The Economics of Coal in Kentucky: Current Impacts and Future Prospects

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MACED
Mountain Association for Community Economic Development

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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.

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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 Economics of Coal in Kentucky: Current Impacts and Future Prospects

Introduction

The coal industry has been a mainstay of Kentucky's economy for more than a century. In eastern Kentucky in particular, mining jobs have provided good wages and opened up economic opportunities for generations of Kentucky families, bringing prosperity to some in a region with historically high poverty rates. Today, coal remains an iconic symbol of the state's economy. However, recent and current trends tell a less optimistic story about the economic impact of and prospects for the mining industry in Kentucky.

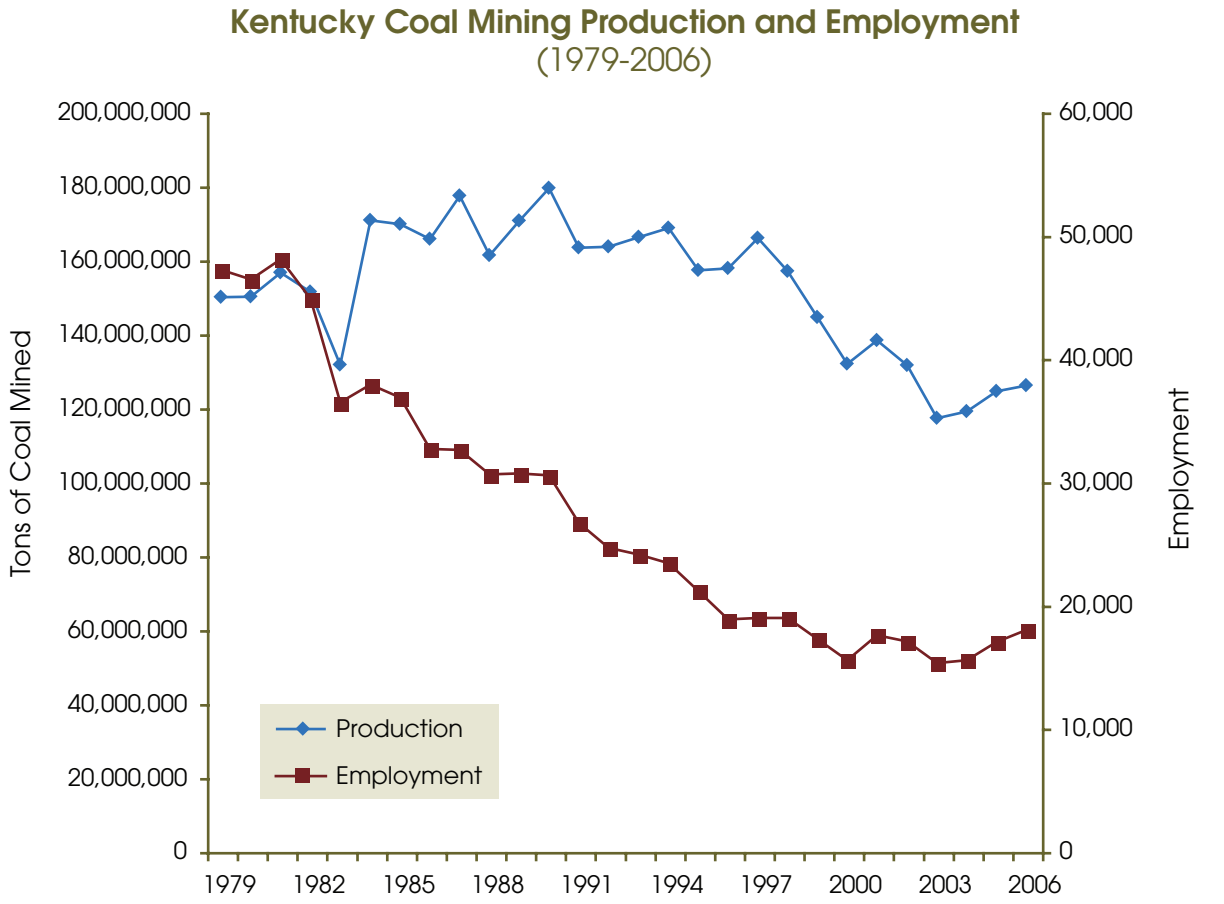
Coal employment has been declining in the state for many years. Coal maintains a significant economic presence in some eastern Kentucky counties, but makes up only one percent of state-wide employment. Kentucky's coal-producing counties are among the poorest in the United States. The presence of the industry has helped Kentucky maintain low electricity prices, but low prices do not correlate with stronger state economies. And the price of coal-fired power will rise as older coal-fired power plants are retired and the cost of carbon emissions is included in the price of coal.

The competitiveness of Kentucky coal is in decline relative to western U.S. coal due to higher production costs, diminishing recoverable reserves and, for western Kentucky, higher sulfur content. Greater awareness of the impacts of coal on the land and the environment brings new challenges for the coal industry. Growing concerns about climate change mean pressure on the coal industry to significantly reduce emissions—a development that will further increase production costs. While the future of the coal industry in Kentucky is uncertain, it is clear that significant change is coming. Here we provide a snapshot of the current economic impact of the coal industry in Kentucky, the competitiveness of Kentucky coal and prospects for the future.

I. The Economics of the Coal Industry in Kentucky

Mining Employment and Production Trends

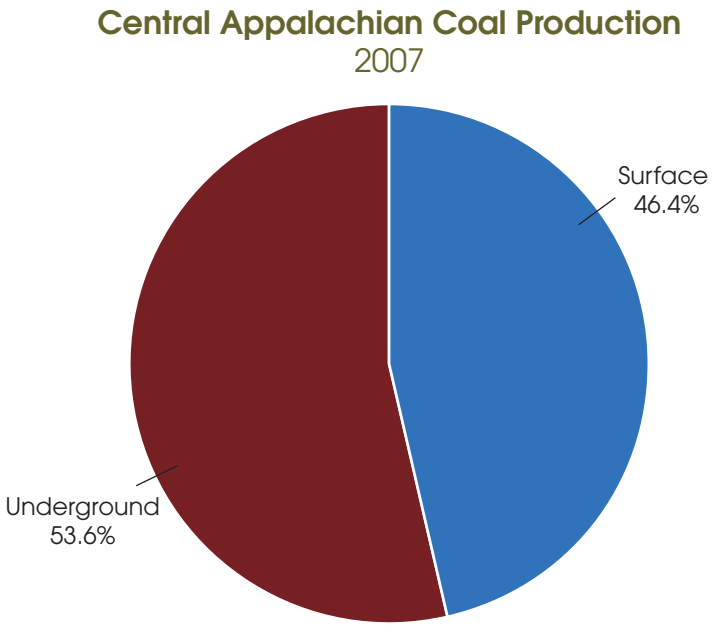
The amount of coal mined in eastern Kentucky has fluctuated since the late 1970s, dropping briefly in the early 1980s, rising sharply and remaining high through the late 1980s and mid 1990s, then declining somewhat in the late 1990s. Despite these fluctuations, coal production in 2004 was only slightly lower than it was in 1979. By contrast, mining employment in eastern Kentucky declined dramatically over the same period. This is primarily the result of technological innovations that enabled more coal to be mined with fewer workers (see Figure 1).



Sources: Kentucky Office of Energy Policy, Kentucky Coal Association, Energy Information Administration

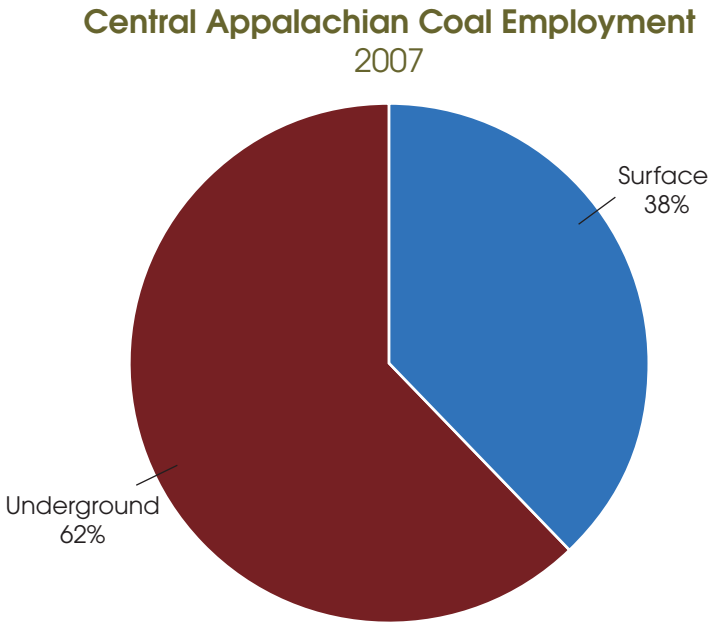
Figure 1: Mining Employment and Production

One reason for this drop in mining employment is the increase in surface mining in Appalachian Kentucky. Cost varies significantly by mine type, with deep or underground mining incurring higher cost than surface mining or mountaintop removal. Surface mining and mountaintop removal are more cost-effective for producers. As noted in a 2006 article on the competitiveness of coal: "Although both contour strip mining and underground mining were common throughout Central Appalachia in the past, there has been a significant decline in the amount of contour stripping being done and a significant increase in the development of large, mountaintop removal mines during the past 25 years. This is a function, in part, of economies of scale and, in part, of the increasing cost of contour stripping."[1] As a result of this shift, while nearly half of Central Appalachian coal currently comes from surface mining, these mines account for only about 38 percent of mining jobs in the region (see Figure 2 and Figure 3).



