Lignite Energy Council and Gulf Coast Lignite Coalition
Meeting with the Office of Management and Budget
Impact of the Clean Power Plan on Lignite Generation in the United States
July 16, 2015

EPA's 111(d) Rule,[1] as proposed, presents a significant threat to lignite electric generation and lignite mining in the United States. Nationwide, lignite-fired power plants have an installed electric generation capacity of about 18,000 megawatts ("MW") at 34 operating units (with the Kemper County IGCC plant, rated at 582 MW, scheduled to begin operations next year).[2] Each of these plants is supplied fuel, in whole or in part, by at least one adjacent or nearby surface lignite mine. These plants and mines are located in Louisiana, Mississippi, Montana, Texas, and North Dakota. The Lignite Energy Council ("LEC") and the Gulf Coast Lignite Coalition ("GCLC") represent the vast majority of the lignite-fired power plants and/or related lignite mines in the United States.[3]

UNIQUE CHARACTERISTICS OF LIGNITE ELECTRIC GENERATION AND MINING

Lignite power plants are uniquely tied to their lignite fuel source, resulting in a significantly greater economic and employment impact compared to the closure of a power plant alone. Due to its unique characteristics, lignite is not transported long distances, but must be extracted, and subsequently used, in a relatively concentrated area. Therefore, virtually every lignite power plant is a "mine-mouth" power plant – built literally at or near the mouth of the mine. As summarized by EPA in its Mercury & Air Toxics Standards ("MATS") Rule: lignite units are "universally constructed 'at or near' a mine containing" lignite with designated and narrowly limited conveyance mechanisms to transport lignite from the mine to the power plant.[4]

Lignite power plants are relatively recent vintage. Many lignite power plants were built in the 1970s and 1980s, some as recently as the 2000s. This makes them very recent vintage with decades of remaining useful life, particularly compared to other coal-fired generation fleets which are often significantly older vintage.

Many lignite power plants were purpose-built to meet U.S. Energy Policy. The Powerplant and Industrial Fuel Use Act of 1978 (in effect through 1987) required that any new baseload power plant had to be able to use coal (or another non-natural gas alternative fuel). This federal law effectively outlawed the use of natural gas for power generation throughout the country, and encouraged power suppliers and lignite miners to construct many of the lignite power plants targeted by this rule.

Lignite generation provides a significant amount of power to rural users and electric cooperatives. In addition to the Fuel Use Act driving construction, the Federal government in the 1970s and 1980s actively funded the construction of lignite power plants through loans financed by the U.S. Department of Agriculture's Rural Utility Service. In fact, over 363 million dollars of debt is still backed by the Federal government. Many of these rural communities also do not have access to other forms of electric generation due to lack of supply and/or infrastructure.

DETRIMENTAL IMPACT PRESENTED BY THE 111(d) RULE

Despite the fact that the proposed 111(d) rule does not impose unit-specific emission limits, and regardless of EPA's emphasis that states will have "flexibility" in developing compliance plans, the mandatory emission budgets will place lignite operations at a significant economic disadvantage relative to other electric power generation sources. As described in detail in the written comments on the proposed 111(d) rule filed by GCLC, LEC, and several member companies and cooperatives, Blocks 1 and 2 of EPA's Best System of Emissions Reduction ("BSER") methodology involve assumptions that undermine the continued viability of lignite units. Under Block 1, overly optimistic assumptions of what can be accomplished, in terms of heat rate

improvements, are built into the budget derivation in such a way that efficiency improvements already accomplished are not rewarded or accounted for. Under Block 2, EPA directly assumes that a significant percentage of coal (and, therefore, lignite) generation will be reduced in favor of natural gas (e.g., Texas [51.9%], Louisiana [52.5%], and Mississippi [100%]).[5] EPA's own integrated planning model (IPM) analysis in the docket projects significant retirements within the lignite fleet to begin as early as 2016, continuing into the 2020s. In addition to Blocks 1 and 2 and EPA's IPM modeling, simple arithmetic raises the question of how lignite units (which average between 1,900 and 2,700 lbs CO2/MWh) will be able to survive in electricity markets forced to comply with mandatory fleet-wide budgets such as 791 lbs CO2/MWh (Texas), 883 lbs CO2/MWh (Louisiana), 692 lbs CO2/MWh (Mississippi); and 1,783 lbs CO2/MW (North Dakota).[6]

Therefore, it is reasonable to insist that EPA recognize the risk that a significant component, if not all, of the lignite-fired plants and associated mines could be forced to retire as a result of the rule. The final state standards and Regulatory Impact Assessment (RIA) must account for the uniquely larger economic impact of lignite mine-mouth retirements. In order to provide OMB and EPA the best data available to consider adjustments to the final state standards, LEC and GCLC surveyed its members to assess the economic value and employment of the lignite power plants and supplying mines that are threatened by the Clean Power Plan. The following provides additional source information about the uniquely large economic value of the lignite industry to the states where it is located.

AGGREGATED ECONOMIC DATA RELATING TO THE LIGNITE FLEET AND ASSOCIATED MINES

Set out below in Figure 1 is the aggregated value and employment of the power plants and mines. To ensure consistency among data sets, the valuation data is based on the projected net book value of the power plants and mines in 2030 (in present day dollars). Employment includes only direct employees of the plants and mines.

Figure 1: Aggregated Economic Value and Employment of Lignite Power Plants and Mines (Present-Day $; Projected 2030 Compliance Date)	
Value of Power Plants & Mines	$9,831,931,806
Power Plant & Mine Employment	7,468

The values in Figure 1 are conservative – meaning they are likely on the low side of what would result from the premature retirement of the lignite fleet and associated mines (note that EPA projects significant retirements as soon as 2016). The presented data is in the lower range of estimated values, with estimate increases approaching 600 million dollars in additional value and 200 additional employees. Values in 2030 reflect depreciation that might not be realized if retirement occurred sooner. Moreover, premature retirement will accelerate many significant costs that are currently expected to be incurred much further down the road such as plant decommissioning and final mine reclamation. Furthermore, outstanding debt, in the hundreds of millions of dollars per plant, is expected to be paid through ongoing power sales through the life of the plant and mine. Power plants and mines will be confronted with costs, otherwise incurred over the next decades, over the next few years. Figure 1 does not capture the full economic impact that will occur from such accelerated retirement timelines. Similarly, the potential employment impact reflected in Figure 1 is conservative because it does not capture contractors and suppliers to the plants and mines, which can number in the hundreds at each individual plant and mine at varying times throughout the year. Nor do the employment numbers reflect indirect jobs. It has been shown that business activity associated with the lignite industry supports nearly three times as many employees as are directly employed by the industry.[7] Finally, the data in Figure 1 do not include induced tax and other economic losses that would result from the adverse impacts on the lignite industry in the states where it plays a major role.

