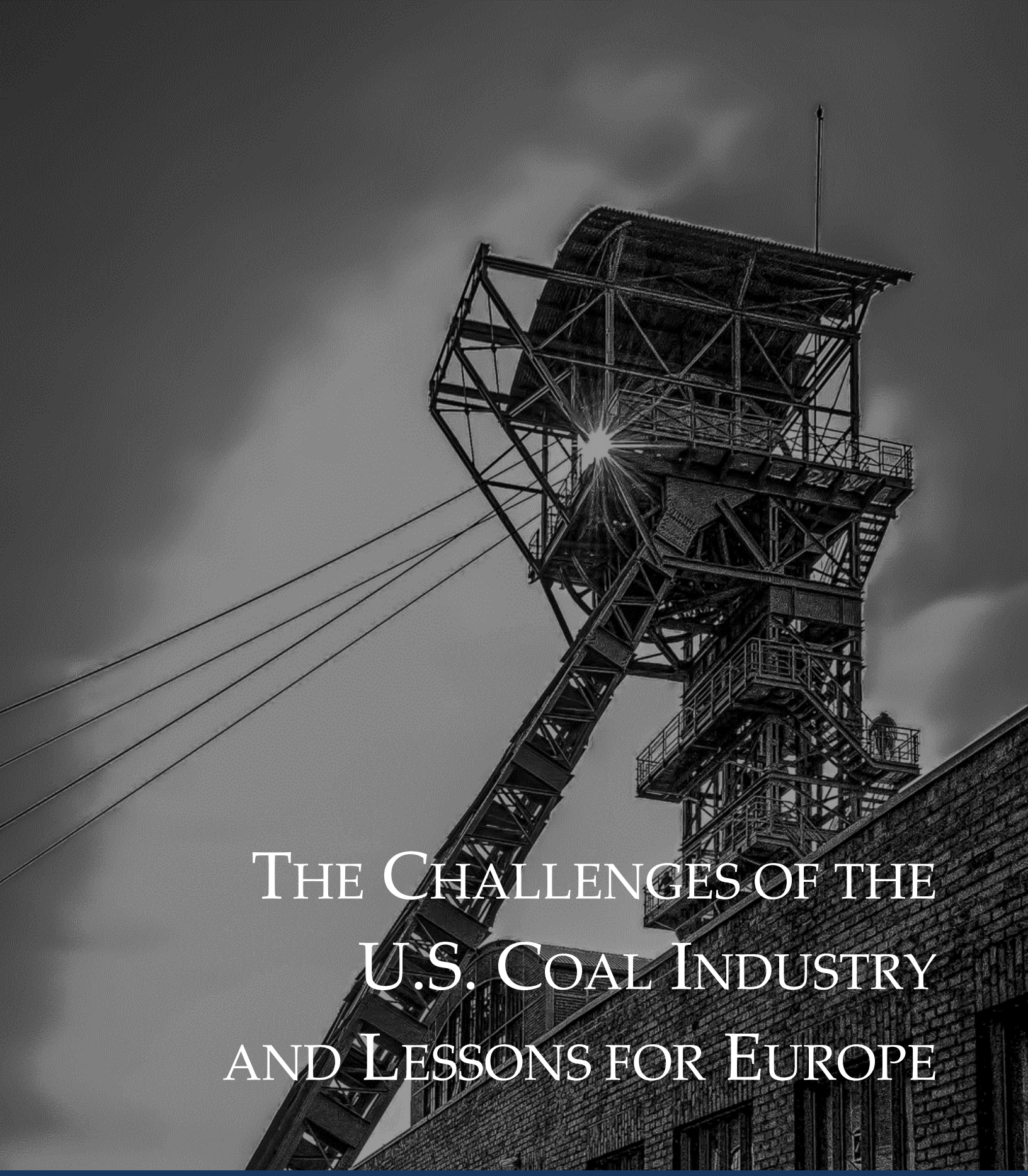

The Challenges of the U.S. Coal Industry and Lessons for Europe

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EXECUTIVE SUMMARY

In recent years, economic, social, and political forces have reduced the global demand for coal, threatening the historical dominance of coal for power generation, and greatly diminishing the outlook of the U.S. coal mining sector. The development of U.S. shale gas reserves have brought about an abundant supply of cheap domestic natural gas, with utilities increasingly turning away from coal and into natural gas for baseload generation. Renewables also see increasing cost competitiveness as they move along the experience curve, and its development and use is strongly supported by the public. Beyond economic woes, the introduction of stringent environmental regulations which are less favorable against coal have added another dimension to the coal's industry troubles. Together, these forces have brought about a structural rather than cyclical transformation in the coal industry in which traditional coal companies face financiall.

Against this backdrop of The United Nations Economic Council on Europe (UNECE) and their Committee on Sustainable Energy is committed to ensuring its member countries have the information necessary to adapt to this shifting market landscape. Through their subdivision, the Group of Experts on Coal Mine Methane, they work with the energy officials of member states and their national coal producers to cope with the deteriorating coal outlook. Our project aims to assist the Group of Experts on Coal Mine Methane in its work to educate decision makers in its European member states about the economic as well as social impacts of this declining national coal market, and suggest policy changes that help their national coal producers to avoid bankruptcy.

To this end, the research team undertook four main tasks. First, the team analyzed the recent trends in the U.S. coal production and determined that flat electricity demand, falling natural gas prices, weak demand for U.S. coal exports, and a more challenging regulatory environment have contributed to the recent decline. The team also examined the U.S. electric utility sector and how U.S. companies have adjusted to the increased regulation and changes in fuel prices. The team examined the forces driving coal-to-gas switching, and uncovered geographic location and market regulations as the main factors that influence utility strategy. Second, the team performed case studies of U.S. coal companies, and highlighted the trends of financial restructuring, diversification away from coal, and concentrating operation to boost efficiency, as the common survival strategies for coal companies. Third, the team studied the effects of coal mining company bankruptcies on the populations they support, examining the impacts of a collapsed local economy (lost tax revenue, discharged pension liabilities, and devastating unemployment), and identifying federal policies that provide support for the coal miner communities and promote a smoother transition away from coal. Finally, the team considered the applicability of lessons from the U.S. coal industry for the European context.

The research conducted for this report revealed several important trends. U.S. coal production peaked in 2008 and has been declining since, while electricity demand has flattened since 2010. Declining costs have enabled natural gas and renewables to displace coal. These market factors in addition to falling global steel demand and more stringent regulations, have contributed to the steady fall of U.S. coal prices. At the same time, utilities across the U.S. are decisively shifting away from coal and towards natural gas and renewables, with the depth and speed of this shift depending on local regulations and geography. The switch from coal-to-gas presents its own challenges to the utilities, leading to the fall of both plant lifespans and capacity factors.

This confluence of coal sector trends, is a main driver of the major bankruptcies recently seen in the coal mining sector. This report examines how excessive optimism about the coal sector led to aggressive investment and growth strategies, with major companies taking on massive debt to finance asset acquisitions. While diversification and low-cost/high-efficiency mining operations have allowed some coal companies to survive, these surviving companies still face financial distress. While the case studies in this report highlight the path forward for coal companies that diversify or streamline themselves, cash flow constraints and investor attitudes may be a challenge to implementation. The research also suggests that the potential for coal mine methane, to assist in coal sector diversification, is limited.

This report identifies the threat coal sector bankruptcy and economic woes pose to U.S. coal mining communities, and suggest new sector job training and the use of severance taxes to create permanent funds to support those communities. It also examines the increasing similarities between the U.S. and European energy markets and their views on environmental protection. It also identifies opportunities to support European economies through increased coal sector productivity, financial responsibility and energy sector diversification.

This project is significant because it identifies the best and worst practices of the U.S. coal sector and translates them for use in the European context. Any successful labor policies from the U.S. could benefit Europe as well. Additionally, the shift from coal to sustainable energy sources has created a growing renewable energy sector that could provide new jobs while meeting European emissions targets. It is also important to note that, as coal becomes less significant to domestic electricity generation, European countries, especially in Eastern Europe, will need to contend with security concerns resulting from a loss of energy independence. It is the goal of this report to be beneficial to the United Nations Economic Council for Europe, Committee on Sustainable Energy, Group of Experts on Coal Mine Methane, in their efforts to learn from the collapse of the U.S. coal mining sector and apply the lessons learned in helping their member states smoothly transition their nationalized coal production sector towards more environmentally sustainable energy policies that align with the broader climate goals of the European community.

