of the largest buyers of Eagle Ford Shale oil, has three Texas refineries in close proximity to the Eagle Ford Shale play: one in Three Rivers and two in Corpus Christi. “Today, the majority of the oil that’s being processed at Three Rivers is coming from a 50 mile radius around the refinery rather than from all over the world,” explains Bill Day, Executive Director of Media Relations for Valero Energy. “We can expect more of the refining at Three Rivers to be done with Eagle Ford crude and an increasing amount in Corpus Christi to be done with Eagle Ford crude.” Prior to the burst of activity in the Eagle Ford Shale region, the Three Rivers plant was processing only imported oil. Valero began purchasing Eagle Ford crude oil in late 2010, and now processes an average of 60,000 barrels daily from the Eagle Ford Shale at its Three Rivers plant. Valero projects to increase this figure to 100,000 barrels daily by the end of the second quarter of 2012.

Using more locally produced crude oil reduces costs and boosts profit margins for Valero. “Valero expects that by 2015, we will be able to push out all of the imported light sweet crude oil that’s coming in from the Gulf Coast,” says Day, “and that’s excellent news for the state and for people who produce oil here in Texas.”



One of the issues faced by Valero was a lack of sufficient pipeline to transport the oil. “There was no real infrastructure in place to do that and a lot of the oil was coming in by truck,” Day says. Valero has since added a new truck terminal and collaborated with NuStar Energy, a midstream development company, to build additional pipeline in the Eagle Ford Shale area. Day emphasizes the positive impact that the Eagle Ford Shale activity is having in Texas. “People have concentrated on some of the negative impacts of this,” says Day. “But if you look at what’s been happening with the economy around the country and how Texas has been [exempt] from the economic downturn, to a large extent is because of the development of the Eagle Ford Shale and the fact that we are hiring people rather than letting people go is a very good sign and is rare right now around the country.”

Land Leases

Based on information provided by respondents to a survey for firms in the Eagle Ford Shale area conducted by the Center for Community and Business Research,²¹ there were an estimated \$150.0 million in lease payments made to land owners during 2011. Without complete data, this provides a conservative estimate of lease payments made, and it is possible that the number is substantially higher. Most direct lease agreements with household owners of mineral rights to land in the Eagle Ford Shale region were made prior to this year, leaving a relatively small number of new leases to be considered in 2011. One established way to estimate the impacts of these payments is to treat these lease payments not as income but as a sudden increase in wealth.²² Based on a study by Y. Mehra, only five percent of lease payments are included in the impact analysis as money that would be expended in the area as a direct result of these payments; this is referred to as a “wealth effect.” Under this assumption, only \$7.5 million are considered as expenditures in the area. Landowners receiving these payments also spend part of this money in other regions. Therefore, these payments translate into \$4.8 million in total output impact, \$2.9 million in total gross regional product, and the support of 40 full-time jobs.

Estimated Lease Payments Impact for Eagle Ford Shale at the Regional Level (2011)

	Economic Impacts		Induced	Total
	Direct	Indirect		
Output	\$0	\$0	\$4,789,653	\$4,789,653
Employment	0	0	40	40
Gross Regional Product	\$0	\$0	\$2,855,306	\$2,855,306
Payroll	\$0	\$0	\$1,182,602	\$1,182,602

It should be noted that even though related studies suggest that only between five to seven and a half percent of lease payments are spent in the area, we expect that additional dollars may stay in the Eagle Ford Shale study area. This is because unlike other oil and gas finds such as the Barnett, Haynesville, and the Permian Basin, more of the land owners are likely to own sub-surface mineral rights in the Eagle Ford area.

²¹ Four companies responded to the survey (from a potential group of thirty companies) within the period required for the study. A fifth survey was provided with limited information on some aspects of the study.

²² Based on a study by Yash Mehra, *The Wealth Effect in Empirical Life-Cycle Aggregate Consumption Equations*, Federal Reserve Bank of Richmond Quarterly Review, Spring 2001; and used by Dr. Loren C. Scott & Associates (April 2010) *Economic Impact of the Haynesville Shale on the Louisiana Economy*. Mehra’s study relates changes in stock market values to changes in consumption using a cointegrated model, obtaining short- and long-run impacts. This seems to be similar to a lease payment that could only occur once in the landowner case.

Insight from a Petroleum Landman: Chris Johnson

Geologists have been aware of shale play formations in Texas for decades, but only recently have current advances in technology, coupled with commodity prices capable of supporting drilling activity, made tapping into these resources an economically feasible endeavor. As oil and gas companies now seek to tap into the vast resources available in the Eagle Ford Shale area, residents of the area have learned quickly that life in South Texas as they have known it is changing. Owning mineral rights to a piece of property in South Texas presents an opportunity for leasing and royalty income from drilling companies, as mineral rights are the dominant estate in Texas when determining who is entitled to sign leasing agreements with these companies. South Texas landowners are often curious to see what portion of their land they own the mineral rights to, and what their rights are as landowners. Conversely, oil and gas companies require access to information about who owns land parcels of interest and assistance in facilitating leasing agreements. Through the services of petroleum land managers, or “landmen,” like Chris Johnson, both landowners and drilling companies are finding assistance in this area.

When thinking about landmen, a common misconception is that these individuals are operating out of oil fields and on the actual land where they facilitate leases. In fact, Chris Johnson explains, this is typically not the case.

“What most people don’t fully understand is that landmen rarely set foot out on the actual property. We are mostly in a county courthouse running records to see what lands are available and open to explore and develop natural resources. A landman sees who owns the mineral estate and the surface estate. The landman will go to the county clerk to look at the official public records and see who owns the property and who owns the minerals,” Johnson explains. “Another thing is to see if there has been production on land or certain areas. Now we can do that by online access through the Texas Railroad Commission or Drillinginfo.com. What a lot of people don’t understand is the difference between surface and mineral rights. A landman’s job is to see who owns what and to be the middleman between the oil and gas company and the mineral or land owner. A landman will negotiate an oil and gas lease so that both parties are happy [with the contract].” Negotiations can often include provisions for surface damage clauses, where a company would agree to make provisions to mend portions of a property damaged by the materials, vehicles, and activities involved in the drilling process.

Mr. Johnson is one of many individuals that have been pleased to see the increased activity and the potential for long-term economic development in the area. However, he acknowledges, there are some new frustrations that the communities’ residents are not used to dealing with. Where it might have taken someone a minute or two to commute a mile to work before, the drive may now take twenty minutes with the increased traffic. Both short- and long-term housing options are now far more difficult to secure and much more expensive. These inconveniences fall into the context of a broader picture, however, and the future for the Eagle Ford Shale is certainly a positive one.

Royalties

For this study, royalties were estimated at 20 percent of total revenues from oil and gas operations. These royalties serve as an important source of income to the owners of mineral producing property. These payments represent close to \$933.0 million paid to landowners. Similar to lease payments, these are treated as increases in wealth. Differently, however, royalties are considered a more permanent change in wealth. Based on established methods for capturing the impacts of royalty payments,²³ this study assumes that these more permanent changes in wealth will have a larger impact on consumption. For that reason, ten percent of total royalty payments are assumed to be a base for inclusion in the impacts. These assumptions translate into household expenditures of \$93 million for 2011. These payments create a total output impact of \$59.9 million and total gross regional product impact of \$35.5 million. The royalty payments supported close to 500 full-time jobs in 2011.

Estimated Royalty Payments Impact for Eagle Ford Shale at the Regional Level (2011)

	Economic Impacts			Total
	Direct	Indirect	Induced	
Output	\$0	\$0	\$59,585,915	\$59,585,915
Employment	0	0	495	495
Gross Regional Product	\$0	\$0	\$35,521,578	\$35,521,578
Payroll	\$0	\$0	\$14,712,216	\$14,712,216

²³ Lettau and Ludvigson (2004) Understanding trend and cycle in asset values: reevaluating the wealth effect on consumption, *The American Economic Review*, Vol. 94, No. 1, pp. 276-299, showed that most estimations of the relationship between wealth and consumption do not take into consideration the temporary nature of stock market impacts in wealth. K.J. Ruhl (2005) Solving the elasticity puzzle in international economics, University of Texas at Austin working paper, shows that trade elasticities can change substantially (more than three times) if the trade changes are permanent rather than temporary.

Insight from a Royalty Owner: Terry Retzloff

Terry Retzloff, owner of TR Measurement Witnessing LLC and Vice President of the National Association of Royalty Owners Texas grew up in Southern Atascosa County and graduated from Karnes City High School and has worked in the oil and gas industry for 30 years. Retzloff himself is a third-generation mineral owner and has been impressed by the sudden increase in Eagle Ford Shale activity. “If you were to tell me two or three years ago that something like this was going to evolve into what it has, I would’ve probably questioned it, if not certainly laughed at it,” Retzloff says. “It’s pretty impressive.”

“When I was growing up here in the 70’s the majority of the rural people were farmers and ranchers and maybe a few town merchants,” Retzloff adds. “So now you see the transformation. Most of my generation left the ‘country’ and went to the cities because of how tough it was to make a living farming and ranching while experiencing the droughts. The economics weren’t there to be a full time farmer or rancher. People have had their mineral rights passed down through their family generations and probably never fully fathomed what they’re experiencing right now. Perhaps some people realize the value of owning minerals rights, most probably didn’t.”

When speaking about other mineral royalty owners who may be new to leasing their rights, Mr. Retzloff suggests, “I would like to encourage people to learn by self-education which includes gathering all the facts. People should understand that that is not something you learn in a couple of hours. It takes a lot of studying, a lot of educating yourself in various ways.”



Photograph by Terry Retzloff.

Eagle Ford well on artificial lift in the form of a pumping unit. Many Eagle Ford wells on the northern fringes of the play (known as the oil window) are put on pump within a year of coming on line. There simply isn’t enough natural gas produced with many of the Eagle Ford wells in the oil window to help naturally lift the oil for any substantial length of time. Consequently, they require artificial lift (options range from compression, gas lift, and pumping units).

“Rural people,” Retzloff adds, “as a rule of thumb have a very big heart, although very conservative; each individual has to determine how they’re going to handle this income to see how much they are going to give back to the people in need. I think churches and the youth will benefit tremendously.”

“People need to understand that the Eagle Ford varies so much in a 20 mile window,” Retzloff also notes. “Unfortunately we don’t all sit on the best acreage. We see a variety of well performance across the respective windows. It’s a wide range parameter with each window being unique. People can easily assume that everyone is going to experience the same well density, but likely that will not be the case. The geology and well completion process will dictate that some areas will be extremely productive and others will be marginal at best. The current level of activity will only last as long as commodity prices support it, so people need to be conscious about making predictions of how long this will last because they can’t predict how long oil prices are going to stay where they’re at. In the dry gas window when natural gas prices are in the low two-dollar range, they are already well below the economic benefit point. While oil prices are high, having much of the infrastructure being put in place will help bring down the average cost over time.”

Right-of-Way Payments

The rapid development of the Eagle Ford Shale was significantly hindered by restrictions on the gathering and transportation of the oil, gas, condensates, and natural gas liquids extracted in the area. Without adequate pipelines to transport these products, companies are forced to hire specialized trucks and drivers numbering in the hundreds to transport these products. Therefore, companies are now spending hundreds of millions of dollars developing the pipelines needed to move the products to the refineries and processing plants located in close areas. These pipelines must pass through large areas of private land, necessitating compensation to the landowners for the rights to transport their products through the land. This compensation is referred to as right-of-way payments. These payments translate into expenditures in the same way that lease payments do. Based on information from a small number of firms, it was estimated that \$124.9 million in right-of-way payments were made in 2011. Similar to lease payments, this study assumes that only five percent, or \$6.2 million, of those payments translated into increased household expenditures. These impacts, shown in the table below, indicate that the area enjoyed close to \$4.2 million in total output impact and \$2.5 million in total gross regional product impact from these payments. The right-of-way payments also supported 35 full-time jobs.

Estimated Right-of-Way Payments Impact for Eagle Ford Shale at the Regional Level (2011)

	Economic Impacts			Total
	Direct	Indirect	Induced	
Output	\$0	\$0	\$4,163,683	\$4,163,683
Employment	0	0	35	35
Gross Regional Product	\$0	\$0	\$2,504,652	\$2,504,652
Payroll	\$0	\$0	\$1,027,481	\$1,027,481

Drilling rig in
Atascosa
County.



Photograph by Terry Retzloff.

Insight from a Land Owner: Jason Nelson

Jason Nelson's family has owned land in the Carrizo Springs and Crystal City area for thirty years. Over the last two to three years, he says, the area has experienced tremendous change. For landowners in the area, the recent Eagle Ford activity has come with some drawbacks, but as he says, "We know it's a positive, at least for economic generation in the area."

The rise in traffic and wear and tear on the roads seems to be the biggest concern of many of the local land owners. Although there have been efforts by drilling companies to repair failing county roads, there needs to be a more proactive approach to ensure the stability of the infrastructure in the area. Many local residents fear that when the surge in activity is over, the cities will suffer from an overabundance of vacant housing and other long-term problems. "Community leaders need to develop plans for sustainability," emphasizes Nelson.

With the rise in drilling activity, many RV parks have sprung up in the area surrounding Nelson's property, in order to house the many workers and in many cases their families. Nelson regards this strategy largely as a positive one, as these will be easy to remove as the surging demand for housing peaks and eventually decreases. On the local level, however, Nelson acknowledges that this creates some problems. "People who actually live down here," Nelson mentions, "know that [the oil boom] will bring the good with the bad." The families moving into RV parks drive up the attendance at local schools, but do not necessarily contribute to the education system through property taxes, putting a greater burden on schools and homeowners. Also, Nelson notes, the lack of available and affordable housing coupled with the increased school enrollment has led to teachers commuting long distances to teach in the Carrizo Springs and Crystal City areas.