The data in Figure 1 are also presented in the aggregate – for both plant and mine – since many of the plants and mines have common owners, operators, and/or closely integrated business relationships. The link between the plant and mine which, as discussed above, goes far beyond common business relationships is particularly relevant and unique to lignite mines. Because of this nexus, the shutdown of a plant will result in a significantly greater economic and employment impact compared to closure of a power plant alone. This will be particularly felt in communities that depend on the mines for employment, because mine-mouth power plants often require approximately twice the employees in the mines as they do in the plants.

Attached for reference are third-party economic impact studies that provide documentation of the types of indirect and induced economic benefits associated with the lignite industry in North Dakota, Texas, and Mississippi that, along with Figure 1, should be factored into the final RIA and lead EPA to provide a categorical exclusion or subcategorization for lignite in the final 111(d) rule.

NEED FOR A CATEGORICAL EXCLUSION OR SUBCATEGORY FOR LIGNITE

In light of the above-stated unique characteristics of the lignite fleet and economic impact of retirements, EPA's final 111(d) rule should include a categorical exclusion of lignite-fired plants or, at minimum, a subcategory for lignite (similar to how EPA handled the MATS Rule), which dramatically reduces the retirement risk to lignite units and ultimately risk to local and regional economies. An exclusion or other subcategorization would be well within EPA's authority based on the unique characteristics of lignite, the role the federal government played in the energy policy direction and financing of lignite plants, and the unique, direct, and significant economic impacts of lignite plant retirements and associated mine closures. We are hopeful that EPA will recognize the severity of the economic impact to the members of the lignite industry and accommodate the requests made here and in the detailed comments submitted by LEC, GCLC, and their members. As discussed in those comments, failing to do so could expand the legal frailty of this rule beyond concerns about statutory authority and the 10th Amendment to more serious equal protection and more economically damaging takings claims under the 5th Amendment.

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[1] Carbon Pollution Emission Guidelines for Existing Stationary Sources: Electric Utility Generating Units; Proposed Rule, 79 Fed. Reg. 34830 (June 18, 2014).

[2] U.S. Energy Information Administration, Form EIA-860 Data – Schedule 3, "Generator Data" (Operable Units and Proposed Units). Information on the Kemper County IGCC Plant can be found at Mississippi Power's Kemper County Energy Facility website, available at: http://www.mississippipower.com/about-energy/plants/kemper-county-energy-facility/ (last accessed July 14, 2015).

[3] GCLC represents lignite power plants and mines in Texas, Louisiana, and Mississippi. LEC represents lignite power plants and mines in North Dakota and Montana. GCLC and LEC, and their member companies, are generally opposed to the Clean Power Plan and nothing in this document should be construed as endorsement of the rule.

[4] National Emissions Standards for Hazardous Air Pollutants from Coal- and Oil-Fired Electric Utility Steam Generating Units and Standards of Performance for Fossil-Fuel-Fired Electric Utility, Industrial-Commercial-Institutional, and Small Industrial-Commercial-Institutional Steam Generating Units, Final Rule, 77 Fed. Reg. 9304, 9379 (Feb. 16, 2012). EPA used the term "low rank virgin coal" with a heat-input value of 8,300 Btu/lb, which is almost exclusively lignite.

[5] Clean Power Plan Technical Support Document, Data file: Goal Computation – Appendix 1.

[6] EPA, 2012 Unit-Level Data Using the eGRID Methodology.

[7] Randal C. Coon, et al., *North Dakota Lignite Energy Industry's Contribution to the State Economy for 2013 and Projected for 2014* (June 2014).

Regulatory Language for Subcategorization Recommended by NA Coal

- Revise Section 60.5795(b) to read:

(b) An affected EGU is a steam generating unit, integrated gasification combined cycle (IGCC), or stationary combustion turbine that meets the relevant applicability conditions specified in paragraph (b)(1) or (2) of this section, **and is not a facility specified in paragraph (c) of this section**.

- Then add a new Section 60.5795(c), as follows:

(c) A steam generating unit that is part of the "Unit designed for low rank virgin coal subcategory" defined in 40 C.F.R. Section 63.10042 shall not be an affected EGU.

AAE14002 **June 2014**

North Dakota Lignite Energy Industry's Contribution to the State Economy for 2013 and Projected for 2014

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The lignite energy industry's contribution to the North Dakota economy has been measured using key economic indicators, including retail trade activity, personal income, total business activity, employment, and tax revenues. These estimates were based on actual industry expenditures for 2013 and projected expenditures for 2014. This analysis contains several measures of the relative importance of the lignite energy industry in North Dakota. First, expenditures (obtained from a survey of firms involved in lignite mining and conversion) were used to estimate the business activity the industry generates in the sectors of the state's economy. Second, the industry's share of the state's total sales to final demand (or exports) is evaluated. Third, annual wages paid by lignite energy related industries will be compared to all industry wages in the state.

The methods used for this analysis are similar to those described in Coon et al. (1983) and Coon and Leistritz (1986). Expenditures of companies involved in lignite-related activities in North Dakota constitute the basic data for the study. The North Dakota Input-Output Model was used to analyze these data. The model uses interdependence coefficients, or multipliers, that measure the level of business activity generated in each sector from an additional dollar of sales to final demand in a given sector. For a complete description of the input-output model, see Coon et al. (1985 and 1989). Levels of business activity were used to estimate tax revenues and indirect and induced employment, based on historic relationships (Coon et al. 1992). Lignite industry sales for final demand for 2012 and the resulting level of business activity were compared to 2012 state values (the most recent data available) to indicate the industry's role in the economy. All values in this analysis are expressed in current year dollars (i.e., nominal dollars).

The expenditures of firms involved in lignite-related activities are assumed to work their way through the local economy the same as expenditures of firms in other sectors of the North Dakota economy. The estimated ratio of secondary employment (jobs generated in other sectors of the North Dakota economy) to direct employment (jobs in the mines and plants using lignite in the state) in previous studies was higher for the lignite industry than for some other sectors of the state's economy. An updated methodology was adapted to estimate secondary employment in 2012 (Coon et al. 2012). This methodology was used to avoid possible overestimation of secondary workers, and to provide direct to indirect ratios more in line with other industries in the state.

Results

The North Dakota lignite industry's in-state expenditures totaled $1.1 billion in 2013 and were projected at $1.1 billion for 2014 (Table 1). Actual expenditures for 2013 were very close to those projected ($1.1 billion) by the previous year's study (Coon et al. 2013). Lignite energy industry expenditures were considerably higher than those for earlier years. For example, expenditures in 2013 were 214 percent higher than those for 1986, ($346.2 million) (Coon and Leistritz 1987). Inflation was about 113 percent, nationwide, during this period.

