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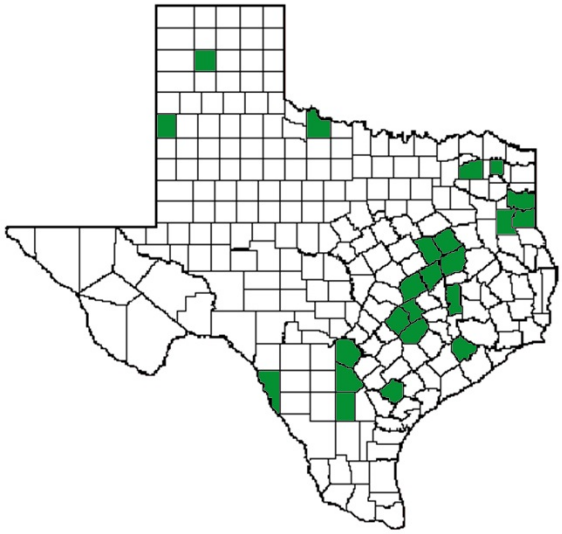
Coal Mining and Coal-Fired Power Plant Generation in Texas: Economic and Fiscal Impacts



Prepared for
Texas Mining and Reclamation Association

Prepared by
Center for Economic Development and Research
University of North Texas

Center for Economic Development and Research

UNT UNIVERSITY OF NORTH TEXAS

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Executive Summary

This report examines the economic and fiscal impacts of coal mining and coal-fired electric power generation and related activities in the state of Texas. Coal mining and coal-fired electric power generation are important economic engines in Texas. Economic activity generated from these industries spark business activity up and down their respective supply chains creating new jobs and income for Texas residents. Moreover, as a reliable local source of fuel for electric power generation, Texas lignite coal is an important component of our power source diversification efforts and makes us more energy independent, which makes Texas a more competitive place to do business. Power generation facilities fueled by Powder River Basin sub-bituminous coal further boost state economic activity and contribute to energy fuel diversification. Our findings include:

- Lignite coal mining, the manufacture of activated carbon from lignite coal, and coal-fired electric power generation creates just over $7 billion in economic activity in Texas annually. This activity supports 24,290 jobs that pay $1.8 billion in salaries, wages, and benefits. State and local taxing jurisdictions receive over $690 million in annual revenues from coal related activities.

Table ES1. Economic and Fiscal Impacts of the Lignite Coal Mining Industry, the Manufacture of Activated Carbon, and Coal-fired Electric Power Generation in Texas*

Description	Impact
Economic Activity	$7,074,597,000
Labor Income	$1,807,810,000
Total Employment	24,290
Total State and Local Tax@	$693,314,000

** Based on coal mining and power plant operators' figures. @ Includes sales, excise, property taxes, fees for licenses and permits, and other revenue. Sources: Industry Sources, IMPLAN, authors' estimates.*

- Lignite coal mining in Texas is a key generator of economic activity for many of the state's smaller communities. In total, in-state coal mining creates over $2.2 billion in statewide economic activity each year, generating $688 million in salaries, wages, and benefits, and providing jobs for over 10,000 Texans. Coal mining also supports about $129 million in direct and indirect tax revenues.

Table ES2. Economic and Fiscal Impacts of Lignite Coal Mining in Texas*

Description	Impact
Economic Activity	$2,209,810,000
Labor Income	$688,126,000
Total Employment	10,436
Total State and Local Tax@	$129,847,000

**Based on coal mining operators' figures. @ Includes sales, excise, property taxes, fees for licenses and permits, and other revenue. Sources: Industry Sources, IMPLAN, authors' estimates.*

- Electric power generation fueled by Texas-produced lignite coal and Powder River Basin sub-bituminous coal is a major source of economic activity in Texas. This industry creates $4.9 billion in statewide economic activity supporting over 13,900 direct and indirect jobs, and boosting labor income by $1.1 billion. Tax revenues for state and local jurisdictions total $552 million each year from coal fueled power generation in Texas.