Construction

In conjunction with the rise in activity in the Eagle Ford Shale region, hundreds of millions of dollars have been spent by companies in the oil and gas extraction and supporting industries to expand and build new facilities. For example, several companies have built new facilities in Beeville (Bee County): Weatherford International, Crescent Services, Stream Flow, Halliburton,²⁴ ConocoPhillips, Baker Hughes and M-I SWACO (A Schlumberger Company), among others, for \$5 million in construction expenses. Other construction projects exceeded more than \$10 million for warehouses, offices, and other improvements in 2011. In Karnes County, Select Energy Services built a facility costing \$8 million. Because of these construction activities, the 14-county Eagle Ford Shale region experienced \$18.2 million in total output impact and \$8.5 million in total gross regional product impact. These activities also supported 127 full-time jobs.



Estimated Related Construction Impact for Eagle Ford Shale at the Regional Level (2011)

	Economic Impacts			Total
	Direct	Indirect	Induced	
Output	\$13,000,000	\$2,136,395	\$3,101,475	\$18,237,868
Employment	85	16	26	127
Gross Regional Product	\$5,451,655	\$1,206,259	\$1,850,936	\$8,508,851
Payroll	\$3,976,619	\$561,104	\$774,295	\$5,312,018

²⁴ From left: Neil Schmidt, Senior Manager of the Alice, Texas District, Halliburton; County Judge Nelson W. Wolff; Joe Foster, Vice President, South Texas Area, Halliburton; and Henry Cisneros, San Antonio Economic Development Foundation Chair, break ground on the Halliburton facility.

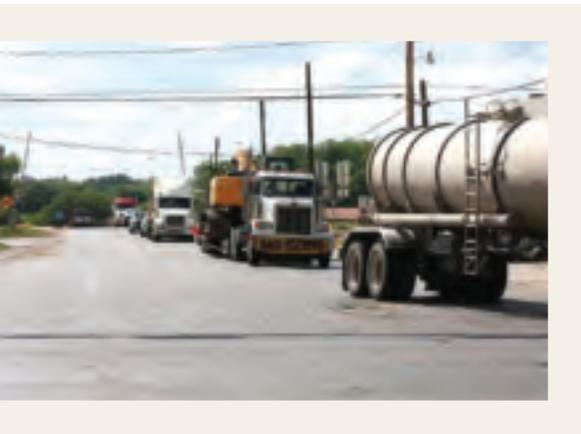
Economic Development

Economic development is an important topic of conversation for the Eagle Ford Shale area. Local communities, counties, chambers of commerce, small businesses and small business advisors, large companies from the oil and gas industries, and even individual residents play an important role in the ongoing development of the area. Constant communication and long-term strategic planning are responsibilities that are shared among these stakeholders, as all stand to benefit from the sustainable economic development of the communities in the Eagle Ford Shale production area. By building linkages and alliances between communities, the shared interests of the area can be maintained on a region-wide basis. As communities and counties invest in local infrastructure, it is important to keep two pieces of information in mind in order to proceed with a long-term perspective. First, the shale activity will eventually begin to decline and revenues will also decrease at that time. Second, the local population will likely also decline as production decreases, as workers in the oil and gas industries are gradually displaced and move on to other opportunities. While tax dollars are flowing into local community coffers, it is important to use the investment wisely.

One example of mismanaged local investment may be found in Mansfield, Louisiana, a community located in the Haynesville Shale production area. The local community was overwhelmed by the windfall from the activity, and spent their revenues on over \$6.3 million in annual bonuses for the school district, expensive football fields, and similar expenditures. Once activity began to slow in response to decreasing natural gas prices, however, the community was soon unable to fill its hotels or populate its restaurants, and the school district was left with nice football fields but newfound difficulty funding the pension accounts of employees.²⁵ This is intended to serve as a cautionary tale of sorts. Fiscal discipline will be essential so that funding increases of a finite duration are spent wisely and with careful regard for the future.

Planning efforts should keep a medium- to long-term perspective. Easily repurposed buildings and temporary buildings may be one construction solution, as these allow for easy conversion from one use to another. Sustainable infrastructure is also important – building better medical facilities, improving aesthetics locally, and creating public attractions are some examples of ways that communities can increase their desirability. Fixing and improving roadways is another effort that is proving essential to communities with the increase of heavy truck traffic. These efforts can keep current residents from leaving and even attract new residents to the small communities of south and southwest Texas.

Citizen engagement is an important facet of the sustainable economic development of the Eagle Ford Shale communities. By participating in strategic planning processes and holding leaders accountable for established strategic planning goals, local residents can ensure that the communities are maintaining a long-term perspective and creating a local environment that will continue to attract and retain residents in the future.



²⁵ *Wall Street Journal*, "Natural-Gas Windfall Wanes," March 14, 2012.

Mixed-Use Facilities and Form-Based Zoning

Mixed-use development and form-based zoning provide options for sustainable development in the Eagle Ford Shale region. Mixed-use facilities are pedestrian orientated and contain elements of the live-work-play environment in a single location. The benefits of these types of facilities in an area can result in positive externalities spread throughout the entire community to include landlords, tenants, the environment, and the city itself.

Mixed-use projects generally look to incorporate residential, commercial, and industrial developments into a single structure by renovating existing structures that might once have been used strictly as office buildings into environments that house a variety of business types and living quarters. A typical example of a mixed-used facility would include residential living units in the upstairs portion a building and retail and service businesses on the street-level.

Mixed-use developments are more versatile than traditional single-use facilities because they can be used to incorporate office, retail, medical services, apartment or condos, senior housing, lodging, recreational, and industrial uses in one development. *Mixed*-use facilities are different from *multi*-use facilities, which can also be used for several purposes, but do not *integrate* residential, commercial and industrial developments.

Mixed-use facilities provide several advantages to local economy and business owners. They promote economic vitality and expand market opportunities by providing a steady market of consumers to local businesses. Local businesses receive significant boosts in commerce as the addition of tenants brings much needed commercial activity. Synergy is achieved when occupants of the residential and office spaces shop at the on-site retail facilities and when office and retail space users live in the residential units.²⁶ Mixed-use facilities create vibrant communities because they are commercially active during the daytime, while residential and restaurant tenants keep the environment alive at night and on weekends.

²⁶ Mixed-Use Development: A review of Professional Literature. National Association of Industrial and Office Properties Research Foundation. Nov 2007.

Insight from the Eagle Ford Shale Consortium: Leodoro Martinez, Jr.

In November 2010, community leaders from nine counties in south Texas gathered to discuss labor issues relating to the Eagle Ford Shale. These leaders recognized that the oil and gas industry was starting to move into their part of Texas and began table discussions about the effects of these changes. One issue of particular concern was whether the local labor force would be able to meet the labor demands of the oil and gas companies. These initial meetings of the Eagle Ford Shale Consortium provided a bridge for oil and gas companies to meet with educational institutions from the counties to talk about the occupational training opportunities needed locally in order for the workforce to meet the increasing workforce demands of the Eagle Ford Shale activity.

“After the initial meeting, the community leaders found that they had even more questions that were beyond the workforce issues,” says Leodoro Martinez, Executive Director for the Middle Rio Grande Development Council. “That led to some questions concerning the water, the environment, the infrastructure and transportation, and the taxation within these counties.” These leaders met sixty days later and broke into committees to discuss the varying topics and issues. Over the past year and a half, many more meetings have taken place with additional community leaders and more industry professionals gathering to discuss issues and topics which then led to the Eagle Ford Shale Consortium.

Since the Eagle Ford Shale Consortium meetings have begun, leaders in these communities are using the ideas from networking events held to address and implement solutions to many issues, such as families being displaced due to the lack of housing, hotel development, moderate to good housing construction, small business and restaurant construction, and water concerns. Mr. Martinez recommends to small businesses: “When businesses write their business plans, they should go ahead and make allowances to their overhead [costs] because they’re going to have to transport and bring in some of their employees. That means that some people are going to be transported back and forth from San Antonio, Eagle Pass, or Laredo. All those things have taken place since we started. These are issues that we have made different people aware of and they’re now trying to address as a group.”

Mr. Martinez is most concerned with providing “solid recommendations that provide a sustainable approach, and by that I mean it’s very important that we as communities that are in the middle of the shale, and even the surrounding communities, have a vision of what we want them to look like ten, fifteen, twenty years from now. How are we preparing and how are we addressing the immediate while still preparing for the future? What sort of communities do we want to have at the end of the day when the support of the play will be gone? That’s been the purpose of our consortium.”



Insight in Economic Development: Mario Hernandez



Photo courtesy of San Antonio Economic Development Foundation.

The Eagle Ford Shale is having a major impact on San Antonio, and Mario Hernandez, president of the San Antonio Economic Development Foundation, is dedicated to helping San Antonio make the best of the opportunities presented. “The key goal is the increase in investment and jobs in the oil and gas sector,” Hernandez emphasizes. “The economic development community is very committed to assisting the companies involved and providing whatever tools and incentives and overall assistance they may need.”

San Antonio has been significantly affected by the increase in jobs within the past two years and has projected 4,000 new jobs for 2012. “We have focused on the activities of the Eagle Ford formation to try to maximize the economic impact to San Antonio and South Texas. From our perspective it is identifying opportunities, and specifically job-producing opportunities tied to this oil and gas formation, and trying to bring the opportunities in terms of jobs closest to Bexar County and San Antonio. That maximizes the impact for this metro area,” Hernandez says.

Regarding the economic development of the communities around the Eagle Ford Shale, Hernandez says, “With the growth and the economic opportunity, of course, comes some issues and problems, and our advice is to make sure that the companies that are benefitting from this oil and gas formation are involved directly with the communities. It’s in their best interest to help solve any housing, or infrastructure, transportation difficulties. And if the communities will partner with the private companies that are creating these jobs, it can be a win-win for everybody.”

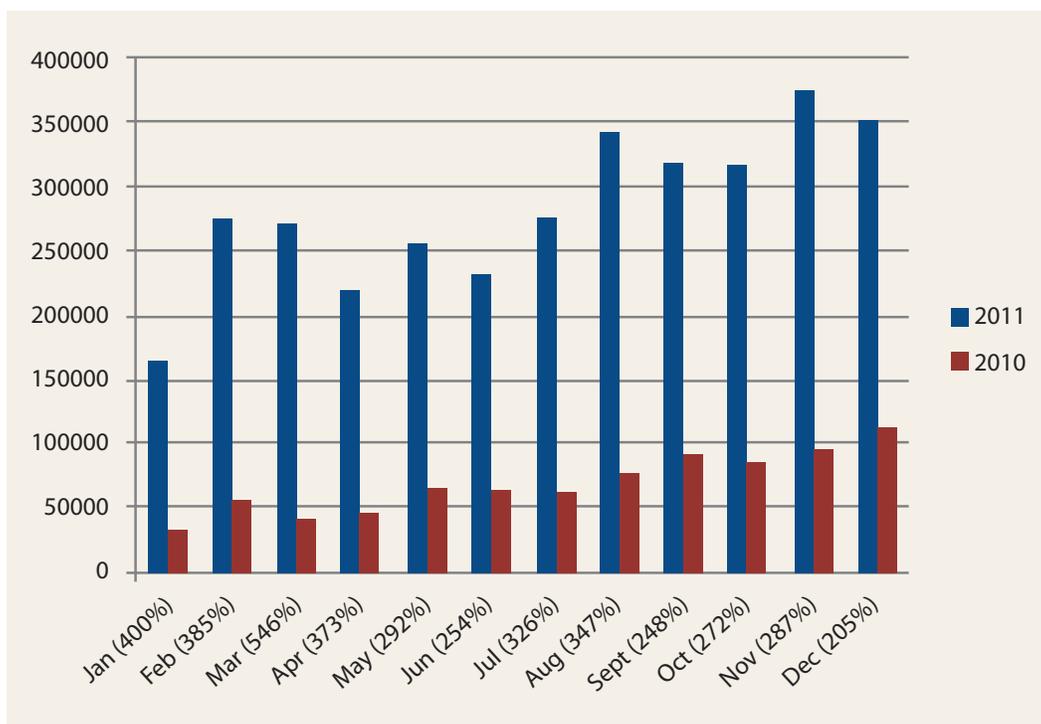
“We view the Eagle Ford activity as an economic opportunity of a lifetime,” Hernandez concludes. We really think that if we maximize the impact it will have dramatic change and improvement of a regional economy for many years to come.”

Taxes

Property tax collections provide the largest source of revenue that local governments have available for providing services such as schools, streets, and health and safety efforts.²⁷ When local governments plan budgets, property tax revenues are a more stable monetary source. However, these revenues can take up to a year to see an increase when development takes place and their stability is dependent on housing appraisals. One current issue faced by communities in the Eagle Ford Shale region regarding property tax revenue is that property taxes are not generally collected from RV occupants in the counties. The owners of the RV parks are also not responsible for those property taxes or the tax burden the residents of the RV parks place on local infrastructure and municipal services. These residents may not pay into the school tax system where their children attend, therefore increasing the burden to others. While housing developments are currently under construction in various locations throughout the Eagle Ford Shale region, there remains a substantial lag time for collecting property tax revenue on these homes. Despite these challenges, property taxes are expected to increase dramatically as residents continue relocating to the area and property values rise.