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SECTION I
U.S. COAL TRENDS

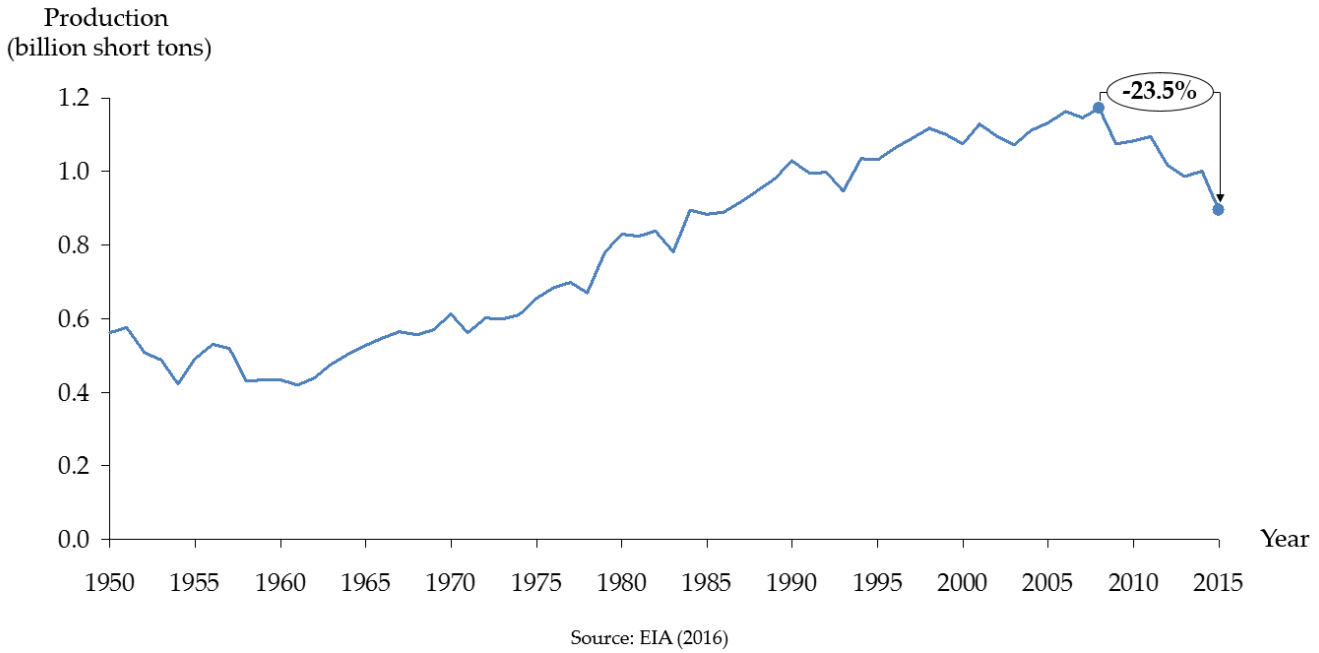
This section provides an overview of developments in the U.S. energy landscape, with a focus on trends most relevant for coal companies. The four main trends driving the decline in coal in the U.S. are flat domestic electricity demand, low natural gas prices, falling demand for global exports, and stricter environmental regulations. This section also examines the national and regional trends affecting utilities' fuel mix decisions.

1.1 OVERVIEW

U.S. coal production has been declining dramatically since its 2008 peak.

In 2015, U.S. coal production was at 895 million short tons, 10.5% lower than in 2014, and at its lowest point since 1986. In 2016, production is projected to decrease further by 150 million short tons, or 17% from 2015 levels, making this potentially the largest absolute and relative fall to date.

Fig. 1.1: U.S. ANNUAL COAL PRODUCTION, 1950-2015



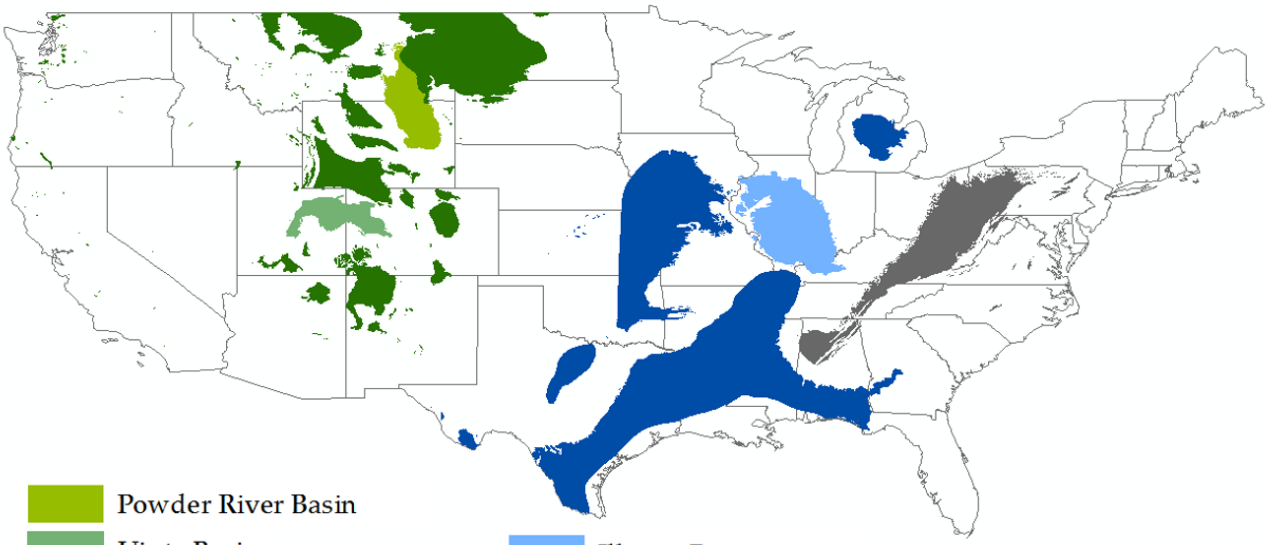
Source: EIA (2016)

Fig. 1.1 looks at U.S. coal production over a longer time horizon. While production has generally been increasing over time, 2009 marked a clear trend reversal, and production has since fallen by 23.5%. This downward trend was driven primarily by economics, and, to a lesser extent, policy.

While coal prices and production have fallen across all regions in the United States, Appalachia has been hit the hardest.

Fig 1.2 shows that U.S. coal production is located in three main regions: Appalachia (North, Central, and South), Interior (Illinois Basin and other Interior), and Western (Powder River Basin, Uinta Basin, and other Western).

Fig 1.2: U.S. COAL BASINS



Source: EIA (2016), U.S. Geological Survey (2014)

Fig. 1.3 lists the specifications and prices for coal spot markets in the five major U.S. coal basins. This report makes reference to two main types of coal: Central Appalachian (CAPP) coal, which is primarily bituminous with higher heating value but contains more sulfur content; and Powder River Basin (PRB) coal, which is subbituminous with lower heating value and lower sulfur content. Most coal produced in the United States are steam or thermal coal, which is used to generate heat and electricity, but a small portion of Appalachian production goes to metallurgical or coking coal, which is used to make steel.