Source: Energy Information Administration

Figure 2: Central Appalachian Coal Production



Source: Energy Information Administration

Figure 3: Central Appalachian Coal Employment

In 1979, coal mining provided over 50,000 jobs in Kentucky, with nearly 36,000 of those jobs located in the Appalachian region of the state. By 1992, mining jobs in eastern Kentucky had fallen below 20,000, and by 2004 only 13,000 remained. Mining jobs have increased somewhat in the last few years due to rising global demand for coal only to decline due to the recession. But temporary booms in employment have not negated the overall downward trend in mining jobs over the last three decades. Mining employment currently makes up only one percent of total nonfarm employment in Kentucky (See Figure 4).[2]

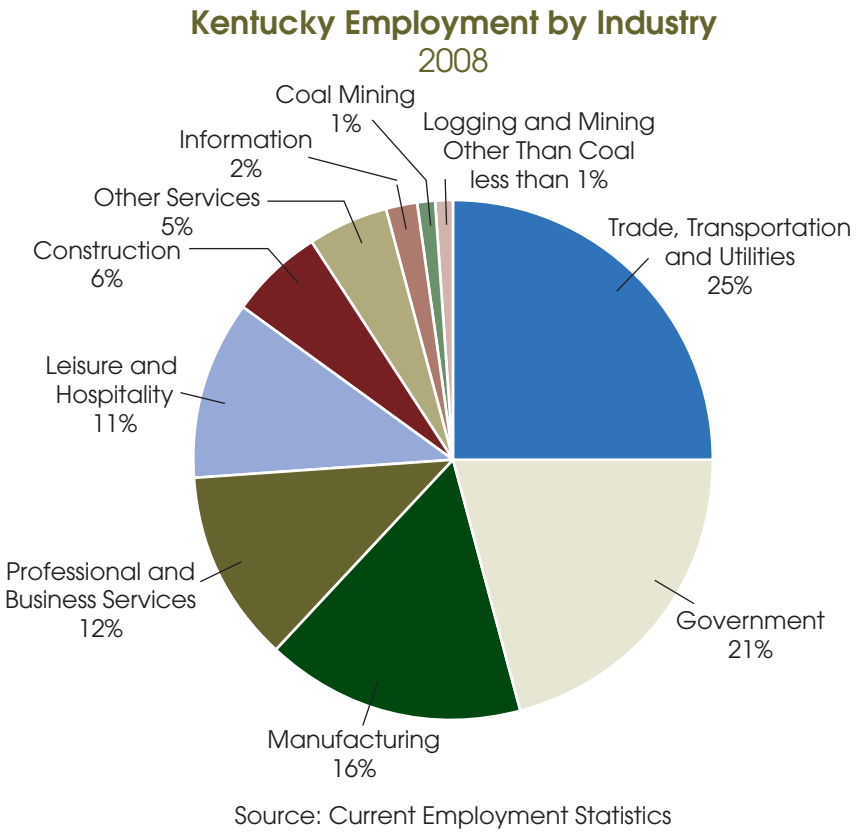
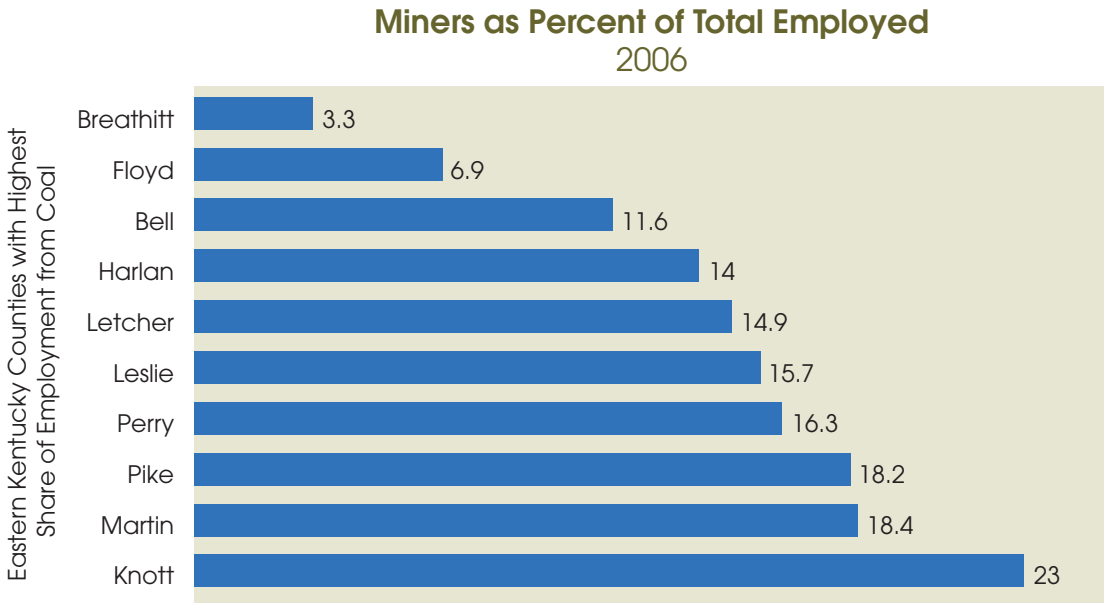


Figure 4: Kentucky Employment by Industry

Economic Impact of Mining Wages

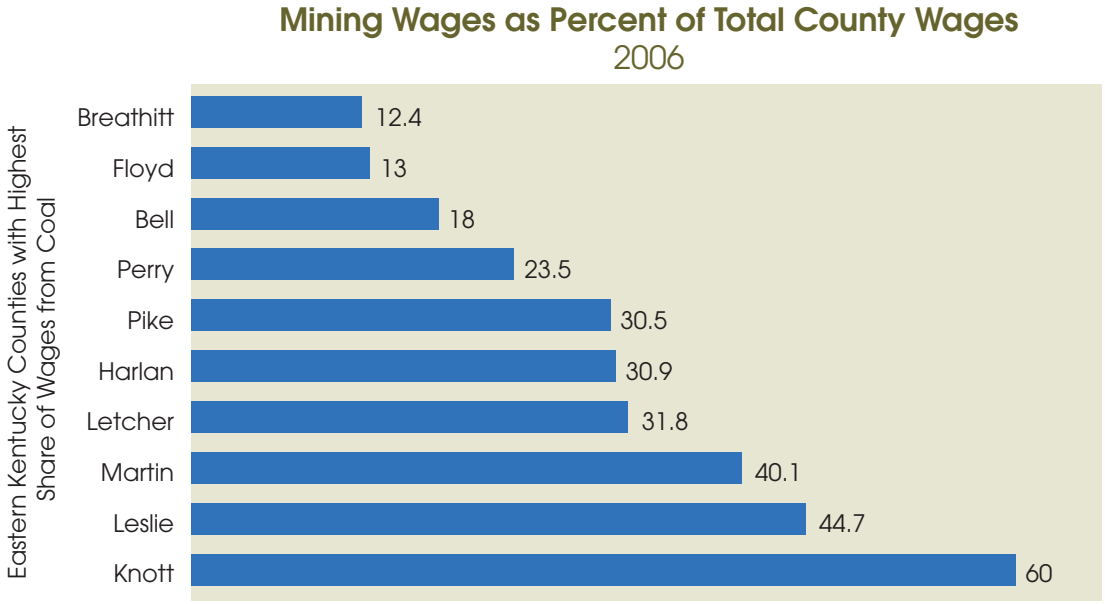
Despite its overall decline in the region, mining is still a significant industry in certain counties—particularly in eastern Kentucky. Mining accounts for over 10 percent of total employment in eight eastern Kentucky counties, peaking at 23 percent in Knott County (see Figure 5).



Sources: Kentucky Office of Energy Policy, Kentucky Coal Association, Bureau of Economic Analysis

Figure 5: Miners as Percent of Total Employed

When we consider mining wages as a percent of total county wages, it is clear that mining's economic role in some counties exceeds its employment impact. In 2006, for example, mining wages accounted for 60% of all county wages in Knott County, 44.7% in Leslie, and 40.1% in Martin (see Figure 6). As a result, even relatively small changes in the mining industry have particularly strong effects on these communities.