Even with the various challenges related to the collection of property taxes, sales taxes have experienced a tremendous jump in the period from 2010 to 2011. This tax, imposed on all retail sales, leases, and taxable services, has created a new wave of revenue for local communities. For illustrative purposes, the sales tax collections for two counties in the Eagle Ford Shale region, Karnes and Dimmit, are illustrated here – both of which have experienced triple-digit increases (noted in parentheses). In addition, Karnes City Sales Tax Receipts increased from \$204,429 to \$458,291 from 2010 to 2011, a 124 percent increase

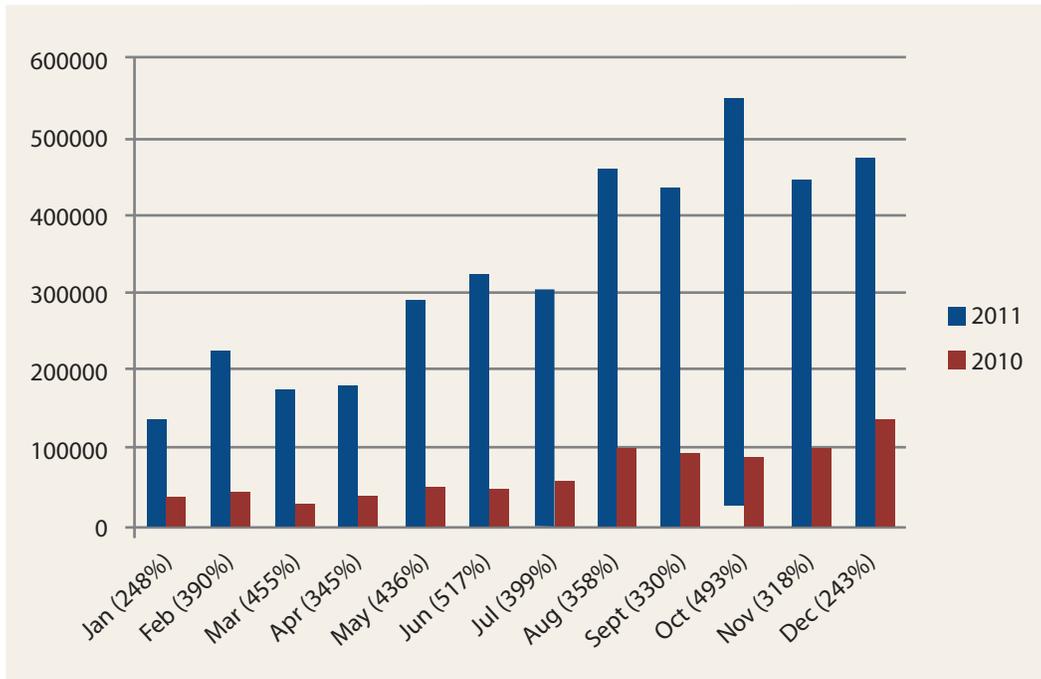
Sales Tax Receipts: Karnes County 2010-2011



²⁷ Texas Comptroller of Public Accounts.

Similarly, Carrizo Springs Sales Tax Receipts have increased from \$831,619 to \$1,711,344 from 2010 to 2011, a 106 percent increase. Dimmit County’s year-over-year sales tax increases are highlighted in the table below.

Sales Tax Receipts: Dimmit County 2010-2011



Small Business

Small business is one arena in which the Eagle Ford Shale provides a multitude of both opportunities and challenges. The explosion of activity in the Eagle Ford Shale region provides opportunities for existing businesses to expand and for new businesses to locate to the area.

From hotels and motels to food service, service and hospitality industry businesses are in high demand because of the increasing population and their need for those amenities on a daily basis. One challenge that these businesses may face is a difficulty in paying a wage comparable to higher-wage jobs available in the oil and gas industry sector. Another challenge is sustainability – as Eagle Ford Shale production declines after the spike in activity is over, these small businesses need to have a strategy in place to remain sustainable and cover their costs.

One recommendation that Tom Kennelly, project manager for the UTSA Rural Business Program, makes is for small business owners to repay debt quickly, while the Eagle Ford Shale activity is booming and their revenue is at its highest levels. This may be an ideal time for many small businesses to open or expand because of the high demand, and paying off outstanding debt at the peak of activity is essential for staying in business after the burst in activity has calmed down.

Small businesses in industries related to the Eagle Ford Shale activities may also find opportunities in the area. Research and development, construction, drilling and support services, trucking companies, and other similar industries may all find opportunities locally. Challenges that may be faced by such businesses are locating experienced workers and locating housing for these workers. With hotels, motels, apartments, and RV parks operating at capacity, finding ways to help workers commute from a great distance may be necessary for these businesses to employ the workers that they need.

Overall, the rise in activity provides a great opportunity for small businesses to either locate or expand with the increased local population and their accompanying demands for services. Maximizing this opportunity requires careful planning, especially for the long term, to be successful.



Insight from a Small Business Owner: Monica Contreras

Photo courtesy of Miguelito's Mexican Grill.

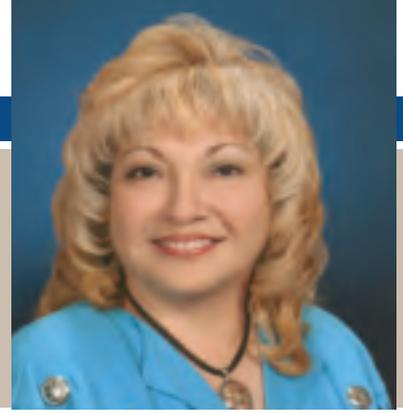
Restaurants are busier than ever and grocery stores are filled with unknown faces. Hotel rooms are sold out weeks, months, and in some cases years in advance. Housing and rental prices have escalated, not just for Eagle Ford Shale workers, but for local residents as well. There is now traffic where there never was before. Employee retention in small businesses is being challenged by the competition of oil wages. The Eagle Ford Shale is drastically impacting local communities in South Texas. Small business owner, Mrs. Monica Contreras, shares her experience managing Miguelito's Mexican Grill in Crystal City, just north of Carrizo Springs.

The influx of workers due to the Eagle Ford Shale activity has been both a blessing and a challenge. "Our volume has increased significantly," she explains, "The number one challenge for us is to keep our restaurant with enough staff to meet the demands in the increase in sales." One issue she faces is that, as rent and housing prices rise, people are leaving their traditional employment to seek the higher wages with the Eagle Ford Shale companies, making it difficult to maintain a full workforce in the smaller businesses. "All the restaurants and all the businesses are struggling with workforce," she says. "It's a challenge for us to compete with that type of pay." Although the economy is strengthened and employees are earning higher checks than previously, it is not enough for many to afford the inflated cost of living in the local community.

Modifications must be made in business to satisfy customers in order to prevail in this economy. "Business is good," she says. "We have made some adjustments to our product to satisfy our customers. Different tastes; they come from different areas, but it's been good.... We just have to learn what they like so we can make good recommendations for them."

Contreras has been running Miguelito's Mexican Grill for eight years now, and now has plans for the expansion of her restaurant to an additional location in Carrizo Springs. Just as evolving has brought success to Contreras in her restaurant, she emphasizes that local communities will need to adapt quickly in order to maintain stability at the growing pace of the Eagle Ford Shale. "We need for our community leaders, as challenging as it is, to stay on top of the growth and the challenges that come with it," she says.

Insight from a Chamber of Commerce: Paula Seydel



Paula Seydel has been the Manager of the Dimmit County Chamber of Commerce since January 2006, and has found that the Chamber has, “definitely evolved since then.” The Eagle Ford Shale play has enhanced the economy in Dimmit County, and the Chamber of Commerce has become the common ground for businesses. “The activity level has reached a really high level right now,” Seydel says. “The phone is constantly ringing – it is not unusual for me to leave the office for a little bit and come back to 15-25 missed calls sitting on the machine.”

Businesses have utilized the Dimmit County Chamber of Commerce as an essential resource when looking to expand. “We have become the center of information when somebody comes in – it is the first stop where they get the maps when they are looking for perhaps purchase of land,” Seydel says. The Chamber of Commerce provides visitors and businesses with information on realtors, water-hookups, electricity, telephone services, internet providers, land, and much more. “Really it is a one-stop shop for setting up a business.”

As the Eagle Ford activity affects the local residents, the Chamber bridges the gap between community and industry leaders with residents. “Not only are we, the Chamber, involved in the business part of the community; the other part of the chamber business is to look out for the quality of life for the residents and getting involved in the community projects. We have to be the referees sometimes.”

The Dimmit County Chamber of Commerce is currently organizing the Joint Initiative for Developmental Planning, which will coordinate with Carrizo Springs, Big Wells, and Asherton to ensure unified county development and share the same “growing pains.” Seydel suggests that all Eagle Ford Shale communities form similar collaborations between city and county leaders. “It is a known thing that sometimes cities or counties don’t get along with each other, but we can’t do that anymore; we can’t afford to do that anymore. We need to open up the lines of communication, be able to sit at the table and discuss it like grown-ups, and figure out not *what’s in it for me* but *what’s in it for them*... And if we do it right, it will be sustainable and it will last.”

Transportation

Despite the benefits that Eagle Ford Shale activity has created for the counties it spans, it has also created quite a few problems with road damage and traffic.²⁸ As oilfield highway traffic in South Texas has increased, so too have the complaints of local residents and workers. Currently, almost all Eagle Ford Shale oil and condensate production is being moved to market by trucks. Some wells produce over 1,000 barrels a day, and crude transport trucks have the capacity of about 200 barrels. Traveling the roads of these rural counties are oil and gravel hauling trucks, equipment trucks, roughnecks, and service company vehicles going to and from new wells. The Texas Department of Transportation reports that nearly 1,200 loaded trucks are needed to bring just one gas well into production - the traffic equivalent of roughly 8 million cars.

As truck traffic throughout the Eagle Ford Shale play increases, there is a growing need for trucks and truck drivers that is not currently being met locally. This shortage is partly attributable to the lack of pipelines in the northern producing part of Eagle Ford shale, making it difficult to carry the produced oil to refineries and ultimately to market. Companies are making their best efforts to build the critically needed pipelines quickly to match the growing demand. Until pipeline construction has time to catch up, EOG Resources Chairman Mark Papa anticipates that almost all Eagle Ford shale liquids production will be moved by truck, probably until mid-2012.

While counties wait for these pipelines, however, damage to county roads is inevitable. The oilfield traffic is taking a toll on roads that were not designed to handle so much weight. On rural roads with no shoulders, trucks carrying oversized loads sometimes have to veer off of the pavement, creating depressions that can become dangerously steep drop-offs. Many counties are realizing the severity of the struggle to keep up with roadwork. One Texas Department of Transportation engineer has indicated that if keeping up with maintenance becomes too difficult, some farm-to-market roads may have to return to gravel.

Also facing a heavy impact are county bridges. Even though most small load zoned bridges have an alternative route around them, large amounts of traffic still goes across them, leading to rapid wear and tear.

Eagle Ford Shale oilfield traffic is causing many county governments to scramble to find funds to repair roads and bridges. With increased cash flow into the counties stemming from skyrocketing Eagle Ford Shale extraction and production activity, many city and county officials say they will primarily be spending the money on infrastructure, especially roads. In Wilson and Karnes Counties, the Sheriff's departments are reporting that many overweight vehicles are using county roads to avoid Texas Department of Public Safety (DPS) troopers enforcing weight limits on state highways. The city of Pleasanton in Atascosa County is considering an ordinance banning 18 wheelers from city streets, which may also be worrisome for non-oilfield related trucking companies.

The damage inflicted on county roads and bridges has not gone unnoticed by officials associated with the Eagle Ford Shale play. The Eagle Ford Task Force was created under the directive of Texas Railroad Commissioner David Porter in 2011 to address any issues that arise in the affected counties. The task force has announced several advisements to address the deterioration of roads and concern for public safety. The task force supports trucking companies partnering with the Texas Department of Public Safety to develop a program that would alert companies when their drivers receive moving violations or drivers' license suspensions. The task force also supports the creation of road use agreements or trucking plans, between operators and local authorities. Proposed agreements include:

- Operators must avoid peak traffic hours, school bus hours, and community events
- Operators must establish overnight quiet periods
- Operators must ensure adequate off-road parking and delivery areas at all sites to avoid lane/road blockage

²⁸ *The Eagle Ford Shale Blog* "Eagle Ford Shale Road Traffic from Crude Bottleneck" May 5, 2011.
The Eagle Ford Shale Blog "Will Lack of Infrastructure Slow Eagle Ford Shale Activity?" February 17, 2010.
The Eagle Ford Shale Blog "Photos of Eagle Ford Shale Activity" September 26, 2011.
Caller.com article "Eagle Ford Shale Enriches but also Challenges South Texas Boomtowns", October 8, 2011.
Chron.com article "Eagle Ford Windfall Carries Pluses and Minuses", November 19, 2011.
The Eagle Ford Shale Play "Infrastructure Issues Addressed by the Eagle Ford Task Force", October 12, 2011.

Environment

The debate over the environmental safety of hydraulic fracturing to obtain gas and oil from underground shale formations has been the source of controversy between the public, regulators and the oil and gas industry. Hydraulic fracturing involves the high-pressure injection of water, sand and chemicals into a shale bed, which causes the rock to shatter, releasing natural gas. The practice has been in use for decades but has come under scrutiny in recent years from environmentalists and others who fear it poses a threat to public health. Growing concerns over groundwater contamination due to the chemicals involved have ignited controversy over this issue and even delayed or temporarily halted all development in some cases.²⁹

In response to these concerns, the Energy Institute at the University of Texas at Austin performed a study to assess these issues and found no direct connection between the hydraulic fracturing process and groundwater contamination. According to Charles Groat, an Energy Institute Associate Director and the lead author of the study, “These problems are not unique to hydraulic fracturing.” Findings from the study, indicate that any contamination that does occur is not a result of the fracturing process itself but rather from errors in other parts of the drilling process. Examples of this might be casing failures that allow drilling fluids and gas to escape from a well and faulty cement jobs that cause spills on the surface. Energy Institute researchers examined data from three shale formations with active fracturing sites: the Barnett Shale in north Texas, the Haynesville Shale in western Louisiana and northeast Texas, and the Marcellus Shale in Pennsylvania and New York. The results found no confirmed cases of drinking water contamination due to chemicals escaping through underground fractures.

A common contaminant in drinking water wells located in aquifers above shale gas reservoirs is methane. Historically, local residents and water well drillers have reported methane contamination years before any shale gas drilling activity to place the area. According to the Energy Institute report: “Methane in water wells is so common in Pennsylvania that both the Pennsylvania State University Extension Service and the Pennsylvania Department of Environmental Protection (PADEP) have for decades distributed pamphlets for home owners entitled ‘What to do if you have methane in your water well.’ The USGS sampled 170 residential water wells from 47 counties in West Virginia years before any shale gas activity took place in the area and detected dangerous concentrations of methane in the water. The methane is believed to be coming from coal mines area but no further research has been made.”³⁰

The Energy institute found no evidence directly links the hydraulic fracturing process with underground water contamination. Nonetheless, investigation into this matter is ongoing at many universities, and more research is needed before this question is resolved. In the meantime, extensive precautions must always be taken and regulations followed throughout the drilling and hydraulic fracturing process.