Table ES3. Economic and Fiscal Impacts of Coal-fired Electric Power Generation in Texas*

Description	Impact
Economic Activity	$4,904,339,000
Labor Income	$1,127,414,000
Total Employment	13,916
Total State and Local Tax@	$552,150,000

**Based on power plant operators' figures. @ Includes sales, excise, property taxes, fees for licenses and permits, and other revenue. Sources: Industry Sources, IMPLAN, authors' estimates.*

Introduction

This report examines the economic and fiscal impacts of coal mining, coal-fired electric power generation, and related industries in the state of Texas. Coal mining and related activities, as well as coal-fired electric power generation, are important economic engines in Texas. Economic activity generated from these industries sparks business activity up and down their respective supply chains creating new jobs and income for Texas residents.

The Texas Mining and Reclamation Association (TMRA) commissioned the Center for Economic Development and Research at the University of North Texas in 2013 to study the impacts of coal mining and coal-fired electric power generation in the state of Texas.[1] This study is an update of that original work. Based on data obtained from miners, power producers, TMRA, the U.S. Bureau of Economic Analysis (BEA), and the U.S. Energy Information Administration (EIA), we estimate the economic and fiscal impacts of coal mining and related activities and coal-fired electric power generation activities using publicly available economic models. Our impact estimates for coal-fired electric power generation include plants that use Texas-produced lignite coal and sub-bituminous coal from the Powder River Basin. The following section provides a brief history of coal mining in Texas. We then offer a description of the methodology employed in our analysis and report our research findings. The final section discusses other less quantifiable impacts of coal mining and coal-fired electric power generation.

World and United States Coal Reserves

Coal reserves can be found in coal seams across the entire world. Using current technologies, just over 80 countries are endowed with recoverable reserves. Approximately 70 percent of the estimated total reserves in the world are contained in five countries: United States, Russia, China, Australia, and India (U.S. Energy Information Administration [EIA], 2014a).

In the United States (U.S.), recoverable coal reserves can be found in 25 states. Wyoming is the state with the largest proven reserves of 6,932 million short tons, which represents 37 percent of the nation's total (see Table 1). Coal reserves in Texas are estimated to be about 751 million short tons, or 4 percent of the country's total (EIA, 2013a). Coal reserves in Texas include substantial deposits of lignite coal located in a belt from the far northeast through central Texas and to the southwest, and some bituminous and sub-bituminous coal in the north central and southwest areas.

[1] The 2013 study can be found online here: http://tmra.com/wp-content/uploads/2014/01/Coal-in-Texas-Economic-and-Fiscal-Impacts-Feb-2013.pdf

Table 1. Recoverable Coal Reserves by State, 2012
(Twelve largest)

	States	Coal Reserves (Million Short Tons)	Percent of U.S. Total
1	Wyoming	6,932	37.1%
2	Illinois	2,215	11.9%
3	West Virginia	1,842	9.9%
4	Kentucky	1,263	6.8%
5	North Dakota	1,128	6.0%
6	Montana	960	5.1%
7	Texas	751	4.0%
8	Indiana	600	3.2%
9	Pennsylvania	554	3.0%
10	New Mexico	497	2.7%
11	Virginia	283	1.6%
12	Alabama	265	1.5%
	U.S. Total	*18,664*	*100.0%*

Source: U.S. Energy Information Administration, Table 14 Recoverable coal reserves and average percentage at producing mines by state (http://www.eia.gov/coal/annual)

The United States is one of the largest producers of coal in the world. In 2012, 1 billion short tons of coal were produced in the country, with Texas being the 6th largest producer during that year (EIA, 2014b). In 2012, Texas produced 44.1 million short tons of lignite coal from surface mines, claiming five of the 50 largest coal mines[2] in the U.S. (EIA, 2014c).