Sources: Kentucky Office of Energy Policy, Kentucky Coal Association, Bureau of Economic Analysis

Figure 6: Mining Wages as Percent of County Wages

Economic Status of Coal-Producing Counties

To put coal employment in perspective, however, it helps to look at unemployment in coal counties. Even though mining jobs make up a large percentage of employment in these counties, the actual number of mining jobs is still relatively small. Mining accounts for a large percentage of county wages not because mining jobs are so numerous, but because other jobs are so scarce. The unemployment rate in Central Appalachia is much higher than the rest of the nation, and eastern Kentucky's unemployment rate is among the highest in Central Appalachia. The percentage of working-age adults who are not employed is far higher than the official unemployment rate, which only counts those who are actively seeking employment.[3] So while coal is a significant employer in some counties, the industry only provides jobs for a small fraction of the working age population in those counties (see Figure 7).

This combination of extremely high unemployment and heavy economic dependence on a single industry leaves Kentucky's coal-producing counties in a vulnerable position. While coal employment has brought decent jobs and wages to a region in desperate need of employment opportunities, eastern Kentucky remains one of the most economically distressed regions in the country. The poverty rate in Appalachian Kentucky was nearly double that of the nation in 2000 (see Figure 8).

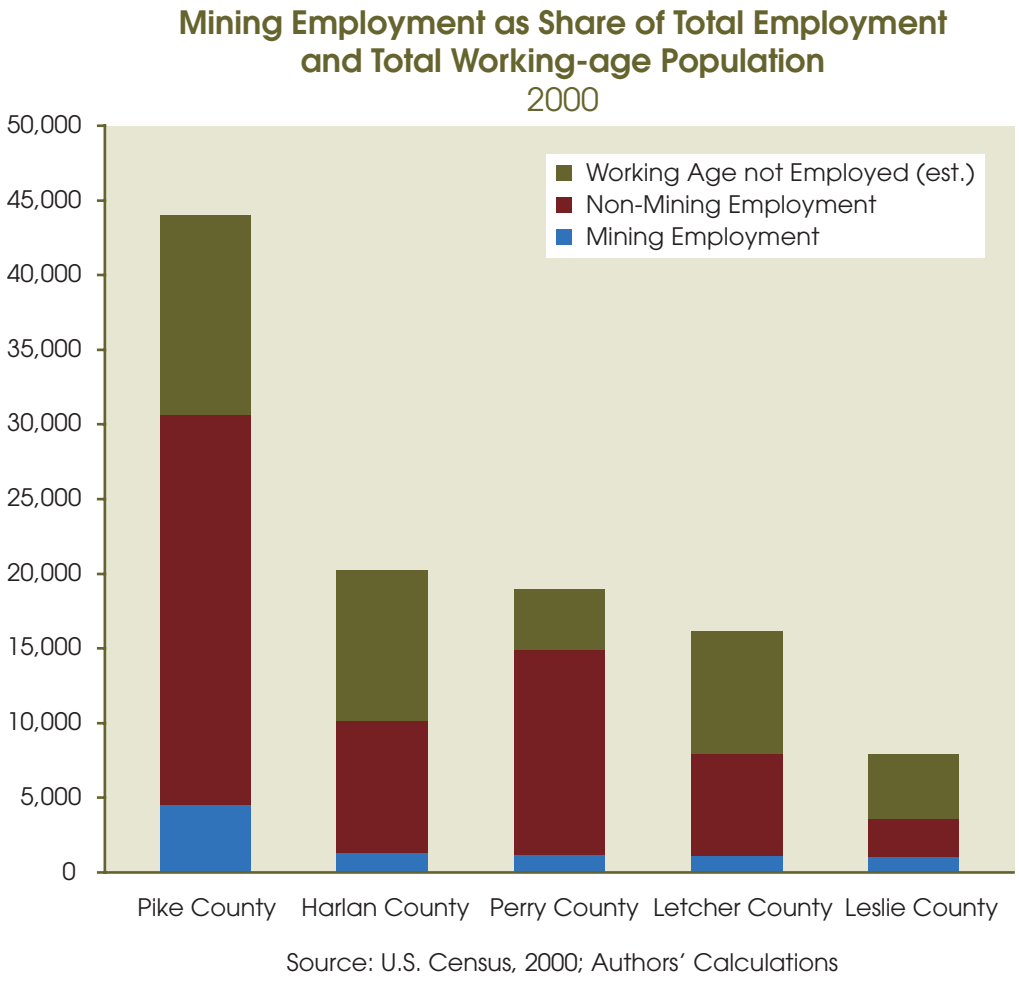


Figure 7: Mining Employment as Share of Total Employment

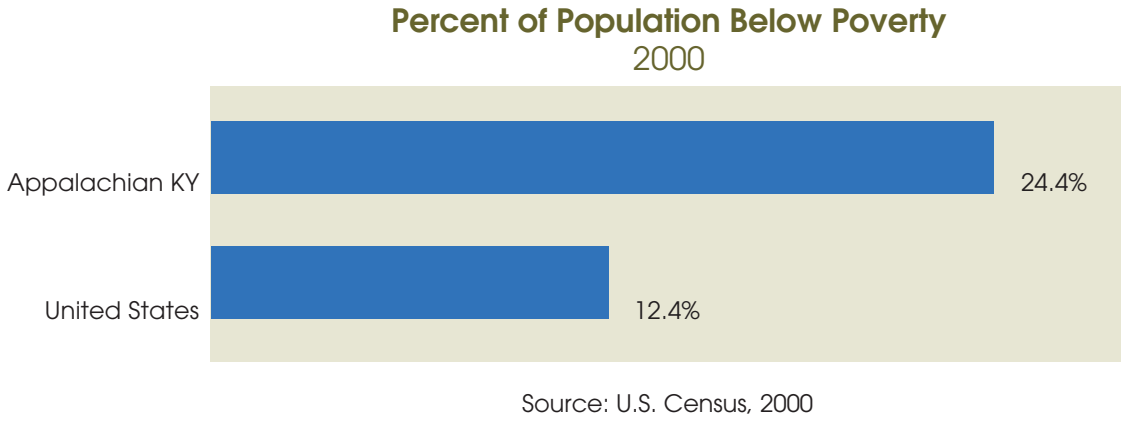


Figure 8: Percent of Population Living Below Poverty

Even within eastern Kentucky, coal-producing counties are among the most economically distressed counties. The top coal-producing counties have some of the highest poverty rates in the region (see Figure 9). Of the top eight coal-producing counties in eastern Kentucky, all but one (Pike County) have a higher poverty rate than Appalachian Kentucky as a whole. So while mining employment is extremely important as a source of income for individuals in coal-producing counties, the benefits of these jobs do not translate into prosperity for the region. A 2001 study on the future impacts of the coal industry in Kentucky concluded: "In some counties, coal mining represents such a significant part of the economy that even small changes in demand and output often have a dramatic impact on the well-being of the residents."[4] With the Central Appalachian coal industry in long-term employment decline, the region needs other sources of income to offset losses and promote economic development.