³⁷ “Separating fact from fiction in Shale Gas Development,” Energy Institute at the University of Texas at Austin.

³⁸ “Separating fact from fiction in Shale Gas Development,” Energy Institute at the University of Texas at Austin Pg 171 - 172



Insight from an Environmentalist: Dr. Susan Stuver

Dr. Susan Stuver is the Assistant Director at the Texas Center for Applied Technology (TCAT), a center within the Texas A&M university system. The center focuses on taking discoveries that occur within the university setting and applying them into the marketplace.

Last summer, in an onsite source survey to measure and verify emissions from the Hydraulic Fracturing process, Dr. Stuver and her team analyzed engine types on the through measurements of their activity, run times, and engine loads. The traditional technique to test these emissions uses a drone fly-over and may overestimate emissions data by assuming that the loads on the engines are operating at one hundred percent. Stuver's team compared the engines and could determine the differences between engines with greater accuracy than would otherwise be possible, information that can be useful to companies and regulators alike.

When speaking about water concerns, Dr. Stuver points out a study done by one of TCAT's partners, GSI Environmental, Inc. (GSI). "They're doing isotope fingerprinting of ground water methane and what they found is cases where people are saying 'we found methane in the water, it must be coming from that well,' but methane in groundwater can come from a variety of different sources and you can really tell where that methane came from based on isotope fingerprinting. So GSI has become very popular in isotope finger printing because you can actually tell 'yes' this water came from a well, or 'no' this water came from shallow methane, or this methane came from a coal seam and not from deep shale gas. They all have different fingerprints."

TCAT also studies site access roads in the Eagle Ford region. The Disappearing Roads Program, included a student competition to build roads that will "disappear" when development in the area is complete. The goal is to build roads that are necessary for Eagle Ford Shale activity without "leaving the landowner with a bunch of permanent scars on their land," Stuver explains. Ideas range from roll-out roads to roads that will eventually decompose.

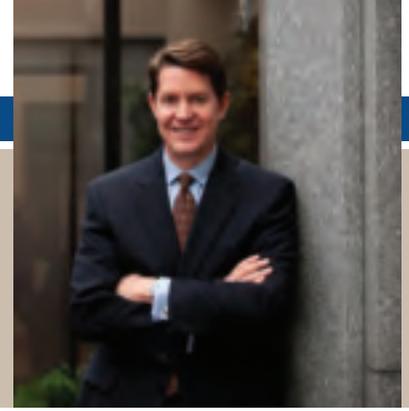
Regarding community planning, Stuver recommends that planners discuss development with other communities who have experienced similar activity. Also, she recommends building structures that can be easily repurposed into different uses. "Build for the boom, design for the bust' and do not sprawl, keep everything as centralized as possible," Stuver suggests. "What would be really great, would be to connect the people who have been through this in Midland to the people in the Eagle Ford. I think sharing of ordinances, design ideas; expansion/retraction would be so beneficial for them."

"My biggest concern is that politicians and elected officials, for whatever reason, are starting to manipulate science," Stuver says. "Science needs to be left as just the facts, and that's that. It needs to be the ground truth and not be manipulated for different agendas, particularly political ones. I think that's harming." There are many topics and concerns in the Eagle Ford that the environmental science community has become aware of and are addressing. The Texas Center for Applied Technology is one of many organizations working with community, industry, and political leaders to address some of these concerns and become pro-active to sustain the communities in the region.

Pump Trucks that are running at output rates controlled by engineers.
The frac process generally takes between 2 and 10 days, depending on the formation.



Insight on Water: Warren Sumner



Photos Courtesy of Omni Water Solutions.

Treatment of the water used in the drilling processes around the Eagle Ford Shale requires particular attention and oversight. The color of the water after it is used in the frac'ing process is very dark brown with a consistency thicker than water. Recycling this wastewater has the potential to reduce discharges to treatment facilities or surface waters, minimize underground injection of wastewater and conserve water resources.³¹

Omni Water Solutions is just one of the companies integrating advanced technologies into the oil and gas drilling sector. "Omni makes mobile water treatment systems that enable oil and gas companies to treat and re-use produced water and flowback water in subsequent frac'ing activity," explains Mr. Warren Sumner, Chief Executive Officer of Omni Water Solutions. "Typically, operators will set up at either at a frac'ing location or at a centralized water gathering station and we will station the H.I.P.P.O. (Hydro Innovation Purification Platform for Oil & Gas) there," Sumner explains of the frac'ing flowback water treatment technology. "We are pulling contaminated water from storage vessels that could be a series of frac tanks or it could be a very large in-ground pit or surface pit. We pull that contaminated water through our system and we utilize eight different treatment technologies on board along with sensors that are sensing the contaminants in the water and then sending that water through the proper treatment sequence and applying the proper amount of treatment to pull out the contaminants that the oil companies want to remove. After it cycles through our machine then it goes typically to another storage area and that again could be frac tanks, it could be large above ground tanks, or it could be large in-ground pits."

"What Omni is concerned about," Sumner explains, "is the use of fresh water and we want to help oil companies re-use as much water as they can because today their practice is to take fresh water, perform a frac operation, and then take the polluted water that comes back from the frac operation and throw it away in a disposal well. And when they do that, that water leaves the hydrological cycle forever."³²



³¹ US Environmental Protection Agency.

³² Omni platforms feature a combination of water treatment technologies and robust analytical software.

Housing

Throughout the Eagle Ford Shale counties, there is consistently not enough housing (temporary or permanent) to accommodate the influx of oil field workers.³³ There are virtually no vacant motel rooms across the Eagle Ford Shale oil and gas play, and oil company workforce, land men, and others have made reservations for months into the future. People are opening recreational vehicle (RV) parks, hotels and restaurants to capitalize on the arrival of oil field personnel. In Pleasanton, Jourdanton, Three Rivers, Cotulla, Carrizo Springs, and other South Texas towns, Eagle Ford Shale activity has increased home leasing activity. Rental rates for homes and commercial property are increasing. In some areas, rates have doubled, indicating the early stages of major real estate investment across South Texas. In addition to housing, there is also a strong demand for office, warehouse, and shop space for the companies that have found their way to the Eagle Ford Shale play.

There have been several initiatives to alleviate the shortage of housing. One has been to build more hotels. Texas hotel room revenues have jumped nearly 13 percent in the second quarter of 2011, and areas related to oil and gas production accounted for a third of that growth. (Compare this with a 7 percent gain from the second quarter of 2010 and a 15 percent loss for the same period of 2009.) Leodoro Martinez Jr., executive director of the Middle Rio Grande Development Council, says that 14 new hotels are under construction or in the planning stages in various small cities across the region. Best Western expects to add as many as 400 new hotel rooms in the Eagle Ford region by the end of 2012. It currently operates 111 hotels across South Texas, and recently was approved for new franchise applications in Carrizo Springs and Pleasanton. (Hotels are already under construction in Kenedy and Lytle, and an application is pending for Dilley). Non-flagged properties are bringing in revenues per room of \$100 a night. Existing hotels are considering expansions and upgrades.

Another attempt to solve the housing dilemma has been the creation of RV parks throughout the Eagle Ford Shale counties. Existing RV parks are generally filled from the Eagle Ford production areas all the way to San Antonio. Not only are the city owned RV parks completely filled, but independently owned RV parks are also filling their slots quickly. Many of these parks are being opened by people who don't own mineral rights but are looking to cash in on the Eagle Ford Shale activity.

When hotel rooms and RV parks are unavailable, workers can look to stay at "man-camps", the industry term for temporary oil field housing. These camps are often built by the companies operating in the Eagle Ford Shale play. For example, Frac Tech Services has 400 employees in Pleasanton and built a 100-bed camp in Asherton, south of Carrizo Springs, as a satellite location to offer workers hot meals, laundry service, and sleeping quarters. Austin-based Eagle Ford Shale Housing LLC offers fully furnished double-wide trailers that were former model homes. The company offers full kitchens, Wi-Fi, satellite cable and TVs in every room. One company, Remote Logistics, has 300 employees throughout the world servicing man-camps wherever the need may be. Remote Logistics brings upscale hotel amenities to wherever oil companies are located. One was opened in Three Rivers in July 2011 and another, the RLI Carrizo Springs Lodge, had its grand opening in March 2012.



Many of these small and rural communities can expect to face a demand for more than just housing. Economists expect that restaurants and grocery stores may be following hotel developer's leads of expansion. H-E-B is in negotiations to double the size of its Cuero store. The Dog & Bee Pub (a San Antonio franchise) recently opened in Beeville. Even Dunkin Donuts, which plans a 20- to 25- store push into the San Antonio metro area, says it is specifically seeking franchises willing to spread its outlets into the Eagle Ford area.

³³ *San Antonio Business Journal* "Eagle Ford Shale Boom is Sparking Demand for More Hotel Space", August 12, 2011.

San Antonio Express News "Luxury in the Oilfield", August 19, 2011.

Chron.com "Housing Booms with Shale Work in South Texas", June 29, 2011.

The Eagle Ford Shale Blog "Will Lack of Infrastructure Slow Eagle Ford Shale Activity?" February 17, 2010.

The Eagle Ford Shale Blog "Photos of Eagle Ford Shale Activity" September 26, 2011.

Impacts to Higher Education

The activity in the Eagle Ford Shale region has the potential to reach into and benefit many industries and arenas outside of the drilling and extraction sector. Higher education is one such area.

Local demand for workforce training and both undergraduate and graduate level instruction in petroleum related industries is expected to continue increasing as the local workforce seeks to match the demands of the industry. Sciences, engineering, and even business are broad areas of study with new and increasing employment prospects locally, and institutes of higher education within the local region will have the opportunity to provide programs of study tailored to the unique workforce needs of the Eagle Ford Shale region. Coastal Bend College, for example, offers programs customized to the needs of the Eagle Ford Shale drilling region including an Associates of Applied Science in Oil and Gas Technology and a 3-day CDL (commercial driver's license) Certification Course.³⁴

Philanthropy is another potential area of benefit to institutes of higher education. One example of the benefit of such activity is the estate gift of Mary E. McKinney to the University of Texas at San Antonio. This gift, valued in 2010 at \$22 million, includes real estate in Atascosa and Frio Counties, including the surface, oil and gas rights to three ranches totaling over 5,000 acres. UTSA has already had the opportunity to sign a mineral lease in Frio County with a 25 percent royalty on production, allowing for continued revenue generation for the school.³⁵ University donations and planned giving are areas in which the local and regional higher education community may continue to benefit as local communities and residents experience increased revenue and wealth.

The University of
Texas at San Antonio's
President Dr. Ricardo
Romo at a McKinney
Ranch well.



³⁴ Coastal Bend College Petroleum Industries Training. <http://www.coastalbend.edu/uploadedFiles/Oil%20%20Gas%20PamphletV2.pdf>

³⁵ "Mary E. McKinney Bequeaths \$22 Million Estate for UTSA Student Scholarships," UTSA Today. October 6, 2010.

County Highlights

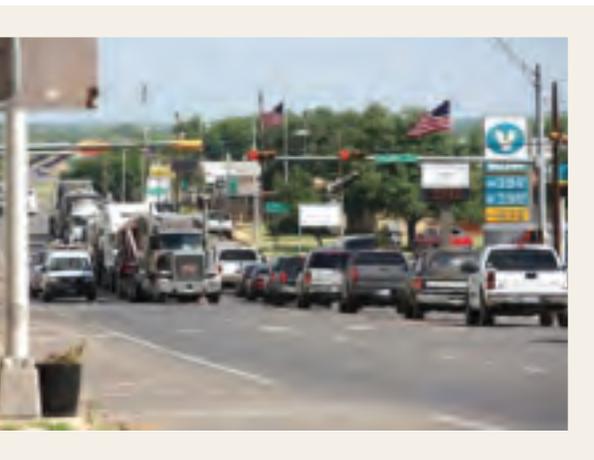
Atascosa County

Real estate is benefiting from the drilling activity in the Eagle Ford Shale play. Rents are increasing because of high demand and limited supply, and more people are interested in renting homes than ever before. Home sales, particularly for houses priced between \$140,000 and \$280,000, are strong. Clifton Shearrer, a real estate broker in the area, says that the strength of the local housing market is 100 percent due to Eagle Ford Shale activity. Much like the rest of the Eagle Ford area, RV parks are springing up throughout the county, and retail activity is booming.

Bee County

Bee County first began seeing an influx of people at the beginning of 2011 when the Eagle Ford drilling really kicked into gear.³⁶ One major issue faced locally is a lack of housing in the area. Many landowners in the county have been able to benefit from the increased demand for housing by renting their land as RV parks. County residents can invest \$15,000 to get 10 spaces for portable living and recoup their investment quickly, given the amount of people searching for housing. Fourteen RV parks were built in 2011 alone in Bee County. Renters may be long term or short term, with stays ranging from a couple days to several months.

In addition to the creation of new RV parks, new apartment complexes are also being built in the area to address the high occupancy rate in Beeville. In the first quarter of 2011, hotel receipts were up 164 percent in Beeville compared to 2009. When workers are paying \$180 to \$200 a night for a month, they would do better to look for some kind of permanent housing, like apartments or condos, and seek out such housing opportunities where they are available.



³⁶ *Beeville Bee-Picayune* "Building Permit Issued for 104-Unit Apartment Complex", April 18, 2011.

Beeville Bee-Picayune "Condominiums are Coming to Beeville", October 14, 2010.

Beeville Bee-Picayune "Danville Village Becoming a Reality", February 09, 2011.

Beeville Bee-Picayune "Residents Feel the Pressure", November 09, 2011.