History of Coal Mining in Texas

While it is speculated that early Texas settlers mined coal for use in homes and business enterprises, commercial coal mining did not begin until the 1880s. The first record of commercial coal production was in 1884 when production totaled 125,000 tons. Most Texas mines were small and yielded from 10,000 to 50,000 tons per year, with most of the coal being used in the state. Lignite was processed into briquettes and used in boilers to produce steam that generated power; it was also used in homes and in the sugar-refining industry (Henderson & Kleiner).

In the early years, the industry experienced many production peaks and valleys. A production high was reached in 1901 at 1.1 million tons. Following a brief industry-wide recession, 1901 production totals were surpassed in 1904, which proved to be the start of a steady production climb that reached 2.4 million tons in 1913. This production was due in part to coal mining

[2] Mine Name/Company: Kosse/Luminant Mining Company LLC, Three Oaks/Luminant Mining Company LLC, South Hallsville No 1 Mine/Sabine Mining Company, Jewett Mine/Texas Westmoreland Coal Co., and Beckville/Luminant Mining Company LLC.

operations in Erath County, which ran from the mid-1880s until the 1930s. During this period, the Erath County area led the state in coal production (Henderson & Kleiner).

Coal production dipped slightly just prior to World War I but rebounded in 1917. In the 1920s, the coal industry throughout the nation was in decline due to competition from petroleum and electric power. A slight production increase occurred in 1927, but it was followed by a steady decline that resulted in a 30-year low in 1935, with state production totals reported at 757,529 tons. Production post-World War II was practically non-existent, as evidenced by the 1950 reported production total of only 18,169 tons. Industry wide production was later boosted during the 1950s when the Aluminum Company of America (Alcoa) began using approximately 300,000 tons of lignite per year in its operations. Despite this boost, coal production remained fairly stagnant until the 1970s when both bituminous coal and lignite coal production in the state was reinvigorated (Henderson & Kleiner).

Prior to the 1970s, bituminous coal production had practically ceased in Texas; it resumed in the 1970s and was used in the cement industry. Lignite mined from counties including Freestone, Limestone, Milam, Harrison, Hopkins, Panola, and Titus was used at power generating plants. In 1975, it was estimated that four lignite surface mines in the state yielded 11 million short tons that was used in power generation. This production represented increases of 43 percent over 1974 and 172 percent over 1972 production totals. Lignite production in 1986 was reported at 48.5 million tons and was primarily used to generate electricity (EIA, 2014d). By the 1990s, almost all (99%) coal produced in the state (over 50 million tons annually) was lignite, and Texas was the 6th leading coal mining state in the nation (Henderson & Kleiner).

Present Day Coal Mining in Texas

At present, almost all of the coal mined in Texas is lignite, which is entirely consumed within the state. On average, coal production in Texas decreased by 36.4 percent between 1996 and 2009. However, production increases starting in 2010 resulted in 2013 production being just over 20 percent higher than 2009 totals (see Figure 1).

In 2013, 39 percent of the electricity consumed in the U.S. was generated by coal in more than 500 coal-fired power plants across the country (EIA, 2014e). In 2012 about 32 percent of the electricity generated in Texas was produced from coal-fired power plants. In 2012, Texas coal-fired power plants generated 138 million MWh (9.1 percent of U.S. total coal-fired electricity), including both lignite fueled plants and plants fueled by sub-bituminous coal from the Powder River Basin (EIA, 2014f).