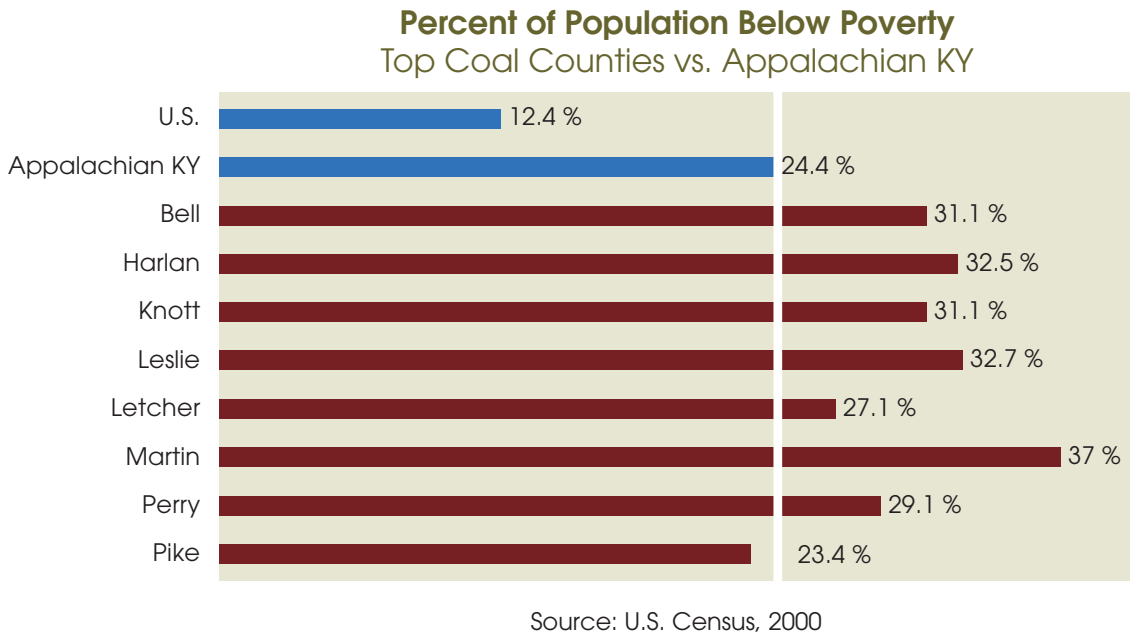


Figure 9: Population Below Poverty, Top Coal Counties

Electricity Prices

Coal is often viewed as a key to economic development in Kentucky—not only for the jobs it creates, but also because of the low electricity rates it provides. Kentucky has had some of the cheapest electricity in the nation, making it more attractive to industries considering locating in the state. Because the cost of electricity is one factor in attracting outside industry, policy-makers and industry representatives often argue that cheap electricity will translate into better economic development and (ultimately) economic prosperity. In Kentucky, low prices help attract energy-intensive industries to the state, from aluminum smelters in western Kentucky to automotive plants in central Kentucky.

Electricity prices, however, do not appear to be correlated with a higher standard of living. Indeed, states with the lowest electricity prices also have some of the lowest per capita income rates in the nation (see Figure 10). While electricity prices are not the underlying cause for these disparities, the correlation between low energy rates and low per capita income suggests that low energy prices do not produce significant long-term economic development results. Moreover, historically low-cost electricity has led to underinvestment in energy efficiency in Kentucky. Kentucky ranks third among states in per customer electricity use, and Kentucky's residential sector is 24 percent more energy intensive than the national average.[5] So while the Commonwealth's electricity rates are low, its electricity bills are not.

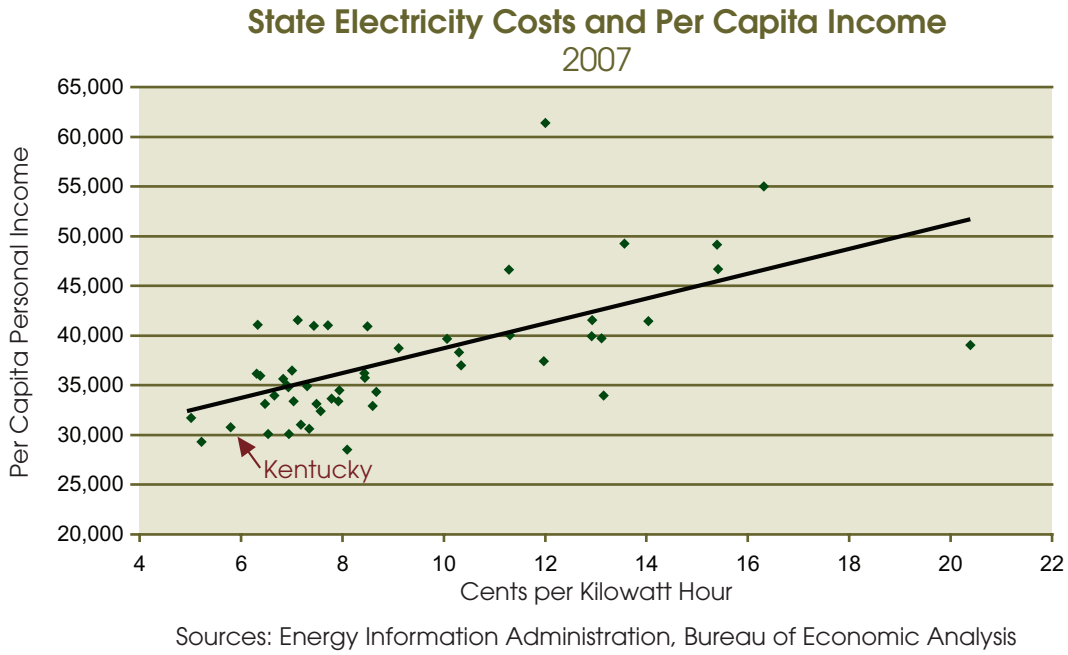


Figure 10: Electricity Costs and Per Capita Income

Cheap electricity will not last forever — even in Kentucky. As global demand for coal rises, electricity prices also rise. This trend started to take hold in 2000 though the global recession disrupted the trend over the last two years (see Figure 11). Electricity prices are expected to continue to rise considerably as utilities face increasing regulations on carbon and other emissions. A 2007 report from the Kentucky Department of Energy Development and Independence notes: "The economic impact of a carbon-controlled future on the state of Kentucky could be significant... Any legislation that adds costs to coal-fired electricity generation that are not also levied against other forms of generation would raise Kentucky's rates disproportionately compared with states having other resources and would thus lessen the differential in cost of electricity that Kentucky currently enjoys with respect to other states."[6]

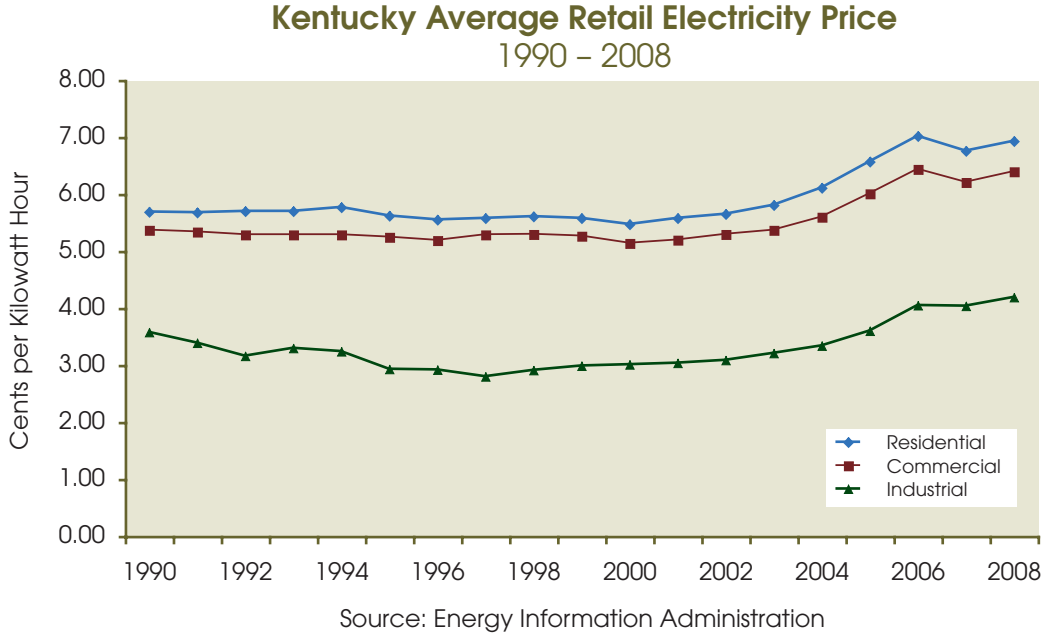


Figure 11: Average Retail Electricity Price

Another reason Kentucky's electricity prices are low is that the state is primarily dependent on aging coal-fired power plants, the capital costs of which have already been paid. The average coal-fired power plant in Kentucky is 43 years old.[7] The need for new electricity generating capacity in future years will mean new capital costs that will raise electricity prices, whether the new capacity is for coal or other energy sources.

The coal industry's impact on jobs in Kentucky is mixed. On one hand, coal provides good jobs in a region where well-paying jobs are scarce. On the other hand, mining communities have become so dependent on coal that they are vulnerable to even small swings in the industry. This creates a dilemma regarding how to achieve long-term stability. In a recent study of a full boom and bust cycle (1970's-1980's) in the Central Appalachian coal industry, Black et al found that job, income and population losses during the coal bust were greater than gains in these areas during the coal boom. Their findings suggest that the availability of jobs in the industry helped retain "prime-aged" men and spurred some return migration during the boom period; however this population declined with greater intensity during the bust period. They hypothesize that the decline in this population during the bust period may be related to the up-skilling of the labor force and the rise in income during the boom period, leading to greater mobility and employability outside the region.[8] Perhaps in part because of this trend, mines in the Central Appalachian region face labor shortages as older workers retire and much of the younger generation moves out of the area to pursue other opportunities.[9] Given its centrality to eastern Kentucky in particular, the coal industry will continue to be a player in the region's economic development efforts in the short term. In the long term, as the industry continues to decline, its role in economic development is likely to diminish considerably.