Beeville Bee-Picayune "Gusher of New Jobs", September 23, 2011.

Beeville Bee-Picayune "Got Growth?", September 23, 2011.

Beeville Bee-Picayune "\$3.5 Million in Park Bonds get Approval", September 17, 2011.

Beeville Bee-Picayune "Parks Will Get Their Due and Even a Million Dollars More", June 17, 2011.

Beeville Bee-Picayune "Council Says Go on Park", December 14, 2011.

Beeville Bee-Picayune "40 Years in the Making", December 22, 2011.

Beeville Bee-Picayune "Oil Company Steps up to Repair Damaged Road", May 29, 2011.

Beeville Bee-Picayune "ConocoPhillips signing new lease for old bank building", October 22, 2010.

Beeville Bee-Picayune "Housing Shortage Prompts New Apartments", March 26, 2011.

Chron.com "Housing Booms with Shale Work in South Texas", June 29, 2011.

Woodallscm.com "South Texas Gets 14 New RV Parks This Year", October 28, 2011.

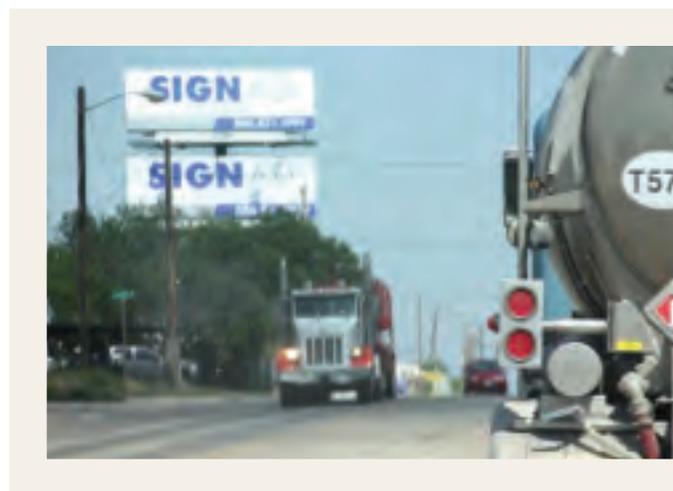
San Antonio Express News "Dog & Bee Brings a bit of Britain to Beeville", August 22, 2011.

Construction began in May 2011 on a new complex called The Reserve at Jones Road Apartments. The estimated costs are \$5.5 million for the 104-unit complex, containing 60 one-bedroom units, 32 two-bedroom, two bath units, and 12 three-bedroom, two bath units. Brooke Holdings, LLC, the company developing the complex, expected apartments to be ready for rent by the end of 2011 at monthly rates of \$600 to \$950 per unit. Similarly, in February 2011, San Antonio's ThornGraves started construction on the initial phase of Danville Village Condominiums. The initial phase of the project is \$3.1 million, with each unit costing about \$120,000 to build. The condos, with about 120 planned units, will have features such as granite counter tops with prices starting at \$145,000.

In addition to space for housing, office space is in increasingly high demand. ConocoPhillips has acquired the former State Bank & Trust (SBT) building in Beeville for office space, spending approximately \$500,000. Bee Development Authority Director Montez believes that dozens of oil field-related businesses will be looking for places to locate offices, shops, and equipment yards. Montez also goes on to say that he has spoken to representatives of two Canadian companies and one from Britain looking for property and land. Among other construction projects in Bee County, Beeville saw a particularly large amount of construction (planned and completed) by oil and gas companies in 2011. Weatherford International is spending \$800,000 on improvements. Crescent Services is spending \$1.8 million to build a warehouse and office complex. Stream Flow is spending approximately \$800,000 on a facility. In Phase One of a warehouse and office space project, Halliburton is planning to spend \$1.6 million. In total, the company expects to spend \$3.2 million. Baker Hughes has opened a facility at the cost of around \$1 million. Across the street from Baker Hughes, M-I SWACO has set up an equipment yard and plans to spend \$3.6 million on new construction.

With the influx of money attributed to the Eagle Ford Shale, Beeville has embarked on several city improvement projects. Beeville's junior college, hospital, public school system, retail opportunities, and recreational facilities are all expected to benefit from upgrades and improvements at the cost of about \$3.5 million. Park improvements totaling an estimated \$3.5 million have begun in Beeville as of December 2011. The park project is being funded through sales tax bonds, which is ideal since Beeville's sales tax receipts are expected to be better than normal for the next 10 years because of oil field activity. In November 2011, two water pumps were activated in Beeville that will elevate the water pressure to some of the city's homes. The pumps are intended to handle the growing population for the next 10 or 15 years attributable to Eagle Ford. Total cost of the project was \$600,000, but this also included construction of a control center, a backup generator, and tie in to the city's main utility offices.

Like the rest of the counties, Bee county roads deteriorated due to heavy truck traffic. Data was collected on the number of permits referencing Bee County as the area for travel for loads that exceed the state's 80,000 pound weight limit, and the number rose from 3,850 in 2010 to 5,854 in 2011. To offset some of the damage done to county roads by the increase in oil field traffic, Welder Exploration gave the city of Beeville \$30,000 in 2011.



DeWitt County

Like other major cities in the Eagle Ford counties, there is a housing shortage in Cuero. Hotels are at capacity and RV parks have mushroomed across town to accommodate workers. These RV parks developed at such a rapid rate that city officials were caught by surprise and were without ordinances for the developments. Recently, they have enacted ordinance laws that would protect property owners around the parks, but remain loose enough to entice people to further develop Cuero.³⁷

Motels are also filled to capacity. The Best Western (recently opened) is adding another wing to accommodate demand. Hotel Texas was expected to break ground in 2011 in Cuero on a 40-room property and La Quinta Inns and Suites plans to develop a 72-room facility. Lead officials want to see more permanent housing though, since hotels don't encourage workers to bring along their families. However, the economics of building single-family homes or apartments presents an ongoing challenge, as real estate agents want guarantees that the play will be long term.

New restaurants are opening and local businesses are growing. The courthouse and the grocery store are expanding their hours to accommodate the flood of business. Cuero currently houses the offices of Petrohawk Energy Corp and other firms, like Pioneer who built a 90,000 square foot building in Cuero because of the location. With the inflow of money, Cuero plans to build an animal control shelter, an updated recycling center, and a new city administration building.

Yorktown has also seen a rise in business activity. The city owned RV park has been full for two years (expansion being considered), and more parks are being established to provide housing for the oil workers. In addition to the RV parks, eating establishments, energy related companies, and two new motels have been opened in Yorktown.

Many communities complain of traffic and road damage, including the noise brought along with trucks. Roads in these small communities are really taking a beating from oilfield traffic. Road work in DeWitt County due to Eagle Ford is anticipated to last more than a decade and could run up infrastructure costs in the tens of millions of dollars. To help offset costs, DeWitt County Judge Daryl Fowler has negotiated \$8,000 per-well-drilling fees that companies pay into county coffers. As of December 2011, both Petrohawk Energy Corp. and Pioneer Natural Resources Co. agreed to the payments. Judge Fowler indicated that the reimbursement is nowhere close to what the actual damages are, but it should add \$2.4 million to county coffers to address road damage. Fowler anticipates striking similar deals with other firms soon.



In Cuero, the number of vehicles coming through town doubled in six months, and the DeWitt County Sheriff's Office and the Cuero Police Departments have worked hard to cover all the traffic problems that have come with the increased population. One possible reason for the uptick in traffic accidents is that anyone with a commercial license can be employed as a truck driver, regardless of their level of experience. As a result, many recently employed drivers have no truck driving experience. In Yorktown, signs have been put up on small roads in an attempt to keep trucks away. There have also been changes in traffic light functions to help ease congestion, and more citations are being written in an effort to maintain road safety.

³⁷ *San Antonio Express News* "Eagle Ford Boom Brings Trick Problems", September 28, 2011.

Bloomberg Business Week "Eagle Ford Drilling Rush May Boost Texas Tax Revenue 15-Fold", December 22, 2011.

San Antonio Business Journal "Truck Traffic Snarling Shale Counties' Roads", December 16, 2011.

San Antonio Business "Eagle Ford Shale Boom is Sparking Demand for More Hotel Space", August 11, 2011.

Victoria Advocate "Cuero Awakens to a New Shade of Green", October 29, 2011.

Victoria Advocate "Yorktown Feeling Eagle Ford Shale Effects Too", October 29, 2011.

Dimmit County

The main city in Dimmit County is Carrizo Springs. Here, for the first quarter of 2011, hotel receipts were up 51 percent compared to 2009. Some hotels do not accept phone reservations because there is not enough space. Rooms are usually given on a first come, first served basis, with the best chance of getting a hotel room being on the weekend when workers go home to see their families. In addition to the overcrowding of hotels, there is a void of other facilities in the area, such as bowling alleys or movie theaters. Restaurants are overcrowded, grocery stores are running out of supplies, and Laundromats are overcrowded as well.³⁸

RV parks are also popping up throughout the area, and remained filled. While there were only two in the area a few years ago, the county now has more than 60 RV parks in use. Rates may vary from \$325 a week to rent an RV, or \$450 a month for an RV slot. As mentioned previously, there is a 100-bed camp in Asherton that offers hot meals, laundry service, and sleep quarters.

Other facilities are finding their way to Carrizo Springs, like the Rural Business Program of UTSA's Small Business Development center. They are scheduled to open an SBDC Information Center to reinforce efforts to help communities become sustainable during the ongoing oil and gas extractions projects in the Eagle Ford Shale region.

From the influx of people associated with Eagle Ford, Dimmitt County's sales-tax receipts have grown eight-fold over the past four years. In 2011, the county \$4.6 million in debt to renovate municipal buildings. With all of the increased activity, improvements were seen as necessary.

Frio County

In the first quarter of 2011, hotel receipts were up 106 percent in Pearsall, and 647 percent in Dilley, compared with the same months in 2009.³⁹

Gonzales County

Construction for a new Holiday Inn, to be three stories with 62 rooms, a meeting room, fitness center, and pool, commenced in September 2011.⁴⁰ Costs of construction are estimated to be \$5.3 million.

Also in 2011, a major player in the Eagle Ford area, Pioneer Natural Resources, donated \$25,000 to Victoria College (VC) for the VC Gonzales Center Expansion Project. The donation will help VC with the expansion of facilities and resources, including new classroom space and a fully equipped laboratory.



³⁸ *Bloomberg Business Week* "Eagle Ford Drilling Rush May Boost Texas Tax Revenue 15-Fold", December 22, 2011.

Chron.com "Housing Booms with Shale Work in South Texas", June 29, 2011.

The Eagle Ford Shale Play "Small Business Development Center Opens in Carrizo Springs", November 16, 2011.

KSAT.com "South Texas Struggling With Oil Boom", October 14, 2011.

³⁹ *Chron.com* "Housing Booms with Shale Work in South Texas", June 29, 2011.

⁴⁰ *The Gonzales Cannon* "Business Plans: Lynn Theater Sale Price Listed, Plans for a New Hotel Begin", March 31, 2011.

The Gonzales Cannon "Holiday Inn Groundbreaking", September 1, 2011.

The Gonzales Cannon "Pioneer Donation Will Help Expand Gonzales Campus", July 28, 2011.

Karnes County

Similar to the other counties in the Eagle Ford Shale play, Karnes County has felt a strain on availability of housing.⁴¹ To help with rising housing demands, Tierra Point Apartments were built in August 2010 in Karnes City. The estimated construction costs were \$10.7 million. Work began more recently in Early 2011 on a real-estate development called Kenedy Station (in Kenedy). It will be located on 166 acres, and will feature home sites, multi-family apartments or town homes, a day care center, a city park, hotels and light commercial or retail sites. The development will include 194 four single family homes (ranging in size from 1400 to 2000 sq. ft.). Fifty-eight lots have been delegated for larger homes (2500 to 4500 sq. ft.) and 18 acres have been set aside for multifamily use (200 to 250 units). Two 2-acre sites are being marked for hotel/motel development. The estimated cost of the development is \$78 million. In addition, two traffic lights are expected to be installed in two high traffic areas in Kenedy. One traffic light, located at the intersection of US HW 181 and Business Park Blvd, has a projected cost of \$600,000.

Kenedy has also welcomed two companies to the city due to Eagle Ford activity. Select Energy Services opened a new facility in October 2011 between Kenedy and Choate. The project had an estimated cost of about \$8 million and construction began sometime around September 2010. Select Energy Services has several locations throughout Texas that focus solely on supplementing the oil industry with well site rentals, water management operations, pipeline construction, rig logistics, and heavy haul services. Also, Alliance Drilling Fluids has purchased a former Wal-Mart in Kenedy with plans to retrofit is as a drilling fluid plant.

La Salle County

Like the other counties, hotels are being built to offset the housing demand in the Eagle Ford Shale counties.⁴² HotelWorks Development LLC broke ground in July 2011 in Cotulla on a 77-room hotel called Ciena Hotels & Suites. The hotel will have a pool, spa, playground, 24-hour restaurant with indoor and outdoor seating, lounge areas, a gift shop, multiple meeting spaces, a media room for movie watching, and a fitness center.

A Houston-based company completed a terminal in 2011 near Cotulla that will allow trucks to unload crude from the Eagle Ford shale onto rail cars for delivery to refineries and processing plants. As pipeline infrastructure is developed, the hub will provide the market with both rail and outbound pipeline solutions to the major refining and distribution markets. The terminal is on a United Pacific Corp. rail line, where trucks will be able to load as much as 40,000 barrels of oil a day onto rail cars.



The road damage throughout La Salle County has been immense due to Eagle Ford activities. Increased truck traffic has led to a wear and tear of county roads and bridges. According to La Salle County Judge Joel Rodriguez in April 2011, the county was pursuing a lawsuit with some of the oil companies over damage of \$5 million to \$7 million.