Actual 2013 outlays were similar to projections, being only $3.7 million more than projected. Construction expenditures were $6.0 million less than projected, but outlays for Professional and Social Services were $16.4 million more than projected. Lignite energy industry firms are projecting 2014 expenditures to increase by only $1.7 million from 2013 levels. During this period, Household Sector expenditures (primarily wages and salaries) are projected to increase by $7.9 million.

Rising oil prices worldwide since 2000 are a key reason for projected growth in the lignite energy industry. Oil prices have risen rather dramatically since mid-1999, reaching over $140 per barrel in 2008. Oil prices have been extremely volatile the past couple of years, and currently are in the $100 per barrel range. This is less than the all-time highs during July 2008, but still high enough to create strong demand for lignite energy products.

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Table 1. Estimated North Dakota Direct Expenditures by Economic Sector for Companies Involved in Lignite-related Activities, 2013 and Preliminary 2014

Sector	2013	2014
	-million dollars-	
Construction	118.2	91.4
Transportation	25.9	26.9
Comm & public utilities	118.2	119.3
Wholesale trade & misc mfg	157.2	159.7
Retail trade	161.4	169.9
Fin, ins & real estate	86.0	91.9
Bus & personal serv	55.3	56.4
Prof & social serv	83.9	84.4
Households	279.4	287.3
Total	1,085.5	1,087.2

Expenditures from firms involved in lignite-related activities generated total business activity over $3.3 billion in 2013 with projected business activity of $3.4 billion for 2014 (Table 2). Expenditures by lignite-related firms resulted in $762.5 million of retail sales activity in the state in 2013 and were projected to be $775.6 million for 2014. Also, the industry's activities generated over $1.0 billion in personal income in 2013 and 2014.

Lignite energy companies contribute substantially to state tax revenues. Total taxes attributable to the industry were estimated to be $97.7 million in 2013 and $97.9 million in 2014 (Table 3). Coal severance and energy conversion taxes were 10.1 percent and 23.8 percent of the total, respectively, in 2013. The lignite energy industry directly employed 3,883 workers in 2013 and was projected to provide employment for 3,979 workers for 2014. Business activity attributed to the lignite energy industry provided employment for over 11,000 indirect workers (secondary employment) in 2013 and projected to support nearly 11,500 in 2014 (Table 4).

The importance of the lignite industry to the North Dakota economy can be measured using sales for final demand (value of exported goods and services) and gross business volume (economy-wide business activity resulting from exports). When lignite energy industry sales for final demand for 2012 ($1.7 billion) were compared to the total economic base (sales for final demand or exports) for North Dakota for 2012 ($42.3 billion), the lignite energy industry comprised 4.0 percent of the state's total (Coon et al. 2014). When petroleum and natural gas exploration, extraction, and refining were included, the energy sectors accounted for 31.9 percent of the state's total economic base in 2012. Business activity generated by the lignite industry's sales for final demand ($3.9 billion) was 3.2 percent of the 2012 state's total gross business volume ($121.1 billion). This was slightly less than the 3.9 percent reported in 2011. The industry has maintained a consistent share of the state's economic base, which illustrates the role that the lignite energy industry plays in the North Dakota economy.

Table 2. Estimated Direct Plus Indirect Personal Income, Retail Sales Activity, Business Activity for All Business Sectors, and Total Business Activity for Companies Involved in Lignite-related Activities, 2013 and Preliminary 2014

Item	2013	2014
	-million dollars-	
Personal income	1,039.3	1,050.0
Retail sales	762.5	775.6
Business activity for all business sectors[a]	2,003.6	2,007.9
Total business activity	3,346.9	3,367.1

[a] Includes all sectors except agriculture (livestock and crops), households, and government.

Table 3. Estimated State Tax Revenue Resulting from Activities of Companies Involved in Lignite-related Activities, 2013 and Preliminary 2014

Tax Revenue	2013	2014
	-million dollars-	
Coal severance	9.9	10.5
Energy conversion	23.3	22.3
Sales and use	35.3	35.9
Personal and corporate income	21.8	22.0
Other	7.4	7.2
Total	97.7	97.9

Previous versions of this analysis have reported that the state's coal mining sector wages were the highest in the state. This may still be the case, but due to disclosure problems the coal mining industry is now

Table 4. Estimated Direct and Secondary Employment for Companies Involved in Lignite-related Activities, 2013 and Preliminary 2014		
Employment	2013	2014
Direct	3,883	3,979
Secondary	11,416	11,497

reported as all mining, except oil and gas. The 2009 average annual wage for all mining, except oil and gas, for the first time exceeded 2005 coal mining salaries of $70,938, (Coon and Leistritz, 2007). Industry wages continue to increase, reaching an average annual wage of $77,380 in 2012. Also, mining wages, except oil and gas, were near the highest in North Dakota, following gas and electrical production. Mining salaries, except oil and gas, were nearly double that of all covered wages in North Dakota for the 2009 to 2012 period, the latest years data were available (Table 5). Mining, except oil and gas, average annual wages have increased each year from 2009 to 2012. The lignite energy industry (coal production and conversion) provides average wages higher than almost all other industries in North Dakota.

Mining wages are much higher than all wages in state regions that have lignite energy activities (Table 6). State Region 8 had the highest mining industry annual wages per employee in 2011 ($93,512) and also had the highest 2012 per employee wages ($99,640). County mining and all industry wages are presented in Table 7 for those with mining activities. Wages were not available for Adams, McLean and Oliver Counties for 2011 and McLean and Oliver Counties for 2012, to avoid disclosing proprietary data because of the number of firms located in these counties. McLean County had the highest mining wages of all counties in 2004, but due to data disclosure problems it was not possible to determine if it continued to have the highest mining wages in 2011 or 2012. Average mining wage for Mercer County was $89,745 in 2011, and remained virtually unchanged at $89,326 in 2012. In 2011, Williams County had a slightly higher annual mining wage ($92,926) than Mercer County. Williams County average mining wages increased to over $100,000 in 2012, influenced by oil production in the county. Wage data clearly illustrates that the lignite energy industry provides high paying jobs in North Dakota.

The lignite energy industry contributes to the state's economy through business activity, tax revenues, and employment. On a local and regional basis, the lignite energy industry also provides good paying jobs that help retain people in coal-producing counties.