II. The Competitiveness of Kentucky Coal

A vital question for the future of Kentucky's coal industry is its ability to compete with other coal-producing regions and other energy sources. Kentucky's competitiveness in the coal industry declined in recent years, losing market share both in Kentucky and in surrounding states. In 1992, 82 percent of coal used in Kentucky was supplied by producers within the state; nearly ten years later, this number had fallen to 60 percent. Kentucky's share of the Kentucky coal market declined as other states increased their shipments of coal to the state (see Figure 12). West Virginia, Colorado and Wyoming gained the most ground in Kentucky markets during this period.[10]

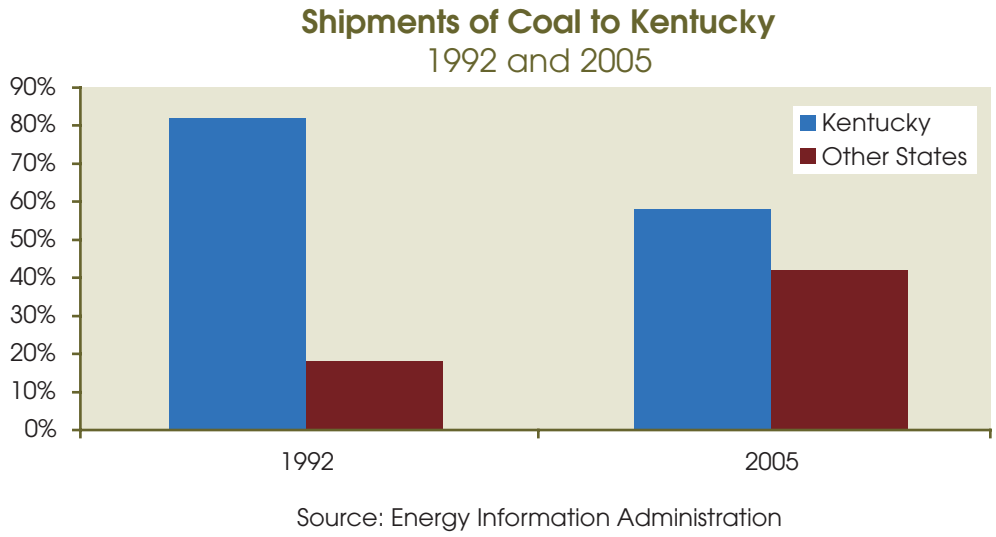


Figure 12: Shipments of Coal to Kentucky

Similarly, Kentucky coal producers have lost market share nationally since the 1990s. As Kentucky's market share declined, other states made gains in these markets.[11]

Production Costs and Coal Reserves

Numerous factors affect the competitiveness of Kentucky coal, but one of the most substantial is the cost of mining. Kentucky has a large number of small mines and few large operations. Larger mines are able to capture the benefits of economies of scale. The productivity of Kentucky coal operations has not kept pace with that of other states and of the industry nationwide (see Figure 13).

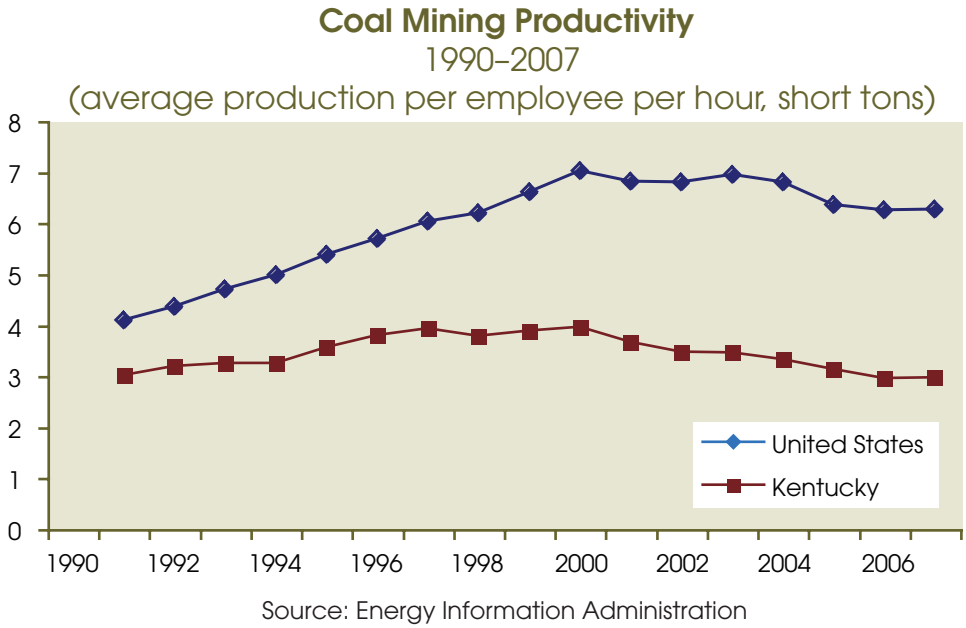


Figure 13: Coal Mining Productivity

Western states dramatically increased their share of the coal market over the past 20 years. Between 1990 and 2004, Wyoming's share of the U.S. market skyrocketed while Kentucky's share declined significantly (see Figure 14).

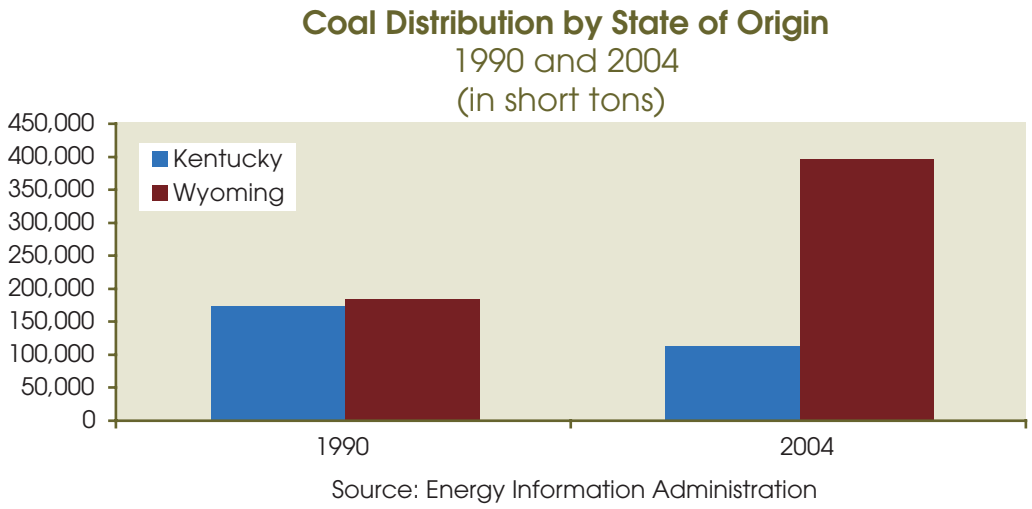


Figure 14: Coal Distribution

Wyoming coal seams are thicker and more easily accessible than Kentucky coal seams — a key difference between eastern and western mining reserves. The limited accessibility of the remaining coal resource drives up costs for Central Appalachian companies, leaving them at a competitive disadvantage. Figure 15 shows that while Kentucky remains in the top five states in terms of estimated recoverable reserves according to the Energy Information Administration (EIA), the state's reserve base is the smallest of the five and is considerably smaller than the reserves of the top three states. If the state is broken down by region, the EIA data show that 61 percent of Kentucky's estimated recoverable reserves come from western Kentucky, while only 39 percent come from the Appalachian region of the state.