⁴¹ NewsBank “New Businesses, Drilling Projects Mean Growth for Karnes County”, July 27, 2010.
San Antonio Business Journal “Truck Traffic Snarling Shale Counties’ Roads”, December 16, 2011.
San Antonio Business Journal “Oil Patch Fueling Housing Demand in South Texas”, October 29, 2010.
Texas Department of Transportation, Project Detail, December 01, 2011.
San Antonio Business Journal, “Abrego Development Planning to Tap into Shale-Driven Housing Demand”, September 23, 2011.

⁴² San Antonio Express News, “South Texas Enjoys Boom While it Lasts”, April 6, 2011.
San Antonio Express News “Luxury in the Oilfield”, August 19, 2011.
Chron.com “Oil terminal is close to completion near Cotulla”, June 21, 2011.
San Antonio Express News “Eagle Ford Poor are Shut Out of Housing Market”, September 22, 2011.
Uvalde Leader-News “Ground to be broken for Cotulla hotel construction”, July 21, 2011.
Austin Business Journal “HotelWorks names Envision Creative Agency of Record”, August 12, 2011.

Live Oak County

As of November 2011, the occupancy rate of local motels in Live Oak County was at an all-time high with apartment and home rental property at a 100 percent occupancy rate.⁴³ Rooms at small, independently-owned motels that a year ago went for \$50 are now renting for \$100 to \$150 a night. The Atria – a 42-unit hotel that opened in April 2011 – was full in its first week. Landlords who once leased three-bedroom houses to locals for \$500 a month are letting their leases run out, doubling or tripling rent, and then leasing the properties to oil field workers from San Antonio.

Magellan Midstream Partners and Copano Energy announced in December 2011 that they are joining forces to build 140 miles of pipeline to connect an existing 50-mile pipeline segment to Karnes, Live oak, McMullen, and La Salle counties in Texas. The companies will split the \$150 million cost for the pipeline and a new truck terminal near Three Rivers, which should be completed by early 2013.

Like the rest of the Eagle Ford Shale counties, roads are crumbling in Live Oak County. Trucks are going through the town at all hours of the night. Roads are withering away at from the edges, and getting narrower as they deteriorate. Eighteen wheelers drive on the already deteriorated roads at highway speeds. The Texas Department of Transportation officials said maintenance budgets can't always keep up with repairs. As a result, miles of paved roads have been converted to gravel in Live Oak County. By one measure, heavy truck traffic in the county is up 44 percent from 2010.

Murell Foster, executive director of the Three Rivers Chamber of Commerce in Live Oak County, says, “With any excess money we have, we plan to primarily use it for repairing and improving our infrastructure. Everything has taken a beating from the heavy trucks.” To help offset money being spent on construction projects, Pioneer donated two \$100,000 contributions to Live Oak County in 2011 to repair individual projects, like road repair.

Maverick County

Marriott Hotels built an 80-room Marriott hotel in Eagle Pass in 2011. The growth in Eagle Pass, the high need of hotel rooms, the high occupancy rate, and the booming Eagle Ford-Shale oil and gas play in the region are cited as reasons why Eagle Pass was selected for a Marriott Hotel. The estimated cost of construction was \$10 million.⁴⁴

Pipeline right of way by an operator in Live Oak County. With planning and negotiation, some pipeline rights of way can be negotiated such that oak trees are saved. The contractors will bore under the oak trees rather than destroy them.



Photograph by Terry Retzlöff.

⁴³ *San Antonio Business Journal* “Truck Traffic Snarling Shale Counties’ Roads”, December 16, 2011.

NewsBank “Copano Energy and Magellan Midstream Form Joint Venture to Deliver Eagle Ford Shale to Corpus Christi”, December 20, 2011.

Beeville Bee-Picayune “El Oso Bringing Water to TR Area For Growth”, September 23, 2011.

Beeville Bee-Picayune “Eagle Ford Shale play promises overall wealth for McMullen, Live Oak counties”, November 03, 2010.

San Antonio Express News “Luxury in the Oilfield”, August 19, 2011.

Chron.com “Eagle Ford Windfall Carries Pluses and Minuses”, November 19, 2011.

⁴⁴ *Eagle Pass Business Journal* “Marriott Hotels to Build in Eagle Pass”, June 22, 2011.

McMullen County

In McMullen County, Eagle Ford Shale activity has resulted in a significant increase in traffic. Highway fatalities have increased from one in 2009 to four in 2010 and three in 2011. Driver fatigue seems to be the main factor in all of the fatalities. To help with traffic safety, McMullen County's Sheriff Department has doubled its force from three deputies to six as of December 2011, and will likely add more as the boom continues. In addition, 22 additional state troopers are focusing on commercial vehicle violations in the counties involved in the Eagle Ford Shale boom.

With the influx of people to the Eagle Ford Shale counties, many speculated that school attendance would rise. However, some superintendents expect attendance to grow only slightly because of the shortage of housing. In many counties, the rise in school enrollment has been minimal, since oilfield workers cannot find suitable housing for their families. Still, other counties have experienced higher enrollment despite housing challenges.⁴⁵

In Tilden, the seat of McMullen County, the school system has experienced a 42 percent enrollment jump in just a year and half. With 235 students in pre-K through 12th grade, an addition of only 50 more students would max out the school's capacity. To accommodate the increase in students, the district added a school bus last fall to bring the total number of buses to 7. Two "teacheridges" - cottages intended to house employees - have been added since 2010, bringing the total to 9. Some of these cottages are being leased to students' families who cannot find housing. While expansion seems like a feasible option, no immediate plans have been made to add new classrooms. However, the board has asked voters to approve almost \$12 million in bond debt to address growth and safety issues. A new playground serves as a direct reminder of population growth of all ages, built with the use of corporate donations from companies like Petrohawk Energy, Chesapeake Energy, and Rush Truck Centers.

Webb County

Laredo, the county seat of Webb County, has experienced its own growth due to the activity in the Eagle Ford Shale. It is estimated that 800 to 1,000 hotel rooms per night in Laredo are going to energy industry workers.⁴⁶



Plains oil storage facility being constructed in McMullen County, near west of Tilden.

Photograph by Terry Retzloff.

⁴⁵ *San Antonio Express* "School in Eagle Ford Shale swells with Newcomers", March 3, 2012.

⁴⁶ *Chron.com* "Housing Booms with Shale Work in South Texas", June 29, 2011.

Wilson County

Floresville isn't directly atop Eagle Ford, but industry workers have filled beds and made it hard to find a room. Like other counties, many developments are being built in Floresville, including hotels and RV parks. Floresville's economic director says "we have had an influx of oil workers from the area", and most of those field workers are looking for housing.⁴⁷

Some additional facilities have found some use in Wilson County for commercial buildings. GreenHunter Energy has leased acreage and plans to build a commercial water facility in Wilson County. The facility will house at least one disposal well, a frac tank yard, and a treatment plant for produced water, frac water, and drilling muds. In 2011, La Vernia became home to new businesses supplying the oil-and-gas play: VZ Environmental, Old School Services, D&D Power LLC, and Coastal Flow Measurements.

Zavala County

As with other counties, Zavala County has seen a swell of residents with increased activity in the Eagle Ford Shale play area. Undoubtedly, the county will face similar issues in terms of sustainable housing development, infrastructure construction, and road repair.



⁴⁷ GreenHunter Corporate website "GreenHunter Water Announces Second Water Service Property Acquisition", August 17, 2011.
The Eagle Ford Shale Play "Floresville Housing Stretched by Eagle Ford", September 6, 2011.
San Antonio Business Journal "La Vernia feeling the rush of the Eagle Ford Shale play", November 18, 2011.

Future Activity/Projections (2021)

The combined total impacts of the Eagle Ford Shale activity in the 14- and 20-county areas of analysis are projected for the year 2021 in this segment. Because it is difficult to estimate projections for the future with the same degree of precision as current impacts, a three-level projection scenario is provided for illustrative purposes. The moderate scenario is the expected impact for 2021 based on our current information and best guess for future development of the Eagle Ford Shale area. The low estimate provides a more conservative figure, while the high estimate provides impacts for a scenario in which Eagle Ford Shale activity is higher than what is currently expected.

It is important to note that the art of forecasting is a treacherous business. We have witnessed a slowdown in natural gas shale plays in Haynesville, Barnett and Marcellus because of low prices. Key variables that can impact the forecasts presented here include:

- Commodity prices
- Production yields
- Advances in technology
- Levels of investment
- Regulation and associated cost factors
- Environmental and water issues
- Foreign competition
- Global demand
- Consumer behavior

As such, it will important to revisit and make adjustments to the forecasts below as the landscape changes over the coming years.

Total Projected Impacts for 2021

The total impact of the Eagle Ford Shale activity in 2021 is more than \$62 billion in the moderate scenario, with 82,645 jobs anticipated and revenues just under \$890 million for the local government and \$1.6 billion for the state government.

Estimated Impacts for Eagle Ford Shale at the Regional Level 2021 in millions of dollars (14-County Area)

	Total Impacts Three Scenarios		
	Low Estimate	Moderate Estimate	High Estimate
Output	\$26,141	\$62,338	\$96,001
Employment	44,237	82,645	115,669
Payroll	\$2,810	\$6,019	\$8,993
Gross Regional Product	\$13,700	\$34,112	\$54,031
Estimated Local Government Revenues	\$326	\$888	\$1,426
Estimated State Revenue, incl. severance taxes	\$495	\$1,567	\$2,593

Source: IMPLAN software version 3, database 2010.

Taking into consideration all three scenarios, the impacts can be summarized as:

- Output regional impact between \$26.1 and \$96.0 billion;
- Employment regional impact between 44,000 and 116,000 jobs; and
- Gross regional product impact between \$13.7 and \$54.0 billion

The ranges of these figures are broad due to high variability in the prices of oil and gas and the challenges of forecasting future oil and gas activities, changes in the number of wells per rig, and changes in productivity per worker for relevant industries in the study. As with the 2011 impacts, the IMPLAN model was adjusted to avoid double counting the impacts of several industries in the same area.

These impacts also include refining activities from Valero’s Three Rivers plant and future refining activities of Blue Dolphin’s refinery in Nixon, which lies on the border of Gonzales and Wilson Counties. Valero’s plant and the Nixon plant are expected to process approximately 100,000 and 15,000 barrels of oil per day, respectively.

Detailed Combined Future Impacts: Moderate Scenario

Projected impacts are structured in much the same way as the current impact estimates, as they also include oil and gas extraction, oil and gas drilling and completion, royalties, and lease payments. The combined total impacts are shown in the table below, which summarizes the projected impacts of the Eagle Ford Shale activity in the 14-county area for the moderate expected scenario. These results are presented in 2011 dollars to facilitate the comparison to current activities.

Projected impacts include:

- More than \$62 billion in total economic output (revenues) impact
- Nearly 83,000 full-time jobs supported in the area
- Approximately \$6.0 billion in salaries and benefits paid to workers
- More than \$34.1 billion in gross regional product (value added)
- Estimated local government revenues of \$888 million
- More than \$1.5 billion in state revenues, including \$740.9 million in severance taxes

Moderate Scenario Estimated Combined Impacts for Eagle Ford Shale at the Regional Level 2021 (14-County Area)

	Economic Impacts			Total
	Direct	Indirect	Induced	
Output	\$55,101,000,000	\$3,915,000,000	\$3,322,000,000	\$62,338,000,000
Employment	30,391	24,304	27,951	82,645
Payroll	\$4,182,000,000	\$1,008,000,000	\$829,000,000	\$6,019,000,000
Gross Regional Product	\$29,892,000,000	\$2,238,000,000	\$1,982,000,000	\$34,112,000,000
Estimated Local Government Revenues				\$888,000,000
Estimated State Revenue incl. severance taxes				\$1,567,000,000

* 2011 dollars

With the inclusion of the additional 6 counties not directly involved in production, the economic impacts under the moderate scenario are even more significant:

- 116,972 full-time jobs supported
- \$7.7 billion in salaries and benefits paid to workers
- \$42.0 billion in gross regional product (value added)
- \$1.09 billion in local government revenues
- \$1.76 billion in state revenues, including \$740.9 million in severance taxes

Moderate Scenario Estimated Combined Impacts for Eagle Ford Shale – 20 County Study Area (2021)*

	Economic Impacts			Total
	Direct	Indirect	Induced	
Output	\$77,614,198,522	\$7,426,776,462	\$5,015,020,831	\$90,055,995,814
Employment	33,023	42,504	41,445	116,972
Payroll	\$4,606,413,835	\$1,843,396,163	\$1,295,533,871	\$7,745,343,869
Gross Regional Product	\$34,709,838,562	\$4,256,848,276	\$3,045,530,317	\$42,012,217,155
Estimated Local Government Revenues				\$1,088,669,641
Estimated State Revenue incl. severance taxes				\$1,761,423,697

* 2011 dollars

Moderate Scenario: Top Ten Industries Affected by Employment, 2021

Industry	Employment
Extraction of oil and natural gas	17,927
Drilling oil and gas wells	9,652
Maintenance and repair construction of nonresidential structures	5,522
Food services and drinking places	4,241
Support activities for oil and gas operations	2,767
Non-depository credit intermediation and related activities	2,038
Real estate establishments	1,767
Wholesale trade businesses	1,684
Transport by truck	1,664
Offices of physicians, dentists, and other health practitioners	1,659

**Moderate Scenario: Top Ten Industries Affected
by Gross Regional Product (Value Added), 2021, in millions of dollars**

Industry	Gross State Product (Value added)
Extraction of oil and natural gas	\$21,585
Drilling oil and gas wells	\$6,833
Petroleum refineries	\$742
Support activities for oil and gas operations	\$734
Imputed rental activity for owner-occupied dwellings	\$466
Maintenance and repair construction of nonresidential structures	\$377
Real estate establishments	\$271
Wholesale trade businesses	\$264
Electric power generation, transmission, and distribution	\$238
Monetary authorities and depository credit intermediation activities	\$219

**Moderate Scenario: Top Ten Industries Affected
by Output, 2021, in millions of dollars**

Industry	Output
Extraction of oil and natural gas	\$35,452
Drilling oil and gas wells	\$12,067
Petroleum refineries	\$6,242
Support activities for oil and gas operations	\$1,344
Imputed rental activity for owner-occupied dwellings	\$651
Maintenance and repair construction of nonresidential structures	\$551
Real estate establishments	\$513
Wholesale trade businesses	\$387
Electric power generation, transmission and distribution	\$348
Monetary authorities and depository credit intermediation activities	\$291

**Forecasted New Oil and Gas Wells (2012 – 2021)
In Three Scenarios**

Years	Moderate Price Scenario	High Price Scenario Scenario	Low Price Scenario
2012	2,425	3,118	1,732
2013	2,603	4,047	1,487
2014	2,615	3,855	1,420
2015	2,650	3,672	1,391
2016	2,611	3,514	1,346
2017	2,600	3,419	1,315
2018	2,537	3,325	1,276
2019	2,472	3,207	1,240
2020	2,352	3,025	1,194
2021	2,239	2,856	1,136
2012-2021	25,104	34,039	13,537

**Moderate Scenario Forecasts for Production
from New and Old Wells, 2012-2021⁴⁸**

Year	Gas Production thousands mcf	Casinghead thousands mcf	Oil thousands bbls	Condensate thousands bbls
2012	451,310	63,335	65,049	48,448
2013	532,034	74,664	88,818	66,151
2014	597,604	83,865	106,229	79,118
2015	658,478	92,408	121,361	90,389
2016	707,653	99,309	133,362	99,327
2017	753,210	105,702	144,195	107,396
2018	789,770	110,833	152,875	113,860
2019	820,574	115,156	160,161	119,287
2020	841,243	118,057	165,188	123,031
2021	864,923	121,380	168,956	125,837

Future Impacts in Additional Counties

In addition to the counties actively engaging in Eagle Ford Shale production, several communities are expected to receive auxiliary benefits from the shale play, primarily as a result of their proximity to those counties with active drilling. These include Bexar, Jim Wells, Nueces, San Patricio, Victoria and Uvalde Counties. The projected future impacts for these counties are reported in the tables below, separately from the 14-county production region impacts.