Table 5. North Dakota Covered Annual Average Wages By Industry, 2009-2012				
Industry	2009	2010	2011	2012
	----------$----------			
Agriculture	34,579	34,994	36,174	39,489
Mining	73,055	79,976	89,730	96,569
Mining, except oil & gas	72,318	75,585	76,167	77,380
Construction	45,406	46,536	51,201	56,478
Manufacturing	41,577	43,408	44,778	46,717
Trans, Comm, Util	48,599	51,215	56,168	60,609
Elec Prod	76,833	78,406	81,639	81,712
Gas Prod	81,427	83,649	87,810	88,434
Wholesale Trade	48,772	51,358	57,560	63,658
Retail Trade	23,233	24,159	25,653	27,470
FIRE	42,805	44,391	48,655	52,218
Services	34,171	36,163	38,351	41,430
Government	37,282	38,565	40,281	41,223
TOTAL	35,970	38,127	41,778	45,909

Source: Job Service North Dakota, 2010, 2011, 2012 and 2013.

Table 6. Covered Annual Average Wages for Mining and All Industries, For State Planning Regions Involved in Mining 2011 and 2012				
	2011		2012	
Region	Mining	Total	Mining	Total
	----------$----------			
Region 1	92,103	68,333	98,866	76,027
Region 2	83,615	40,741	89,887	46,042
Region 7	85,608	46,539	89,622	43,034
Region 8	93,512	46,850	99,640	55,400

Source: Job Service North Dakota, 2012 and 2013

The world energy situation has been changing rapidly in recent years. The demand for oil has increased significantly with more nations becoming industrialized. Demand for oil, instability in oil producing countries, and oil production quotas have resulted in price increases. These price increases (crude oil prices have previously spiked over $140 per barrel) have promoted demand for reliable sources of domestic energy. Along with the prospect of producing renewable energy (ethanol, biodiesel, wind energy, etc.), new technologies have led to

development of domestic oil reserves. North Dakota has massive lignite coal reserves that could help supply our nation's energy needs.

This is an exciting time for North Dakota's lignite energy industry. An ethanol plant in western North Dakota has partnered with an electrical generation plant to use waste heat to power a highly efficient plant. A demonstration facility in southwest North Dakota is in the process of testing coal beneficiation to convert lignite coal from around the world to a higher BTU content fuel source, for use in conversion facilities. The Leland Olds Station and Milton R. Young Station each recently completed $400 million upgrades, that include scrubbers which will greatly reduce emissions.

Several other projects are being discussed that would also use lignite coal. American Lignite Energy is considering building a plant that would use 6 million tons of lignite coal per year to produce liquid fuels. The plant would produce 25,000 barrels per day of refined fuel products including gasoline, diesel, and jet fuel. Construction of the Dakota Spirit AgEnergy ethanol plant (owned by Great River Energy) would add an additional 65 million gallons annually to the state's ethanol production. The Spiritwood Station, which uses lignite coal as a fuel source, is expected to become operational in November 2014. It will provide electricity for Minnesota residents and steam for Dakota Spirit AgEnergy and the adjacent malt plant.

The North American Coal Corporation is scheduled to open the Coyote Creek Mine in 2016, annually supplying 2.5 million tons of coal to the Coyote Power Station. Dakota Gasification Company plans to start construction in 2015 on a 1,100 tons per day urea fertilizer plant, with start up in early 2017. Projected cost for the plant is $402 million. BNI Coal has currently scheduled new mine construction to begin in 2014 with completion in 2015.

Also, two major lignite-generated electricity transmission projects are either underway or soon will be. One project will bring electricity from the Milton R. Young Station to the Red River Valley, and another large transmission line will bring electricity from Antelope Valley Station to the oil fields in western North Dakota. These projects illustrate how North Dakota's lignite energy industry is helping to meet the energy needs of residents, businesses, and industries in North Dakota and regionally.

New technologies and processes (i.e., coal beneficiation) have made North Dakota's lignite coal a more efficient and environmentally friendly. With the state's vast lignite reserves, this points to continued strength in the lignite energy industries.

Table 7. Covered Annual Average Wages for Mining and All Industries, For Counties Involved in Mining 2011 and 2012

	2011		2012	
Region	Mining	Total	Mining	Total
	----------$----------			
Adams	N/A	32,325	57,580	35,156
Bowman	70,496	37,325	75,323	40,764
McLean	N/A	43,139	N/A	44,736
Mercer	89,745	54,837	89,326	56,727
Oliver	N/A	59,832	N/A	60,808
Williams	92,926	70,027	100,452	78,364
N. D.	89,730	41,778	96,569	45,909

Source: Job Service North Dakota, 2012 and 2013

The U.S. Environmental Protection Agency (EPA) continues to impose regulations that threaten the vitality of power plants and coal mines in North Dakota. EPA has proposed to regulate greenhouse gases from new power plants and expects to finalize the rule in the near future. Unless significant modifications are made, the proposed rule would effectively ban the construction of any new conventional coal-based power plants. EPA recently announced greenhouse gas regulations for existing power plants. The billions of dollars that have been invested in coal-based power plants could be jeopardized if new regulations are not cost-effective.

This study estimated the 2013 and projected 2014 economic contribution of the lignite energy industry to the North Dakota economy. The industry currently provides high-wage jobs for western North Dakota residents and generates levels of business activity that benefit the entire state. Construction and operation of new projects would greatly increase the level of economic activity attributed to the lignite energy sector. North Dakota could realize significant economic benefits as a result of growth and development of the lignite energy industry. The role of North Dakota's lignite-energy industry in the state's economy will be increasingly important as the lignite coal reserves are utilized.

The lignite energy industry's economic contribution to the North Dakota economy has been assessed annually since 1982. The North Dakota Lignite Council, the North Dakota Industrial Commission, and recently the Lignite Energy Council have funded these studies. For a discussion of the annual economic contributions the lignite energy industry (that is, those firms involved in the mining or conversion of the state's lignite) has made from 1982 through 2011, see Coon et al. (1983); Coon and Leistritz (annually 1985-2011); and Coon et al. (2012, 2013).

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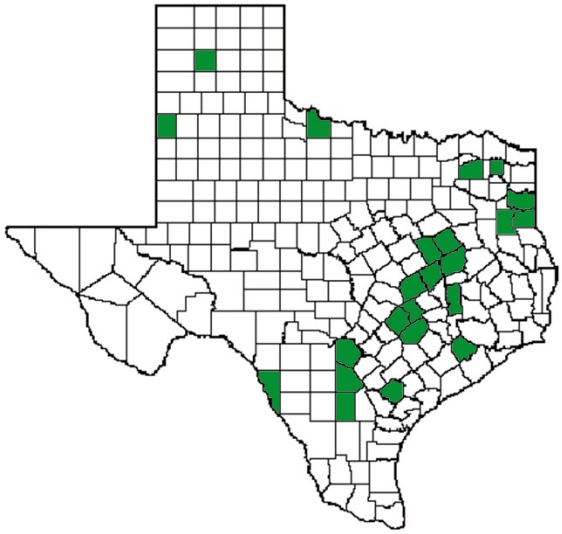
Coal Mining and Coal-Fired Power Plant Generation in Texas: Economic and Fiscal Impacts



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Note: Cover map illustrates counties that have coal mining operations and/or coal-fired electric power stations.