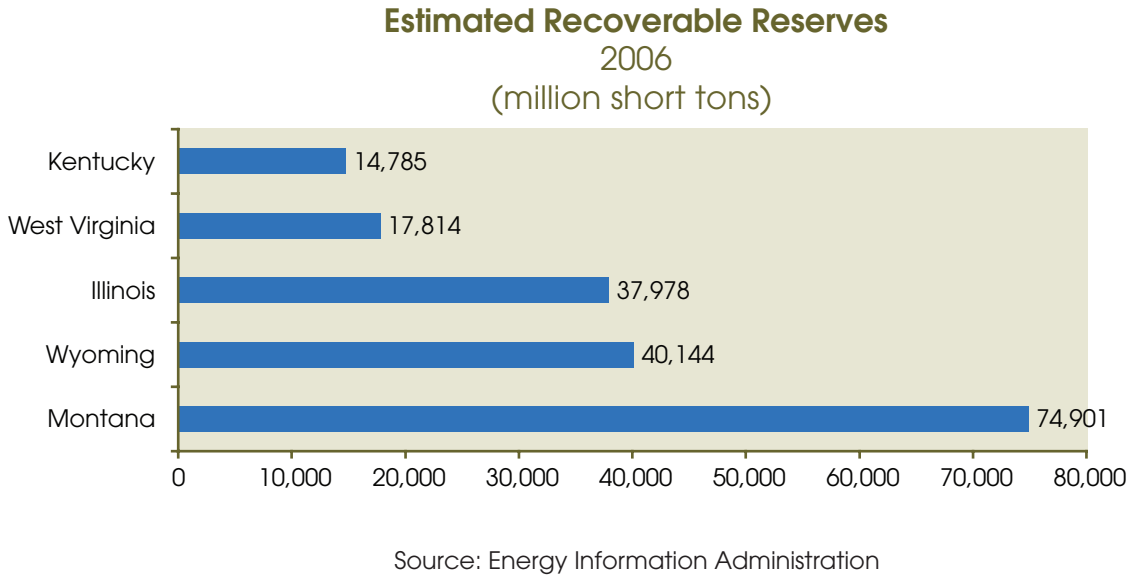


Figure 15: Estimated Recoverable Reserves

Stakeholders and experts debate the issue of how much technically and economically recoverable coal remains in Kentucky. Different sources use different definitions of what is recoverable. In 2007, a National Academies of Science study called for a federal commitment to more accurately estimate how much recoverable coal remains.[12] At current rates of recovery, the EIA data on estimated recoverable reserves suggest over 100 years of remaining Kentucky coal. But EIA states in its report "US Coal Reserves: 1997 Update" that:

> The usual understanding of the term "reserves" as referring to quantities that can be recovered at a sustainable profit cannot technically be extended to EIA's estimated recoverable reserves because economic and engineering data to project mining and development costs and coal resource market values are not available.[13]

In the same report, EIA estimates only about 19 years of recoverable coal from existing mines based on current rates of removal; the rest of the recoverable reserves would require opening new mines. A 2000 U. S. Geological Survey (USGS) report estimated that only nine percent of the remaining coal resources in Central Appalachia are economically recoverable. It concludes: "much of the remaining coal in all five coal beds and zones is thinner (<3.5 ft.) and deeper (>1,000 ft.) than the coal that has been mined." The USGS report says only that mining in the region "will continue throughout this decade and into the next given market conditions."[14]

Similarly, EIA indicates that coal in the Appalachian region is becoming more difficult and costly to mine because so many of its resources have already been used up. In the 2008 Energy Outlook report, EIA notes: "Although producers in Central Appalachia are well situated to supply coal to new generating capacity in the Southeast, that portion of the Appalachian basin has been mined extensively, and production costs have been increasing more rapidly than in other regions." As a result, EIA predicts that this region will continue to decline relative to western producers over the next 25 years.[15] Similarly, a 2008 article on the future of coal concludes that while there are numerous uncertainties in the industry, "[w]hat will likely continue to occur is the shift in coal production from the eastern United States to the western United States, a trend that has been steadily increasing since the mid-1970s."[16]

This trend puts Kentucky at a disadvantage relative to western states in particular, although eastern Kentucky is losing competitiveness relative to other regions as well. A 2008 article on the relative competitiveness of coal in the United States makes the following projections:

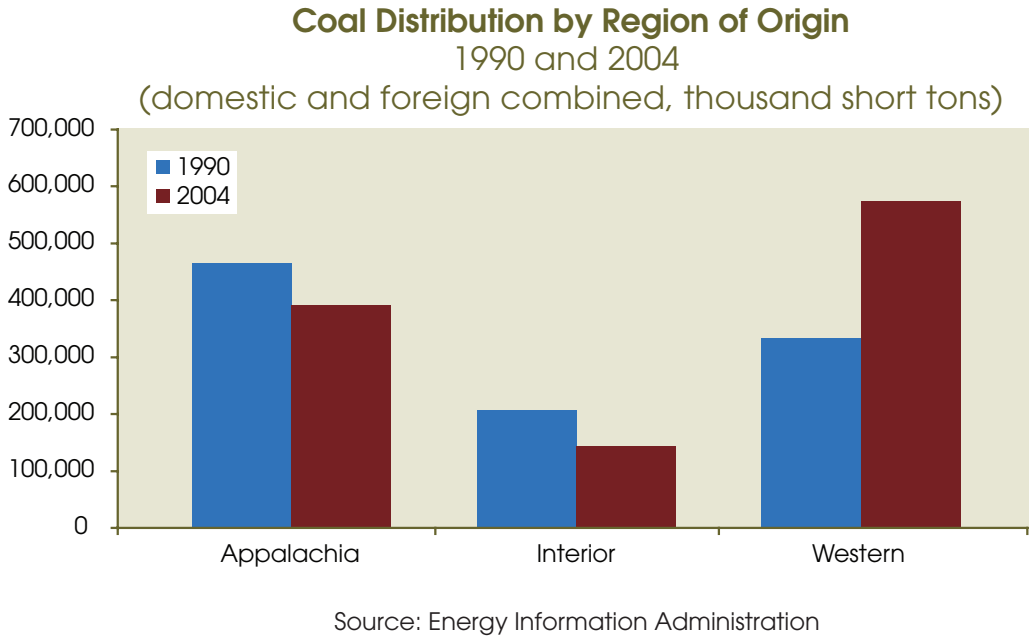
> Central Appalachian productivity will decline by a total of 6 percent over the next five years as producers continue to move into thinner and more geologically challenging seams. Northern Appalachian productivity will not decline as rapidly as Central Appalachia, with only a 2.5 percent drop over the next five years... Even though

Illinois Basin production capacity will grow over the mid term, productivity is expected to decline through 2010. Productivity in the Powder River Basin is expected to flatten over the next three years, but remain the highest of all the U.S. coal basins.[17]

Coal is a finite resource and Kentucky's remaining reserves suffer from several competitive disadvantages. The industry will continue to play a central role in energy production in the Appalachian region for the short term, but Appalachian coal does not provide a solution to the long-term economic and energy needs of the Commonwealth.

Transportation Costs

Deregulation of the railroads played a major role in increasing the competitiveness of western coal. In the past, high transportation costs gave the Central Appalachian region a competitive advantage. Because the majority of coal transport is done by rail, high rail rates made it difficult for western states to compete in Kentucky's key coal markets. However, the deregulation of the railroad industry provided new opportunities for western states to tap into distant markets, bolstering their competitiveness in the eastern United States. This shift took hold in the early 1990s, and Central Appalachia started losing market share to western producers. According to a 2000 report from the Energy Information Administration (EIA), "Concurrently, the combined portion of coal supplied by the Powder River Basin and the Rockies soared from 18.8 percent in 1988 to 36 percent in 1997."[18] This trend has continued as western states have capitalized on lower costs and thicker and more accessible coal seams. Western states significantly increased their distribution relative to other coal-producing states between 1990 and 2004, while Appalachian states saw a significant decline (see Figure 16).



Source: Energy Information Administration

Figure 16: Coal Distribution by Region

The price of oil may also impact the relative competitiveness of eastern and western coal, as rising oil prices give the railroads competitive advantage over trucking companies. Railroads have expanded as a result, opening new travel routes (and hence potential markets) for western coal in recent years.[19] On the other hand, eastern states could benefit from a rise in oil prices relative to western states in the short term, due to shorter transport routes.[20] According to the EIA's July/September 2008 Quarterly Coal Report, the rise in fuel prices and slowing economy have reduced the demand for coal from the Powder River Basin, while Appalachian producers have captured more of the international markets due to their proximity to ports in Maryland and Virginia. These developments benefit West Virginia producers more than Kentucky producers, and may continue to do so in the short term. Nevertheless, these trends are not expected to reverse the dominance of western coal in the long run.[21]

Regulatory Challenges

The future competitiveness of Kentucky coal is inextricably tied to national regulatory policy. The Clean Air Act Amendments of 1990, for example, made it more expensive to use high-sulfur coal by regulating sulfur dioxide emissions. This had a significant impact on the competitiveness of Kentucky coal—particularly western Kentucky, where coal has a higher sulfur content. Some electric utilities responded to the new regulations by incorporating desulfurization technologies (such as scrubbers) to reduce emissions while still burning high-sulfur coal. In recent years, the adoption of these technologies has allowed high-sulfur coal to continue to compete. However, according to a representative from Duke Energy, the renewed interest in high-sulfur coal is likely to have a negative impact on Central Appalachian coal, which is lower in sulfur but more expensive to mine.[22] How this renewed interest in high-sulfur coal will impact the state of Kentucky as a whole remains to be seen.