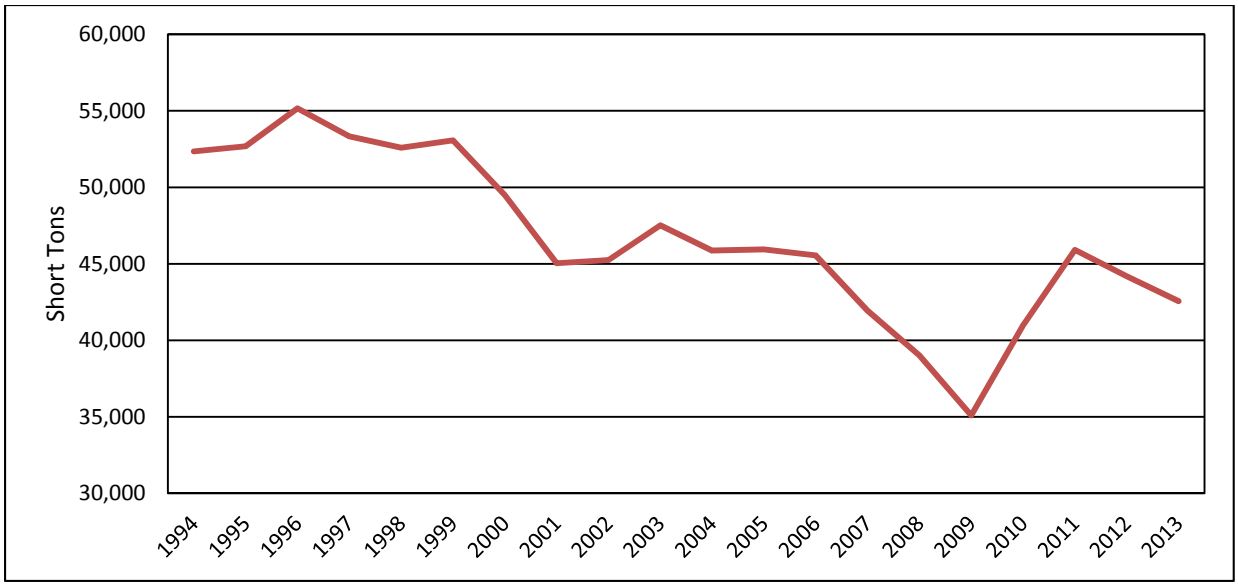

Figure 1. Coal Production in Texas (1994-2013)
Source: U.S. Energy Information Administration, retrieved from http://www.eia.gov/coal/annual/

The number of employees engaged in coal production in Texas has varied over the past several years but is showing an increase since the mid-2000s. Statewide coal mining employment in Texas reached a two-decade high exceeding 2,900 jobs in 2011 and 2012 (see Figure 2) (EIA, 2013b).