⁴⁸ In contrast to the CCBR report published in 2011, these production forecasts are comparable with the Railroad Commission from Texas production statistics, as they include production from new and old wells (those that began production before 2012). This allows for ongoing comparison with Texas Railroad Commission statistics.

Projected Impacts in Bexar County, 2021

Bexar County will continue to benefit from the shale in 2021. These benefits are calculated as indirect impacts and jobs as several companies have announced the construction of facilities to house thousands of jobs in response to the Eagle Ford Shale activity.

More than 3,500 employees are expected to work in the facilities of companies including Halliburton (1,500 jobs), Schlumberger (500 jobs), Baker Hughes (400 jobs), Howard Energy (300 jobs), Weatherford (100 jobs), EOG, Chesapeake, Marathon Oil, and Lake Truck Lines. These jobs are presented as indirect jobs in Bexar County for this analysis. These workers will spend their incomes in the area and generate further impacts, presented here as induced impacts.

NuStar is expected to process 14,000 barrels of oil per day in Bexar County and will produce 50 direct jobs in the area. Valero's refining activities will also benefit Bexar County through its two refinery plants in Corpus Christi.⁴⁹ In addition to the Three Rivers Plants, Valero will refine oil in Corpus Christi and it is assumed that in the year 2021 it will process close to 150,000 barrels of oil per day from the Eagle Ford Shale. Because Valero has its headquarters in San Antonio, the Bexar County impacts for 2021 include indirect impacts from the Corpus Christi activity.

Estimated Impacts for Eagle Ford Shale on Bexar County (2021)

	Economic Impacts			Total
	Direct	Indirect	Induced	
Output	\$613,199,949	\$1,275,198,790	\$757,662,993	\$2,646,061,732
Employment	50	6,145	5,432	11,627
Gross County Product	\$273,543,292	\$776,109,878	\$482,911,455	\$1,532,564,625
Payroll	\$5,685,184	\$285,528,037	\$216,304,471	\$507,517,692

Marathon Oil central production facility that has multiple wells flowing to it. The final separation of free liquids from the natural gas stream and ultimate selling of oil (or condensate) will occur at this central production facility. The crane in the background indicates that work is ongoing.



Photograph by Terry Retzlaff.

⁴⁹ Valero has two refineries in Corpus Christi with a total capacity close to 300,000 barrels of oil per day.

Projected Impacts in Jim Wells County, 2021

Estimated Impacts of the Eagle Ford Shale on Jim Wells County (2021)

	Economic Impacts			Total
	Direct	Indirect	Induced	
Output	\$0	\$202,058,136	\$39,945,579	\$242,003,714
Employment	0	868	353	1,221
Gross County Product	\$0	\$95,147,034	\$23,743,532	\$118,890,566
Payroll	\$0	\$64,376,565	\$9,900,754	\$74,277,319

Projected Impacts in Uvalde County, 2021

Estimated Impacts of the Eagle Ford Shale on Uvalde County (2021)

	Economic Impacts			Total
	Direct	Indirect	Induced	
Output	\$0	\$36,624,148	\$6,616,536	\$43,240,684
Employment	0	159	54	213
Gross County Product	\$0	\$22,698,260	\$4,030,684	\$26,728,944
Payroll	\$0	\$5,052,456	\$1,489,027	\$6,541,483

Projected Impacts in Victoria County, 2021

Estimated Impacts of the Eagle Ford Shale on Victoria County (2021)

	Economic Impacts			Total
	Direct	Indirect	Induced	
Output	\$0	\$43,038,144	\$12,155,649	\$55,193,793
Employment	0	176	90	266
Gross County Product	\$0	\$24,425,543	\$7,674,128	\$32,099,671
Payroll	\$0	\$8,829,075	\$3,069,985	\$11,899,059

Projected Impacts in Nueces County, 2021

By 2021, two companies will be actively refining oil from the shale, Flint Hills and Valero. Flint Hills manages a facility with a capacity close to 300,000 barrels of oil per day while Valero manages two plants with similar combined capacity. In the moderate scenario of this study, it is assumed based on company announcements that Flint Hills will be processing 250,000 barrels of oil per day, whereas Valero will be processing 150,000 barrels per day from the Eagle Ford Shale. These refineries will have direct impacts in the area. As with previous impacts, drilling and extraction activities from the Shale will produce indirect jobs in the area, which in turn will generate more impacts through induced spending.

Estimated Impacts of the Eagle Ford Shale on Nueces County (2021)

	Economic Impacts			Total
	Direct	Indirect	Induced	
Output	\$21,899,998,573	\$1,485,381,388	\$822,524,012	\$24,207,903,973
Employment	2,582	9,040	7,077	18,699
Gross County Product	\$4,544,295,270	\$832,446,310	\$513,340,588	\$5,890,082,168
Payroll	\$418,728,651	\$384,623,235	\$223,736,052	\$1,027,087,938

Projected Impacts in San Patricio County, 2021

Similar to the benefits received by Bexar County, San Patricio will benefit from the activities of Valero as well as the activities of Flint Hills. Both refineries will add indirect impacts to the activities produced by drilling and extraction activities in the Shale.

Estimated Impacts of the Eagle Ford Shale on San Patricio County (2021)

	Economic Impacts			Total
	Direct	Indirect	Induced	
Output	\$0	\$469,475,856	\$54,116,062	\$523,591,918
Employment	0	1,812	488	2,301
Gross County Product	\$0	\$268,021,251	\$31,829,930	\$299,851,181
Payroll	\$0	\$86,986,795	\$12,033,582	\$99,020,378

Forecast Methodology

To forecast the future impact of the Eagle Ford Shale, we developed a methodology to project future production of oil and gas in the area.⁵⁰

1. To forecast the number of wells drilled into the future, up to the year 2021, the study estimated the following equation:

$$\ln(R_t) = \beta_0 + \beta_1 * D_t + \beta_2 * \ln(POIL_t) + \beta_3 * \ln(PGAS_t) + D_t * \beta_4 * \ln(POIL_t) + D_t * \beta_5 * \ln(PGAS_t) + \mu_t$$

Where:

Parameter Estimates				
Variable	Estimate	Standard Error	t Value	Approx Pr> t
β_0	2.5544	1.0657	2.4	0.023
$D * \beta_1$	-5.7789	1.6359	-3.53	0.0014
β_2	0.8105	0.2411	3.36	0.0021
β_3	-1.0541	0.2448	-4.31	0.0002
$D * \beta_4$	0.8744	0.3764	2.32	0.0271
$D * \beta_5$	1.097	0.4024	2.73	0.0106

And:

R is the number of rigs in districts 1 and 2 from the definitions of the Texas Railroad Commission. This information came from the Baker Hughes web site;

$POIL$ is the WTI price of oil;

$PGAS$ is the Henry Hub price of oil;

D is a structural parameter shifter that takes values of 1 or 0 (dummy variable); and

μ is the error term.

⁵⁰ See Appendix B for complete methodology.

2. The following equation was used to forecast either gas or oil per well:

$$F_i(t) = K_i * t^{-0.585}$$

Where:

i is either oil or gas production per month;

K is the monthly production for the well, could be oil or gas:

For gas, $K = 206.1$ mmcf of gas per month. For the impacts, casing head gas provides additional production per well;

For oil, $K = 10,785$ barrels of oil per month. For the impacts, condensate production adds more barrels of oil equivalent production to the wells in the area.

t is the number of months in production for each well.

3. The future production of condensate was assumed to be a proportion of the oil produced, using percentages obtained from the production values of 2011.
4. The future production of casinghead was assumed to be a proportion of the gas produced, using percentages obtained from the production values of 2011.
5. Prices for three different scenarios – moderate price, low price, and high price – were obtained from the Energy Information Agency.⁵¹
6. For each scenario, the study forecasted the number of rigs and assumed differences in the number of wells per rig for each scenario.⁵² For the moderate scenario, based on 2011 data, 14 wells per rig were assumed. For the low price scenario, 10 wells per rig were assumed, and 18 wells per rig were assumed for the high price scenario.⁵³

⁵¹ See Appendix C for information on prices used for these scenarios.

⁵² The number of rigs was taken from Baker Hughes and the historical data showed rig per district and not per county. Some adjustments were made to calculate the number of rigs for the 14 counties included in the study.

⁵³ Based on communications with UTSA College of Engineering and literature review.

Closing discussion

Upside Implications for Low Natural Gas Prices

Because of a relatively mild 2011-2012 winter as well as the increased natural gas output from shale gas in the U.S., storage facilities as of March of this year are at nearly 60 percent capacity. In 2009, inventories peaked at 98.7 percent and drove down prices significantly. This scenario seems likely to repeat in 2012, which will continue to put pressure on natural gas prices in the U.S., at least until temperatures begin to drop again. While low natural gas prices are not good news for energy producers, plentiful, low-cost natural gas does present opportunities in other areas.

Replacing Coal as the Input for Electric Power Plants

As of February 2012, the use of coal was responsible for 42 percent of electricity generation in the United States, compared to 25 percent for natural gas.⁵⁴ Since gas-fired plants can readily meet the Obama administration's proposed carbon-emissions standard, we can expect to see a continued increase in the use of gas instead of coal for the production of electricity.⁵⁵ CPS Energy in San Antonio, for example, has agreed to purchase an 800 megawatt gas plant that will replace the energy output of a two-unit coal plant coming offline in 2018. According to a recent company press release, this was a less expensive option for CPS than the alternative of spending \$565 million to install carbon scrubbers at the existing coal-fired plant that would have been required to meet EPA standards.

Use as a Feedstock for Chemical Manufacturers

Chemical companies use ethane (or natural gas liquid) as a raw material (feedstock) to develop thousands of products that include plastics and fertilizer.⁵⁶ Recent low gas prices are providing U.S.-based manufacturers a competitive edge because many competitors in other countries rely on a more expensive oil-based feedstock called naphtha. The American Chemical Council estimates that the increased use of ethane as a feedstock for manufacturers will create more than 17,000 direct new jobs in the United States, many of which are knowledge-intensive, high-paying positions. Over the same ten-year period, another 165,000 jobs are expected to be created elsewhere in the economy as a result of this increased manufacturing activity.⁵⁷ As just one example, Methanex plans to dismantle an idled Chilean factory and reassemble it in Louisiana in order to take advantage of abundance of inexpensive natural gas supplies being developed in the U.S.

⁵⁴ U.S. Energy Information Administration, "Electric Power Monthly", February 2012.

⁵⁵ *The Economist*. "A Blow to Coal", March 31, 2012, p. 38.

⁵⁶ End products developed from ethylene include food packaging, film, trash bags, diapers, toys, housewares, siding, window frames, swimming pool liners, pipes, antifreeze, pantyhose, clothing, carpets, bottles, models, cups, instrument lenses, tires, footwear, sealants and paper among others.

⁵⁷ Swift, Thomas, Martha Moore, and Emily Sanchez. "Shale Gas and New Petrochemicals Investment: Benefits for the Economy, Jobs and US Manufacturing" American Chemical Council, Economics and Statistics Department, March 2011.

Increased Use of Compressed Natural Gas (CNG) Vehicles

CNG (compressed natural gas) is composed primarily of methane and is made by compressing natural gas to less than 1 percent of its volume. CNG has been used as a transportation fuel since the 1940s. There are approximately 12 million CNG powered vehicles in use worldwide – however in the U.S. currently there are only 112,000 in operation.

Many companies with local fleets now use CNG as a fuel because of its lower cost and reduced emissions. These fleets operate in a limited geographic area and can be refueled from local in-house company facilities. For typical commercial and passenger drivers, however, the lack of refueling options is a significant roadblock to the widespread adoption of CNG-powered vehicles.

States such as Oklahoma have implemented tax credits for vehicle conversion, purchases of new CNG vehicles, or installation of home refueling units. There are also tax credits available there for businesses that build infrastructure, such as fueling stations. These incentives may have increased the use of CNG as a motor fuel – approximately 60 CNG public fueling stations have been built in Oklahoma to-date compared to about 26 in Texas. The table below provides a snapshot as of April 2012 of the CNG fueling infrastructure in selected cities.