While some utilities have paid for improvements that allow them to burn high-sulfur coal, others have found it more economical to purchase low-sulfur coal from the western United States. The Clean Air Act also brought new requirements for Kentucky and other coal-producing states to limit emissions of nitrogen oxide (NOx). At present, older power plants are exempt from these regulations. As of 2009, only one-third of U. S. coal plants have scrubbers targeting sulfur dioxide, and even fewer have nitrogen oxide scrubbers.[23] However, new restrictions on power plant emissions are likely in coming years. NOx regulations are most likely to impact Kentucky coal by encouraging utilities to switch from coal to other, less polluting forms of fuel such as natural gas.[24]

Another important regulatory arena is mine safety. Recent mining disasters in the United States underscore the importance of mine safety and heighten pressure for more robust safety regulations for underground operations. The Mine Improvement and New Emergency Response Act of 2006 and subsequent proposed legislation will impact underground mining operations across the country. Larger operations will likely be able to absorb the costs of these new regulations, but already struggling smaller operations may not. The change will have a particularly heavy impact in Central Appalachia, where mines tend to be smaller and more expensive to operate and maintain.[25]

Safety regulations for underground mines and other cost concerns have led Central Appalachian producers to increase surface mining relative to underground mining in order to cut costs and boost efficiency. Mountaintop removal mining—a common surface mining technique in Central Appalachia—and its significant environmental impacts are the subjects of considerable debate in Appalachian Kentucky and throughout the region. In 2007, a number of mountaintop removal permits were blocked in Central Appalachia due to violations of the Clean Water Act, and many more lawsuits are pending in an attempt to preserve mountain ecosystems and protect headwater streams. As noted in the Wall Street Journal, "pending litigation filed by environmental groups ... limited surface mining in the Appalachian region... [leaving] more market share for coal miners using other methods in other regions that don't have the environmental-permit problems of... Central Appalachian producers."[26] A 2007 report from the Energy Information Administration concurred that concerns over water quality will further impact the Central Appalachian mining industry in the foreseeable future.[27] In February 2009, the ruling requiring additional environmental reviews of mountaintop removal was overturned.[28] While challenges to such rulings continue, it is expected that environmental regulation will increase under the Obama administration.

The most significant regulatory challenge for the industry is the impending regulation of greenhouse gas emissions. At current production levels, coal is responsible for 30 percent of climate change pollution in the United States. As demand for coal grows, this number is expected to rise.[29] A recent report by the National Academies of Science notes that regulation of greenhouse gas emissions is one of the most pressing challenges facing the coal industry over the next 25 years.[30] A 2007 Supreme Court ruling classifying carbon dioxide as a pollutant under the federal Clean Air Act underscores the immediacy of the issue.[31] Growing concerns about climate change support a host of proposed regulatory policies calling for drastic reductions in carbon dioxide emissions, creating a tentative mood within the carbon-intensive coal industry. In 2007 alone, more than 50 proposed coal-fired power plants were cancelled or delayed due to uncertainties about cost and regulatory climate, at the same time that operations in several locations halted due to blocked mining permits.[32]

In February 2009, the Obama administration announced that the Environmental Protection Agency (EPA) would move toward carbon dioxide regulations based on the 2007 Supreme Court ruling.[33] As environmental concerns mount, such regulations and court challenges are expected to intensify. Faced with increasing regulations, many utilities will likely explore greater energy efficiency, renewable energy, natural gas and other power sources. While demand for coal is expected to continue in the short term, its competitiveness relative to other energy sources is expected to decline in the decades ahead.

The coal industry has responded to mounting climate change concerns by embracing potential new technological solutions to the carbon problem. Existing and proposed emissions regulations have generated increased interest in new technologies, such as facilities with Carbon Capture and Storage (CCS) capabilities. A 2007 Massachusetts Institute of Technology report, *The Future of Coal*, argues that CCS technologies will be vital to the future of the industry in a carbon-constrained world. The report argues that rapid deployment of these new technologies will be necessary in order to meet demand while addressing carbon caps, and that large-scale demonstrations of cutting-edge technologies are a necessary first step toward this end.[34] A response from the Natural Resource Defense Council suggests that CCS technologies must be mandated for all new coal-fired power plants in order to avoid escalating carbon emissions in the face of rising demand.[35] A November 2008 EPA ruling finds that, at minimum, coal-fired power plants will have to address carbon dioxide emissions or risk losing their permits.[36]

The United States Department of Energy's FutureGen is the most publicized CCS initiative. Originally envisioned as a single large "zero emissions" coal plant in Mattoon, Illinois, the projected costs of the plant skyrocketed until it was eventually cancelled. The FutureGen initiative was restructured in 2008 to focus on integrating advanced CCS technologies into multiple commercial-scale demonstration plants across the country. The restructuring of FutureGen is indicative of a larger problem in the industry: the relative costs and benefits of new coal technologies remain unknown. In the past two years, numerous CCS and other clean coal projects have been scrapped due to escalating costs.[37] While such technologies are said to be vital to the future of the coal industry in an increasingly carbon-constrained world, they are riddled with risks many companies and regulatory commissions are simply not willing to take absent a federal mandate.

This tentative mood is apparent in Kentucky and across the nation. A 2007 report from the Kentucky Department of Energy Development and Independence cites the necessity of these technologies for reducing carbon emissions while simultaneously pointing out the costs and risks associated with incorporating them into the state's aging and outdated plants. The Department states: "The impact on existing units would be higher due to the nature of adding equipment to units not designed from the start for such technologies.... At this time, the costs of retrofitting existing sources with carbon capture technologies are highly speculative." The report goes on to estimate a staggering increase in electricity costs as a result of the adoption of CCS technologies: "The economic impact of a carbon-controlled future on the state of Kentucky could be significant. Estimates are that the cost of adding carbon capture and sequestration capability at existing coal-fired facilities will increase electricity costs between 50% and 300%."[38] The report concludes that while Kentucky coal may eventually benefit from CCS and related technologies, the industry will require much greater public subsidies to make this a viable option.[39]

Seeking New Markets

Many Kentucky coal producers are touting the potential of new markets in liquid and gas coal products. Coal-to-liquid involves the conversion of coal to liquid fuel such as diesel. This process starts by gasifying coal and then converting the gas to liquid form. Some political leaders have supported this concept as a potential boon for the state's coal industry in tough economic times. They argue that coal-to-liquid plants in Kentucky would increase the demand for Kentucky coal and create an innovative economic niche in an economically distressed region.

The conversion of coal into liquid fuel is not new. In the wake of the 1973 Arab oil embargo, several coal gasification projects were undertaken in the Appalachian coalfields. However, after the investment of more than $500 million in

pilot projects in Appalachia, most were abandoned as gas prices fell—before the projects even got off the ground.[40] As oil prices rose again in the past five years and soared in 2007 and 2008, many proponents decided the time was right to revisit the issue.

Gas prices aside, there are two major limiting factors associated with coal-to-liquid: cost and carbon. Liquid coal produces roughly twice the climate change pollution of gasoline, making it a risky endeavor at a time when carbon caps and increasing regulations of such pollution are imminent. Even if current carbon capture and storage technologies were applied successfully, liquid coal would produce more pollution than gasoline.[41] A 2006 report from the Kentucky Office of Energy Policy notes that Kentucky already ranks seventh among the states in carbon emissions, making technologies that increase that pollution a huge economic challenge for the state.[42] Furthermore, coal-to-liquid technologies are extremely expensive. A 2004 Department of Energy report estimated construction costs alone for a single coal-to-liquid plant at $7 billion.[43] This does not include the cost of adding CCS technologies. Like CCS, coal-to-liquid will require large public subsidies if it is to succeed in the state or in the nation. Both the monetary cost and the carbon cost of coal-to-liquid will be substantial.

Coal-to-gas involves the creation of synthetic natural gas through coal gasification. This technology is cheaper and simpler than coal-to-liquid technology. According to the University of Kentucky's Center for Applied Energy Research:

> The production of synthetic natural gas ... is a way of converting coal into the equivalent of pipeline quality natural gas. The technology involved in SNG production is much less cumbersome than for CTL [coal-to-liquid]....SNG [synthetic natural gas] from coal is particularly attractive in situations where relatively cheap coal is available while there is demand for natural gas (methane) which can be logistically transformed or when natural gas prices are high enough to sustain the economics.[44]

Because Kentucky imports a large percentage of its natural gas from other states, coal-to-gas is appealing from an energy independence perspective. For these reasons, a large investment in coal-to-gas operations is proposed in the Governor's 2008 energy plan.[45]