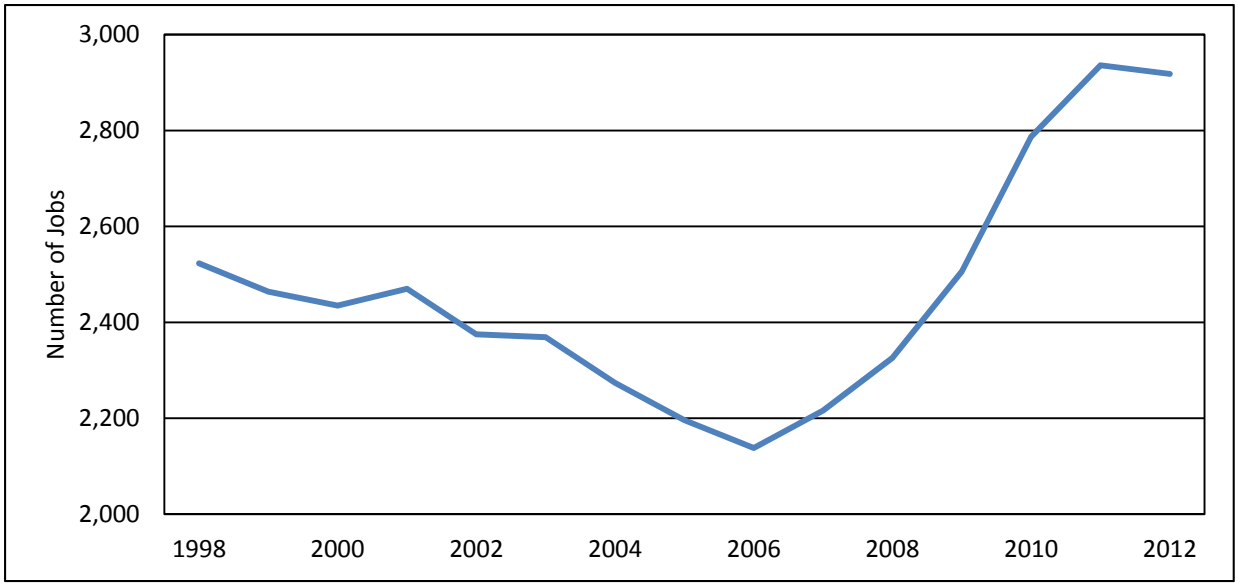

Figure 2. Number of Employees in Coal Production in Texas (1998-2012)
Source: U.S. Energy Information Administration, retrieved from http://www.eia.gov/coal/annual/

Lignite coal has lower thermal energy properties than other types of coal. The carbon content in coal combined with the moisture determines the energy content. Lignite coal contains 25 to 35 percent carbon (EIA, 2014g) and a moisture content of 35 to 40 percent (Pavlish, 2005). The energy content of lignite coal ranges from 9 to 17 million British Thermal Units (BTU) per short ton, with an average of 13 million BTU per short ton consumed in the U.S. These same properties make lignite coal especially favorable for the production of activated carbon products and for use in coal gasification.

Coal Mining Counties in Texas

Currently, there are 23 counties that have either lignite coal mining operations or coal-fired electric power plants or a combination of both. There are lignite coal mining operations in 13 Texas counties operated by seven companies. The economic characteristics of these counties vary as do the lignite coal production dynamics of each mine. Coal-fired electricity from lignite coal is generated in ten different power plant complexes administered by six companies in nine counties. Additionally, coal-fired electricity from non-lignite coal sources is generated in ten different power plants across nine counties. A large number of additional employees directly related to the coal mining industry in Texas are also located in other corporate and business offices throughout the state.

Methodology

To measure the impacts that the coal mining industry has on the state economy, we utilize the IMPLAN economic input-output model developed by the Minnesota IMPLAN Group. The IMPLAN model is widely used in academic and professional research. Input-output models track how spending flows through a specific geography. This analysis measures statewide impacts. The IMPLAN model provides estimates of total economic activity including direct, indirect, and induced impacts based on the activities of a given entity. For example, consider the economic impacts of mining. The direct effects would include the activities of the mining firm that hires employees, pays wages, and purchases materials. In addition, the firm will buy equipment, office supplies, vehicles, and engage professional service providers such as accountants and attorneys as part of their normal business operations.

Indirect effects capture the economic activities of the mining firm's vendors. For example, the accounting firm that provides bookkeeping services to the mining firm buys office supplies, rents space, purchases computer equipment, and hires services for their business needs. Induced effects include the impact of the employees of all these firms spending a portion of their wages and salaries in the local economy. The IMPLAN model adjusts the impact estimates for spending that leaks out of the local economy. For example, if mining equipment is not manufactured in Texas, then only a small amount of the estimated purchase value of that equipment is counted as contributing to the state economy. When added together, the sum of all the activity from

direct, indirect, and induced impacts is typically greater than the local portion of the spending, which is the "multiplier effect."

The IMPLAN model estimates the total level of economic activity (transactions) supported by the base spending and resulting job and economic impacts. Income impacts are categorized as labor income (salaries, wages, and benefits) and property income (rents, royalties, corporate profits, dividends, and other income) derived from direct, indirect, or induced spending. The model also estimates indirect business taxes, which include sales and use taxes, property taxes, permit and license fees, and other business taxes paid to local entities. We also obtained information from companies regarding their direct tax payments to state and local jurisdictions that are added to indirect tax estimates.

Economic and Fiscal Impacts

This analysis examines the economic and fiscal impact of the coal mining industry, the manufacture of activated carbon, and coal-fired electric power generation on the state of Texas. These industries generate just over $7 billion of economic activity, support over 24,000 total jobs in the state, and pay $1.8 billion in salaries, wages, and benefits each year (see Table 2). In addition, state and local taxing jurisdictions enjoy a considerable boost to revenues from sales and property taxes, licenses, and permit fees, totaling $693 million.

