The Impact of Coal on the Kentucky State Budget

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June 25, 2009

We extend special thanks to all those who reviewed and commented on earlier drafts of *The Impact of Coal on the Kentucky State Budget* and *The Economics of Coal in Kentucky*. We received a tremendous amount of feedback that no doubt improved the quality of our work.

We appreciate the hard work of several student interns who helped bring the report and support pieces to completion: Thupten Dhondup, Jenna Lowe, Kristin Tracz and Dilshod Yusupov.

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For over 30 years, MACED has worked to improve the quality of life in eastern Kentucky and Central Appalachia by creating economic opportunity, strengthening democracy and supporting the sustainable use of natural resources. MACED seeks to transform the lives of people and places in need through sustainable development. We employ three main strategies toward this goal: 1) Community Investment — Investing capital and capacity-building technical assistance in people and enterprises to create economic opportunities, protect natural and cultural assets and provide critical services; 2) Demonstration Initiatives — Developing new approaches to old problems and testing them out on the ground; and 3) Research for Policy Change — Conducting research around policy opportunities and barriers that results in better development practice and opportunities for people who need them.

The Impact of Coal on the Kentucky State Budget

Executive Summary

Rapid and dramatic changes in the world's approach to energy have major implications for Kentucky and its coal industry. Concerns about climate change are driving policy that favors cleaner energy sources and increases the price of fossil fuels. The transition to sustainable forms of energy, already underway, will become a major economic driver, as states move aggressively to develop, produce and install the energy technologies of the future. Long reliant on coal for jobs and electricity, Kentucky faces major challenges and difficult choices in the coming years.

These energy challenges come in the midst of Kentucky's state fiscal crisis and sluggish economic performance. The gap between Kentucky's revenues and expenditures makes it increasingly difficult to sustain existing public services. A recent University of Kentucky report notes that Kentucky ranks 44th among states in per capita income, just as in 1970, while other southern states like North Carolina and Georgia have out-performed the Commonwealth in recent years.[1] Eastern Kentucky still includes 20 of the 100 poorest counties in the United States measured by median household income.[2]

In this critical energy, fiscal and economic context, it is increasingly important for Kentuckians to understand the role and impact of coal in our state. Coal provides economic benefits including jobs, low electricity rates and tax revenue. But the coal industry also imposes a number of costs ranging from regulatory and public infrastructure expenses to environmental and health impacts.

Revenues	
Industry-generated	$303,172,748
Generated from direct employment	83,040,392
Generated from indirect employment	141,509,362
Total Revenues	**$527,722,502**
Tax Expenditures (Foregone Revenues)	
Off-budget items (tax expenditures) specific to coal	(84,753,280)
On-Budget Expenditures	
On-budget items supporting coal	(270,467,828)
Support for direct employment	(73,140,605)
Support for indirect employment	(214,192,262)
Total Expenditures	**($642,553,975)**
Net Impact	**–$114,831,474**

Figure 1: Fiscal Impact Summary

Coal and the Budget

The Impact of Coal on the Kentucky State Budget tells one aspect of the story of coal's costs and benefits. The report provides an analysis of the industry's fiscal impact by estimating the tax revenues generated by coal and the state expenditures associated with supporting the industry. **We estimate for Fiscal Year 2006 Kentucky provided a net subsidy of nearly $115 million to the coal industry (see Figure 1).**

Coal is responsible for an estimated $528 million in state revenues and $643 million in state expenditures. The $528 million in revenues includes $224 million from the coal severance tax and revenues from the corporate income, individual income, sales, property (including unmined minerals) and transportation taxes as well as permit fees. The $643 million in estimated expenditures includes $239 million to address the industry's impact on the coal haul road system as well as expenditures to regulate the environmental and health and safety impacts of coal, support coal worker training, conduct research and development for the coal industry, promote education about coal in the public schools and support the residents directly and indirectly employed by coal. Total costs also include $85 million in tax expenditures designed to subsidize the mining and burning of coal.

The Impact of Coal on the Kentucky State Budget examines coal-related state revenues and expenditures in three parts.

1. **Industry-generated revenues and expenditures.** A review of coal industry-generated revenues to the state and expenditures from the state suggests that the industry actually costs more than it brings to the state. Using state budget and other official state agency data, we estimate the coal industry generated revenues of $303 million for Fiscal Year (FY) 2006. In the same year, on-budget spending to support coal industry activities totals more than $270 million and off-budget tax expenditures add $85 million to the coal industry's bill for a total of more than $355 million. The net direct impact of the industry on the state budget for FY 2006 is an estimated –$52 million.

2. **Revenues and expenditures attributable to direct employment by the industry.** State data sources suggest that FY 2006 revenues attributable to direct employment in coal total $83 million while coal employees' share of state expenditures totals $73 million. The net impact of direct employment in coal on the state budget for FY 2006 is $10 million.

3. **Revenues and expenditures related to indirect employment attributable to the coal industry.** Based on public data and the use of economic impact multipliers, revenues generated by the employment of Kentuckians in supply industries and in sectors that serve those employed by coal total $142 million for FY 2006. State spending to support those whose employment is indirectly attributable to coal totals $214 million. The net impact of indirect employment on the Kentucky state budget is –$73 million.

These figures cover only a portion of the full costs of the coal industry to the state. We do not include the many externalized costs imposed by coal including healthcare, lost productivity resulting from injury and health impacts, water treatment from siltation caused by surface mining, water infrastructure to replace damaged wells, limited development potential due to poor air quality, and social spending associated with declines in coal employment and related economic hardships of coalfield communities. Some of these externalities impose additional costs directly to the state budget while others are borne by communities that mine and burn coal and by those outside the region. The report relies on 2006 figures and does not include the significantly expanded subsidies for advanced coal enabled by House Bill 1 of the 2007 special session of the Kentucky General Assembly.

Assessing the fiscal impact of an entire industry, especially one that is tied to natural resources and that has been a part of our economic and policy structure for so long, is methodologically difficult. The task requires that we rely on numerous assumptions and estimates. However, the approach used here improves upon unsubstantiated speculation of the industry's impact and assessments that only focus on coal's benefits.

Economic Context

The economic and energy contexts for the coal industry are changing. Coal employment continues its long historic decline due to ongoing mechanization of the industry (see Figure 2). In 2008, coal mining accounted for only one percent of Kentucky employment (see Figure 3). Even in the eastern Kentucky counties with the highest share of jobs in coal, mining jobs range from three to 23 percent of the employment base, although coal's high wages make it a larger share of county income. These counties, however, face significant long-term unemployment and poverty rates as high as 37 percent.

Kentucky coal struggles to remain competitive with western coal due to higher production costs. Debate continues over how many years of economically recoverable coal remain in Kentucky, but official sources project a significant decline in production as easy-to-mine coal is depleted. In the future, coal faces additional challenges as aging coal-fired power plants are retired and new laws on carbon emissions raise the price of coal relative to cleaner alternatives. Industry representatives and supporters embrace the potential for new technologies like Carbon Capture and Sequestration to solidify a future for coal. But these technologies face high costs and significant risk and uncertainty, and are already utilizing large public subsidies.

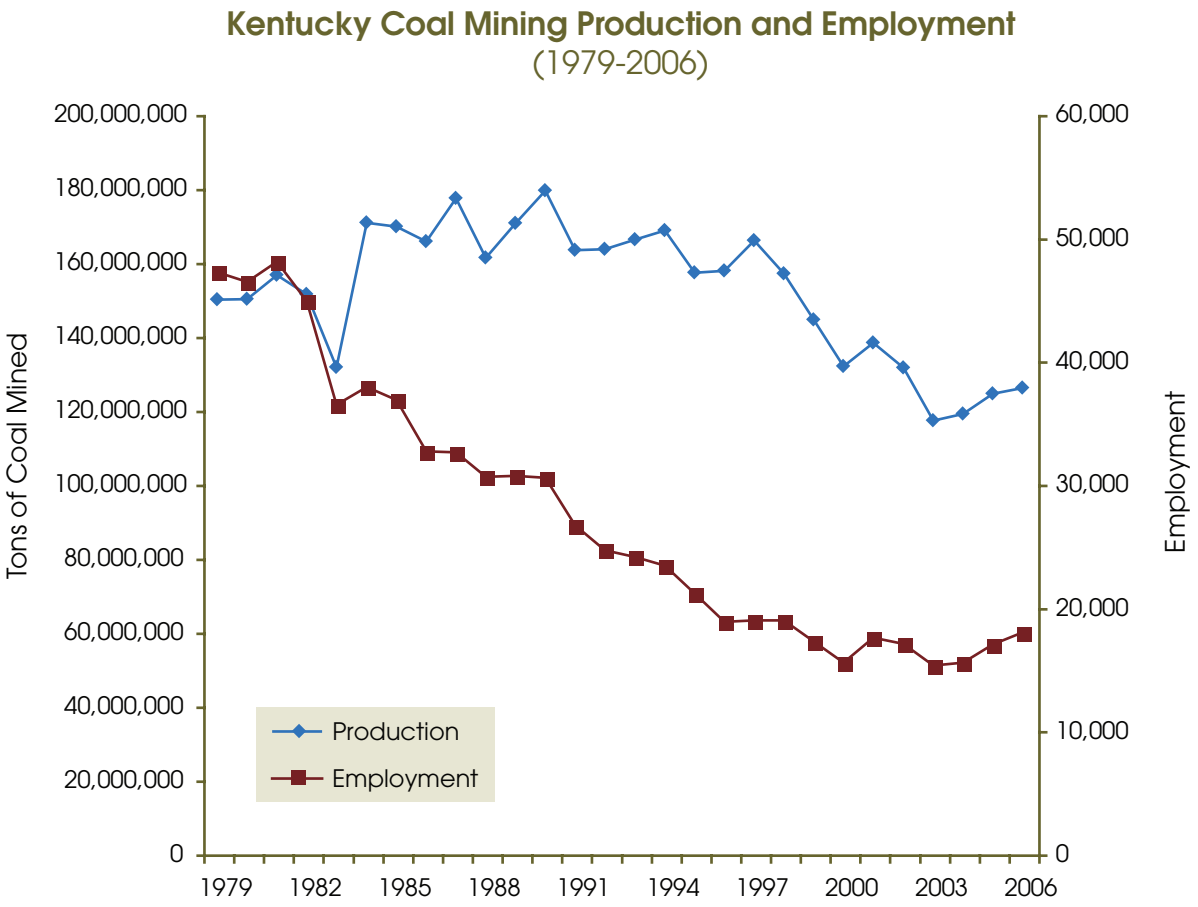

Figure 2: Kentucky Coal Mining Production and Employment.
Source: Kentucky Coal Facts (http://www.coaleducation.org/Ky_Coal_Facts/default.htm)
For more information on the economy of coal in Kentucky, visit www.maced.org/coal.

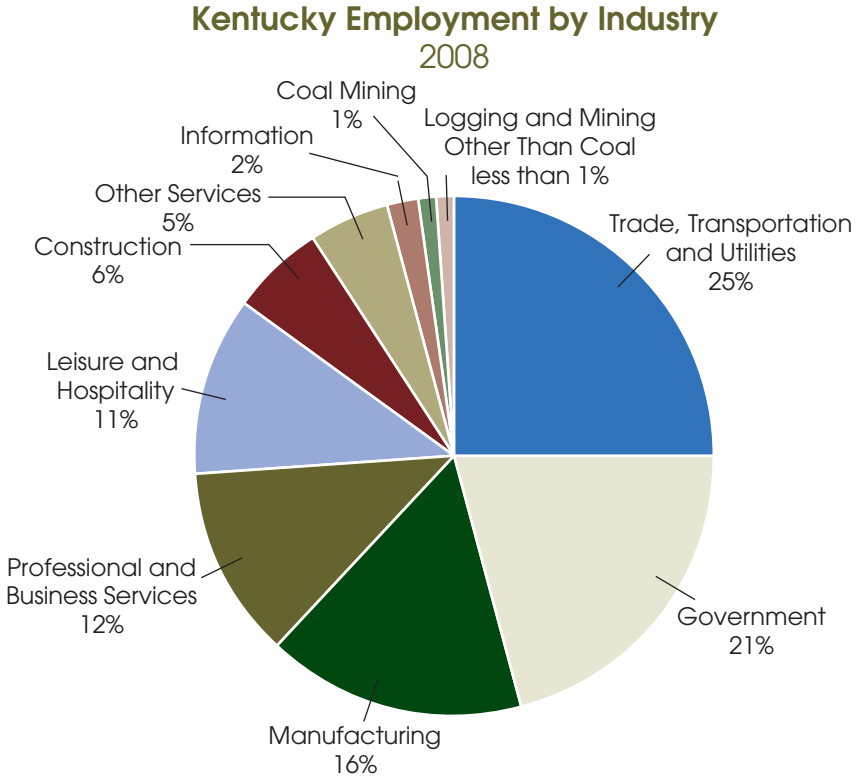

Figure 3: Kentucky Employment by Industry.
Source: Kentucky Workforce Investment, Current Employment Statistics, 2008 Annual Data.

Recommendations

The Impact of Coal on the Kentucky State Budget suggests three key recommendations for Kentucky leaders.

- **Compare future investments in coal to investments in energy alternatives.**
  The state launched a period of more active energy policy with the recent passage of House Bill 1 in a 2007 special session, House Bill 2 in the 2008 General Assembly, and the release of Governor Beshear's new energy plan. Kentucky invests modestly in renewable energy and energy efficiency, while it aggressively pursues policies to support coal and invest in new coal technologies. As the nation and the world begin to reduce dependence on fossil fuels, the Commonwealth must make strategic energy choices based on the full costs and benefits of the options before us.

- **Pursue economic diversification.**
  As this report indicates, the costs associated with hosting the coal industry are significant. The long-term downward trend in coal employment and the approaching end of low coal-fired electricity prices further diminish the industry's economic development benefits. While no one knows for sure how long coal will be mined in Kentucky, it is not a renewable resource. We must work harder to achieve lasting economic diversification throughout Kentucky and its coalfield communities.