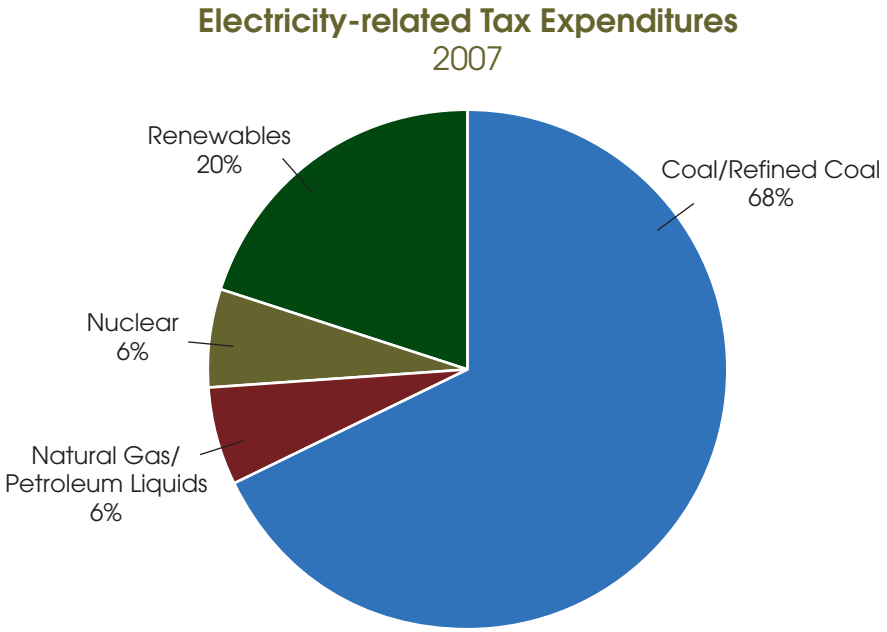
Despite the fact that coal-to-gas is cheaper than coal-to-liquid, there are considerable unknown costs with this technology. The U.S. is home to only one operating coal-to-gas facility, located in North Dakota. While coal-to-gas plants include carbon capture as part of their design requirements, estimated costs do not include costs of transporting and sequestering carbon once it is removed. Furthermore, it would take seven years for a coal-to-gas plant to be up and running in Kentucky. In the meantime, given the current political climate, it is quite likely that additional limits on carbon emissions will be imposed.[46] The adoption of coal-to-gas technologies in the state would result in significant monetary and carbon costs—some of which are not reflected in state estimates.

The Role of Federal Subsidies

The possibly dramatic rise in the cost of coal seems inevitable in the foreseeable future, but the question of who should pay for these changes is far from settled. Some research and demonstration projects focused on advanced coal technologies are currently subsidized by the federal government. One such project is the Clean Coal Power Initiative, described by the Department of Energy as "a 10-year, $2 billion program designed to support the Clean Coal Technology Roadmap milestones with the government providing up to 50 percent of the cost of demonstrating a range of promising technologies."[47] In 2003, two of the eight funded projects were located in Kentucky; however, both of these were eventually withdrawn.[48] In 2008, the program funded a portion of a research and development project at the University of Kentucky's Center for Applied Energy Research (CAER).[49] Most recently, the American Recovery and Reinvestment Act of 2009 allocated $3.4 billion for fossil fuel research and development.[50] The majority of this money is expected to be invested in carbon sequestration and related technologies.

In August of 2008, the Department of Energy announced that the University of Kentucky CAER would receive $1.425 million to support ongoing research on coal-to-liquid for transportation fuel. In addition, the DOE and the Appalachian Regional Commission provided $850,000 for a year-long study in 2007 that led to plans for a coal-to-liquid plant in Pike County, Kentucky. Though they have not received the funding to build the plant, officials say they have support from key legislators and are planning to use state and federal funds to build the $4 billion plant. Whitley and McCracken counties have also discussed the possibility of coal-to-liquid facilities.[51] Most recently, Governor Beshear released his energy plan which includes a proposed $7.5 billion coal-to-liquid plant in Paducah.[52] Many concerned groups protest funding and support for coal-to-liquid facilities because they believe the plants will violate the Clean Air Act and accelerate the rate of mountaintop removal mining.[53]

While the future of these specific plants and proposals is unknown at this time, it is clear that the future of coal will be expensive. Coal is already heavily subsidized in the United States, and investments in new technologies will require additional subsidies. Research and Development (R&D) funding has remained fairly constant in the last five years, while tax expenditures on the industry have risen sharply. According to a 2007 report from the United States Government Accountability Office, the fossil fuel industry received $3.1 billion in federal money for electricity-related R&D between 2002 and 2007. During this same time period, the industry received $13.7 billion in tax expenditures — a 43% increase over the five-year span.[54] In 2007, the coal industry received 68% of electricity-related tax expenditures (see Figure 17 and Figure 18).



Sources: Government Accountability Office, Department of Energy

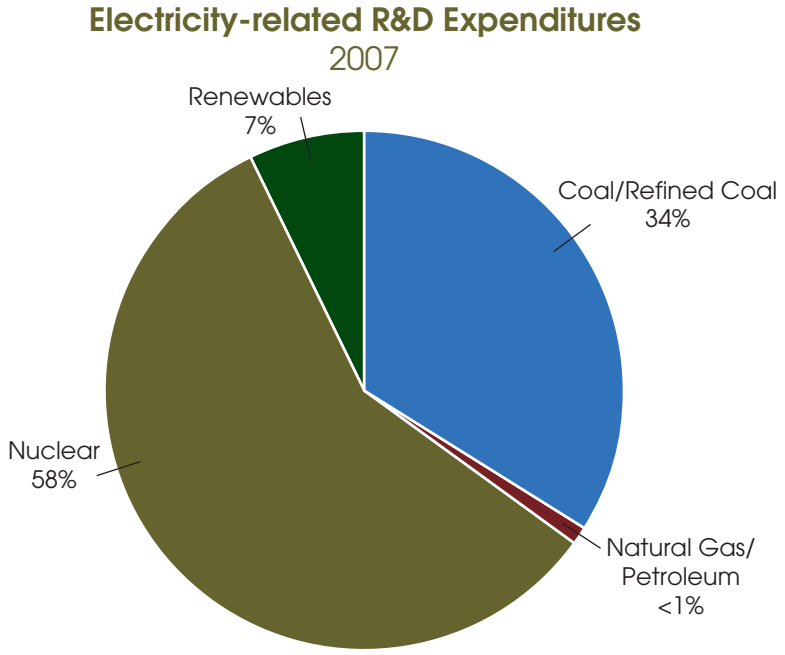
Figure 17: Tax Expenditures by Fuel Type[55]

Electricity-related Tax Expenditures
2007
(in millions)

Coal/ Refined Coal	$2,420
Renewables	$724
Natural Gas/ Petroleum	$203
Nuclear	$199

Figure 18: Tax Expenditures by Fuel Type

The majority of tax expenditures for coal in recent years can be attributed to the synfuel tax credit—a federal subsidy enacted in Section 29 of the Crude Oil Windfall Profit Tax Act of 1980. This tax credit, originally intended to reduce dependence on foreign oil by building infrastructure for a competitive synthetic fuels sector, was resurrected in the 1990s as a way for enterprising coal operations to increase profitability.[56] Synfuel is made by spraying small pieces of coal with a petroleum-based product, creating a more consistent fuel product. Because the tax credit rewards high heat content, synfuel producers migrated to areas with high-Btu coal. This increased the competitiveness of Kentucky coal.[57] In 2007, however, the synfuel tax credit expired. A recent report from the Energy Information Administration states: "Without the credit, coal synfuel production is unprofitable and it is expected that all coal synfuel plants will shut down after 2007."[58] This is expected to significantly reduce coal's share of electricity-related tax expenditures.



Sources: Government Accountability Office, Department of Energy

Figure 19: Research and Development Expenditures by Fuel Type[59]

Electricity-related R&D Expenditures
2007
(in millions)

Nuclear	$922
Coal/ Refined Coal	$522
Renewables	$108
Natural Gas/ Petroleum	$4

Figure 20: R&D Expenditures by Fuel Type

In 2007, coal received 34% of R&D expenditures (see Figure 19). If the American Recovery and Reinvestment Act of 2009 is any indication of future policy, R&D expenditures will rise significantly in coming years. In 2007, $522 million in R&D expenditures went toward coal and refined coal. By comparison, the 2009 legislation set aside $3.4 billion for fossil fuel R&D, particularly for carbon sequestration and related technologies.

Summary

Kentucky's coal industry remains a significant economic player in some areas of the state and will be part of the state's economy and nation's energy mix for the immediate future. In the long term, however, it is an industry in decline. Current trends suggest that Kentucky-based coal companies are at a competitive disadvantage vis-à-vis western and other producers, and that this disadvantage is likely to increase in the future. Economically-recoverable coal reserves are diminishing. Meanwhile, Kentucky's top coal-producing counties remain among the most distressed counties in the nation, leaving them vulnerable to future shifts in mining employment. While potential new technologies provide some emerging opportunities for coal markets, the impacts of these developments are unknown. As costs and regulatory concerns mount, the future of Kentucky's coal industry is uncertain. What is known is that Kentucky's coal industry faces tough challenges with regard to rising costs, labor shortages and a growing national push for cleaner energy. These issues will be at the forefront of debates about Kentucky coal in the foreseeable future.

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