Metropolitan Area	Public CNG Fueling Stations
Oklahoma City	15
Dallas	14
Houston	6
Fort Worth	2
Austin	2
Corpus Christi	1
Laredo	1
San Antonio	0

Further Research

Further research will be needed to answer a multitude of questions that will arise throughout the ongoing development of the Eagle Ford Shale region. The projections provided within this report are conservative. As production continues to grow in the area, updated research will be needed in order to maintain an accurate pulse of the changes in activity and production. When permitting, drilling, completion and production activities all increase between two- and six-fold within one year, it is important to maintain updated figures in order to be able to more closely predict future production.

As individual cities and counties grow both in terms of oil and gas activity and in terms of overall community and economic development, continued research will be useful on the individual city and county level to maintain informed strategic focus and decision-making. Tracking local economic indicators will be a critical component to smart, sustainable development on the local level.

Transportation studies will continue to be an important component of research for the Eagle Ford Shale region going forward. As production increases and continues for what may potentially turn into several decades of high activity, local roads will require repair and improvement. Major interstate routes to surrounding locations will continue to experience increased traffic, resulting in far-reaching transportation impacts.

Workforce development assessments are a useful component of further research. The demand for high-wage and high-skilled jobs is increasing, and can be met by the local labor force only if the appropriate training is available to local residents and the workforce is attaining the skills necessary to be competitive in these fields. Ongoing development of relevant training opportunities for local residents will be an important component of this, and research serves as a necessary foundation for approaching workforce development in an efficient and effective manner.

Housing studies are an important component of further research, as we seek to understand how current housing shortages affect price, demand, and commuting patterns, and how communities should plan their short- and long-term housing construction so as to achieve the most sustainable level of community growth and economic development. A housing study is currently being compiled by the College of Architecture at the University of Texas at San Antonio, which will begin to answer some of these questions in greater detail.

Finally, cluster development studies are an important direction for further research. South Texas has an opportunity to develop industry clusters in the areas of oil and gas production and its support industries, as well as in areas of technology. Some of the current technologies being developed have been discussed in this report; bringing more research and development companies to the area and providing educational opportunities in this area may help south Texas develop this important related industry cluster.

Innovation Spillovers

Extraction and production efforts in the Eagle Ford Shale region will continue to support a rising abundance of natural gas resources nationwide. This, in turn, provides a gateway for innovation and technology leaps. In March 2012, GE and Chesapeake Energy Corporation announced their new collaboration in seeking to develop technology that would allow for the use of natural gas in the transportation sector as a source of fuel.⁶⁰ It is believed that advances in this arena will allow for the wider use of liquefied natural gas and compressed natural gas in the transportation arena and result in reduced emissions and lower costs to fleet operators and other consumers.

⁶⁰ GE and Chesapeake Energy Corporation Announce Collaboration to Speed Adoption of Natural Gas as Transportation Fuel. 3/7/2012, Chesapeake Energy. <http://www.chk.com/news/articles/Pages/1670077.aspx>.

Appendix A

Actual production for 2011:

Oil in bbls	Gas in mcf	Condensate in bbls	Casinghead in mcf
28,315,540	271,831,688	21,089,214	38,147,773

The price of condensate is assumed to be 57 percent of the price of oil, and the price of casinghead is the same as gas.⁶¹

Prices:

Year	Henry Hub Price	Price of Crude Oil per bbl
2011	\$2.92	\$93.22

Production in dollars for 2011, for a combined total of \$4,665,206,357:

Oil	Gas	Condensate	Casinghead	Total
\$2,639,509,889	\$793,748,529	\$1,120,556,333	\$111,391,497	\$4,665,206,249

⁶¹ From EIA web site at http://www.eia.gov/dnav/ng/ng_pri_sum_dcu_nus_m.htm. "Average 2009 propane spot prices at Mt.Bellevue were 43 percent below the cost of the West Texas Intermediate (WTI) marker crude oil price when measured in dollars per barrel." Taken from 2010 Propane Market Outlook from the Propane Education and Research Council at: http://www.propanecouncil.org/uploadedFiles/Ad/2010_Propane_Market_Outlook_Final.pdf.

Appendix B

This is an exploratory study⁶² for the relationship between rig activity, the price of oil, and the price of gas. The purpose of the study is to provide a basis for forecasting future rig activity in the 14 counties under study based on price forecasts made by the Energy Information Agency (EIA).

The study used a time series model to estimate the effects of the prices of oil and gas in drilling activity in South Texas. The price of oil corresponds to the West Texas Intermediate (WTI) quotes while the price of gas corresponds to the Henry Hub quotes. The period of analysis begins in January 2008 and ends on December 2011.

The effects of prices of oil and gas on drilling activity have been under study for several years⁶³ and more recent studies have led to estimation of the effects of future and spot prices on current drilling activity⁶¹ or the relationship between crude oil and natural gas prices.⁶⁴ Some studies obtained estimations of the price elasticities of drilling for oil or gas in the state of Texas.⁶⁵

The information for the number of rigs was collected from the Baker Hughes web site and corresponds to districts 1 and 2 from the Railroad Commission of Texas definitions; these districts include almost all of the 13 of the 14 counties included in the study, excluding only Webb County. After the parameters were estimated and forecasts made, additional modifications were added to include Webb County rigs and to deduct vertical related rigs in the forecasts.

The study reviewed model specifications with only one price at a time, either using the price of oil or the price of gas as explanatory variable, but the final specification included both variables because of the better statistics obtained when using both at the same time. These results highlight the different effects that the price of gas has had in the gas and oil drilling activity in the Eagle Ford Shale in recent months: at a time when the price of gas has decreased, drilling activity in the Eagle Ford has increased.

CUSUM and CUSUMSQ tests were implemented to find out if there were structural breaks in the time series. These tests helped determine the existence of structural changes from March 2009 through February 2011.

⁶² SAS version 9.3 was used for this part of the study.

⁶³ For instance, Steele, J.L. *The Use of Econometric Models by Federal Regulatory Agencies*. (1971) D.C. Heath and Company, Lexington, Massachusetts.

⁶⁴ Chen, Fan, Energy Futures Prices and Drilling Activity (September 10, 2011). Available at SSRN: <http://ssrn.com/abstract=1925748>.

⁶⁵ Villar, J.A. and Joutz, F.L. The Relationship Between Crude Oil and Natural Gas Prices (October 2006). Energy Information Administration. Available at: ftp://ftp.eia.doe.gov/pub/oil_gas/natural_gas/feature_articles/2006/reloilgaspri/reloilgaspri.pdf.

⁶⁶ Mine, K. Y. and Thies, J. Oil and Gas Rises Again in a Diversified Texas (First Quarter 2011) *Southwest Economy*, Federal Reserve Bank of Dallas. Available at: <http://www.dallasfed.org/assets/documents/research/swe/2011/swe1101g.pdf>.

Because of the structural changes, a dummy variable was included in the model; this variable takes the value of 1 for the period of structural change and zero otherwise. The dummy variable acted as slope shifter (for both prices) and as an intercept shifter.

Durbin-Watson tests indicated the presence of positive serial correlation as is usual in time series data. Further Lagrange Multiplier tests confirm the presence of serial correlation for lags larger than one. Given the monthly data, lags of up to twelve months were specified. Serial correlation makes the error variance too small rendering t-tests with unreliable high values. To correct this problem a Yule-Walker procedure was implemented. The following tables show the results:

Yule-Walker Estimates			
SSE	1.314158	DFE	30
MSE	0.04381	Root MSA	0.2093
SBC	34.75818	AIC	10.76566
MAE	0.145732	AICC	24.66277
MAPE	3.580723	HQC	13.8149
Log Likelihood	-188.745	Regress R-Square	0.5706
		Total R-Square	0.9312
		Observations	48

Parameter Intercepts					
Variable	DF	Estimate Error	Standard	t Value	Approx Pr> t
Intercept	1	2.5544	1.0657	2.4	0.023
Log price of oil	1	0.8105	0.2411	3.36	0.0021
Log price of gas	1	-1.0541	0.2448	-4.31	0.0002
dummy * log price of oil	1	0.8744	0.3764	2.32	0.0271
dummy * log price of gas	1	1.097	0.4024	2.73	0.0106
dummy * intercept2	1	-5.7789	1.6359	-3.53	0.0014

To estimate a time series regression it is necessary to find out whether the variables follow a stationary process. Standard Augmented Dickey-Fuller (ADF) tests were used to find out if the variables have unit roots. If they do, then they are not stationary and standard OLS estimations produce spurious regressions. If the variables are not stationary, it is important to find out if they are cointegrated in the long run as this means that their relationship is not spurious. The level tests for the original variables showed that they were not stationary. A second set of tests, using the differences of the level variables, indicated that the first differences of these variables were stationary. The results signify that they are integrated of order 1.

The following table displays results for the first differences for up to nine lags. Due to the small size of the sample, the procedure could not be implemented for a twelve lag structure test.

Dickey-Fuller Unit Root Tests					
Variable	Type	Rho	Pr < Rho	Tau	Pr < Tau
DiffRig	Zero Mean	-14.66	0.0053	-2.72	0.0075
	Single Mean	-19.46	0.0067	-3.06	0.0366
	Trend	-38.5	<.0001	-4.56	0.0036
DiffOil	Zero Mean	-16.04	0.0034	-2.81	0.0059
	Single Mean	-16.05	0.0196	-2.78	0.0688
	Trend	-16.54	0.095	-2.84	0.1903
DiffGas	Zero Mean	-35.16	<.0001	-4.2	<.0001
	Single Mean	-36.99	0.0004	-4.3	0.0013
	Trend	-37.44	0.0001	-4.31	0.007

These results indicate that the variables were integrated of order 1 for the single mean specification. The inclusion of a time trend makes the price of oil not integrated of order 1. Because the order of the integration is the same for all variables in the single mean specification, the study team implemented a cointegration test.

A Johansen cointegrating test, using the trace statistics and the maximum eigenvalue showed one cointegrating relationship among the variables when considering a constant with no trend and nine lags. Another test with a constant and a trend showed no cointegrating relationships. The following table outlines the results for the cointegrating relationship:

Cointegration Rank Test Using Trace						
H0: Rank=r	H1:	Eigenvalue Rank>r	Trace	5% Critical Value	Drift in ECM	Drift in Process
0	0	0.4177	29.6397	29.38	Constant	Linear
1	1	0.098	4.7674	15.34		
2	2	0.0005	0.0222	3.84		

The final model specification is:

$$\ln(R_t) = \beta_0 + \beta_1 * D_t + \beta_2 * \ln(POIL_t) + \beta_3 * \ln(PGAS_t) + D_t * \beta_4 * \ln(POIL_t) + D_t * \beta_5 * \ln(PGAS_t) + \mu_t$$

Where:

Parameter Estimates				
Variable	Estimate	Standard Error	t Value	Approx Pr> t
β_0	2.5544	1.0657	2.4	0.023
$D * \beta_1$	-5.7789	1.6359	-3.53	0.0014
β_2	0.8105	0.2411	3.36	0.0021
β_3	-1.0541	0.2448	-4.31	0.0002
$D * \beta_4$	0.8744	0.3764	2.32	0.0271
$D * \beta_5$	1.097	0.4024	2.73	0.0106

And:

R is the number of rigs in districts 1 and 2 from the definitions of the Texas Railroad Commission. This information came from the Baker Hughes web site;

$POIL$ is the WTI price of oil;

$PGAS$ is the Henry Hub price of gas;

D is a structural parameter shifter that takes values of 1 or 0 (dummy variable); and

μ is the error term.

Appendix C

Year	Moderate Henry Hub Price per Thousand Cubic Feet	Moderate WTI Price of Crude oil per bbl
2012	\$2.96	\$100.64
2013	3.05	103.62
2014	3.12	111.43
2015	3.25	118.12
2016	3.36	121.47
2017	3.45	124.95
2018	3.56	126.33
2019	3.68	127.70
2020	3.89	129.08
2021	4.11	130.45

Year	Low Henry Hub Price per Thousand Cubic Feet	Low WTI Price of Crude oil per bbl
2012	\$2.96	\$100.64
2013	2.46	81.97
2014	2.46	78.02
2015	2.52	75.74
2016	2.59	73.52
2017	2.65	71.36
2018	2.73	69.25
2019	2.81	67.19
2020	2.92	65.19
2021	3.07	63.24

Year	High Henry Hub Price per Thousand Cubic Feet	High WTI Price of Crude oil per bbl
2012	\$2.96	\$100.64
2013	3.90	131.78
2014	4.08	133.69
2015	4.37	138.30
2016	4.59	143.07
2017	4.75	147.98
2018	4.91	153.04
2019	5.11	158.27
2020	5.43	163.65
2021	5.76	169.21

About the Center for Community & Business Research

The Center for Community and Business Research (CCBR) is one of ten centers within the University of Texas at San Antonio's Institute for Economic Development. Each center is specifically designed to address different economic, community, and small to medium sized business development needs. CCBR conducts regional evaluation, assessment, and long-term applied research on issues related to community and business development.

CCBR serves the needs of economic development agencies, workforce development boards, businesses, associations, city, state and federal governments and other community stakeholders in search of information to make better informed decisions.

CCBR develops, conducts, and reports on research projects that shed light on how organizations, communities, or the economy work. This is done through the use of various techniques including, but not limited to:

- Economic impact analyses
- Feasibility studies
- Surveys of business and community organizations
- Transportation studies
- EB-5 Regional Center studies
- Analysis of secondary data
- Report writing and presentation

For more information about CCBR or the Institute for Economic Development, please contact (210) 458-2020.

The mission of the Institute for Economic Development is to provide ongoing consulting, training, technical, research and information services in tandem with University-based assets and resources and other state, federal and local agencies, to facilitate economic, community and business development throughout South Texas and the Border Region.

Working together to build the economy one business at a time.

Institute for
Economic
Development



Center for **Community**
and **Business Research**

The University of Texas at San Antonio