- **Examine the way coal is taxed and subsidized in the state.**
  While the coal severance tax is often referenced for its contribution to Kentucky communities and the state budget, its benefits are diminished when the costs associated with hosting the coal industry are more fully represented. At the same time, tax expenditures for the coal industry are a set of growing but largely hidden subsidies that reduce revenue to the state budget. Taxation theory suggests higher taxes on activities, like the mining of coal, which cannot be relocated to other states. But the Commonwealth has not adjusted several coal-related taxes and fees in many years.[3] Kentucky should examine its rate of taxation and use of subsidies and think strategically about the needs of the Commonwealth and the best path to a prosperous future.

The energy landscape is changing in the U.S. and beyond. Kentucky coal faces a challenging future. Kentuckians must think carefully about how we will engage the coming transition. We must move forward making informed choices about policy and public investments with a clear and honest accounting of the costs and benefits of our choices. *The Impact of Coal on the Kentucky State Budget* raises important questions to consider as we chart our economic and energy future.

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Introduction

Coal has long been important in Kentucky. Generations of Kentuckians have earned a living and supported their families by mining coal. Kentucky coal helps to keep electricity rates in the state low and is a source of tax revenue, particularly through the coal severance tax. Today the coal industry continues to provide well-paying jobs to thousands of residents in eastern and western Kentucky.

Public discussion of coal often references these economic benefits. Coal's full impact on the state, however, is more complex and problematic. The industry imposes major costs, including its impact on health, environment and quality of life in coalfield communities and beyond, and the costs of the coal infrastructure and regulatory systems. The boom-and-bust cycles of the industry, the long-term downward trend in coal employment and the persistent poverty of coal-producing counties add to the complexity.

The story this report tells is troubling. While coal generates significant revenues, its costs are considerable. Major public expenditures go into maintaining the coal haul road system; operating the health, safety and environmental protection systems necessary for coal; supporting training and research and development for the industry; and providing various tax breaks and subsidies. Without including harder-to-quantify costs of negative externalities from the industry, the estimated net cost to the state is over $100 million annually.

Given the considerable costs, Kentuckians need to carefully consider the role of coal in our economy. The rapidly changing energy market and policy environment create new challenges for the industry. Increasing concerns about climate change and a push for cleaner forms of energy across the country mean an uncertain future for coal. These pressures will inevitably raise the price of coal-fired power relative to other cleaner sources, increasing electricity costs for Kentucky residents and impacting coal's ability to compete in the energy marketplace.

How the energy future unfolds has special implications for the state's coal-producing regions. Long dependent on coal as a source of jobs and electricity, Appalachian Kentucky faces huge economic challenges that require smart planning and immediate action.

Decisions, especially concerning public policy and the investment of public dollars to meet energy and economic challenges, should be made based on a clear understanding of the full costs and benefits of the alternatives before us. *The Impact of Coal on the Kentucky State Budget* is intended to contribute to that conversation.

Methods

The Impact of Coal on the Kentucky State Budget provides an estimate of the annual impact of the coal industry on *The Budget of the Commonwealth of Kentucky*. The report compares coal-related tax revenues to coal-related public expenditures in three parts: 1) those related to the industry's activity; 2) those related to individuals directly employed by the industry; and 3) those related to employment indirectly attributable to the coal industry.

This report is an update of a 1986 MACED study titled "A Public Sector Income Statement for the Coal Industry in Kentucky, 1985-2000," authored by Dr. Richard Sims. Sims, a former Kentucky Legislative Research Commission (LRC) economist, also authored a 1980 LRC study titled *The Fiscal Impact of the Kentucky Coal Industry*. The fiscal impact report builds on the methodology of Sims' 1986 MACED study while updating it with new information and approaches where appropriate. While not perfectly comparable because of methodological changes, the two studies come to similar conclusions. The 1986 report estimated a net fiscal impact of –$130 million for 1985 and projected an impact of –$57 million in 2000. Our estimates arrive at a net fiscal impact of –$115 million for 2006.

The data included in this report are for 2006, the most recent year for which data across categories and sources are available. Our analysis includes facts and figures for state fiscal year 2006 except in cases where only calendar year 2006 numbers are available. Because we rely on multiple estimates, our figures cannot be precise; however, we make every effort to use estimation methods that others use and find to be reasonably accurate.

In an effort to isolate coal's net impact on the state budget, this report uses only general fund and road fund revenues and expenditures. The analysis excludes federal funds allocated to Kentucky and various restricted funds that agencies raise and then use for their own purposes. The report uses a combination of actual spending and revenue numbers from the Revised Fiscal Year 2006 *Budget of the Commonwealth* and data provided by various state agencies upon request. All references to government agencies and offices reflect the organizational structure and unit titles in place in 2006. We maintain the 2006 names for the sake of consistency with cited tax and budget documents.

Section I, "Direct Industry Revenues and Expenditures," presents state budget impacts of industry activities. We examine taxes paid by the coal industry and state spending to support the industry. This section includes revenues from the coal severance, sales, corporate income and unmined minerals taxes as well as coal-related transportation and permit fees. We include expenditures to maintain the coal haul road system, the coal regulatory system, job training and research and development. We also include coal-specific tax expenditures in our calculation of state expenditures. Tax expenditures refer to the estimated value of foregone revenues from tax exemptions or subsidies created for particular industries or groups. Tax expenditures are a form of spending similar to direct appropriations. The state offers a growing number of tax exemptions and subsidy programs directly targeted to the coal industry, making a study of coal's fiscal impact incomplete without them.

Section II, "Direct Employment Revenues and Expenditures," provides estimates of the fiscal impact of direct employment in the coal industry. We use the state's *Kentucky Coal Facts* as a source for data on coal industry employment and wages. Combined with reported state revenues and expenditures, these data allow us to estimate tax revenues generated by coal employment and coal employees' share of state expenditures.

Section III, "Indirect Employment Revenues and Expenditures," applies economic impact multipliers to direct employment and income figures to estimate the economic and state budget impact of employment indirectly attributable to coal. Policymakers and planners use economic impact analyses to estimate the effects of development projects on local and regional economies. These analyses rely on what economists call economic development or impact multipliers. Multipliers allow analysts to make projections about the economic impact of proposed developments or firm closures. In the case of the coal industry in Kentucky, the Kentucky Coal Association and state officials use revenue numbers based on impact models to discuss the importance of the coal industry to the state's economy.

The indirect impact figures rely on *Kentucky Coal Facts*, state budget data and the Bureau of Economic Analysis RIMS II 2006 multipliers for the Kentucky coal industry. Indirect employment includes those employed in industries that supply the coal industry and those that provide goods and services to coal employees. In this section of the report, we explain the economic impact modeling that we use, concerns about these models and our rationale for using them.

The Impact of Coal on the Kentucky State Budget provides important information for better understanding the impact of coal in Kentucky, but it does not present a complete picture. We include a discussion of issues and concerns not addressed in our analysis as a means of putting our data in the larger context of more recent policy decisions and the broader impact of the industry on the state. The report concludes with a brief discussion of our findings and the policy implications that stem from this work.

I. Direct Industry Revenues and Expenditures

Revenues	
Severance Tax[4]	$224,490,111
Unmined Minerals Tax[5]	2,118,777
Property Tax	—[6]
Extended Weight Decals and Registrations	3,582,940
Sales Tax on Coal Company Purchases	59,640,000
Strip Mining & Reclamation Fees	1,412,920
Corporate Income Tax	11,928,000
Total Revenues	**$303,172,748**
Tax Expenditures (Foregone Revenues)	
Corporation Income: Exclusion of 50% of Coal Royalties	Minimal
Corporation Income: Coal Conversion Credit	($200,000)
Corporation Income: Coal Incentive Tax Credit	(100,000)
Sales: Coal Used in Manufacture of Electricity	(78,700,000)
Energy and Energy Producing Fuels	(5,753,280)
Total Tax Expenditures	**($84,753,280)**
On-Budget Expenditures	
Commerce	($2,273,200)
Environmental and Public Protection	(22,594,195)
Education and Workforce Development	(6,731,075)
Transportation	(238,869,358)
Subtotal	**($270,467,828)**
Total Expenditures	**($355,221,108)**
Net Impact	**–$52,048,360**

Figure 4: Industry-Specific Impact on General and Road Fund Revenues and Expenditures

As corporate entities severing coal and doing business in the Commonwealth, coal companies pay a variety of taxes and fees. These taxes and fees provide revenue streams in the state budget that help to support the various goods and services provided by the state to the coal industry. This section provides estimates of state revenues from the coal industry along with estimates of on- and off-budget state spending to support the coal industry and its activities in the Commonwealth. We use *The Budget of the Commonwealth* Revised Fiscal Year (FY) 2006 and state revenue figures to document and estimate both revenues and expenditures directly associated with coal. Each item includes a description as well as the method used to calculate the revenue or expenditure estimate. We find that the state receives approximately $303 million directly in revenues from the coal industry and spends roughly $355 million directly supporting the industry for a net fiscal impact of –$52 million for FY 2006.

Direct Industry Revenues

Coal provides several direct revenue streams for the state. The largest stream is the coal severance tax, but coal also generates revenue from the unmined minerals tax, extended weight decal and registration fees, sales tax on company purchases, strip mining and reclamation fees and corporate income tax.

Severance Tax

According to *The Budget of the Commonwealth*, the coal severance tax serves two key functions: "to improve the environment for new industry and to improve the quality of life of the residents."[7] In the year 2006, the coal severance tax generated $224,490,111 in general fund revenue.

Unmined Minerals Tax

The unmined minerals tax is a property tax assessed on the value of the coal that remains underground. The state real property tax rate for 2006 was 12.8 cents per $100 of assessed value. The total amount collected in local and state taxes in 2006 was $14,369,975.[8] Of this, $2,118,777 went into the state's general fund under property tax revenue. This revenue stream is related to coal that has not yet been mined. Ongoing mining means this is ultimately a declining revenue source.

Extended Weight Registration Permits and Coal Haul Decals[9]

Trucks carrying more than 80,000 pounds are subject to a $1,410 registration fee for the 73,281-80,000 pound weight class.[10] Coal truck drivers pay an additional fee for the privilege of carrying extremely heavy loads not generally permitted on state roads.

All coal trucks purchasing extended weight decals must register their vehicles in the 73,281-80,000 pound weight class, but not all 3,220 extended weight coal trucks pay full registration in the state of Kentucky. Trucks hauling freight in more than one state have apportioned registration and pay partial fees based on how much of their total hauling occurs in each state. The Road Fund receives 70 percent of these revenues and the other 30 percent go to the counties. An estimated 65 percent of extended weight coal haul trucks are fully registered in Kentucky, generating more than $2 million in state revenue. The remaining 35 percent log approximately 50 percent of their miles in Kentucky and generate roughly half a million dollars in state revenue. The Commonwealth receives an estimated $2.6 million in total revenue from truck registrations for extended weight coal haul trucks.[11]

In the mid-1980's the state instituted the extended weight coal or coal by-products road decal permit system in order to legalize what had become a standard practice of loading coal to weights beyond the state limits. *Kentucky Revised Statutes (KRS)* 177.9771 states that "the 'extended weight coal or coal by-products haul road system' shall consist of all state-maintained toll roads or state-maintained roads which were previously toll roads and the public highways over which quantities of coal or coal by-products in excess of fifty thousand (50,000) tons were transported by motor vehicles during" the year prior to the budget year in question.[12] The state sells extended weight decals to coal truck operators and those who purchase the decals are exempt from standard state maximum weight limits. The guidelines and fee schedule for the extended weight decals appear in Figure 5.

Vehicle	Total Number of Axles	Maximum Weight (lbs.)	Tolerance	Annual Decal Fee
Single Unit Truck	3	90,000	5%	$160
Single Unit Truck	4	100,000	5%	$260
Tractor-semi-trailer	5+	120,000	5%	$360

Figure 5: Extended Weight Decal Fees

In 2006, 3,220 extended weight decals generated $960,974 in revenue to the state of Kentucky.[13]

In a 1995 report, researchers at the Kentucky Transportation Center found that the registration and extended weight revenue is offset by the reduction in truck registrations that accompanies the increased carrying capacity of coal trucks.[14] Because the state grants the coal industry exception to standard weight limits, the state effectively loses revenue from additional truck registrations that would be purchased if the industry had to use more trucks to haul the same amount of coal. We can also note that this exception reduces the number of jobs provided by the industry as fewer truck drivers are needed to haul coal and the increase in weight limits adds to wear and tear as well as fatal and injurious accidents on the road.

The extended weight registration and decal fees are not the only sources of revenue related to transportation. Due to data limitations, coal's share of transportation tax revenue from basic vehicle and fuel taxes is rolled into transportation taxes listed later in this report.[15]

Sales Tax on Coal Company Purchases

The state generates revenue when coal companies make purchases in the state and pay sales taxes on those purchases. Coal companies, just like other corporations, are able to take advantage of a wide range of tax exemptions—some of which apply to purchases. We do not account for exemptions beyond those specific to coal in this report. Our estimate of sales tax receipts for coal company purchases is based on methods used by University of Kentucky researchers in a 1996 study of the economic impact of the coal industry in Kentucky.[16] Based on interviews with coal industry executives, that report estimates coal company purchases subject to sales and use tax at 20 percent of total output. We assume the six percent sales tax rate on 20 percent of total output and estimate that the state receives nearly $60 million in sales tax revenue from the coal industry.[17]

Strip Mining & Reclamation Fees

Kentucky charges fees for strip mining and reclamation permits. These fees cover the costs of issuing permits and generate some revenue for the state's general fund. Strip mining and reclamation fees account for state general fund revenues totaling $1,412,920 in fiscal year 2006.[18]

Corporate Income Tax

Corporate income taxes are taxes assessed on the taxable net income of corporations. Kentucky does not publicly report corporate income tax revenues by industry so we cannot report actual corporate income tax revenues from the coal industry. For corporations operating in more than one state, corporate income tax payments are apportioned among the states in which they do business.