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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).

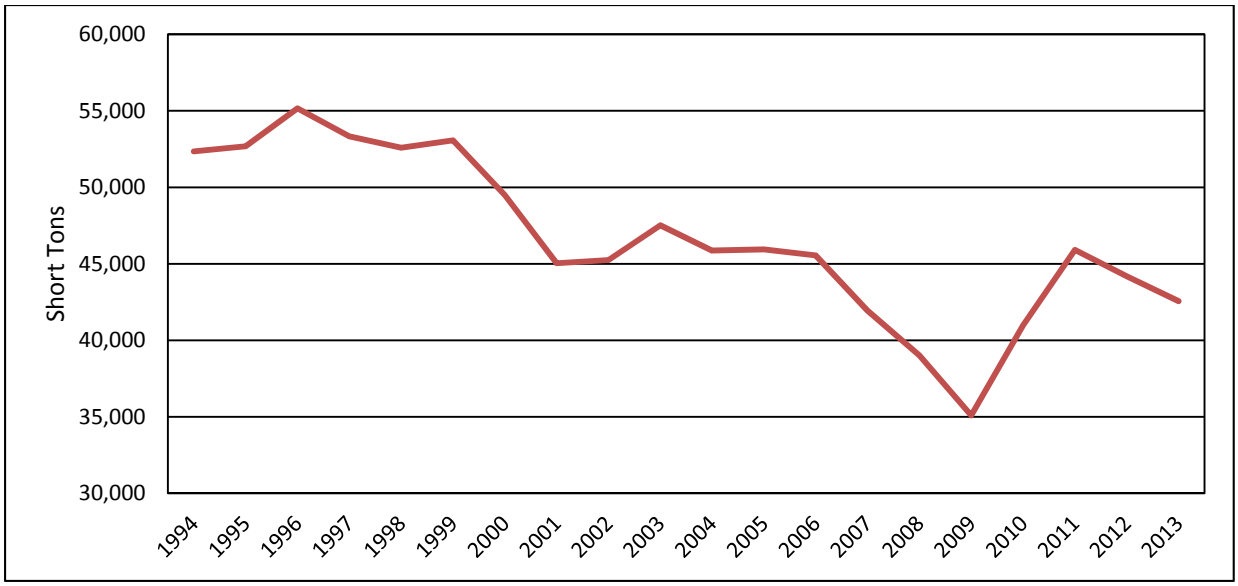

Figure 1. Coal Production in Texas (1994-2013)
Source: U.S. Energy Information Administration, retrieved from http://www.eia.gov/coal/annual/

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).

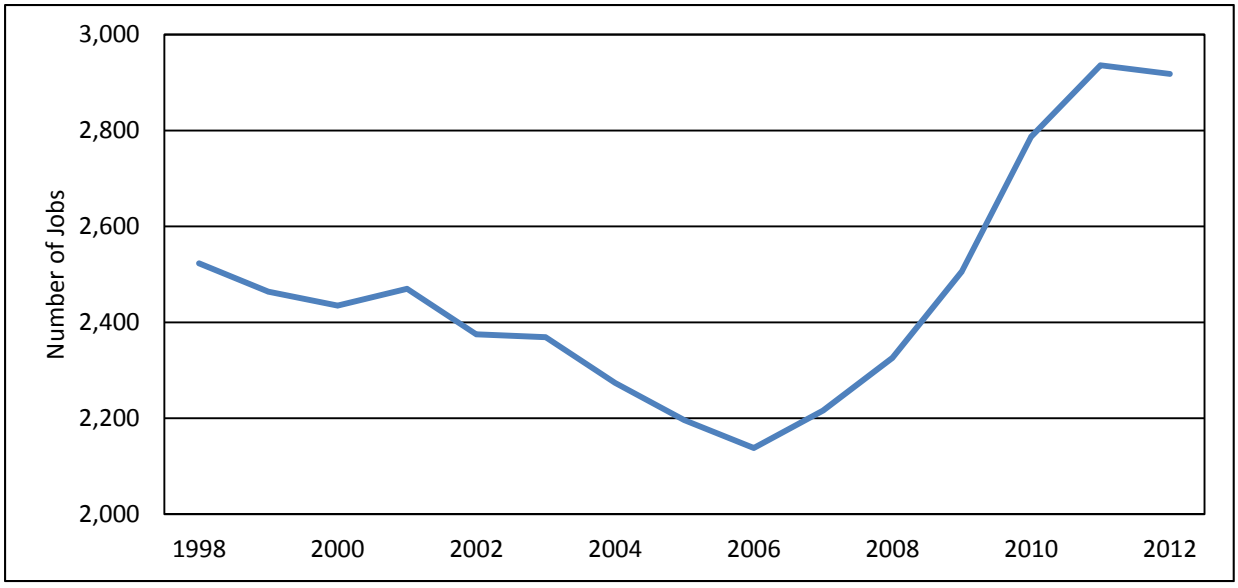

Figure 2. Number of Employees in Coal Production in Texas (1998-2012)
Source: U.S. Energy Information Administration, retrieved from http://www.eia.gov/coal/annual/

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.

RED HILLS MINE AND POWER PLANT

Economic Impact Analysis

Table of Contents

Introduction:

Faced with new regulations by the Environmental Protection Agency (EPA), both the Red Hills Mine and Power Plant are in danger of ceasing production. The Red Hills Mine, an operation of Mississippi Lignite Mining Company produces approximately 3.2 million tons of lignite coal a year. Due to the unique properties of lignite coal, its high moisture content and low energy density, it is advantageous to minimize transportation from mine to power plant. Lignite coal has a relatively low heat content and is considered the lowest rank of coal in the market. These qualities are what make the Red Hills Ecoplex in Ackerman, Mississippi so ideal. The Red Hills Power Plant, a 440 megawatt generating plant owned by Southern Company, is collocated with the mine (Red). This setup minimizes transportation of the lignite coal, and maximizes the interoperability of the mine and power plant.