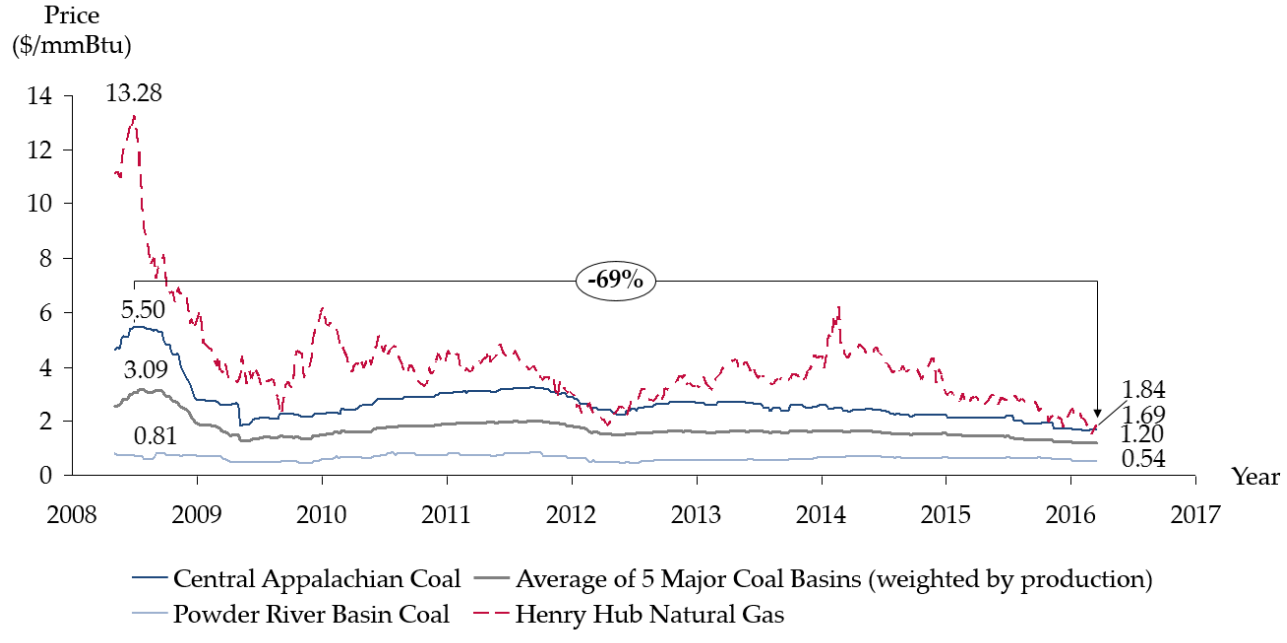
Fig 1.3: SPECIFICATIONS FOR U.S. COAL SPOT DELIVERY

Region	Heat Content (Btu)	Sulfur Content (% SO_2)	Average Spot Price for Week Ending April 15, 2016 ($/mmBtu)
Central Appalachia	12,500	1.2	1.69
Northern Appalachia	13,000	<3.0	1.79
Illinois Basin	11,800	5.0	1.34
Powder River Basin	8,800	0.7	0.53
Uinta Basin	11,700	0.8	1.62

Source: EIA (2016)

Fig. 1.4 shows that U.S. average coal prices have fallen 69% from its peak in 2008. In 2015, except for PRB coal, thermal coal prices in other basins experienced double-digit percentage declines.

Fig. 1.4: U.S. COAL AND NATURAL GAS PRICES, 2008-2016



Source: SNL (2016), EIA (2016)

While all regions have experienced a decline in coal production and prices, Central Appalachia, home to many coal mining communities, has seen the greatest fall. Because of geological reasons, Appalachia has many mines that are small in size, whereas Powder River Basin has fewer mines but they are larger in scale and use surface mining. As a result, productivity in Powder River Basin is much higher, making PRB coal far cheaper than Appalachian coal. In addition, air pollution legislation and the associated scrubber costs have also worked to favor greater demand for PRB coal, which has lower sulfur content.

Across the United States, four broad trends led to the decline in coal production and prices.

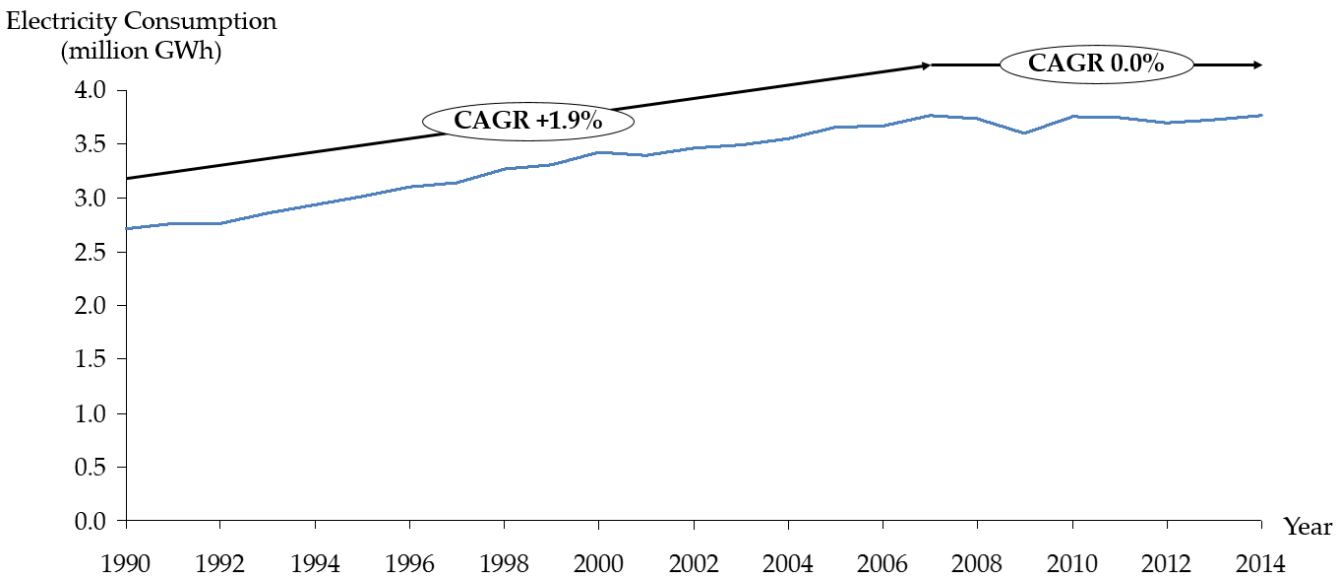
The four broad trends are: flattening electricity demand, falling natural gas prices, weaker demand for coal exports, and an increasingly challenging regulatory environment.

U.S. electricity demand has flattened in recent years, resulting in lower derived demand for coal.

In recent years there has been a clear decoupling between economic growth and electricity demand in the United States. While the U.S. economy has grown by over 2.2% annually since 2008, the growth in net electricity demand has averaged only 1.3% during this period.

Fig. 1.5 shows that while U.S. annual electricity consumption grew by 1.9% between 1990 and 2007, there has been zero growth since then. This is primarily due to a greater uptake in energy efficiency, demand response, and distributed generation. Naturally, with lower electricity demand, the derived demand for coal for electricity generation has also decreased over time.

Fig. 1.5: U.S. ANNUAL ELECTRICITY CONSUMPTION, 1990-2014

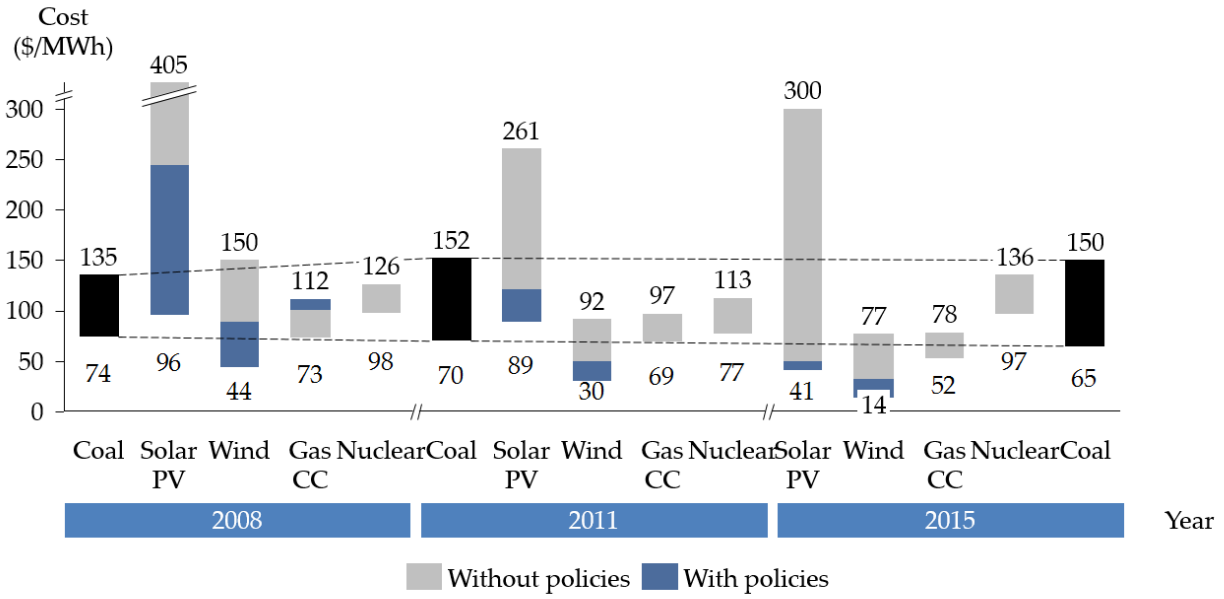


Source: EIA (2015)

Declining costs have enabled natural gas and renewables to displace coal.