Reuter's Industry Benchmarks reports an effective federal tax rate (Trailing Twelve Months) for the coal industry of zero percent and a five year effective federal tax rate of zero percent.[19] We found no information in publications produced by the coal industry to indicate how much state corporate income tax coal companies pay.

The corporate income tax rate in the Commonwealth for 2006 was four percent for businesses with taxable net income up to $50,000, five percent for businesses with taxable net income between $50,000 and $100,000, and seven percent of taxable net income over $100,000. Beginning in 2007, the top rate was lowered to six percent.

The Kentucky coal industry reported output of $4.97 billion in 2006.[20] Annual reports of several coal and energy companies indicate wide variation in net income ranging from significant losses to 16 percent profit. Kentucky allows companies to count prior years' losses against current net income, thereby decreasing and, in some cases, eliminating any tax burden even in profitable years. This arrangement is particularly helpful to the boom and bust coal industry. In 1996 researchers at the University of Kentucky Center for Business and Economic Research (CBER) estimated Kentucky coal companies' net income at four percent of total output. Given the variation in information about net income and the lack of actual data, we use the CBER figure as our guide. We estimate net income at four percent of total output[21] and an average tax rate of six percent which accounts for portions of net income that are charged both higher and lower rates under *KRS* 141.040.[22] Using these figures, we estimate revenue to the Commonwealth of $11,928,000, about 1.2 percent of Kentucky corporate income tax revenue.

Direct Industry Expenditures

Direct industry expenditures include off-budget spending through tax exemptions and subsidies (tax expenditures) and on-budget costs including those associated with state energy policy, mine safety and regulation offices, environmental protection, workforce development and education and transportation infrastructure.

Tax Expenditures Specific to Coal

Sales and Use	
Coal Used in the Manufacture of Electricity	($78,700,000)
Energy and Energy Producing Fuels	($5,753,280)
Corporate Income	
Exclusion of 50% of Coal Royalties	Minimal
Coal Conversion Credit	($200,000)
Coal Incentive Tax Credit	($100,000)
Estimated Tax Expenditures FY 2006	**–$84,753,280**

The Budget of the Commonwealth includes a requirement that the Office of the State Budget Director (OSBD) produce a detailed report of the estimated impact of state tax expenditures. This report defines tax expenditures as

"an exemption, exclusion, or deduction from the base of a tax, a credit against the tax, a deferral of a tax, or a preferential tax rate."[23] Two of the eight principles used to guide the inclusion of tax expenditures are important to note in our discussion of those expenditures that support the coal industry (items are numbered as they are in the tax expenditure report):

(2) A tax expenditure does not include an exemption for entities, items, or transactions that are commonly and traditionally exempted from payment of taxes.
(3) A tax expenditure does not include a credit or exclusion which prevents the taxation of the same base more than once. As an example, a "sale for resale" exemption in the sales tax is not considered a tax expenditure since in the absence of such an exemption an article could be subjected to the tax multiple times as it moves through the production cycle.

The coal industry in the state of Kentucky and throughout the U.S. is subject to a variety of exemptions designed to support energy production. These expenditures effectively take away a portion of the state's potential tax revenues. Because we do not collect these taxes from the industry, other general fund monies are used to support the industry and those whose employment is attributable to the industry.

The industry benefits from exemptions particular to coal as well as broader exemptions available to other industries. In the *Tax Expenditure Analysis* summary tables, expenditures specific to coal appear under the heading "Energy Development and Coal Industry Support." Our estimates of corporate income and sales tax revenues (presented above) are high as we do not account for the various exemptions that are specific to coal. These figures help to correct those estimates and document off-budget spending. The OSBD estimated a total of $79 million in FY 2006 in sales and corporate income tax expenditures specific to coal. Coal's share of the Energy and Energy Producing Fuels (sales and use) expenditure adds an additional $5.8 million to tax expenditures to support the coal industry, bringing the total estimate to nearly $85 million.

Coal Used in the Manufacture of Electricity

The *Kentucky Tax Expenditure Report* states that, "Coal Used in the Manufacture of Electricity is exempt."[24] The total expenditure for FY 2006 is $78.7 million.[25]

Energy and Energy Producing Fuels

The "Energy and Energy Producing Fuels" tax expenditure applies to "energy and energy producing fuels used in manufacturing, processing, mining, or refining, to the extent that the cost of the energy or energy producing fuels used exceeds 3 percent of the cost of production, are exempt." The total expenditure for Energy and Energy Producing Fuels in FY 2006 is $20.8 million. Electricity accounts for 30 percent of industrial energy use in Kentucky while natural gas comprises 21 percent and petroleum 36 percent.[26] *Kentucky Coal Facts* reported that 92.2 percent of Kentucky's electricity came from coal in 2006. We calculate coal's share of the energy and energy producing fuels tax expenditure by attributing 30 percent of the total expenditure to electricity. We then attribute 92.2 percent of electricity's share of the tax expenditure to coal for a total estimated expenditure of $5.8 million.

Coal Royalties

The OSBD reports that "a corporation owning an economic interest in coal land may exclude 50 percent of any royalties received from such land if it does not deduct certain expenses related to the production of the royalty income, including percentage depletion."[27] The expenditures here are reported as "minimal" in the *Tax Expenditure Analysis* and the OSBD provides no dollar amount.

Coal Conversion Credit

According to the *Tax Expenditure Report* "corporations may claim an income tax credit equal to 4.5 percent of the purchase price, minus transportation costs, of coal consumed or substituted in heating facilities that are currently using a different source of energy."[28] The credit resulted in an estimated tax expenditure of $200,000 for FY 2006.

Coal Incentive Credit

The *Tax Expenditure Report* states that "a credit is allowed to any electric power company or any entity that operates a coal-fired electric generation plant, is an alternative fuel facility or gasification facility. The credit is equal to $2 multiplied by the increase in tons burned in the tax year over the tons burned in the base year."[29] The OSBD estimated this expenditure at $100,000 for FY 2006.[30]

Coal Severance Tax Expenditures

Coal Severance Tax Potential Revenue	**$242,590,111**
Coal Severance Tax Expenditures	
Transportation Expense	($17,700,000)
Thin Seam Tax Credit	($400,000)
Coal Severance Actual Revenue FY 2006	**$224,490,111**

Figure 6: Coal Severance Tax Expenditure—Impact on Revenue

In addition to sales and use and corporate income tax expenditures, the state lists two tax expenditures that support the coal industry and decrease state revenues from the coal severance tax. The "Transportation Expense" exemption and the "Thin Seam Credit" exemption reduce revenues for FY 2006 by a total of $18.1 million. Because we include an exact figure for actual coal severance tax revenue above, we do not add these expenditures to the expense side as they are already accounted for in the lower revenue number.

Transportation Expense

As described in the *Tax Expenditure Report*, "transportation expenses incurred in transporting coal from the mine mouth or pit to a processing plant, tipple, loading dock, or customer is deductible in computing gross value."[31] The transportation expense expenditure is $17.7 million for FY 2006.

Thin Seam Tax Credit

The *Tax Expenditure Report* summarizes the thin seam tax credit as follows: "A non-refundable tax credit is allowed for mining coal from thin seams or from areas with a high mining ratio. The credit is on a sliding scale from 2.25 percent to 3.75 percent of the value of the severed coal, based on the thickness of the seam, the ratio of overburden removed to coal severed, or the sulfur content of the coal." The Thin Seam Credit expenditure is $400,000 for FY 2006.

Total Tax Expenditures

Tax expenditures are an important tool for governments to promote activities that they want to encourage. Among tax expenditures to support energy development in the state of Kentucky, 98 percent of estimated tax expenditures for specific energy fuel sources support the coal industry exclusively.[32] Coal has been a cheap energy source in part because the state provides significant tax exemptions and subsidies to lower the costs of mining, processing and distributing coal.

Direct On-Budget Industry Expenditures

This section addresses expenditures specifically targeted at supporting the coal industry. We exclude all restricted and federal funds to focus solely on the industry's impact on the state general and road funds in accordance with the revenue side.

Commerce	
Office of Energy Policy	($1,873,200)
Grant for Energy Education in Schools—Coal Council	(400,000)
Environmental and Public Protection	
Mine Reclamation and Enforcement	(9,661,600)
Mine Safety and Licensing	(9,460,200)
Mine Safety Review Commission	(198,500)
Environmental Protection—Air Quality	(293,180)
Environmental Protection—Water Quality	(2,046,460)
Environmental Protection Administrative and Program Support	(934,255)
Education and Workforce Development	
Coal Academy—Mining Workforce Development	(3,000,000)
Postsecondary Education	
University of Kentucky—CAER	(2,615,032)
University of Kentucky—Mining Engineering	(1,016,043)
Consortium for Fossil Fuel Liquefaction Science	(100,000)
Transportation	
Coal Haul Road System	(238,869,358)
Total Expenditures	**–$270,467,828**

Figure 7: State Expenditures to Support the Coal Industry

Commerce: Office of Energy Policy

The purpose of the Office of Energy Policy is to promote the development of the state's energy resources and work to maintain low energy prices for the Commonwealth. Ninety-two percent of Kentucky's electricity comes from coal and the language of the policy describing the role of the Office of Energy Policy[33] indicates a significant focus on coal while also including programs for renewable energy

and energy efficiency. University, research and development, and demonstration programs include attention to Applied Energy, Clean Coal and FutureGen.[34] We classify 80 percent of the office's general fund expenditures as coal expenditures for a total of $1.9 million in FY 2006.

The state grants $400,000 per year to the Coal Council for energy education in the schools. According to *The Budget of the Commonwealth 2006-2008,* "the duties of the Council include, but are not limited to, promotion of Kentucky coal through development of market information, coordination of ongoing research and marketing programs relating to coal production, transportation, and consumption, identification of national and international market developments relating to coal, and advising coal operators and other industries seeking to enter or expand domestic or export markets."[35] The Coal Council uses the General Fund appropriation to provide materials to educate students in the public school system on the benefits of coal.

Environmental and Public Protection

The Cabinet for Environmental and Public Protection (EPP) is home to all of the Mine Reclamation and Enforcement divisions and the Environmental Protection department. The state receives significant federal funding to support much of the work of this cabinet, but we deduct those funds and restricted dollars from each division's budget in order to focus on the state's general fund expenditures on coal.

The total budget for Mine Reclamation and Enforcement is $31,037,600, with $9,661,600 coming from the state's general fund. Mine Safety and Licensing spends $9,460,200 from the general fund and the Mine Safety Review Commission an additional $198,500. Both industry and environmental groups express concern that state mine safety offices are understaffed. Too few inspectors may mean mine safety is compromised and mining impacts on air, water, land and coal field communities go unchecked.

The state's Environmental Protection Department within the EPP Cabinet had a total budget (excluding federal funds) of nearly $74 million in FY 2006. Divisions within the EPP cabinet manage environmental impact and air and water contamination resulting from coal extraction processes; waste impoundments and particulate matter produced in every stage of extraction, processing, energy production and use. With 92 percent of Kentucky's electricity coming from coal-fired power generation, a significant portion of air and water pollution in the Commonwealth is attributable to coal with development and agriculture as other major contributors.

Lacking exact figures on specific program expenditures, we look to MACED's 1986 *Public Sector Impact Statement* for direction. MACED estimated coal's share of air and water quality expenditures within EPP at 20 percent. Twenty percent of the General Fund expenditures for Air and Water Quality units are $293,000 and $2 million respectively. Administrative and program support expenditures for the Air and Water Quality units, proportionate to work related to coal, total more than $934,000.

Education and Workforce Development

The state grants $3 million to the Coal Academy, a workforce development program offered through the Kentucky Community and Technical College System.

In addition, the University of Kentucky is home to the Center for Applied Energy Research (CAER) which is funded in part by the general fund. CAER conducts research on a wide range of energy sources and technologies, a significant portion of which concerns coal. In FY 2006, state funding for CAER totaled $4.7 million. In order to estimate what portion of the CAER budget supports work on coal, we counted the number of research staff whose areas of expertise include coal-related work. We found that 29 of the 52 research staff listed on the CAER web site include coal related research and technology development in their areas of research. Based on this count, we estimate that coal's share of funds received from the state totals around $2.6 million.

The University of Kentucky is also home to a mining engineering program that received support from the state in the amount of $1,016,043, and the Consortium for Fossil Fuel Liquefaction Science received approximately $100,000 from the General Fund.[36]

Coal Haul Road System and Damages

The coal haul road system has long been a subject of study and concern. Kentucky's coal haul road system consists of rural roads, state highways and interstates that facilitate the transport of coal from mine mouth to tipple, train, barge and power plant. These roads withstand tremendous wear and tear and require frequent extensive maintenance. The coal haul road system includes county and local roads as well as state maintained roadways. The estimates that follow reflect Kentucky Road Fund expenditures for the coal haul road system (Please see Technical Appendix for a review of relevant research and a full explanation of various coal haul road calculations).

Pavement construction, reconstruction and repair are expensive and even more so when roads must meet specifications for carrying heavy trucks. The Kentucky Transportation Center (1995) reports overlay costs of $100,000 ($132,280 in 2006 dollars) per mile for a four-lane roadway and an average $500,000 ($661,420 in 2006 dollars) per mile for thicker overlays. Even roads that do not require pavement overlays will still require annual maintenance including crack and joint filling, patching, chip sealing and pothole repair. Costs for this type of annual maintenance are higher in coal producing areas than in the rest of the state (an average $397 higher per mile).[37] The extended weight (EW) system adds costs above and beyond the already higher costs resulting from coal truck damage throughout coal producing and impacted counties. With these costs in mind, we construct three models of total cost and then use the average of the three estimates for our fiscal impact analysis.

All three models use the previous estimate of the Kentucky Energy Cabinet that 75 percent of the costs of maintaining the nearly 4,000 miles of coal haul roads are attributable to the coal industry.[38] Model 1 is based on road service needs and estimated per mile costs; Model 2 uses Vehicle Miles Traveled for the coal haul road system and the 75 percent cost allocation to estimate the share of expenditures attributable to coal; Model 3 combines that estimate with the debt service and state expenditures to support county coal haul road maintenance to arrive at an estimate that reflects more of the long-term costs of the coal haul roads.