Table 2. Economic and Fiscal Impacts of the Lignite Coal Mining, the Manufacture of Activated Carbon Filtration Systems, and Coal-fired Electric Power Generation in Texas*

Description	Impact
Economic Activity	$7,074,597,000
Labor Income	$1,807,810,000
Total Employment	24,290
Total State and Local Tax@	$693,314,000

** Based on coal mining and power plant operators' figures. @ Includes sales, excise, property taxes, fees for licenses and permits, and other revenue. Sources: Industry Sources, IMPLAN, authors' estimates.*

Isolating our analysis to focus on coal mining activities, we find that in-state lignite coal mining generates just over $2.2 billion in statewide economic activity each year, supporting over 10,000 total jobs paying $688 million in salaries, wages, and benefits (see Table 3). State and local taxing jurisdictions will enjoy $129 million in annual revenue associated with Texas coal mining. Not having lignite coal mining in Texas would result in less overall economic activity in the state. Moreover, the economic benefits of lignite coal mining are concentrated in regions where the mines and their ancillary activities represent a substantial share of total regional economic activity.

Table 3. Economic and Fiscal Impacts of Lignite Coal Mining in Texas*

Description	Impact
Economic Activity	$2,209,810,000
Labor Income	$688,126,000
Total Employment	10,436
Total State and Local Tax@	$129,847,000

**Based on coal mining operators' figures. @ Includes sales, excise, property taxes, fees for licenses and permits, and other revenue. Sources: Industry Sources, IMPLAN, authors' estimates.*

Coal-fired electricity generation using lignite coal and Powder River Basin sub-bituminous coal generates $4.9 billion of economic activity each year supporting over 13,900 Texas jobs that pay over $1.1 billion in salaries, wages, and benefits (see Table 4). State and local taxing jurisdictions enjoy $552 million yearly in revenues from producers of coal-fired electric power.

Table 4. Economic and Fiscal Impacts of Coal-fired Electric Power Generation in Texas*

Description	Impact
Economic Activity	$4,904,339,000
Labor Income	$1,127,414,000
Total Employment	13,916
Total State and Local Tax@	$552,150,000

**Based on power plant operators' figures. @ Includes sales, excise, property taxes, fees for licenses and permits, and other revenue. Sources: Industry Sources, IMPLAN, authors' estimates.*

Conclusion

This analysis clearly shows that economic activity generated by lignite coal mining, coal-fired electric power generation, and related industries in Texas serve as a catalyst for economic growth and development for both the local regions in which mining companies and coal-fired power plants operate as well as the state overall. Moreover, estimations used to isolate lignite coal mining impacts show the importance of this sector by itself. At the state level, coal-fired electricity, using all types of coal (both lignite and Powder River Basin sub-bituminous coal), combined with Texas lignite mining operations creates a total of $7 billion in annual economic output that support over 24,000 jobs for Texas residents. Lignite coal mining by itself creates $2.2 billion in annual economic output and supports more than 10,000 total jobs that pay more than $688 million in wages, salaries, and benefits. Lignite coal mining and reliable, cost effective coal-fired power generation helps Texas provide a highly diversified energy portfolio benefitting Texas businesses and residents while giving the state a competitive advantage in attracting and retaining businesses and economic growth.

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Technical Appendix

The methodologies employed in the analysis of the economic and fiscal impacts of coal mining, coal-fired electric power generation, and other related industries is based on a multi-stage research strategy of data gathering, data testing, and analysis. The first stage was to gather data from mining companies and power generation facilities regarding key operating characteristics. In most cases, the data gathered identified employee headcounts that can be used as input into an economic input-output model. We also included headcounts for certain classes of contract employees to more accurately reflect operating conditions at the subject facilities. In addition, we gathered data on direct sales and use and property taxes paid by the miners, power generators, and others to augment information provided by the economic input-output model. Once these data were gathered, we identified any missing data points and utilized third-party regional economic data sources to fill these data gaps. Data were screened for accuracy by comparing actual and estimated variable values with external sources such as mining regulators, the Texas Workforce Commission, the U.S. Department of Labor Bureau of Labor Statistics, and county appraisal districts.