The U.S. shale boom has allowed domestic natural gas prices to fall steadily since 2008. Fig. 1.4 shows that Henry Hub spot prices declined from a high of $13.28/mmBtu in 2008 and to around $2.00/mmBtu in May 2016. Fig 1.6 compares different fuel sources on a levelized cost of electricity (LCOE) basis. Natural gas LCOE has fallen from $73-112/MWh in 2008 to $52-78/MWh in 2015, which is below the $65/MWh price floor for coal in 2015 (1).

Fig. 1.6: LEVELIZED COST OF ELECTRICITY, 2008-2015



Source: Lazard (2015)

With the gap between coal and natural gas prices narrowing, utilities are taking advantage of low gas prices and using more natural gas to generate electricity. In 2015, electricity generated by natural gas increased by 18%, and electricity from coal fell by 12%.

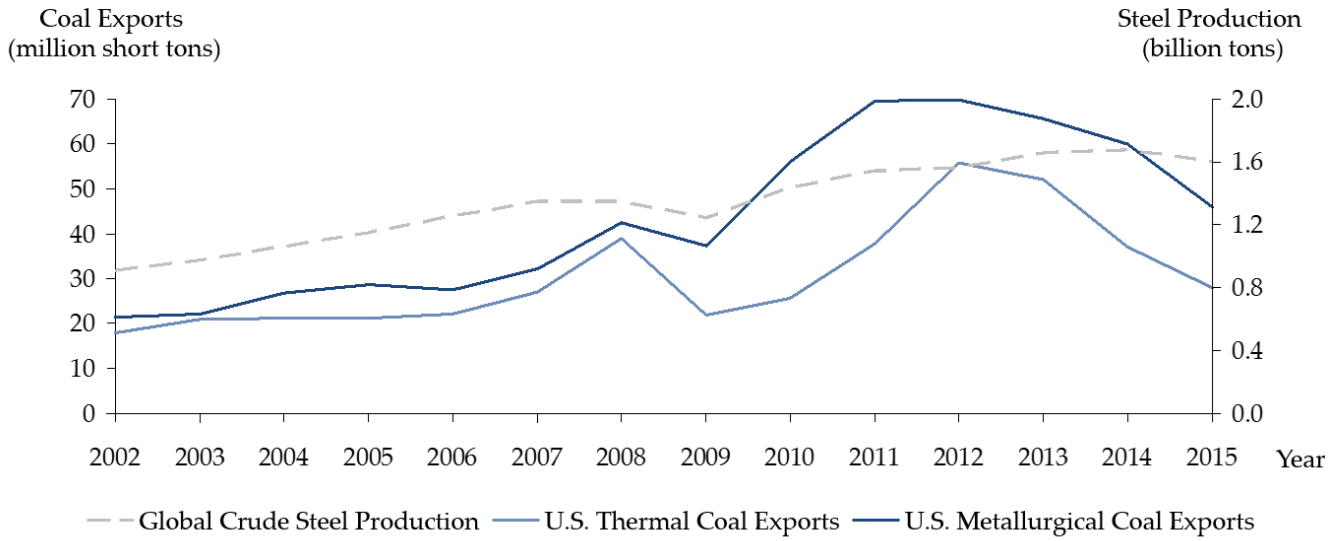
At the same time, costs for deploying renewables have also fallen as a result of technological advances and supply chain efficiency. Renewables are also becoming competitive with coal on a levelized cost of electricity (LCOE) basis, and some forms of renewable power are cheaper than coal, even without federal subsidies. Nevertheless, because of their intermittent nature, renewables alone cannot replace baseload power generation from coal.

Coal exports continue to be hurt from falling global steel demand.

Although global steel production grew fairly strongly in the past decade, recent years have seen demand flatten. U.S. coal companies that previously relied on exports to offset slowing U.S. steel production now have fewer avenues to sell their metallurgical coal. Similarly, U.S. exports of thermal coal have also become less viable due to lower global demand and prices.

Fig 1.7 shows that U.S. coal exports started falling around five years ago. Lower mining costs, cheaper transportation costs, and favorable exchange rates are expected to continue to provide an advantage to mines in other major coal-exporting countries compared to U.S. producers.

Fig. 1.7: GLOBAL CRUDE STEEL PRODUCTION VS. U.S. COAL EXPORTS, 2002-2015



Source: EIA (2016), World Steel Association (2016)

The regulatory environment has become increasingly unfavorable towards coal.

While economics have been the primary driver behind the shift away from coal in the United States, policy also plays a role. The main climate legislation in the United States to regulate greenhouse gas emissions is the Clean Power Plan (CPP), which seeks to reduce carbon dioxide (CO_2) emissions from electricity generation by 32% (relative to 2005 levels) by 2030 (2). The CPP aims to reach this goal by making fossil fuel electricity generation more efficient, substituting coal-fired generation with less carbon-intensive natural gas, and substituting fossil fuels with zero-carbon renewable sources, including solar, wind, and geothermal energy.

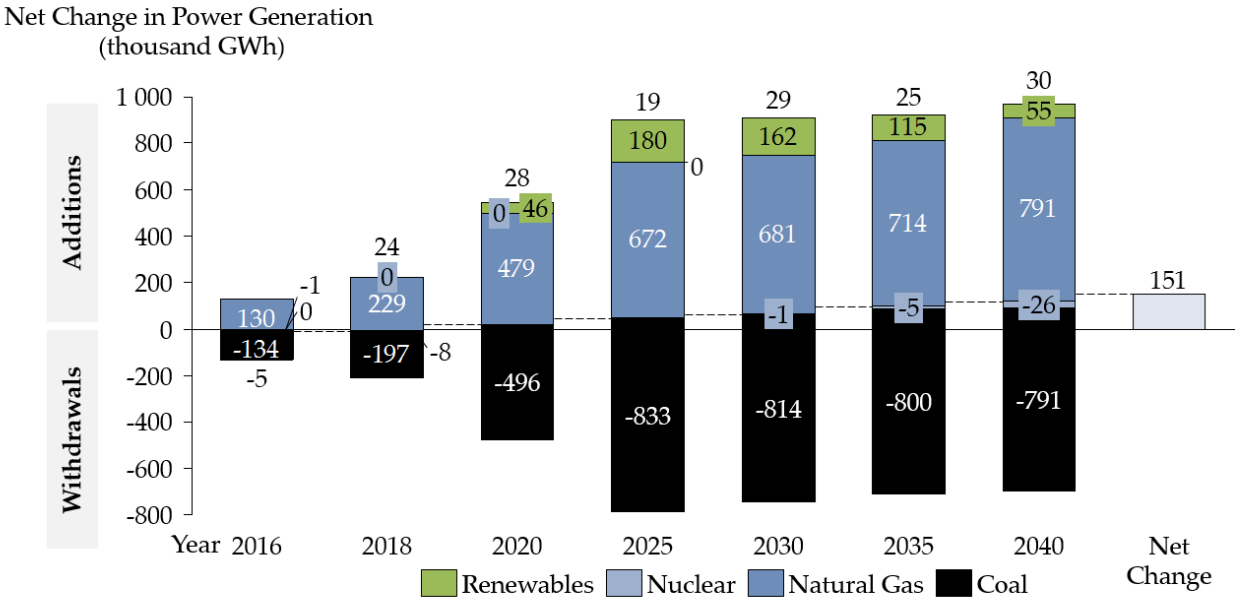
While the CPP does not directly mandate the closure of coal-fired power plants, it does reduce the economic viability of aging, high-emission coal power plants. As a result of the CO_2 emission cap and credit offset mechanism, electricity generators must choose between paying a premium to operate older and less efficient coal-fired plants, or retiring and replacing them with either "clean-coal" plants or natural gas turbines.