The service life of coal haul roads is between two and four years, rather than the standard 20 years. An ideal overlay rotation would have the state placing new overlay on one-fourth of the coal haul road system each year to accommodate the shorter service life and maintain road quality and safety. To support loads over 80,000 pounds, the coal haul road system requires thicker overlays than other roads. We apply the average cost of $661,420 per mile of four-lane road to the coal haul road system and assume that two lane roads cost about half as much (though they are likely to cost more than half given that the shoulder costs are the same or higher for the narrower roads). We find that 17.8 percent of state-maintained coal haul roads were four-lane rural roads in 2006 and 82.2 percent of coal haul road miles were two-lane roads.[39] The total cost to overlay one-fourth of the system is nearly $365 million. If 75 percent of the cost is attributable to coal, then we estimate coal's share at $273.5 million for FY 2006. This scenario is based strictly on cost and an estimate of likely need for the road work based on coal truck activity and damage data. We know that the state is likely to use less expensive maintenance to help defer costs to a later date. Subsequent models are based on actual road spending for FY 2006 and are more likely to reflect that the state defers some costs each year to accommodate budget constraints. Keep in mind, however, that any year's expenditures will include some expenses that were deferred in prior years.

The remaining models use vehicle miles traveled (VMT) as a multiplier for cost allocation. VMT cover some of the added costs associated with higher traffic on these roads than would be there without the coal industry, but do not incorporate the difference between one mile of coal truck travel and one mile of passenger car travel. Heavy trucks cause significant damage to roads whether they are coal trucks or not. The extended weight exception to weight limits means that coal trucks carry heavier loads than other trucks and the resulting wear and tear tends to be geographically concentrated. The types of trucks and axle configurations of many coal trucks cause more damage than the large five or six axle trailer trucks that traverse the interstates with heavy loads of consumer goods. These trucks no doubt cause significant damage, but more axles mean a better distribution of weight to reduce impact on the roads. The axle loads of straight trucks, often traversing mountainous rural roads in the coalfields, have a disproportionate impact on state costs.

The Kentucky Transportation Center (KTC) found that the extended weight (EW) coal haul road system carried 19% of VMT on state maintained roads. If we use VMT as a crude estimator and apply coal county base system VMT estimates to the non-EW coal haul roads, we find that the total coal haul system carries roughly 23.9 percent of travel on state maintained roads. Using VMT to determine a share of costs assumes that administrative, capital and maintenance costs vary by VMT. Without regard to vehicle weights, according to this model, the coal haul road system is responsible for $273.6 million of spending in the FY 2006 state budget. Following on earlier studies, we estimate that 75 percent of road costs on roads that carry coal are attributable to coal hauling (given that coal hauling can reduce service life from 20 years to two to four years, this seems like a reasonable estimate). Using this method, we estimate coal's share of maintenance costs on the coal haul road system to be $205.2 million.

This estimate represents a reasonable estimate of many road related costs. However, the method underestimates capital expenditures for grade, drain, surfacing and resurfacing work and maintenance and operations spending

on structures. Without definitive information on axle configurations for the 3,000-4,000 coal trucks operating in the state and the mileage and payload of those trucks, it is difficult to arrive at accurate cost allocation estimates. These complexities are exacerbated by the fact that we know that many trucks underreport activity or operate off the radar altogether.

In addition, expenditures specific to the Resource Recovery Road System include a state allocation of $1,003,000 to the counties to help cover costs associated with county maintained roads that are part of the coal haul road system and $38,838,600 in debt service for prior construction on the Resource Recovery System. If we take these funds out of the road fund before calculating coal's share of remaining road fund expenses and then add them back in on top of the coal industry's share of all other expenses, we can attribute $237.9 million to the coal industry.

State record-keeping and the inherent limits to regulatory control and monitoring mean that we cannot provide precise figures on the coal industry's share of road expenses to support their use of the roads for hauling coal and equipment. Our purpose is to provide some information that sheds light on the range of costs associated with the industry's presence so that we might better assess the state's role in supporting the activities of the industry.

Given the myriad issues surrounding the task of cost allocation, we use an estimate that accounts for the strengths and weaknesses of the three models. If we take the average of the three models above (Model 1 based on regular thick overlay rotation, Model 2 based on VMT and Model 3 including VMT and debt service and state road fund support for county maintenance of coal roads), we arrive at an estimated coal haul road cost of $238.9 million for FY 2006.

These costs are high, but not unexpected. As we weigh various options, the roads are a significant cost that will vary based on the energy resources in which we choose to invest.

Direct Industry Revenues and Expenditures: Net Impact

A review of coal industry-generated revenues to the state and expenditures from the state suggests that the industry actually costs more than it brings to the state. In our estimation, the industry costs the state roughly $52 million without significant attention to health and social externalities and with limited accounting for environmental impact.

In the next two sections, we look at the impact of the industry on employment and earnings in the state and the resulting impact on revenues and expenditures. Coal employs thousands of Kentuckians in the eastern and western coal fields. Coal employees pay taxes on their earnings and consumption, thus generating additional revenues and expenditures for the state.

II. Direct Employment Revenues and Expenditures

Over the last century, the coal industry attracted thousands of workers to well-paying mining jobs in the Kentucky coal fields. Those employed by coal contribute to *The Budget of the Commonwealth* through the taxes they pay and are also recipients of state services funded by their tax dollars. We use employment and earnings data to estimate state revenues and expenditures attributable to direct employment in the coal industry.

Direct employment generates state revenues through personal income, sales and use, property and motor vehicle taxes. The state uses the revenues to pay for infrastructure, schools and services for those employed by the industry. Direct employment in the coal industry by itself is a net gain for the state of nearly $10 million.

Direct Employment	
Revenues	
Personal Income Tax	$45,086,947
Sales and Use Tax	23,067,740
General State Property Tax	4,414,260
Motor Vehicle Taxes (excluding extended weight decals and registration fees)	10,471,444
Subtotal	**$83,040,392**
Expenditures	
Share of State Expenditures	($73,140,605)
Net Impact of Coal Employment on State Budget	**$9,899,787**

Figure 8: State Revenues and Expenditures Associated with Direct Employment in the Coal Industry

Employment And Earnings

Kentucky Coal Facts reported coal employment at 17,669 people for 2006.[40] Their figures excluded several counties with "less than three employers or one employer with 80 percent of the total county miner workforce."[41] These data are withheld to protect company privacy. We used output figures by county paired with available employment data to arrive at an estimate of total coal employment. Statewide coal employed 17,903 people, less than one percent of employment in 2006.[42]

Year	Direct Employment in Coal Mining in Kentucky[43]	Total Kentucky Employment	Percent of Employed Kentuckians Directly Employed in Coal Mining
2006	17,903	2,029,449[44]	.88%

Figure 9: Mining Employment in Kentucky

In coal producing counties, coal employs a significantly larger portion of the population.[45] Miners do not necessarily live in the counties in which they work, but if aggregate coal county population[46] is used as the primary population from which mining employees are drawn, we find that coal mining accounts for just under five percent of coal county employment in 2006.[47] The industry plays a greater role as employer in the coal counties than statewide, but the share of employment in coal is relatively small even in those counties.

Wages are good for those employed directly in the mining industry: the statewide average weekly wage was $1,126.30 in 2006.[51] Mining wages vary significantly by company and position, but those earning at or above $50,000 per year earn well above the average wage in the eastern Kentucky mining region where poverty rates hover around 30 percent. The employment and earnings figures allow us to estimate total state revenues and expenditures associated with coal employment.

Direct Employment Revenues

Revenue from taxes paid by those employed in the coal industry total an estimated $83 million in FY 2006. Coal industry employees pay personal income, sales and use, state property, motor vehicle and fuel taxes. Precise figures for coal employee tax contributions are not available (nor would they be for any group of citizens) so for each tax, we calculate an estimate based on available data.

Personal Income Tax

We estimate that 17,903 Kentuckians were directly employed in mining earning $1,048,533,659 in Fiscal Year 2006.[52]

The Kentucky Office of the State Budget Director estimates the average effective individual income tax rate at 4.3% of Kentucky Adjusted Gross Income. This average encompasses variations in pay scale, tax brackets and allowable deductions. Using the data available, we estimate Kentucky's state revenue from personal income taxes paid by those directly employed by the mining industry to be over $45 million.

	Direct Impact ($2006)[48]	Additional Direct Impact ($2006)[49]	Total Direct Impact ($2006)
Output	$4.97 billion	--[50]	$4.97 billion
Worker Earnings	$1,034,834,951	13,698,708	$1,048,533,659
Employment	17,669	234	17,903

Figure 10: Output, Earnings and Employment Impact

	Coal Wages	Effective Tax Rate	Individual Income Tax Revenue from Coal Employees	Share of Total State Revenue from Individual Income Tax
2006	$1,048,533,659	4.3%	$45,086,947	1.5%

Figure 11: Wages and Income Tax

Sales Tax Receipts

When individuals employed by the coal industry spend their money in the community, they generate state sales tax revenue. Kentucky has a six percent state sales tax rate. Generally, the portion of an individual's income paid in sales tax declines as income rises. However, sales tax exemptions on goods considered to be necessities temper this regressive character. Individuals do not pay sales tax on food, prescription medications or residential utilities.

Based on wage and employment figures for the state of Kentucky, we can safely assume that most of those employed directly by the mining industry fall into the middle class category.[53] Because people do not spend all of their money on consumption, the effective sales tax rate for the middle class is approximately three percent of their total income.[54] Using earnings from coal employment and average sales tax expenditures for the middle class, we estimate that more than $23 million in state sales tax revenue is attributable to direct employment in the coal industry.

General State Property Tax

State property taxes generate revenue from taxes on real, tangible and intangible property, motor vehicles, bank deposits, distilled spirits, marginal accounts, omitted property tax, delinquent taxes from prior years, apportioned vehicles, public service companies, domestic life insurance, retirement plans and building and loan association capital stock. We use coal's share of state employment to determine the share of state property tax revenue attributable to the coal industry and coal industry employment, which accounted for .88% percent of total state employment in 2006.[55] The estimate assumes that property ownership is distributed proportionately by employment without attention to earnings. Jobs directly attributable to coal range from temporary work providing inconsistent wages to high-end technology and professional services and reflect wide income variation found throughout the economy. Calculating coal-related revenues from general state property taxes as a proportional share based on employment provides a reasonable estimate for our purposes. Using this calculation, we estimate that $4.4 million in general state property tax revenues is attributable to the coal industry and coal employment.

Coal-Related Motor Vehicle Taxes (excluding extended weight decals and extended weight registration fees)

The coal industry creates revenue for the Commonwealth through taxes associated with its extensive use of transportation to move coal from mine to tipple and beyond. Additionally, those directly employed by coal generate motor vehicle taxes from their use of vehicles on public roads. In MACED's 1986 *Public Sector Impact Statement*, Sims assumed that coal's share of general vehicle and transportation taxes was approximately proportional to coal's share of employment. We follow the earlier MACED methodology and assume coal's share of total vehicle and transportation revenue, both from industry activity and from the vehicle and fuel taxes paid by those employed in the industry is proportional to coal's direct employment in the state. Note that coal industry revenue, beyond the extended weight registration and decal revenue noted earlier, is covered in this figure. In other words, this figure includes vehicle and fuel taxes attributable to the industry (and not covered by registration and decal fees) and its direct employment. Data limitations did not allow for a more precise method. Based on these assumptions, motor vehicle tax revenue directly attributable to coal is estimated at $10.5 million.

Total Revenues

Direct employment in coal generates more than $83 million in tax revenues. The coal industry provides many good jobs that contribute to the state's tax base and that stimulate activity throughout the economy. A large portion of the revenue generated through coal employment supports educational and infrastructure needs of those employed in coal as well as their share of all other public goods and services.

Direct Employment Expenditures

Just as the coal industry generates state revenue by employing residents, those residents require support and services provided by the state. Coal employees, like all residents, use schools, roads and other services. A proper estimate of coal's fiscal impact must include not just the revenues generated from employment but also the costs associated with supporting that employment.

Expenditures to support coal employees are calculated based on direct coal employment as a proportion of total state employment. We subtracted coal industry expenditures (excluding tax expenditures as these funds are not reflected in general and road fund expenditures, but rather, in foregone revenue) from the total general fund and road fund expenditures and then multiplied the remainder by coal's share of state employment to arrive at overall state expenditures attributable to coal employment. These figures include money spent to support the industry that are general infrastructure and standard state functions enjoyed by all industries and businesses in the state as well as money spent to support the portion of the labor force employed as a result of the industry's presence in the state.

People directly employed by the industry might live in Kentucky without the presence of the industry, but economic impact studies assume they would not. Economists, planners and policy-makers present the impact of a given development project or industry as if the alternative to the project or industry was no jobs or income. The models facilitate cost-benefit analyses but should be used with the built-in artificial assumptions in mind. We estimate coal employees' share of state expenditures to be $73 million.

Net Impact Of Direct Employment In Coal

The coal industry provides thousands of good jobs for Kentuckians. The level of employment in coal is far lower than it once was, but mining jobs pay strong middle class wages that contribute to state revenues. The net impact of direct employment in coal is nearly $10 million: direct employment revenues exceed direct employment expenditures by $10 million.

Total Direct Impact

Coal industry activities generate significant revenue for the state, but they also exact some high costs. Direct employment revenues surpass direct employment expenditures, but not by enough to cover the direct costs of hosting the industry. We estimate net impact of the industry and its direct employment to be –$42 million (Figure 12).

Revenues	
Industry	$303,172,748
Direct Employment	83,040,392
Total Revenues	**$386,213,140**
Expenditures	
Industry (Including Tax Expenditures)	($355,221,108)
Direct Employment	(73,140,605)
Total Expenditures	**($428,361,713)**
Net Impact of Coal Industry and Direct Employment	**–$42,148,574**

Figure 12: Net Impact of Coal Industry and Direct Employment

Direct industry and employment impacts combined do not reflect the total contributions that the industry's presence makes to the state economy or to public funds in the Commonwealth. The industry triggers economic activity and employment in supply and other related industries, and direct employment in coal leads to employment in sectors that serve those employed by the industry. In coal and other industries, the indirect economic impact is often cited, but the focus remains on the associated benefits and not the costs. In the next section, we explore the indirect economic impact, or spill-over effects, of the coal industry in Kentucky.