More stringent carbon pollution regulations are threatening the future operations of fossil fuel fired power plants throughout the United States. These EPA regulations are driven by the Clean Air Act in an effort to reduce the "pollution-to-power-ratio". On a state-by-state basis, the EPA is setting goals for carbon pollution based off of a "national formula" with reference to the state's specific power profile. Using section 111(d) of the Clean Air Act, the EPA is looking to 1) improve efficiency of coal-fired power plants, 2) increase utilization of existing natural gas fired power plants, 3) expand the use of wind, solar, or other low or zero-emitting alternatives, and 4) increase energy efficiency in homes and businesses (McCabe). Though EPA guidelines do not mandate a specific technology or procedure to ensure compliance with the minimum expected carbon emission reduction, they are a minimum performance standard by which the state of Mississippi must develop a game plan within its power system. In doing so, the EPA must ensure the degree of energy limitations are achievable, measureable, not grossly cost-prohibitive and that they have a positive environmental impact (McCabe). State game plans can differ from the EPA guidelines as necessary but must result in the same or better carbon reduction.

While the EPA is claiming that 2005 levels are not a baseline, they are proposing a 30% reduction in carbon emissions from 2005 levels by 2030. Specifically for Mississippi, the EPA is recommending an increase in some "under-utilized" natural gas fired power plants (McCabe). This increased energy supply from cleaner sources would

lead to the closing of the Red Hills Power Plant, thus closing the mine since the power plant is its only customer.

Objective:

The consulting team has been tasked with analyzing the economic impact on Choctaw County and the five counties that surround its perimeter due to the projected closure of the Red Hills Mine and Power Plant. The team will provide the Reds Hills Mine and Power Plant an accurate portrayal of the economic impact to the local area. This will equip them with the data necessary to make informed decisions when the government regulations take effect. This will specifically be accomplished through quantifying the loss of fiscal and community contributions from the Red Hills Mine and Power Plant, as well as highlight the impact on the average Red Hills employee. As the primary employers in a rural Mississippi community, both the Red Hills Mine and Power Plant are concerned with the resulting impact to the local economy due to the closures of both facilities.

Method:

Economic impacts from the closures of the Red Hills Mine and Power Plant were obtained using the Impact Analysis of Planning (IMPLAN). The USDA Forest Service in collaboration with the Federal Emergency Management Agency (FEMA) and the U.S. Department of Interior Bureau of Land Management originally developed IMPLAN (IMPLAN). The government agencies developed the databases and input-output analysis modeling to predict the economic effects of the forestry industry. Eventually the program became too much for these agencies to support and the IMPLAN modeling program was passed onto a private industry to update and maintain. The IMPLAN database and model in use today was created by MIG, Inc. (formerly known as the Minnesota IMPLAN Group) and it consists of two major parts: 1) a national-level technology matrix and 2) estimates of sectorial activity for final demand, final payments, industry output and employment for each county in the U.S. along with state and national totals (IMPLAN).

The IMPLAN model utilizes a fixed (Leontief) production function and therefore fixed prices. In addition, the input values are assumed to remain constant throughout the analysis period. The Leontief input-output model produces monetary values that show the relationships between industries in a given economy. The economy for this project is the surrounding counties of the mine and power plant. Also, this model only takes into account the effects in a particular region and it does not take into account how any other regions are affected.

For our economic analysis, input data was provided from both of the companies in current year numbers (See Table 1). The data included the number of employees, total payroll, taxes, expenditures, community contributions, and a detailed list of employees per county from both the mine and power plant in the year 2014. This input data was provided to Dr. Alan Barefield, an extension professor in the Mississippi State University School of Agricultural Economics, for input into the IMPLAN model.

Table 1: Economic Impact Analysis Assumptions

	Mine Employee	Mine Contractor	Power Plant Employee	Power Plant Contractor
Sector Number	21	471	31	471
Sector Title	Coal Mining	Commercial and Industrial Machinery and Equipment Repair and Maintenance	Electrical Power Generation, Transmission, Distribution	Commercial and Industrial Machinery and Equipment Repair and Maintenance
Total Payroll	$20,500,000	$1,350,000	$6,500,000	$1,075,000
Total Employees	204	N/A	67	N/A
Avg. Payroll per Employee	$100,490	N/A	$97,105	N/A
Local Employees	200	*All Contractors Assumed Local*	61	*All Contractors Assumed Local*
Total Local Payroll	$20,098,039	$1,350,000	$5,917,911	$1,075,000

The model year was set to 2020 when the final implementation of the new EPA regulations is set to take effect. Input data values for salaries and sales are 2014 values and have not been adjusted for projected inflation. The analysis was performed on the "local" area, which includes the Mississippi counties of Attala, Choctaw, Montgomery, Oktibbeha, Webster, and Winston. This region was agreed upon with the clients because the majority of the employees that would be affected reside in these counties.

The analysis likely overstates the impact of shutting down the mine and power plant, because the model assumes that all employees in the studied area would lose their jobs and would not be able to find new ones. It is more than likely, that while the

employees may not be able to find positions at the same wage level as those reported by the studied industries, at least some of them and perhaps a majority of them would find jobs in the same area but at a much lower wage. While this would have a negative impact on spending, tax revenue, and other industries, it is not likely that the impact would be to the full extent as displayed in our analysis. In addition, the IMPLAN model is very comprehensive in nature and therefore accounts for the far-reaching effects to all industries and services, by these closures.

Results:

The IMPLAN analysis discussed in the methodology section provided output data that shows the impacts on the local economy if the Red Hills Power Plant and the Mississippi Lignite Mining Company in Ackerman, MS were closed. The results generated by the IMPLAN software are very detailed and approach the impact on the local economy from different angles. To understand what the results mean, it is important to define a few terms prior to moving forward.

The overall impact on the local economy is shown through the direct, indirect, induced, and total effects. The **direct effects** are those related only to the mine and power plant closure, and not the additional downstream multipliers (IMPLAN). According to IMPLAN's website, **indirect effects** are "the impact of local industries buying goods and services from other local industries." These effects are not felt directly by the employees of the mine and power plant, but by other businesses and suppliers within the local area. The **induced effects** are "the response by an economy to an initial change (direct effect) that occurs through re-spending of income received by a component of value added." The induced effects are the multipliers that are felt throughout the local economy when money is spent over and over. **The total effects** sum the previous three effects to show the total effects on the local economy. Additionally, the results have the different types of impact that need to be defined.

The effects discussed above fall under the following types of impact: employment, labor income, value added, and output. **Employment** shows the number of jobs that will be lost due to closure. This is broken down according to each effect discussed above. **Labor income** includes "all forms of employment income, including Employee Compensation (wages and benefits) and Proprietor Income" (IMPLAN). **Value added** is "the difference between an industry's, or an establishment's total output, and the cost of its intermediate inputs" (IMPLAN). This is the economic concept that shows the value created by the function of the mine and power plant operation. Finally, **output** is "the value of industry production" (IMPLAN).