As a result, the CPP would significantly change the fuel mix used for generating power in the U.S. (3). In the EIA's CPP Base Policy, which assumes gas prices between $5.83 and $8.15/mmBtu, renewables and natural gas will make up 31% and 25% of the generation capacity, whereas coal's share will decline further. In the EIA's CPP low oil and gas price scenario

suggests, as shown in the chart below, even in a low gas price environment (less than $5/mmBtu), the CPP emissions cap will cause more coal plants to be retired and replaced by a mixture of renewables and natural gas generation.

Although the CPP is facing a stay[1] by the U.S. Supreme Court at the time of this report, it has already influenced utilities' capacity addition plans today as the decisions they make today could incur huge compliance costs for them in the future in the event that the CPP is upheld.

Fig. 1.8: PROJECTED CHANGE IN POWER GENERATION UNDER CLEAN POWER PLAN'S LOW OIL AND GAS PRICE SCENARIO



Source: EIA (2015)

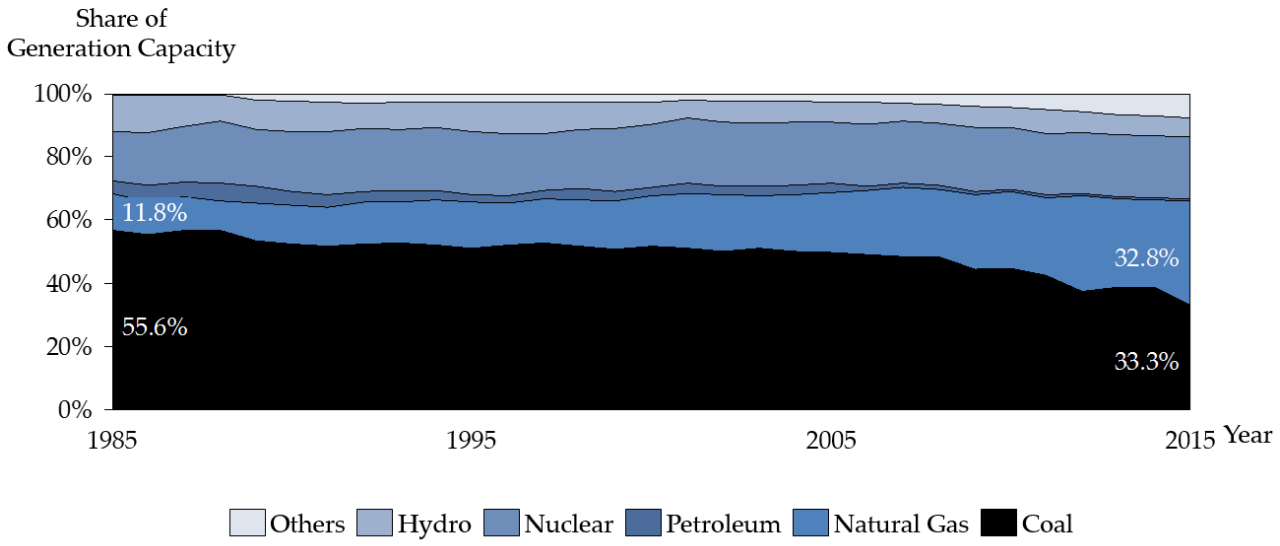
[1] A stay is an act of temporarily stopping a judicial proceeding through the order of a court.

1.2 UTILITIES

Across the United States, utilities are decisively shifting away from coal for power generation.

Coal-fired plants have been the backbone of U.S. power generation for more than a century, but its dominance is waning. From Fig. 1.9, coal made up 55.6% of U.S. generation capacity in 1985, but its share has fallen to just 33.3% in 2015. It will remain a significant source of power generation in the future—coal is expected to account for about one quarter of the country's generating capacity in 2030—but natural gas and renewables will account for an increasing share of the nation's fuel mix (4).

Fig 1.9: U.S. GENERATION FLEET BY FUEL SOURCE, 1985-2015



Source: EIA (2016)

Following the U.S. shale gas boom, cheaper natural gas supply has allowed the share of natural gas in U.S. electricity generation to triple within 30 years to 32.8% in 2015. For the first time, natural gas generation surpassed coal generation in 2015, but only for a few months.

The EIA projects that in 2016, natural gas generation will surpass coal generation on an annual basis for the first time. Aside from natural gas generation, utilities have also deployed greater renewable generation in their fuel mix, following the declining costs of solar, wind, and other renewable sources.

Not only is coal's relative share within utilities' fuel mix being reduced, its absolute level of generation has also declined dramatically since its peak in 2007. Utilities generated 3.02 million gigawatt-hours (GWh) of electricity from coal in 2007; in 2015, this fell to 1.36 million GWh. With distributed generation, efficiency measures, and demand response, utilities that had traditionally experienced strong electricity demand growth are now seeing flattening electricity demand.

At the same time, most of the existing U.S. coal fleet is very old. The average age of a coal plant operating in the United States is 45.2 years. With more than half of the entire U.S. coal generation capacity built at least 40 years ago, it is no longer a question of *whether* coal plants will be retired, but *when* they will be retired. Utilities are, on the whole, retiring their existing coal plants at an earlier age.