III. Indirect Employment Revenues and Expenditures

Indirect revenues and expenditures include tax revenues generated by employment in industries that supply the coal industry and employment in sectors that serve those directly employed by coal. We use economic development multipliers for the coal industry in Kentucky to estimate the indirect economic impact on jobs, earnings and, by extension, state revenue.[56] To simplify, we will include employment in supply industries as well as employment induced by worker spending together under the category of "indirect" impact.

Economic impact multipliers use direct employment projections and information on inflows and outflows related to and stemming from the industry, as well as consumer behavior in a particular geographic location, to determine the spill-over effects of a specific development project (i.e. a manufacturing plant, athletic stadium or large retail store) or firm closing (i.e. closing a manufacturing plant).

Multipliers, in their most complete form, are determined by examining primary data on economic inflows and outflows in the specific region of the proposed site. The multiplier accounts for both increases in economic activity among businesses that will supply the new project and increases among businesses that will serve those employed by the new development. Economic impact analyses rely on several assumptions to provide guiding estimates.

In order to estimate the fiscal impact of the coal industry on the state budget in Kentucky, we model the economic impact in a way that is comparable to prevailing models employed by stakeholders in the state. *Kentucky Coal Facts* uses updated versions of the models produced by the Center for Business and Economic Research in 1996 which employ the Regional Input-Output Modeling System (RIMS) multipliers available through the Bureau of Economic Analysis (our multipliers reflect RIMS updates since the

Kentucky Coal Facts 2007-2008 was published).[57] The RIMS II economic impact multipliers allow us to determine those impacts on state revenue and spending that are dependent on total employment and earnings related to the industry's presence in the state.

The RIMS II is based on an input-output accounting table that shows inputs purchased and outputs sold. First, industry data from across the country are used to create the industry-by-industry requirements table. Next, the adjusted national table is used to prepare a regional industry-by-industry direct requirements table, and finally, a regional industry-by-industry total requirements table is used to derive regionally specific economic impact multipliers. Each step in adjusting the national tables to regionally specific industry tables involves additional assumptions regarding inputs and outputs. More localized impacts require further data adjustments.

The RIMS II, and all economic impact multipliers, is surrounded by criticism of the models based on the assumptions built into the models and the resulting limits of their applicability and accuracy. The model assumes that all direct, indirect and induced effects would not otherwise occur without the project. The absence of the counterfactual—meaning we really have no way of knowing or modeling what activities would occur without the project—is problematic. The base assumption of the RIMS II, and all economic multiplier models, that places all other economic activity on hold is significant and presents obvious problems under the best circumstances. In addition to these concerns, the application of this method to an industry that has been in the region for more than 100 years and is tied to a place-specific natural resource violates basic principles of a model designed to assess the impact of economic shocks such as development projects or firm closures.

With these limitations and caveats clearly in mind, it is important to have more substantive analysis in order to weigh the benefits of one set of choices against another. Because the state of Kentucky and the coal industry in Kentucky use these impact multipliers to support the economic benefits of coal to the state, we think it makes sense to engage the discussion based on some common ground shared analysis, but with the full revenues and expenditures included in the model. The industry and employment figures in the first section of this paper tell part of the story; impact multipliers allow us to complete the analysis by adding the indirect or spill-over effects.

Indirect Employment Revenues	
Coal-Related Personal Income Tax	$65,177,691
Coal-Related Sales and Use Tax	33,346,726
Coal-Related General State Property Tax	12,927,160
Coal-Related Motor Vehicle Taxes (excluding extended weight decals)	30,057,785
Subtotal	**$141,509,362**
Indirect Employment Expenditures	
State Expenditures to Support Citizens Employed as an Indirect Result of the Coal Industry's Presence	($214,590,042)
Net Impact	**–$72,682,738**

Figure 13: State Revenues and Expenditures Indirectly Attributable to Coal

We find indirect employment attributable to the coal industry generates an estimated $142 million in state revenue. State expenditures to support those employed as an indirect result of the coal industry's presence total an estimated $215 million for a net fiscal impact of negative $73 million (Figure 13). The imbalance between revenues and expenditures reflects the prevalence of low-paying jobs in support industries.

Indirect Employment Revenues

The presence of the coal industry creates downstream employment (employment in related sectors—trucking, equipment supply and other related industries), re-spending or induced employment resulting from miners and mining staff spending their paychecks in their communities, and government employment as income tax dollars go to support government agencies that employ other citizens in the state.

As previously noted, earnings are above average for those employed directly in the mining industry. Wages for indirect employment vary widely, but tend to be lower than in the coal industry as evidenced by the fact that the earnings multiplier is lower than the employment multiplier. We estimate that 17,903 Kentuckians were directly employed in mining earning $1,048,533,659 in Fiscal Year 2006.[61] Indirect employment totaled 52,429. We multiply total direct earnings by the RIMS II earnings multiplier for Kentucky coal to arrive at indirect wages totaling $1.5 billion (Figure 14).

	Direct Impact ($2006)	Additional Direct Impact ($2006)	Total Direct Impact ($2006)	RIMS II Impact Multiplier for Appalachian Coal Industry in Kentucky	Indirect and Induced Impact ($2006)	Total Impact ($2006)
Output	$4.97 billion	-- [60]	$4.97 billion	2.16	$5,765.2 million	$10,735,200,000
Worker Earnings	$1,034,834,951	13,698,708	$1,048,533,659	2.4456	$1,515,760,257	$2,564,293,916
Employment	17,669	234	17,903	3.9285	52,429	70,332

Figure 14: Output, Earnings and Employment Impact

Direct Industry Revenues	**$303,172,748**
Direct Employment Revenues	**83,040,392**
Indirect Employment Revenues	
Coal-Related Personal Income Tax	$65,177,691
Coal-Related Sales and Use Tax	33,346,726
Coal-Related General State Property Tax	12,927,160
Coal-Related Motor Vehicle Taxes (excluding extended weight decals)	30,057,785
Subtotal	**$141,509,362**
Total Revenues	**$527,722,502**

Figure 15: Total Revenues

The same revenue streams resulting from direct employment in the coal industry comprise the impacts of employment indirectly attributable to the coal industry. Assuming the same average effective tax rate of 4.3 percent of Kentucky Adjusted Gross Income and using the data available, we estimate Kentucky's state revenue from personal income taxes paid by those employed in jobs indirectly attributable to the coal industry to be $65 million. Using the same methods as in the direct employment section, we estimate $33 million in sales tax revenue, $13 million from general state property tax, and $30 million in motor vehicle taxes including fuel tax. We estimate that indirect employment attributable to the coal industry generates $142 million in state tax revenue, bringing the total state revenue attributable to the industry to $528 million.

Indirect Employment Expenditures

The people employed as an indirect impact of the coal industry's work in the state provide significant revenue, but the state must also spend money to support these people by providing schools, roads and other services. We use the same method to estimate indirect expenditures that we used to determine the share of state expenditures to support those directly employed by the industry. Those employed as an indirect effect of the industry's presence comprise 2.6 percent of state employment in 2006. We subtract state spending to support the coal industry from the general and road fund expenditures and find that 2.6 percent of remaining expenditures is $215 million, bringing total state expenditures associated with the presence of coal in the state to nearly $643 million.

Direct Industry Expenditures	**($355,221,108)**
Direct Employment Expenditures	**(73,140,605)**
Indirect Employment Expenditures	
State Expenditures to Support Citizens Employed as an Indirect Result of the Coal Industry's Presence	**($214,192,262)**
Total Direct and Indirect Expenditures	**–$642,553,975**

Figure 16: Total Expenditures

In this model those indirectly employed as a function of the industry's presence cost the state more than those employed by the industry and they fail to cover their costs in the taxes they pay to the state. This discrepancy is due to the comparatively lower wages of indirect and induced jobs.

The estimates presented here suggest that while direct employment in coal by itself is a net benefit both to those employed and to the state of Kentucky, this benefit comes at a significant cost. The industry itself costs the state more than the industry contributes to public funds and the indirect employment impact, while important, is concentrated in lower wage work such that we do not see a net increase in state revenue. These findings are important, but they still overlook several key elements of the cost of the industry to the citizens of Kentucky.

Omitted Variables and Updates

The Impact of Coal on the Kentucky State Budget is not a comprehensive discussion of the effects of the industry on our state's budget or on economic activity in the state. The externalized costs of the industry should be part of any full discussion of energy and economic development strategies for the Commonwealth. In the case of coal, these costs include but are not limited to healthcare, lost productivity resulting from injury and health impacts, water treatment, water infrastructure to replace damaged wells, environmental remediation, limited development potential due to poor air quality, pollution control, and social spending associated with declines in coal employment and related economic hardships of coalfield communities.

Recent studies indicate links between coal production and combustion and rates of illness and mortality. Michael Hendryx of West Virginia University finds that even when controlling for other factors such as smoking, poverty, education, rural-urban setting, race, ethnicity and other variables, mortality rates increase when coal production increases from one to seven million tons.[62] In another study, Hendryx and his colleagues found that the odds of hospitalization for chronic obstructive pulmonary disease (COPD) and hypertension increased with increases in coal production.[63] A recent study from Johns Hopkins Bloomberg School of Public Health links levels of arsenic in drinking water to higher rates of diabetes. Arsenic can get into drinking water naturally, but is also a pollutant from coal burning and copper smelting.[64] According to the Clean Air Task Force, coal-fired power plants are to blame for higher child asthma rates among those living within a 30 mile radius of coal-fired power plants.[65] The health impacts of coal production and use cost the state in healthcare spending and lost productivity.

In addition, the extended weight coal haul system adds costs not accounted for here. The trucking of coal and the damage to roads in communities throughout the eastern and western coalfields affect health, environment and quality of life for those living on and near the 4,000 miles of road used to haul coal throughout the state. The 1980 LRC study noted that "continuous dust, noise and vibration, for instance, may cause a higher incidence of disease among those living along deteriorated coal haul roads. Coal trucks traveling at high speeds along narrow roads are a safety hazard, as is the broken, rutted pavement of damaged roads."[66] The 1995 KTC study of the extended weight coal haul road system noted that while the higher weights have not caused a significant increase in accidents involving coal trucks, they have caused an increase in the proportion of accidents that involve injuries or fatalities. According to a *Lexington Herald-Leader* analysis, "At least 53 people died and 536 were injured in accidents with trucks licensed to haul coal from 2000 through August 2004."[67]

We also do not address workers' compensation expenditures in this report because the Workers' Compensation Funding Commission (KWCFC) is not funded through the state general fund, but by employer payments to workers' compensation. The Labor Office handles workers' claims and the state workers' compensation program. According to the *Kentucky Office of Workers' Claims 2006-2007 Annual Report*, 14.09 percent of worker claims in 2007 came from the mining industry. We have no reason to believe that mining's share of claims would be significantly different for fiscal year 2006.

These figures represent significant improvements in mine safety over the last 30 years, but mining remains a dangerous occupation. The state established the KWCFC in 1987 to develop a stable funding plan for retiring various liabilities under the state's workers' compensation program. At that time, an assessment was imposed on workers' compensation premiums paid by all employers, including those engaged in the severing or processing of coal. Due to the higher level of liability related to the coal industry, an additional assessment was imposed on the workers' comp premiums received from coal operators. These funds were placed in the "Special Fund" for workers' compensation liabilities. In the early years, the coal rate was as high as 48.9 percent (1994) and came down to 24.0 percent by 1996.[68] In 1996, new legislation (*KRS 342.122*) replaced the additional assessment on coal operators with the specific allocation of $19 million in coal severance tax revenues to the Special Fund. However, due to general fund deficits, state budgets have excluded transfers of coal severance funds to the KWCFC since FY 2002.[69]

Black Lung is covered under a separate workers' compensation fund. In 1996 the Coal Workers' Pneumoconiosis Fund (CWPF) was created (*KRS 342.1242*) to provide benefits for claims based on exposure to coal dust and incurred after December 12, 1996. At that time, assessments were imposed on both coal employers and the severance of coal on a calendar year basis. Revenues from these assessments are restricted to the CWPF. For FY 2006, an annual assessment of 0.50% was imposed on workers' compensation premiums of employers engaged in the severance or

mining of coal, with an additional assessment of $0.025 per ton of coal severed by every such entity. No coal assessments were imposed in 2008 and 2009, as there is sufficient money in the CWPF to pay all claims.[70] Conversations with attorneys working on Black Lung claims suggest that changes in workers' compensation criteria in the state have reduced successful claims in recent years. Unable to receive reimbursements from the state, many miners end up filing for compensation funds available through a federal Black Lung fund.

In addition to omitted variables, the state has established additional tax expenditures and benefits to the coal industry since 2006. In the area of education, the state established a $200,000 per year scholarship fund for the University of Kentucky Mining Engineering program. As the result of the enactment of HB1 during the August 2007 General Assembly Special Session, the coal industry will benefit from additional incentives in the coming years. The bill includes tax incentives for construction of alternative fuel or gasification facilities. The Office of the State Budget Director expects this incentive to result in foregone revenue of $21.3 million in 2010 alone. In addition, coal purchased for an alternative energy (liquid fuel) or gasification facility will be subject to an exemption "equal to eighty percent of the severance taxes paid on the purchase or severance of coal that is specifically used as feedstock for the facility." Because these plants are not expected to be up and running for some time, the *Tax Expenditure Analysis 2008-2010* does not show dollar estimates for these expenditures.

Our estimates provide a rough sketch for understanding the easily counted costs and benefits of the coal industry to the state budget. The omission of numerous externalities, federally funded supports and more recent additions to tax expenditures suggest that our work provides only a small piece of a far more complex relationship between the state and the coal industry. A comprehensive analysis of this relationship would include attention to these complexities and would more fully represent the costs of the industry to the state and its future prospects for sustainable development.