Employment

Based on information from the Mississippi Development Authority, the Red Hills Mine and Power Plant are among the top three employers in Choctaw County (1 and 3 respectively). This alone highlights the impact a closure would have on the surrounding community.

The overall impact on the local economy, consisting of Attala, Choctaw, Montgomery, Oktibbeha, Webster, and Winston counties is shown in Table 2 below.

Table 2: Employment Impact Summary

Impact Type	Employment	Labor Income
Direct Effect	333	$29,932,374
Indirect Effect	128.5	$6,455,859
Induced	140.8	$4,520,431
Total Effect	602.3	$40,908,665

As this table shows, the total effect on employment is a loss of 602 jobs throughout the local economy. Using data from Mississippi's Department of Employment Security webpage, this equates to 1.33% of the total employees in the six counties. This is a significant amount to the local economy. Unemployment rates for the region studied are already well above national averages at 8.5% (national average of 6.4% covering the same time period). An increase of unemployment to nearly 9.8% following the closure of both the mine and power plant will lead to unemployment rates to rise to almost 1.5 times that of the national average. Since the data may be overstated, as discussed earlier, the impact may be slightly lower. Even if the impact was based solely on the direct effect, the economy would lose 333 jobs equating to a 9.2% unemployment rate for the region. These calculations are based on a 12 month moving average updated in September 2014 for the counties studied (MDES).

The total impact is broken down further into the impacts on different industries throughout the local economy (Table 3). IMPLAN defines the different sectors of the economy according to the Bureau of Economic Analysis Input-Output study (IMPLAN). Currently, there are 440 sectors defined using this method and IMPLAN calculates the effects a closure would have on each of them. The results are organized to show which

industries are affected most by each impact type (employment, labor income, value added, or output).

Table 3: Top Ten Industries Affected by Employment

Sector	Description	Employment	Labor Income	Value Added	Output
21	Mining coal	212.2	$23,727,274	$24,783,988	$40,145,658
417	Commercial and industrial machinery and equipment repair and maintenance	73.3	$1,187,940	$1,561,160	$2,461,422
31	Electric power generation, transmission, and distribution	62.8	$6,258,969	$33,448,296	$56,681,694
413	Food services and drinking places	35.1	$645,375	$1,014,399	$2,088,834
39	Maintenance and repair construction of nonresidential structures	22.4	$844,422	$1,218,005	$3,044,702
20	Extraction of oil and natural gas	16.2	$1,025,533	$1,394,675	$4,552,431
319	Wholesale trade businesses	7.7	$490,982	$1,004,424	$1,497,347
329	Retail Stores - General merchandise	7.2	$230,659	$402,375	$480,366
360	Real estate establishments	7	$71,542	$742,255	$1,027,552
394	Offices of physicians, dentists, and other health practitioners	6.8	$467,542	$482,687	$872,372

As Table 3 shows, the top industry affected is Sector 21, mining coal, which stands to lose 212 employees. Since the coal company will shut down in conjunction with the power plant, this result makes sense. The employees lost in the mining operations are a direct effect of the shut down and do not take into account downstream effects. Commercial and industrial machinery and equipment repair and maintenance is the sector that will lose the next highest amount of jobs. Jobs lost in this sector total 73 and are based more on induced effects, as was discussed previously. Since the power plant and mine will no longer be operating all the machinery, they will not require repair and maintenance. This will cause the local community to have decreased demand for those services and lead to the loss of jobs. The electric power generation, transmission, and distribution sector will lose 63 jobs. These effects are similar to the mining coal sector since they are a direct effect of the shutdown. The sector with the fourth highest job loss is the food services and drinking places sector. This is due to the induced effects caused by the loss of employees at the mine and power plant. The employees will either no longer live in the local area or they will not have the means to continue frequenting local restaurants and drinking establishments. The result will be a number of local food service establishments will be forced to either downsize or close their doors based on the decreased demand for their services. Table 3 shows the rest of the top 10 industries affected by the shutdown of the mine and

power plant with respect to employment. The remaining sectors in Table 3 are industries that will be affected by job losses due to induced or indirect effects. Individually the sectors are not affected greatly, but when accumulated, the number of jobs lost in the remaining sectors is still remarkable for an area that is not very populated.

Labor Income

Labor income, which is individual employee compensation and proprietor income, is another metric that is analyzed by the IMPLAN software to show the effects on the local economy. As shown in Table 4, a total of $40.9 million in labor income would be lost annually as a result of the mine and power plant closing. Of this total, the mine and power plant account for $29.9 million of this loss as direct labor income. For every dollar of direct income lost, another 22 cents of indirect personal compensation totaling $6.4 million will be lost and another 15 cents is lost in induced income totaling $4.5 million. Table 4 shows these effects.

Table 4: Local Economic Impact of Power Plant and Mine Closure

Item	Direct	Indirect	Induced	Total
Labor Income	$29,932,374	$6,455,859	$4,520,431	$40,908,665

Table 5 below illustrates how the potential closures will create labor income losses across the 10 most affected industries. Since labor income relates directly to the effects caused by employee compensation and company income, the results are not surprising.

The top two sectors most affected by the closure would be the mining coal and electric power generation, transmission, and distribution sectors, losing $23.7 million and $6.3 million respectively. The third most affected sector is the commercial and industrial machinery and equipment repair. This sector stands to lose $1.2 million in labor income due to the decreased demand for their services. The decreased demand leads to business closures, driving lower employee compensation and proprietor income. The fourth most affected sector is the extraction of oil and natural gas, accounting for $1 million in lost labor income. The rest of the top 10 include: maintenance and repair, food services, wholesale trade businesses, health practitioners,

management offices and banks, with each sector losing less than $1 million in labor income.

Table 5: Top 10 Industries Affected by Labor Income

Sector	Description	Employment	Labor Income	Value Added	Output
21	Mining coal	212.2	$23,727,274	$24,783,988	$40,145,658
31	Electric power generation, transmission, and distribution	62.8	$6,258,969	$33,448,296	$56,681,694
417	Commercial and industrial machinery and equipment repair and maintenance	73.3	$1,187,940	$1,561,160	$2,461,422
20	Extraction of oil and natural gas	16.2	$1,025,533	$1,394,675	$4,552,431
39	Maintenance and repair construction of nonresidential structures	22.4	$844,422	$1,218,005	$3,044,702
413	Food services and drinking places	35.1	$645,375	$1,014,399	$2,088,834
319	Wholesale trade businesses	7.7	$490,982	$1,004,424	$1,497,347
394	Offices of physicians, dentists, and other health practitioners	6.8	$467,542	$482,687	$872,372
381	Management of companies and enterprises	4.9	$453,788	$564,687	$1,079,753
354	Monetary authorities and depository credit intermediation activities	5.7	$336,742	$1,696,397	$2,304,608

Value Added

Value added is the difference between an industry or establishment's total output and the cost of the intermediate inputs. Table 6 below shows the different effects on value added. In the event of a closure, the total value added that will be lost is $79M. This is a measure of the contribution to the Gross Domestic Product by the mine and power plant. Value added of a specific establishment or industry is often referred to the Gross Regional Product.