Fig 1.10: CHARACTERISTICS OF U.S. COAL PLANTS

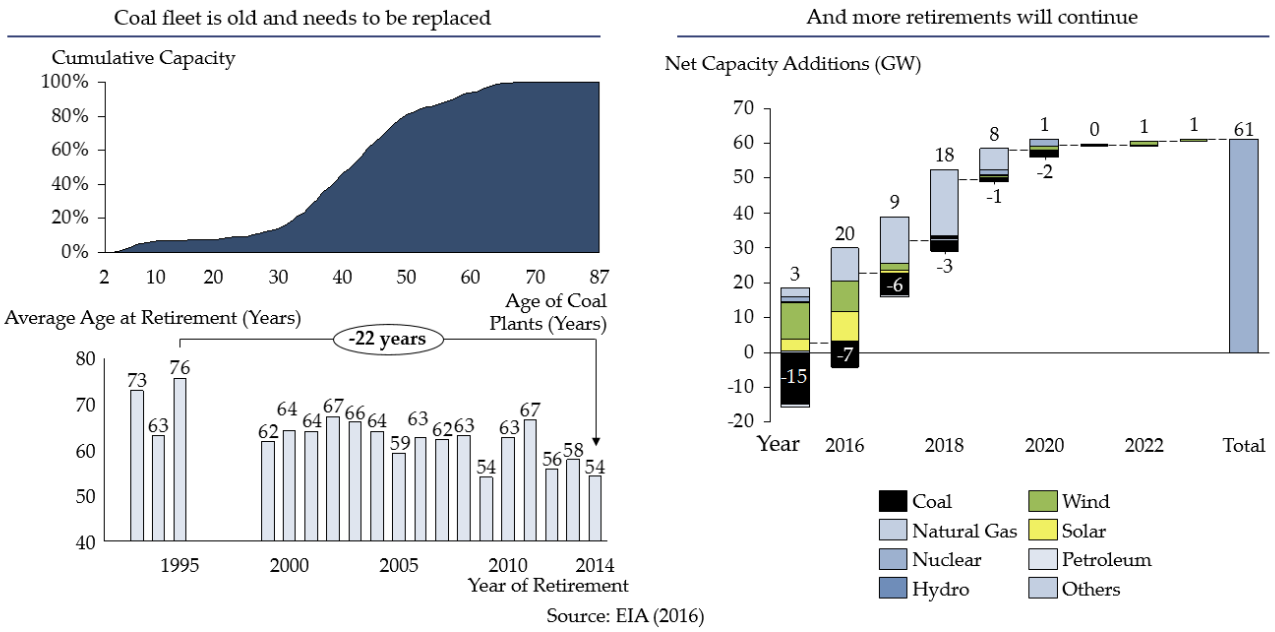


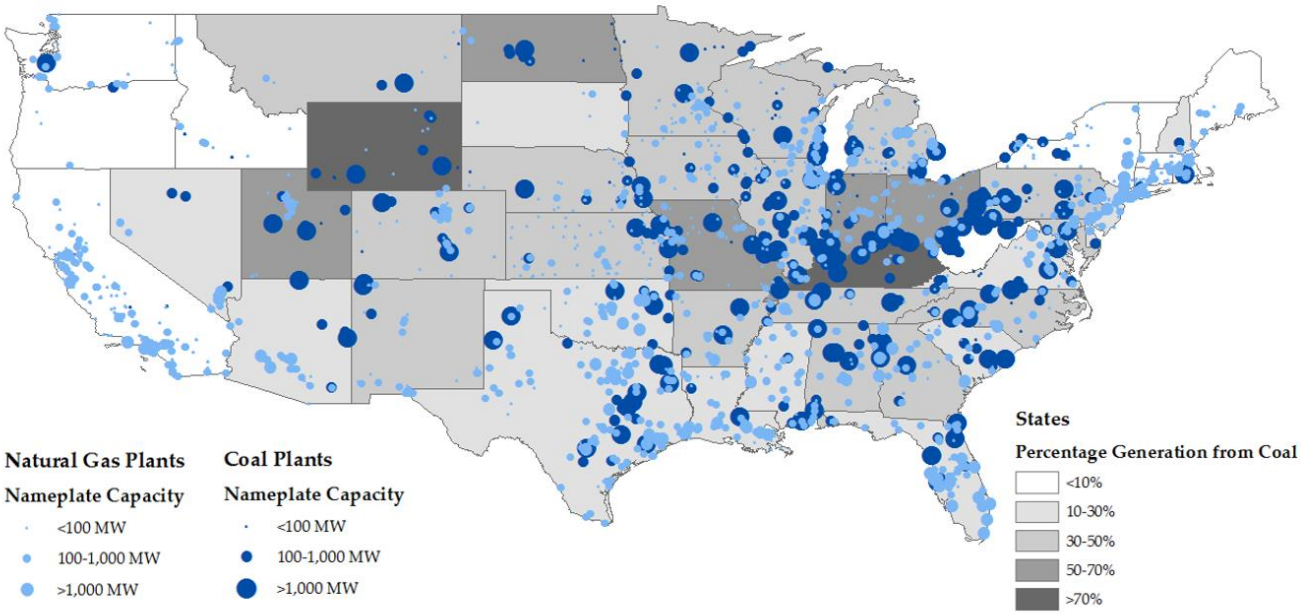
Fig 1.10 shows that the average age of coal plants at retirement in the U.S. has dropped from 73 years in 1993 to 54 years in 2014. Thirty-six GW of coal capacity, or 10.9% of the U.S.' existing coal capacity, will be retired between 2015 and 2023. Between 2015 and 2030, only 2 GW of the 109,391 GW of planned capacity additions will be from coal.

At the regional and local level, coal-to-gas transition is not uniform and depends largely on geography, the state of market regulation, and the transmission and interconnection networks.

While many people are aware that utilities, as a whole, are making this coal-to-gas transition at the national level, the story at the local and regional levels is much more varied. Specifically, the strategies and approaches by individual utilities differ based on their geographic reach, regulatory environment in their respective markets, and access to transmission and interconnection networks.

First, geographic regions shape utilities' fuel mix strategy and choices. Historically, utilities owned generation assets, which were used to service the electricity load in their surrounding areas. Naturally, utilities in areas with higher coal availability generate more of their electricity from coal. Conversely, utilities which are closer to shale gas plays are able to switch more easily to natural gas.

Fig 1.11: U.S. COAL PLANTS AND NATURAL GAS PLANTS



Source: EIA (2016)

Second, utilities' fuel mix strategy and choices are also shaped by the market structure of the states they operate in. In the U.S. energy markets, deregulation in the 1970s started classifying states into regulated or deregulated utility markets. Regulated markets generally feature vertically integrated utilities that own or control the entire flow of electricity from generation to the customer's meter.

In deregulated markets, utilities have divested from owning power generation assets, and are responsible for only the transmission and distribution of electricity to the customer. Deregulated utilities typically bid into the power market, allowing for much more competition in the power generation sector. In states with deregulated and competitive electricity markets, coal's low marginal costs enable energy producers to place lower bids in the power markets, resulting in a tendency for a greater proportion of coal generation in such deregulated markets.

In regulated markets, however, utilities are able to recover from ratepayers their costs of investing in new power plants, mostly gas-fired and renewable, resulting in lower use of coal in their generation mix. Consider the case of American Electric Power (AEP), one of the largest U.S. utilities, which operates in eleven states, nine of which are regulated markets, and the remaining two competitive markets. Coal makes up 73.9% of AEP's generation capacity in competitive markets, compared to 46.3% in regulated markets. This trend does not necessarily indicate that competitive markets will continue to see a dominance of coal, considering the many other influencing factors such as emissions reduction policies and low natural gas prices.

Third, utilities' fuel mix strategy and choices also depend on their scale. Utilities that operate on a larger scale across states have greater flexibility to purchase generation assets in regions with cheaper fuel sources or with more favorable regulatory environments.

Ownership of, or access to, transmission and interconnection networks also influence utilities' fuel mix strategy. For instance, utilities operating in the U.S. West Coast have less flexibility to change their fuel mix in response to the domestic shale gas boom, as the Western Interconnection is not linked to the Eastern Interconnection.

Although clean coal technology is one strategy that utilities can deploy to comply with the Clean Power Plan, few utilities have adopted the technology. For instance, only five of the 1,145 coal plants in the U.S. are integrated gasification combined cycle (IGCC) plants.

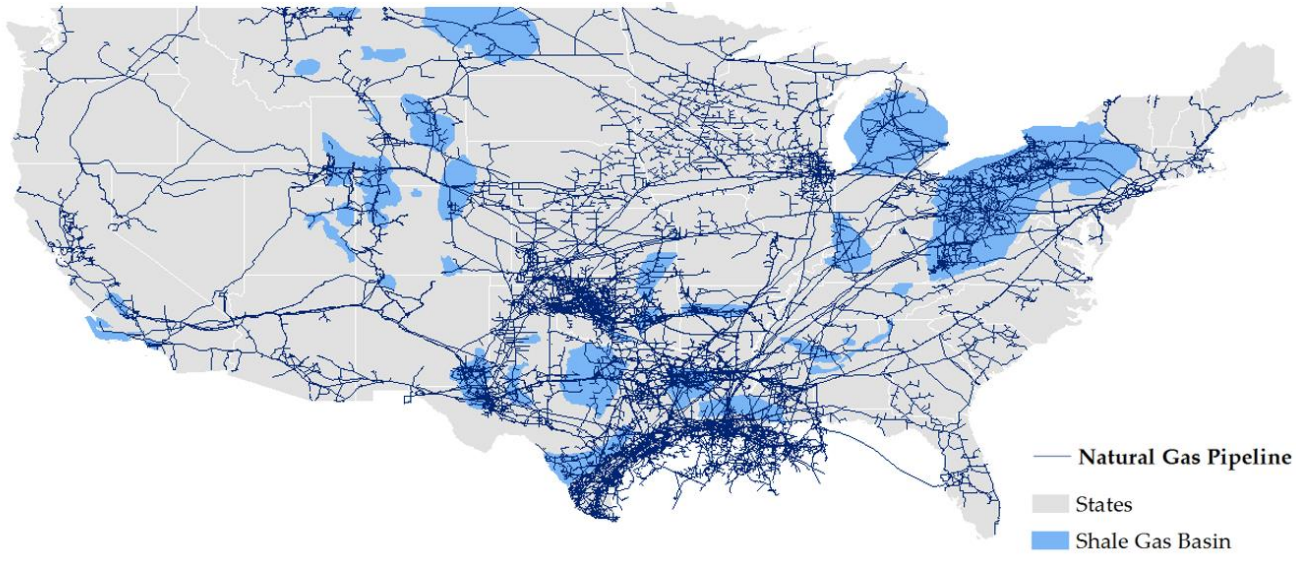
Regardless of regional variations, all utilities face some challenges in pursuing a coal-to-gas transition.