Conclusions and Policy Implications

The Impact of Coal on the Kentucky State Budget provides estimates of the revenues and expenditures attributable to coal in the Kentucky state budget. According to this analysis, the industry provides an estimated $528 million in state revenue, with the coal severance tax making up over 40 percent of that revenue. But those revenues do not offset the expenditures associated with hosting the industry. Based on our estimates, the state spends nearly $643 million on coal-related infrastructure, regulation, tax preferences, research, training and other expenses for an annual net fiscal impact of –$115 million.

The analysis presented here is necessarily based on several assumptions and estimates. A precise analysis of the fiscal impact of an entire industry is impossible to construct. This report does not attempt to quantify and monetize the costs often referred to as externalities, including the industry's impact on health and environmental quality. However, the approach used here improves upon unsubstantiated speculation of the industry's impact as well as assessments that only focus on coal's benefits. The findings shed light on the role of the coal industry in our state and thereby raise important questions about the state's energy, economic development and fiscal policies.

When MACED released its 1986 study of coal in Kentucky, over 39,000 Kentuckians worked in the industry. By 2006, coal employment had declined 54 percent to just under 18,000 workers. Now, as then, technological changes are reducing the demand for labor while new and ongoing environmental concerns raise serious questions about the viability of coal as a future source of energy. Today, carbon dioxide comprises 84.5 percent of U.S. greenhouse gas emissions and fossil fuel combustion is the primary source of these emissions.[71] As the climate impact of a warming planet becomes more apparent, support for regulations to reduce climate-changing emissions grows.

The longstanding historic trends in the coal industry in Kentucky, combined with the reality of a rapidly changing energy landscape, pose challenges to the long-term role of coal as a provider of employment and source of tax revenue for Kentucky. In light of this reality, Kentuckians are engaged in serious discussion about what kind of energy policy state government should support. At the same time, ongoing budget problems plague the state due to a structural imbalance between the growth of revenues and expenditures. Appalachian Kentucky's coal field communities are among the most distressed in the country while the Commonwealth as a whole ranks 44th among the states in per capita personal income; a position Kentucky has occupied since 1970.[72] The Commonwealth faces serious fiscal, economic development and energy choices.

The Impact of Coal on the Kentucky State Budget suggests three key recommendations as we move forward:

- **Compare future investments in coal to investments in energy alternatives.**
  The state launched a period of more active energy policy with the recent passage of House Bill 1 in a 2007 special session, House Bill 2 in the 2008 General Assembly and the release of Governor Beshear's new energy plan. Kentucky invests modestly in renewable energy and energy efficiency, while it aggressively pursues policies to support coal and invest in new coal technologies. As the nation and the world begin to reduce dependence on fossil fuels, the Commonwealth must make strategic energy choices based on the full costs and benefits of the options before us.

- **Pursue economic diversification.**
  As this report indicates, the costs associated with hosting the coal industry are significant. The long-term downward trend in coal employment and the approaching end of low coal-fired electricity prices further diminish the industry's economic development benefits. While no one knows for sure how long coal will be mined in Kentucky, it is not a renewable resource. We must work harder to achieve lasting economic diversification throughout Kentucky and its coalfield communities.

- **Examine the way coal is taxed and subsidized in the state.**
  While the coal severance tax is often referenced for its contributions to Kentucky communities and the state budget, its benefits are diminished when the costs associated with hosting the coal industry are more fully represented. At the same time, tax expenditures for the coal industry are a set of growing but largely hidden subsidies that reduce revenue to the state budget. Taxation theory suggests higher taxes on activities, like the mining of coal, which cannot be relocated to other states. But the Commonwealth has not adjusted several coal-related taxes and fees in many years.[73] Kentucky should examine its rate of taxation and use of subsidies and think strategically about the needs of the Commonwealth and the best path to a prosperous future.

Technical Appendix: Estimating Coal Haul Road System Costs

The coal haul road system has long been the subject of study and concern. This system consists of rural roads, state highways and interstates that facilitate the transport of coal from mine mouth to tipple, train, barge and power plant. These roads withstand tremendous wear and tear and require frequent extensive maintenance. The coal haul road system includes county and local roads as well as state maintained roadways. The estimates that follow reflect only those costs for state-maintained roads in the coal haul system.

In September 1980, the Kentucky Legislative Research Commission (LRC) released *The Fiscal Impact of the Kentucky Coal Industry*. That report used existing data and models to provide four estimates of the cost of the coal haul road system. The LRC presented models that ranged from a very conservative estimate of maintenance costs to a far larger estimate incorporating the annual share of long term construction, maintenance and repair costs. Here we will review the LRC study as well as several more recent analyses of highway cost allocation and the extended weight coal haul road system to arrive at a series of estimates of the coal industry's share of road construction and maintenance expenditures for 2006.

The Commonwealth builds and maintains 96 percent of the roads that comprise the coal haul road system; the other four percent are maintained by county and local governments.[74] The state designates road segments as coal haul roads based on self-report usage data. Within the coal haul road system, road segments carrying loads of more than 50,000 tons of coal in the previous reporting year are designated extended weight and require an extended weight decal for trucks carrying more than 90,000 pounds. Roads in coal producing counties carried 1,577,501,793 ton-miles of coal haul activity in 2006 while coal impacted counties (counties that have roads that are part of the coal haul road system, but that do not produce coal) carried 141,849,747 ton-miles of coal haul activity.[75] The total state coal haul system in 2006 bore 1,719,351,540 ton-miles of coal hauling. The coal haul system covered 3859 miles (3744 on state-maintained roads)[76] of roadway with 2,602 miles comprising the extended weight system.

"The total mileage of highways used to haul coal in Kentucky has declined since the mid-1980s, as has the mileage eligible for the extended-weight system. This occurred at the same time that the total ton-miles for coal transported by highway increased."[77] This suggests that

while total mileage impacted by the industry has decreased since the cost studies of the late 1970s and 1980s, damage on those roads that comprise the system is likely more intense as a result of heavier loads traveling fewer miles of road.

A central element driving increased load size per truck is the 1987 establishment of the extended weight coal haul system. Buttressed by a drive to keep Kentucky coal competitive and ensure that drivers did not feel the need to break the law in order to make a living, the General Assembly chose to legalize excessively heavy coal loads through the extended weight coal haul decal system. Coal haulers are able to purchase an extended weight decal that allows them to travel on the extended weight coal haul road system carrying loads that exceed 80,000 pounds and that often reach as much as 120,000 pounds. In 1995, KTC reported that approximately two-thirds of trucks with extended weight decals registered in the 120,000 pound category.[78] KTC conducted an analysis of data from weigh stations focusing on the types of trucks that are allowed to operate with increased weight limits. They found that "a relatively small percentage of the vehicles exceeded the limits. On US 23 in Boyd County, there were 186 trucks (10.4 percent of the total trucks) which exceeded the extended-weight limits."[79] The Boyd County weigh station was the only site that had more than 10 percent of trucks exceeding the weight limits.

In the 1995 KTC study of the extended weight decal and haul system, researchers estimated annual pavement overlay costs for the extended weight system at around $9 million higher than they would be with previous weight limits enforced. If we adjust the $9 million from 1993 dollars to 2006 dollars we estimate pavement overlay costs at around $12.56 million above what they would be if the extended weights were not allowed (heavier weights increase maintenance requirements). Overlay costs are only a portion of total expenditures for the coal haul roads. The 1995 KTC study concludes that the extended-weight system is a "subsidy of the movement of Kentucky coal by the road users throughout the state."[80] The extended weight decal system caused a significant decline in Truck Permit registrations costing the state more than what it collects in decal revenue.

Coal trucks are not the only road users that fail to cover their costs. The problem of user responsibility for incurred costs is endemic to the road system. In the late 1990's the KTC estimated that pickups and vans, light trucks and medium trucks more than covered their road costs in registration fees and taxes. Cars, heavy trucks and buses all fell short of paying the full cost of their road use. While evasion occurs, the problem is more accurately described as a market failure resulting from the public nature of road use.

Roads are public goods. "Roads are not sold; their use is open to all (except, of course, in the case of a few remaining toll roads."[81] This non-exclusion constraint means that market signals do not appropriately apportion costs for the roads without intervention. Some revenues are collected for road use by coal trucks, but the "amounts are rarely adequate to defray road maintenance expenses. Ultimately, the use of general public funds becomes inevitable."[82] Portions of the direct costs associated with road use by the coal industry become externalities not incorporated into the cost of coal and not collected from the coal industry by the public entities that maintain the roads (the state as well as local and county governments). In effect, Kentucky tax payers subsidize kilowatt-hours fueled by Kentucky coal for utility users in nearly two dozen states and beyond U.S. borders. This dynamic is unfortunate, but also difficult to avoid without far more administrative and regulatory expense. The phenomena is not unique to coal, but rather a common problem, particularly for natural resources. All the same, it must be included in our understanding of the benefits and costs of the industry to the state.

Given the need for the state to provide public use roads, researchers develop methods for estimating cost allocation within the state road system. Without exact figures for road construction, maintenance and enforcement expenditures for coal haul roads and extended weight coal haul roads, it is difficult to provide concrete figures on the cost of these roads. The 1980 LRC study provides some key characteristics of road costs to keep in mind as we try to attribute costs to a particular industry[83]:

- *The use of public roads is not limited to one class of vehicle. The total cost of maintaining coal roads cannot be assessed against the coal industry (costs must be apportioned).*
- *The deterioration of roads, or the need for better roads, due to heavy traffic, imposes a demand for public funds. This cost can be deferred by the responsible agency. The choice to defer costs often results in social costs in the form of longer travel times, lower property values and vehicle damage.*
- *The demand for better roads, imposed by heavy truck use, could be met in several ways: by increased maintenance of existing roads, by construction and maintenance of heavy duty gravel roads, by construction of hard-surface roads*

capable of withstanding heavy use. The costs of alternatives differ, and the choice of alternatives can bias the resulting estimate.

Road costs, cost allocation estimates for the coal haul road system, and tax responsibility calculations for motor carriers are based on self report data, making them vulnerable to underreporting and evasion. Anecdotal evidence, as well as discrepancies between expected and collected revenues, suggests that coal haul mileage is underreported.[84]

One of the greatest obstacles to accuracy in cost allocation studies is the method by which the weight and axle configuration distribution among trucks traveling in Kentucky is determined. Studies base these estimates on "a sample of Kentucky trucks involved in reportable traffic crashes." This sampling technique assumes that coal trucks involved in traffic accidents accurately represent the distribution of weight and axle characteristics of the population of coal trucks operating in the state.

Moreover, traditional methods for road maintenance planning assume a useful service life of 20 years. In a 1983 Kentucky Energy Cabinet study, *The Impact of the Coal Industry on Kentucky's Economy*, John D. Abell notes, "This and other assumptions are really only valid if the coal trucks manage to meet the proper weight requirements."[85] A. R. Romine, assistant state highway engineer for operations was quoted in the Courier Journal in 1979, "The effect of illegal (overweight) vehicles on the (state) highway program has been catastrophic. And it's getting worse. It's beyond our means to maintain a hard-surface road...in eastern Kentucky under those kinds of axle loads."[86] MACED (1986) points out that in the same news article, the director of the Division of Research at the Department of Transportation noted that one particular eastern Kentucky road designed to last 20 years had to be replaced after two years because of increased truck traffic. This observation is confirmed in the 1980 LRC study, "a pavement designed to handle truck traffic at the rate of one hundred 80,000 pound 5-axle semi-trailer trucks a day over a 20-year period will require substantial renovation after 2.4 years if used daily by one hundred such trucks weighing 120,000 pounds each."[87] If we assume that heavier trucks simply mean fewer loads to carry the same amount of coal, these figures still suggest that a 20-year road will need substantial renovation in four years.

Deferred costs, long term road plans and projects, and the methods by which some road work is funded mean that examining one year's numbers can mask costs as well as changing dynamics of the coal haul system and usage. A study of travel activity, vehicle types and loads from 1994 to 2005 offers a narrative for understanding the changing dynamics of road use and impact attributable to the coal industry. A series of regression models based on road type indicates that the total number of trucks on rural roads in the state declined while the proportion of those trucks classified as heavy/coal increased. Coal trucks with fewer axles became more prevalent at the same time that weights increased. Heavier weights on fewer axles, and particularly in the straight trucks most prevalent for coal haul use, cause more damage to road surfaces than the same weight spread across more axles or distributed in the trailer truck configuration. A six-axle, single trailer truck is the preferred configuration, but straight trucks remain common. While fewer trucks and a decline in the mileage comprising the coal haul road system might sound like a recipe for lowering costs, it is not clear that this is the actual impact.

Given the difficulties of accurately measuring road use, damages and cost allocation, we will present several models that produce varied estimates of the coal industry's share of annual road costs. Each model has problems. The first estimate updates the 1980 study published by the Kentucky Legislative Research Commission (LRC) and is based on a weighted average of four distinct cost allocation models. The second estimate adjusts MACED's 1986 figures to account for inflation. The MACED study was written by Richard Sims, an economist who was a primary author on the 1980 LRC study. The MACED estimate is the highest of our estimates as it reflects a very high level of deferred costs and projections for the cost of reducing the backlog. The state of Kentucky made investments to reduce this backlog during the 1980's and the coal haul road system is in better shape today than it was then. With this in mind, we acknowledge that this estimate is high, but we present it as a reminder that continued wear adds to the costs each year and that work done in the 1980's is now 20 years old. Between 1996 and 2003, the state spent $110 million to resurface U.S. 23.[88] On a road system as large and well-used as the coal haul road system there will always be mileage in need of significant reconstruction. The final set of calculations reflects more recent work on cost allocation and the extended weight system combined with assumptions found in early work on the issue. All of these estimates are based on assumptions and incomplete data, but the relative consistency of the estimates suggests that the cost of the coal haul road system to the state of Kentucky is significant.