To estimate the total economic impacts of the subject business activities, we used the IMPLAN economic input-output model developed by the Minnesota Implan Group, Inc. The IMPLAN (IMpact analysis for PLANning) model is widely used in both professional and academic research to track how spending flows through a region. It originated in 1976 as a management tool for the U.S. Forest Service using benchmark data from the U.S. Department of Commerce Bureau of Economic Analysis to measure how economies are affected by the presence of a given economic activity. Economic input-output modeling was developed by noted regional economist Walter Issard in 1950 with models being expanded and improved in detail with the gains in desktop computer processing capabilities.

Based on benchmark data developed from the Economic Census conducted by the U.S. Census Bureau every five years, for any given industry we can estimate the purchases that serve as production inputs for that industry and the consumption of that industry's products as inputs into other goods (intermediate goods) or as final products consumed by government or households. This includes first order purchases and subsequent rounds of purchases, such as a coal mine purchasing safety equipment, which required a series of manufacturing inputs to create, and so on. The benchmark data also allows estimations of the number of employees, and their labor income, required to generate a given level of output for any industry. The impacts of the spending by the employees are also included in the model estimates and are based on household consumption patterns. Importantly, modern input-output models are based on a social accounts method that adjusts patterns of consumption for households at differing levels of household income. The data reflect the intuitively obvious observation that the items purchased by a household earning $50,000 per year is different than a household earning $25,000 per year or one earning $150,000 per year. Of course, not all inputs for industrial production or spending by households remain in the local or state economy. The modeling adjustments for regional or state spending have seen a significant improvement in accuracy over the past few years with IMPLAN's creation of a trade flow model.

The trade flow model improves on previous estimates of the flow of goods and services among counties, which serve as the base geographic unit for the IMPLAN model. The trade flow model is effectively a doubly constrained gravity model that balances domestic imports and exports and represents the relative "attractiveness" of the size of a regional economy. A large economic area attracts more economic activity (purchases) just because more is available, but the attraction of size is inversely proportional to the distance between supplier and purchaser. The trade flow model results in a set of Regional Purchasing Coefficients that estimate the portion of a given purchase that is likely to remain with the study geography. For example, a coal mine in Titus County purchases fuel that is refined in Harris County. From the perspective of Titus County, the only portion of that fuel purchase that impacts the local economy is likely to be for a portion of the cost of transporting the fuel to the mine site. Of course, in a state model for Texas, a greater portion of the value of that fuel purchase is captured since refining occurred in state.

Even with the trade flow model adjustments, the analysis presented in this report required additional adjustments in some components. When estimating the total statewide impacts of coal mining, activated carbon filtration system manufacturing, and coal-fired power generation, we had to adjust certain purchases to prevent double counting. The input-output model for power generation includes the purchase of coal in that industry's supply chain, so we made additional model adjustments (reductions) to enhance the accuracy of our estimates. Thus, the sum of our separate analyses for coal mining and power generation cannot be simply added together for the summary impact estimate. We also note that our methodology took conservative approaches in considering the impacts of ancillary industries. For example, rail transportation services are an important input for electric power generation in Texas, and the IMPLAN model predicts the purchase of rail transportation services and related employment and labor earnings. However, our examination of the estimates of indirect impacts into the railroad industry suggests that the model may not fully account for the value of the presence of major rail operations in Texas, such as the headquarters of BNSF. The presence of the headquarters would tend to expand the relative impact of coal shipments in Texas on total railroad employment. Nonetheless, we have not made adjustments to the IMPLAN model, and therefore our estimates of the total economic impacts of coal-fired power generation in Texas are likely understated.