The transformation of the U.S. power market is creating new challenges for utilities. Specifically, the shortage of natural gas storage sites, inadequate pipeline infrastructure, and long-term contracts with coal providers pose persistent challenges. Utilities must cope with these challenges and balance cost, reliability, environmental, and social considerations in determining their fuel mix strategy.

Utilities switching to natural gas may find it prohibitively expensive to access additional natural gas in spot markets when actual electricity demand exceeds expectations. Few gas storage sites exist, and the high pressurization and liquefaction costs from accessing stored natural gas make this option less attractive. In contrast, coal storage facilities are more widely available, and utilities can easily tap their coal reserves during periods of higher demand. As a result, natural gas has historically experienced greater price volatility compared to coal. Utilities have to consider the trade-offs between cost volatility and the ability to draw from storage and reserves.

The inadequacy of the current domestic pipeline infrastructure is another impediment to full coal-to-gas transition in the United States. (5). Fig 1.12 shows that utilities located in the West Coast remain geographically isolated from the extensive transmission line and pipeline network linking the Eastern part of the country.

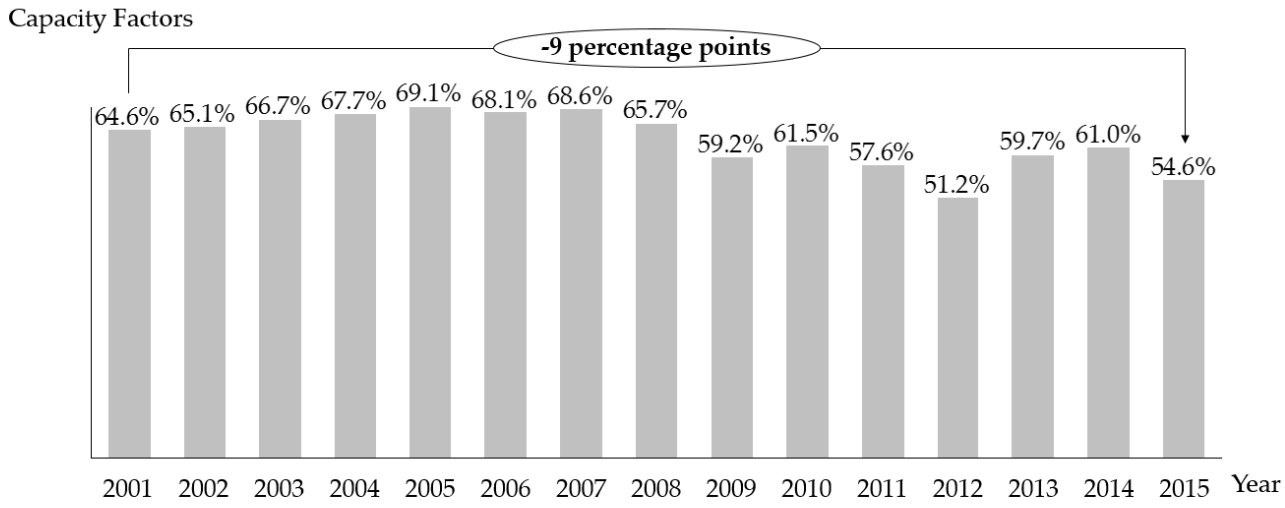
Fig. 1.12: U.S. NATURAL GAS PIPELINES AND SHALE GAS BASINS



Source: EIA (2016)

With increasing use of natural gas for baseload generation, coal plants that are traditionally baseload plants are now being run as load-following plants to serve intermediate load. This new mode of operation involves more frequent ramping up and down of the coal plants, and in doing so, may shorten the effective operating life of the coal plants that were designed to run continuously rather than intermittently (6). As a result, as seen in Fig. 1.13, coal capacity factors have fallen from 64.6% in 2001 to 55.4% in 2014.

Fig 1.13: U.S. COAL CAPACITY FACTORS, 2001-2014



Source: EIA (2016)

Finally, many utilities are still contractually bound to their long-term take-or-pay agreements with coal suppliers, limiting conversion options for coal-fired plants in the short term (7). 93% of the coal consumed for electricity generation in the United States in 2011 was purchased via long-term contracts instead of spot markets. Nevertheless, utilities are currently renegotiating their coal contracts, using the lower natural gas environment as leverage.

The key takeaway from Section 1 is that industry and utility macro trends greatly impact the operations and responses of coal companies. Coal mining operations with low costs and favorable locations will likely survive the downturn, and will be well-positioned when the market re-balances (8). Section 2 explores the various trends that coal companies have followed in the face of this industry decline.

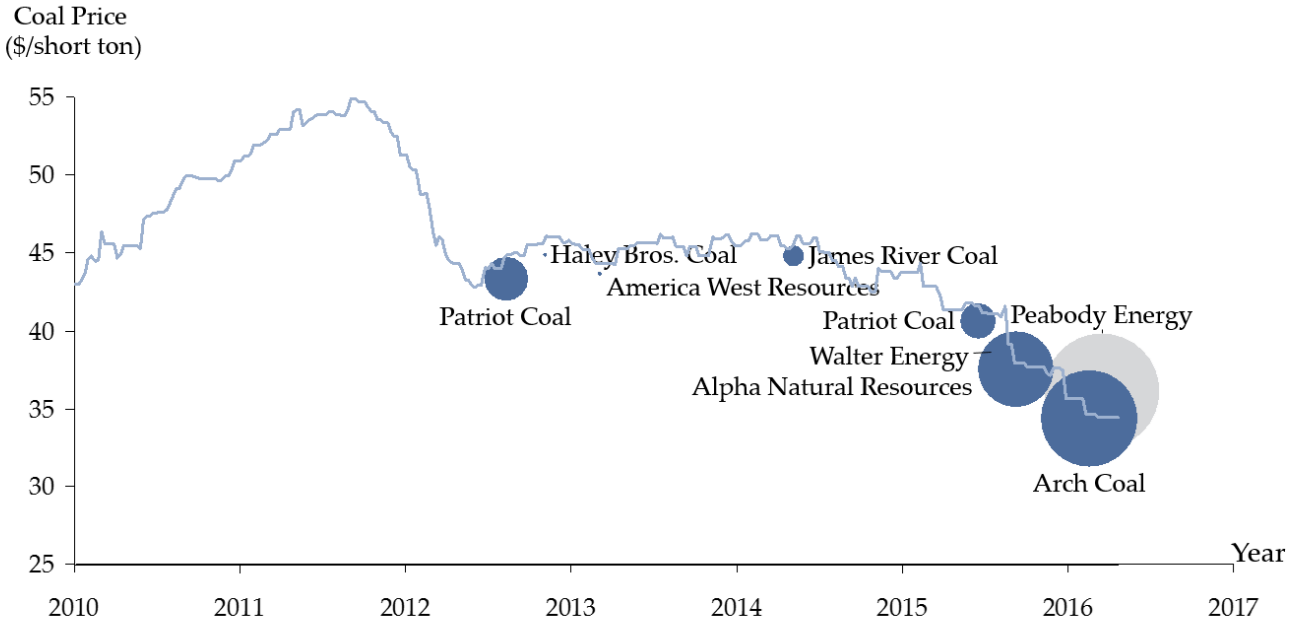
SECTION II
CASE STUDIES

How are U.S. coal producers responding to the changing economic and regulatory energy landscape? We have identified three main trends in coal producers' responses: 1) financial restructuring, 2) diversification away from coal, and 3) a focus on core profitable operations. It is important to note that these responses are not mutually exclusive, and can be pursued simultaneously. Company case studies are provided to demonstrate these trends.

2.1 FINANCIAL AND OPERATIONAL RESTRUCTURING

The first trend is that an overwhelming proportion of U.S. coal companies have had to file for bankruptcy in the past two years. Since 2015, some of the largest U.S. coal competitors such as Arch Coal Inc., Alpha Natural Resources, and Peabody Inc. have filed for protection under the U.S. Chapter 11 bankruptcy code. Frequently referred to as "reorganization bankruptcy," Chapter 11 bankruptcy allows a debtor to propose a plan of reorganization while keeping its business alive in order to repay its lenders over time. Unable to service their debt and left with few other options, these companies are currently in the process of negotiating with their lenders, in hopes of emerging from bankruptcy in a better financial position.