To provide context for understanding coal haul road numbers, it is helpful to have some sense of how much it costs to do standard road work. Road maintenance and

reconstruction costs vary based on the extent of the damage and the standard to which roads must be built or reconstructed. Thin overlay costs are roughly $132,000 per mile of four-lane roadway; thick overlay is roughly five times larger and ranges in cost with an average of $661,420 per mile of four-lane roadway.[89] Coal haul roads must be built to carry weights over 80,000 pounds so their costs tend to be high.

Another way to provide some general sense of a base level to work from is to simply use what we know about general maintenance (this is simply crack filling, joint work and patches) and spread costs by miles (not vehicle miles traveled or axle loads). We compose an algebraic equation that assumes that costs are spread evenly across state mileage with coal haul road system costs averaging $397 per mile more for annual maintenance (KTC's 1995 figure of $300 per mile in coal counties adjusted for inflation). Accounting for debt service on coal road projects and state support to counties for maintenance of coal roads, this method suggests that based strictly on mileage and slightly higher basic maintenance costs, one could estimate coal's share of road fund expenditures at around $188 million. This figure does not account for variation in vehicle miles traveled, axle loads and associated frequent repair or the need to construct to higher standards. The model also does not account for deferred maintenance and long-term needs. We know this is not how monies are dispersed and that this estimate is too low, but it provides a base from which to understand coal haul road costs. This calculation suggests that estimates of state expenditures on the coal haul road system in the range of $200–$300 million per year are reasonable.

Legislative Research Commission 1980

Given the complexity of the road revenues and expenditures, one option for estimating the cost of the coal haul road system is to simply update the careful and inclusive study conducted by the LRC in 1980. The LRC hedged against overly conservative and overly generous estimates by using the mean of four estimates. The first estimate cited in the LRC study includes only maintenance costs for the coal haul road system and attributes 75% of those costs to the coal industry without accounting for accelerated deterioration on coal roads. Maintenance generally refers to joint repair and filling chips and potholes. This model estimates total costs of $ 28,030,500 ($99,313,690 in 2006 dollars). The second estimate assumes that all primary and secondary roads in the coal regions must be built to accommodate 80,000 pound loads. The model assumes these upgrades would be unnecessary without the coal industry and so subtracts an estimate of general repair costs from the estimated cost to improve roads to accommodate coal trucks and then adds an annual construction cost amount to reflect the added damage that would be done in the year in question. This model estimates total costs at $32,417,650 in 1976 dollars ($114,857,610 in 2006 dollars).

Estimate number three contains projections for total construction costs without added damage of the coal industry and subtracts that from total estimated reconstruction costs given the expected traffic patterns of the coal industry. The model estimates total costs at $31,229,800 ($110,648,990 in 2006 dollars). The final estimate presented in the LRC study includes construction, maintenance and reconstruction costs and assumes that the existing design of roads and shoulders would be sufficient if the roads carried no coal at all. Under that scenario, roads would need to be restored to existing design standards not intended to accommodate heavy loads. Estimate number four is quite high, $153,422,850 ($543,586,060 in 2006 dollars). The LRC admits that this estimate is likely too high, but also suggests that the other three estimates are too low. With this in mind, they took a weighted average that lent greater weight to estimates one and two and arrived at a total cost increment for the coal industry of $51.4 million.

If we simply adjust $51.4 million (1976) for inflation, the LRC models estimate total costs of $182.11 million. Simply updating the LRC estimate to reflect inflation accounts for increases in a variety of costs since 1976 (the data year for the 1980 study), but fails to account for other changes such as significant road construction that occurred in the 1980's; the passage and implementation of the extended weight decal system which increased the number of trucks carrying excessively heavy loads, while decreasing the overall number of trucks; and a decline in the number of mines and accompanying decrease in total mileage covered by the coal haul road system—a shift that shrinks the total road area subjected to coal haul wear, but may increase the severity of damage on the more concentrated coal haul road system.

MACED 1986

MACED updated figures from a 1983 Kentucky Energy Cabinet (KEC) report, *The Impact of the Coal Industry on Kentucky's Economy* (the most comprehensive estimate used in the LRC study) to arrive at an estimated cost of $243.8 million for 1985. The KEC model (authored by John D. Abell) considered only the 1,501 miles of road in coal counties rated as below adequate. The model did not include the 18.5 percent of coal roads not in coal-producing counties, nor did it include any maintenance costs for the 4,500 miles

of road in the coal haul system that rated adequate. KEC assumed that upgrades would cost $2 million per mile and that half of the upgraded roads would have a useful service life of 20 years and half 15 years before major improvements would be needed. Abell noted that service life assumptions were only valid if trucks met proper weight requirements. Based on a sense that these service life estimates were overstated, MACED adjusted the service life numbers to 17 years and 12 years. When we adjust for inflation, MACED's 1985 estimate totals $456.8 million for FY 2006.

More recent figures on construction, reconstruction, repair and maintenance costs suggest that the $2 million figure is high, but if you plan on standard annual maintenance plus construction, reconstruction and bridge work throughout the coal haul road system as well as work to accommodate increased weight limits in the extended weight system, then these figures look reasonable.

Heavy Trucks And Cost Increments For FY 2006

Pavement construction, reconstruction and repair are expensive and even more so when roads must meet specifications for carrying heavy trucks. The Kentucky Transportation Center (1995) reports overlay costs of $100,000 ($132,280) per mile for a four-lane roadway and an average $500,000 ($661,420 in 2006 dollars) per mile for thicker overlays. Even roads that do not require pavement overlays will still require annual maintenance including crack and joint filling, patching, chip sealing and pothole repair. Costs for annual maintenance are also higher in coal producing areas than in the rest of the state (an average $397 higher per mile). [90]

The extended weight (EW) system adds costs above and beyond the already higher costs resulting from coal truck damage throughout coal producing and impacted counties. The Kentucky Transportation Center estimates that a full one third of the added expense associated with the EW system are attributable to overweight trucks' (decaled or not) use of the base system (meaning roads in coal producing and impacted counties that are not designated as part of the EW system). This is not surprising as EW roads are not necessarily connected to one another in a continuous system and roads are not designated as EW until after state records indicate more than 50,000 tons of coal transport in a year. In other words, EW trucks do not just travel on the EW system.

An ideal overlay rotation would have the state placing new overlay on one-fourth of the coal haul road system each year. To support loads over 80,000 pounds, the coal haul road system requires thicker overlays than other roads. If we apply the average cost of $661,420 per mile of four-lane road to the coal haul road system, assuming that two lane roads cost about half as much (though they are likely to require significant should work), then with 82.2 percent[91] of coal haul road miles as two-lane rural roads and the other 17.8 percent of coal haul road miles as four-lane roads, the total estimated cost is around $364.6 million. If 75 percent of these costs are attributable to coal (based on Abell's estimate), then we can attribute $273.5 million in 2006 dollars to the coal industry for FY 2006. This scenario is based strictly on cost and some estimate of likely need for the road work based on coal truck activity and damage data. But we know that the state is likely to use less expensive maintenance to help defer costs to a later date. Subsequent models are based on actual road spending for FY 2006 and are more likely to reflect state budget constraints and the decision to defer costs. Keep in mind, however, that any year's expenditures will include some expenses that were deferred in prior years.

The remaining models use vehicle miles traveled (VMT) as a multiplier for cost allocation. VMT covers some of the added costs associated with higher traffic on these roads than would be there without the coal industry, but do not incorporate the difference between one mile of coal truck travel and one mile of passenger car travel. Heavy trucks cause significant damage to roads whether they are coal trucks or not. The extended weight exception to weight limits means that coal trucks carry heavier loads than other trucks and their wear and tear tends to be geographically concentrated. The types of trucks and axle configurations of many coal trucks cause more damage than the large five or six axle trailer trucks that traverse the interstates with heavy loads of consumer goods. These trucks no doubt cause significant damage, but their travel patterns more often include federally maintained portions of the interstate system and more axles mean a better distribution of weight to reduce impact on the roads. The axle loads of straight trucks, often traversing mountainous rural roads in the coalfields, have a disproportionate impact on state costs.

The KTC found that the extended weight coal haul road system carried 19% of vehicle miles traveled (VMT) on state maintained roads. As noted, use of VMT for cost allocation is somewhat problematic in that it assumes that road impact and damages are spread proportionately across the state maintained road system based on miles traveled. Coal haul trucks incur a level of damage that exceeds their share of vehicle miles traveled. Equivalent axle loads for coal

trucks in 2006 varied from 2.275 to 4.299 per axle with number of axles ranging from three to six. Usually the larger number of axles leads to a smaller equivalent axle load as the weight burden is distributed across the road. Smaller trucks with fewer axles tend to have higher axle loads and cause more damage.

Even though the miles of road in the coal haul road system have declined as have the number of mines, the amount of coal transported remains high. Fewer trucks are doing the work and are often carrying heavier loads, but the reduction in number of trucks and miles of road does not lower the burden on the roads. Concentrated hauling of heavier loads means similar levels of damage and demand for road construction, reconstruction and repair. In addition, the extended weight system generates significant demand for bridge reconstruction as many of the bridges in the EW system are not built to carry 80,000 pound loads, much less 120,000 pound or heavier loads. A bridge built for 50,000 pound loads may be sandwiched between two segments of road built to an 80,000 pound standard.

These problems aside, if we use VMT as a crude estimator and extrapolate out to include the entire coal haul road system and we account for somewhat lower traffic on non-EW coal haul roads (we use KTC figures for coal county base system traffic) these roads carry roughly 23.9 percent of travel on state maintained roads. Using VMT to determine a share of costs that assumes administrative, capital and maintenance costs vary by VMT without regard to vehicle weights, the coal haul road system is responsible for $273.6 million of spending in the FY 2006 state budget. Following on earlier studies, we estimate that 75 percent of road costs on roads that carry coal are attributable to coal hauling (given that coal hauling can reduce service life from 20 years to two to four years, this seems like a reasonable estimate). Using this method, we estimate coal's share of maintenance costs on the coal haul road system to be $205.2 million.

This estimate represents a reasonable estimate of many road-related costs. However, the method underestimates capital expenditures for grade, drain, surfacing and resurfacing work and maintenance and operations spending on structures.[92] Without definitive information on axle configurations for the 3,000-4,000 coal trucks operating in the state and the mileage and payload of those trucks, it is difficult to arrive at accurate cost allocation estimates. These complexities are exacerbated by the fact that we know that many trucks underreport activity or operate off the radar altogether.

In addition, expenditures specific to the Resource Recovery Road System include a state allocation of $1,003,000 to the counties to help cover costs associated with county maintained roads that are part of the coal haul road system and $38,838,600 in Debt Service for prior construction on the Resource Recovery System. If we take these funds out of the road fund before calculating coal's share of remaining road fund expenses and then add them back in on top of the coal industry's share of all other expenses, then we attribute $237.9 to the presence of the coal industry.

State record-keeping and the inherent limits to regulatory control and monitoring mean that we cannot provide precise figures on the coal industry's share of road expenses to support their use of the roads for hauling coal and equipment. Our purpose is to provide some information that sheds light on the range of costs associated with the industry's presence so that we might better assess the state's role in supporting the industry.

The coal haul road system was subject to a lot of discussion in the late 1970's and 1980's and the extended weight system and cost allocation modeling are addressed in periodic studies commissioned by the state and completed by the Kentucky Transportation Center. This work is very helpful in understanding the components of road expenses and the complexity of determining sound methods for cost allocation without complete information. Given the myriad issues surrounding cost allocation, we thought it best to follow the LRC's (1980) lead and provide a few estimates pointing out the distinct strengths and weaknesses of each. If we take the average of the three models above (model one based on regular thick overlay rotation, model two based on VMT and model three including VMT and debt service and support for county maintenance of coal roads), we arrive at an estimated coal haul road cost of $238.9 million for FY 2006.[93]

Endnotes

1 Jepsen, Christopher, Kenneth Sanford and Kenneth R. Troske. 2008. "Economic Growth in Kentucky: Why Does Kentucky Lag Behind the Rest of the South?" Lexington, KY: Center for Business and Economic Research.

2 US Census Bureau. 2007 Poverty and Median Income Estimates – Counties.

3 Cheves, John. 2009. "Coal Tax Won't Take a Hike." *Lexington Herald-Leader* (May 6): A1.

4 We use the fiscal year 2006 severance tax revenue figure presented in the state "General Fund Detailed Revenue Estimate" of the Consensus Forecasting Group (CFG) for January 31, 2007. *The Budget of the Commonwealth 2006-2008* reported figures from the 2005 Consensus Forecast for their Severance Tax break downs and their coal severance tax revenue figure was $215,687,000. *Kentucky Coal Facts 2007-2008* reported 2006 coal severance tax revenues of $221,416,062. The CFG figure of $224 million should be the most recent and therefore most accurate reflection of actual collections for FY 2006. These funds do not all go into the General Fund. For 2006, the state used $1,318,500 for the Osteopathic Medicine Scholarship Program (KRS 164.7891) and $1,000,000 went to the Trover Clinic. The state set aside $19 million for Workers' Compensation in the General Fund. Remaining funds totaled $203,171,611, of which 50% is returned to coal producing and impacted counties through the Local Government Economic Assistance Fund and the Local Government Economic Development Fund. A total $101,585,806 should have been distributed through these programs. We do not address local and county revenues and expenditures associated with coal in this report so the details of these disbursements are not included. Coal Severance Revenues remaining in the General Fund totaled $120,585,806. We count all of the severance tax revenue funds in our calculations and do not include disbursements from the coal severance tax as expenditures. If we include only those revenues that remain in the General Fund after disbursements, then the net impact of coal revenues and expenditures on the general and road fund budgets is –$217,952,595.

5 Kentucky Office of Energy Policy Division of Fossil Fuels & Utility Services and the Kentucky Coal Association. *Kentucky Coal Facts 2007-2008*, 10th edition. Frankfort, Kentucky: Commonwealth of Kentucky and the Kentucky Coal Association, p. 15. *http://www.kentuckycoal.org/documents/CoalFacts08.pdf*. This represents an average collection of 84.5% of the amount due.