Table 6: Value Added

Item	Direct	Indirect	Induced	Total
Value Added	$57,696,414	$11,074,969	$10,394,176	$79,165,559

As Table 7 shows, the sector that stands to lose the most is the electric power generation, transmission, and distribution sector at $33.4 million. This is the difference between the company's total output and cost of inputs. The mining coal industry will be the next most affected sector at $24.8 million. These results make sense since the mine

and power plant are the main focus of this study. The two will shut down together and all value added to the economy through their functions will be lost.

Interestingly, the next sector most affected when sorted by value added is the home rental sector. According to the IMPLAN website, the rental activity sector "estimates what owner/occupants would pay in rent if they rented rather than owned their homes." Essentially, it is the economic activity associated with home ownership. IMPLAN estimates a value added of $2.6 million in this sector will be lost. This represents ownership of households and increased home values. With a loss of $2.6 million in value-added, the real estate market within the region will suffer. This suffrage will be visible in decreased home values, a declination in home maintenance, and lastly an increase in the supply of homes on the market.

Table 7: Top 10 Industries Affected by Value Added

Sector	Description	Value Added	Employment	Labor Income	Output
31	Electric power generation, transmission, and distribution	$33,448,296	62.8	$6,258,969	$56,681,694
21	Mining coal	$24,783,988	212.2	$23,727,274	$40,145,658
361	Home Rental	$2,601,437	0	$0	$3,633,151
354	Banking	$1,696,397	5.7	$336,742	$2,304,608
417	Commercial and industrial machinery and equipment repair and maintenance	$1,561,160	73.3	$1,187,940	$2,461,422
20	Extraction of oil and natural gas	$1,394,675	16.2	$1,025,533	$4,552,431
39	Maintenance and repair construction of nonresidential structures	$1,218,005	22.4	$844,422	$3,044,702
413	Food services and drinking places	$1,014,399	35.1	$645,375	$2,088,834
319	Wholesale trade businesses	$1,004,424	7.7	$490,982	$1,497,347
360	Real estate establishments	$742,255	7	$71,542	$1,027,552

Business Output

Business output is defined as the value of industry production. It is a measure of the total sales plus or minus inventory change. The total output lost in the local economy in the event of a closure is assessed as $137.1 million. This is the total impact on the State of Mississippi and most specifically the local study region. A breakdown of the effects on business output is shown in Table 8 below. It is important to pull from the table how much indirect and induced output will be lost if the mine and power plant are closed.

Table 8: Local Economic Output				
Item	**Direct**	**Indirect**	**Induced**	**Total**
Output	$94,561,743	$25,201,347	$17,391,712	$137,154,802

The business output lost in the local economy for the top 10 sectors is shown in Table 9 below. Not surprisingly, the sector that will lose the most with respect to total output is the electrical power generation, transmission, and distribution sector, losing $56.7 million. The next sector is the mining coal sector, which would lose $40.1 million in total output within the local economy. The extraction of oil and natural gas and rental activity sectors round out the top 4, losing $4.6 million and $3.6 million respectively.

Table 9: Top 10 Industries Affected by Output					
Sector	**Description**	**Output**	**Employment**	**Labor Income**	**Value Added**
31	Electric power generation, transmission, and distribution	$56,681,694	62.8	$6,258,969	$33,448,296
21	Mining coal	$40,145,658	212.2	$23,727,274	$24,783,988
20	Extraction of oil and natural gas	$4,552,431	16.2	$1,025,533	$1,394,675
361	Imputed rental activity for owner-occupied dwellings	$3,633,151	0	$0	$2,601,437
39	Maintenance and repair construction of nonresidential structures	$3,044,702	22.4	$844,422	$1,218,005
417	Commercial and industrial machinery and equipment repair and maintenance	$2,461,422	73.3	$1,187,940	$1,561,160
354	Monetary authorities and depository credit intermediation activities	$2,304,608	5.7	$336,742	$1,696,397
413	Food services and drinking places	$2,088,834	35.1	$645,375	$1,014,399
319	Wholesale trade businesses	$1,497,347	7.7	$490,982	$1,004,424
333	Transport by rail	$1,295,927	2.7	$284,302	$538,058

Tax Revenue

Tax revenue represents the money that supports the various levels of government. The tax revenue is generated from employee compensation, taxes paid by the mine and power plant and taxes paid by the suppliers of these two entities (See Table 10). Mississippi and the local region stand to lose over $11.3 million dollars in tax revenue. Red Hills Mine alone pays $725,000 to Choctaw County in the form of Ad Valorem taxes, while the power plant adds $240,000 to the local government through taxes on Ash sales. Local tax revenue is used to fund schools, hospitals, county sheriffs

and other projects funded by the county. With the loss of so much local tax revenue, quality of education is going to decrease, care at hospitals will suffer, and the local area will be less secure. Unfortunately, these are all bad signs for growth in a community that could use some more employment opportunities.

Table 10: Tax Revenue Impacts

Entity	Total
Local and State	$11,382,042
Federal	$8,901,514
Total	$20,283,556

Conclusion

The Red Hills Mine and Power Plant has been in operation since 2000. The mine is the largest employer in Choctaw County and the Power Plant is the third largest employer in the county. These two locations have provided salaries well above the local average. In the event that Mississippi's strategy to meet the requirements of the Clean Air Act involve a closure of the Red Hill's Mine and Power Plant, a significant impact on the local economy will take place. Total effects of the mine and power plant closure are shown in Table 11 below. The impacts on the local economy will include 602 lost jobs – bringing unemployment in the region up to nearly 12%. This region will also experience a loss of $132 million in business output, or 17% of the local GDP. Lastly, the state will lose over $11.3 million in tax revenue.

Table 11: Total Combined Impact Summary

Impact Type	Employment	Labor Income	Value Added	Output
Direct Effect	333	$29,932,374	$57,696,414	$94,561,743
Indirect Effect	128.5	$6,455,859	$11,074,969	$25,201,347
Induced	140.8	$4,520,431	$10,394,176	$17,391,712
Total Effect	**602.3**	**$40,908,665**	**$79,165,559**	**$137,154,802**

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