6 The coal industry does not own many buildings in the Commonwealth, but they do pay taxes on mining equipment. We were unable to obtain industry level figures for property tax revenue. Coal-related state property tax revenues (except the unmined minerals tax) were estimated on the assumption that property taxes are proportionate to coal's share of employment in the state. This means that revenues from the industry's property taxes (except unmined minerals taxes) are reflected in the property tax figures that appear in the Direct Employment section of the report.

7 Office of State Budget Director. *2006-2008 Budget of the Commonwealth*, Volume 1, p. 27.

8 *Kentucky Coal Facts 2007-2008*, p. 15.

9 *Kentucky Revised Statutes*, 177.9771."Extended weight coal or coal by-products haul road system."

10 *KRS* 186.050 (3).

11 Calculations of truck registration revenue are based on the number of trucks that purchased extended weight decals, the extended weight registration fee and Kentucky Transportation Cabinet estimates of the portion of trucks paying full registration, the portion paying partial and the percent of miles logged in Kentucky for those registered in multiple states. The Kentucky Transportation Cabinet provided these estimates via e-mail correspondence with the author.

12 *KRS* 177.9771.

13 The figure for extended weight decal revenue comes from the Kentucky Transportation Cabinet. 2008. E-mail to author, September 30. The amount is slightly higher than that reported in the Road Fund Revenue Estimate of January 31, 2007. The discrepancy simply reflects that the numbers were not final at the time of the CFG report. The Consensus Forecasting Group. 2007. "Road Fund Revenue Estimate," January 31.

14 Pigman, Jerry G., Joseph D. Crabtree, Kenneth R. Agent, R. Clark Graves and John A. Deacon. 1995. *Impacts of the Extended-Weight Coal Haul Road System*. Frankfort, KY: Kentucky Transportation Cabinet.

15 Data limitations make it difficult for us to isolate fuel and vehicle tax revenues from the coal industry. We know that coal trucks, particularly large ones, are able to take advantage of some exemptions, but we are unable to be more precise in our estimates. We follow the method used in MACED's 1986 study and estimate coal's total share (corporate and coal employment) as proportionate to coal employment as a share of total state employment.

16 Thompson, Eric C., Charles Haywood and Mark C. Berger. 1996. "The Effects of the Kentucky Coal Industry on the Economy of the Commonwealth." Lexington, Kentucky: Center for Business and Economic Research.

17 Thompson, et al. 1996, p. 10.

18 Consensus Forecasting Group. 1/31/2007. *General Fund Detailed Revenue Estimate*. The revenue estimate for fiscal years 07 and 08 reports actual revenue for FY 2005-2006.

19 Reuters Benchmarks. Retrieved 7/11/2008 (http://www.reuters.com/finance/industries/benchmarks?industryCode=50111).

20 *Kentucky Coal Facts 2007-2008*, p. 16.

21 Sims, Richard. 1986. *A Public Sector Income Statement for the Coal Industry in Kentucky, 1985-2000*. Berea, KY: MACED. Sims (1986) used a profit margin of 3.4 percent as reported for 1984 coal industry profits in *Forbes* magazine. A 199.

22 Corporate income tax in Kentucky varies for different portions of a firms income. During FY 2006 for those subject to standard corporate income tax, the entity must pay the greater of the following:4% of the first $50,000 of taxable net income; 5% of taxable net income over fifty thousand dollars up to $100,000; and 7% of taxable net income over one hundred thousand dollars; or "an alternative minimum calculation of an amount equal to the lesser of the amount computed under" a subsequent section of KRS 141.040

23 Office of the State Budget Director. *Tax Expenditure Analysis: Fiscal Years 2008-2010,* p. 21.

24 *KRS* 139.480 (2) as cited in Office of the State Budget Director. Tax Expenditure Analysis: Fiscal Years 2006-2008. Frankfort, KY: Commonwealth of Kentucky, p. 136.

25 *Tax Expenditure Analysis: Fiscal Years 2006-2008*, p. 136.

26 U.S. Department of Energy, Energy Information Administration. "Kentucky State Energy Profile," 2006 data. Retrieved 08/13/2008 (http://tonto.eia.doe.gov/state/state_energy_profiles.cfm?sid=KY).

27 *KRS* 141.010(12)(d)

28 *KRS* 141.041, effective 1984 as summarized by the Office of the State Budget Director in the *Tax Expenditure Analysis 2008-2010*.

29 *KRS* 141.0405, effective 2000.

30 OSBD. *Tax Expenditure Analysis Fiscal Years 2006-2008*, p. 37. Retrieved 04/04/2009 (http://www.osbd.ky.gov/NR/rdonlyres/9CA23725-4087-4B41-8B46-953B7F0A5109/0/TaxExp20062008Book.pdf,).

31 KRS 143.010(6)(11), effective 1978 as cited in *Tax Expenditure Analysis Fiscal Years 2006-2008*, p. 50.

32 This figure excludes the sales tax exemption for residential utilities and the Energy and Energy Producing Fuels exemption that is shared among fuel sources (though mostly benefitting coal), but includes the coal severance tax expenditures.

33 "Policy Note," *Budget of the Commonwealth 2006-2008*, Volume 1, pp. 70-71.

34 In addition to the General Fund monies that we include, the following restricted funds are appropriated in support of the industry: *Included in the* Budget of the Commonwealth *is $3.5 million in Restricted Funds in each year of fiscal biennium 2006-2008 for research grants. These funds will originate from the Local Government Economic Development Fund Multi-county Fund (coal severance tax). The General Assembly directed this money to be used for research projects relating to clean coal, new combustion technology, thin-seam coal extraction research, synthetic natural gas produced from coal through gasification processes, and the development of alternative transportation fuels produced by processes that convert coal or biomass resources or extract oil from oil shale and shall be targeted solely to Kentucky's Local Government Economic Development Fund-eligible counties.* "Policy Note," *Budget of the Commonwealth 2006-2008,* Volume 1, pp. 70-71.

35 "Policy Note." *Budget of the Commonwealth 2006-2008*, Volume 1, pp. 70-71.

36 These numbers were provided by the Provost Budget Office at the University of Kentucky via e-mail correspondence.

37 Pigman et al. 1995, p. 31.

38 Abell, John D. 1983. *The Impact of the Coal Industry on Kentucky's Economy*. Frankfort, KY: Kentucky Energy Cabinet, September.

39 We used the 2007 coal haul data (reporting on 2006 activity) to determine what portion of the coal haul roads are two-lane and what portion are four-lane. We coded all Kentucky and US highways as two-lane and all interstates and parkways as four-lane. Based on mileage per road segment, we found that 82.2 percent of coal haul road mileage is two-lane roads and 17.8 percent is four-lane.

40 *Kentucky Coal Facts 2007-2008*, p. 12. Using total production data along with employment data, we estimate that the industry provides an additional 234 jobs in those counties for which employment is not reported to protect the privacy of individuals and companies.

Note: Mining employment figures provided by the Kentucky Coal Facts report do not include those employed in administrative and professional services in Lexington and Louisville and our calculations based on production do not address these missing data.

41 *Kentucky Coal Facts 2007-2008*, p.12.

42 Labor force and employment data for 2006 come from The U.S. Department of Labor Bureau of Labor Statistics Annual Averages (http://www.bls.gov/lau/#tables), "Labor force data by county."

43 *Kentucky Coal Facts 2007-2008*, p. 10. Note: Employment number is slightly larger on page 10. We will use the number on which wage figures are based for the sake of consistency. The larger figure may reflect some of the employment that is not included in the wage data for proprietary reasons. Counties with less than three employers or one employer with 80% of the total county miner workforce were withheld to avoid disclosure of individual company data. These counties include: Boyle, Clark, Elliott, Fayette, Greenup, Hancock, Jackson, Jefferson, Lee, McCreary, McLean, Mason, Ohio and Pulaski. *Coal Facts* report authors suspect that multi-county mining employment contributes to some counties being under reported and others being over reported. We found production data for 2006 for additional counties not mentioned in *Kentucky Coal Facts 2007-2008*. The U.S. Department of Energy, Energy Information Administration reported coal production in 2006 in Christian, Morgan and Owsley counties.

44 Population Division, U.S. Census Bureau. *Table 1: Estimates of the Population by Selected Age Groups for the United States and States and for Puerto Rico: July 1, 2006 (SC-EST2006-01)*, released May 17, 2007.

45 For this report, coal producing counties are defined as those that reported coal severance tax revenues for fiscal year 2006 as presented in *Kentucky Coal Facts, 2007-2008*, 10th edition.

46 If we use coal counties that paid severance tax in FY 2006-2007, then the percentage of the population employed directly in coal is 1.87. If we use counties that report employment or production or are named as counties where production occurred, but data are not published for proprietary reasons, then those employed in mining comprise 1.61 percent of the population.

47 *Kentucky Coal Facts 2007-2008*, p. 10. Coal county designation determined by coal severance tax revenues by county. Calculations of total working age population by county based on data from the Population Division, U.S. Census Bureau. *County Characteristics Resident Population Estimates*. Retrieved 08/20/08 (http://www.census.gov/popest/counties/asrh/CC-EST2007-agesex.html).

48 Direct impact as reported in *Kentucky Coal Facts 2007-2008*.

49 In an attempt to account for those counties excluded from employment and wage data (as noted above), we use county and state level production data along with available wage and employment data to calculate likely aggregate wages and employment for the excluded counties.

50 Output numbers appear to reflect value of total production for 2006—there is no reason to believe that any output data are excluded from this aggregate figure so it requires no adjustment.

51 *Kentucky Coal Facts: 2007-2008 Pocket Guide*, p.12. *http://www.kentuckycoal.org/documents/CoalFacts08.pdf*.

52 *KY Coal Facts 2007-2008* reports $1,034,834,951 in total wages for 25 coal producing counties. Counties with less than three employers or one employer with 80% of the total county miner workforce were withheld to avoid disclosure of individual company data. These counties are as follows: Boyle, Clark, Elliott, Fayette, Greenup, Hancock, Jackson, Jefferson, Lee, McCreary, McClean, Mason, Ohio, and Pulaski. Based on calculations of income by output for included counties and total output for the state, we estimate total earnings of$1,048,533,659. Note: Direct mining employment does not include most of the administrative/professional employees of coal companies located in Kentucky's metropolitan areas of Fayette and Jefferson counties and does not include private services.

53 With 17,669 people employed and a total of $1,034,834,951 paid in wages by the mining industry, average wages are roughly $58,000 per year. *Kentucky Coal Facts: 2007-2008*.

54 Institute on Taxation and Economic Policy. February 2005. *The ITEP Guide to Fair State and Local Taxes*. Washington, D.C.: ITEP, p. 12.

55 Office of Employment and Training. May 2008. "2006 Kentucky Total and Nonwhite Population and Labor Force Data by County." Frankfort, KY: Commonwealth of Kentucky. Retrieved 10/13/2008. (http://www.workforcekentucky.ky.gov/admin/uploadedPublications/340_2006_Total_and_NonWhite.pdf). See endnote 6 for an explanation of industry inclusion in the state property tax figures.

56 In keeping with the models used in *Kentucky Coal Facts 2007-2008*, we use the RIMS II (Regional Impact Modeling System) multipliers for the Appalachian Coal Industry.

57 Thompson et al. 1996. Dr. Charles Haywood updates the figures for the annual *Kentucky Coal Facts* report.

58 Direct impact as reported in *Kentucky Coal Facts 2007*.

59 In an attempt to account for those counties excluded from employment and wage data (as noted above), we use county and state level production data along with available wage and employment data to calculate likely aggregate wages and employment for the excluded counties.

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64 Johnson, Carla. 2008. "Trace arsenic in water may be linked with diabetes." *Washington Post* (August 20).

65 Schneider, Conrad. 2004. *Dirty Air, Dirty Power: Mortality and Health Damage Due to Air Pollution from Power Plants*. Boston, MA: Clean Air Task Force.

66 Sims, Richard G. 1980. *The Fiscal Impact of the Kentucky Coal Industry*. Frankfort, KY: Legislative Research Commission, p. 14.

67 Editorial Board. 2008. "Lower coal-truck weight limit." *Lexington Herald-Leader* (August 13): A12.

68 Figures on Special Fund Assessment rates for 1989-2009. Retrieved 04/16/2009 (http://www.kwcfc.ky.gov/quarterly/ratehistory.htm).

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70 Executive Director of the Workers' Compensation Funding Commission. Wilhite, J.R., Executive Director, Kentucky Workers' Compensation Funding Commission. JR.Wilhite@ky.gov. 16 April 2009. Coal Industry and Workers' Comp [e-mail to Melissa Fry Konty (mfrykonty@maced.org)].

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73 Cheves, John. 2009. "Coal Tax Won't Take a Hike." *Lexington Herald-Leader* (May 6): A1.

74 *Kentucky Official Coal Haul Highway System 2007* report includes data on coal transported in Calendar Year 2006. Data provided by Transportation Cabinet upon request.

75 *Kentucky Coal Facts 2007-2008*.

76 *Kentucky Official Coal Haul Highway System 2007*.

77 Pigman, et al. 1995, p. vii.

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80 Pigman, et al. 1995.

81 Harvey, Curt. 1993. "Appendix A: Issues Surrounding the Trucking of Kentucky Coal in the 1990's." Pp. 77-87 in Pigman, Jerry, J, Crabtree, K. Agent, C. Graves and J. Deacon. 1995. "Impacts of the Extended-Weight Coal Haul Road System." Lexington, KY: Kentucky Transportation Center, University of Kentucky.

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89 Pigman, et al. 1995, p. 31, with numbers updated to 2006 dollars.

90 Pigman, et al. 1995, p. 31.

91 We used the 2007 coal haul data (reporting on 2006 activity) to determine what portion of the coal haul roads are two-lane and what portion are four-lane. All Kentucky and US highways are designated two-lane and all interstates and parkways are coded as four-lane. Based on mileage per road segment, we found that 82.2 percent of coal haul road mileage is two-lane roads and 17.8% is four-lane.

92 Osborne, Monica L., Jerry G. Pigman, and Eric Thompson. 2000. "Highway Cost Allocation Update." Lexington, Kentucky: Kentucky Transportation Center, University of Kentucky, Table 3, p. 23.

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