Fig 2.1: TIMELINE OF MAJOR BANKRUPTCIES, 2010-2016



Source: Company Annual Reports (2011-2015), Market Data (2016)

Fig. 2.1 highlights the major coal company bankruptcies that have occurred recently, against the backdrop of falling coal prices.[2] The circles represent the size of the company at the time of its bankruptcy, based on coal production numbers. It is important to note that the chart does not provide an exhaustive list of bankruptcies over time, as production numbers were not available for all companies. However, a striking observation is that three of the largest U.S. coal companies have all filed for Chapter 11 bankruptcy within the past year as coal prices dropped to an all-time low.

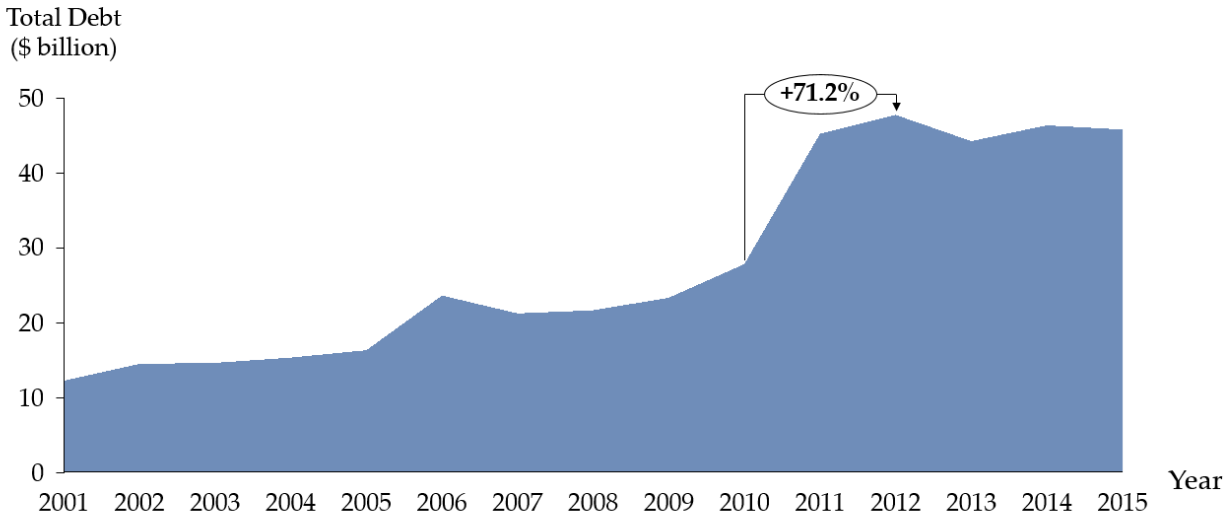
[2] Fig 2.1 contains two circles for Patriot Coal as it filed for bankruptcy twice.

Coal over-optimism led to poor investment decisions.

There has been some debate as to whether the current industry shakeout is the result of structural issues or is merely a cyclical phenomenon, as coal prices have also fluctuated in the past. Many factors contribute to coal's decline, but our analysis shows that the current wave of bankruptcies is more likely the result of structural issues. In the case of many companies, bankruptcies have been the result of companies thinking that there were good times ahead when in fact the industry was about to undergo a structural decline.

When floods in Australia left a supply-side gap in 2010, high prices and positive future coal demand projections led coal companies to be overly optimistic, and major companies went on an acquisition spree, taking on large amounts of debt to acquire new coal mines, particularly metallurgical coal mines. Fig. 2.2 shows a 71.2% increase in cumulative debt across 13 major coal mining companies in the United States from 2010 to 2012. Unfortunately as prices dropped soon after, many of these companies were subsequently unable to service their high debt because of the sharp decline in their revenues and stock prices. Although Chapter 11 bankruptcy does not necessitate mine closures, current bankruptcy restructuring involves financial and operational restructuring, such as asset sell-offs, cost cutting measures, and changes in ownership in order to improve the company's financial position.

Fig. 2.2: AGGREGATE DEBT OF TOP 13 PUBLIC U.S. COAL MINING COMPANIES*



*Peabody, Arch Coal, Alpha Natural Resources, Cloud Peak, Alliance Resources, NACCO Industries, CONSOL Energy, Walter Energy, Patriot Coal, Westmoreland, Foresight Energy, Hallador Energy, James River Coal

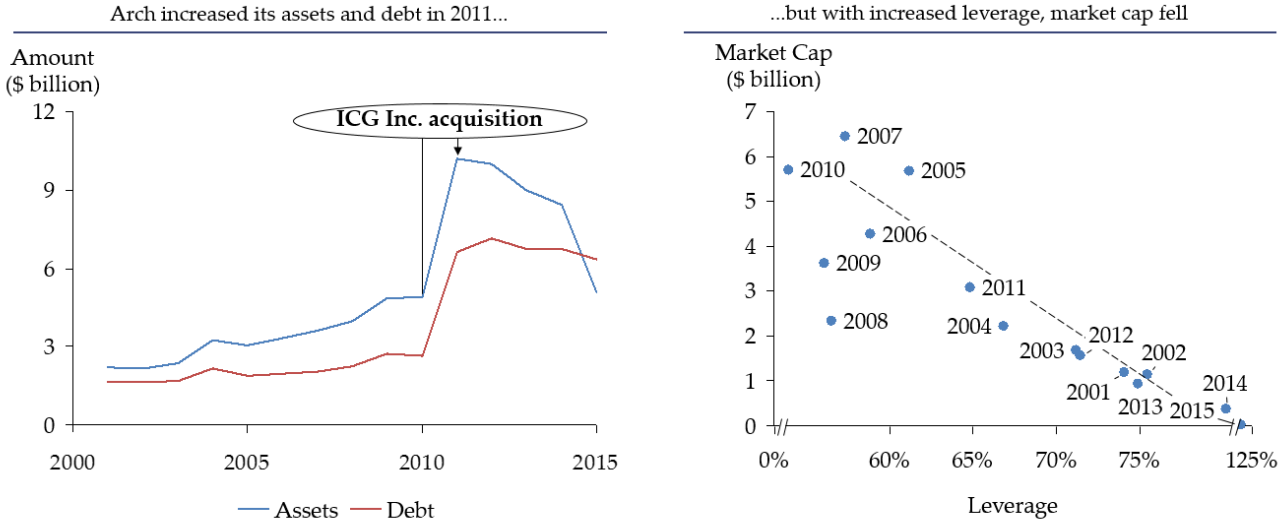
Source: Company Annual Reports (2001-2015)

Case Study: Arch Coal

One example of a company that made the wrong decision to increase investments amidst the structural decline is Arch Coal. In 2010, Arch Coal sold 162.8 million short tons of coal at an average price of $19.58. Eighty-one percent of this total tonnage was shipped from the Powder River Basin, and metallurgical coal accounted for only 3.4% of total shipments. Although debt was still relatively high at $1.5 billion, the company generated ample cash to keep operations manageable (9).

From 2010 to 2011, the company moved to double its assets, increasing its debt leverage nearly four times over. Its acquisition of International Coal Group for $3.4 billion in June 2011, was funded via fresh equity of $1.3 billion and an additional debt of $2.1 billion. The acquisition helped the company to expand its metallurgical coal shipments significantly.

Fig. 2.3: ARCH COAL
ASSET ACQUISITION AND STOCK PERFORMANCE



Source: Company Annual Reports (2001-2015), Market Data (2016)

Almost immediately following the acquisition, coal prices fell across the board. Arch Coal initially made efforts to prevent bankruptcy by attempting to sell off assets and exchange its debt with securities for short-term bonds. The initial negotiations were unsuccessful as lenders were unwilling to trade their debt for lower-return assets. Arch Coal filed for bankruptcy on January 11, 2016. To date, the terms of the bankruptcy have included an agreement with the majority of its senior lenders on financial restructuring that is expected to eliminate more than

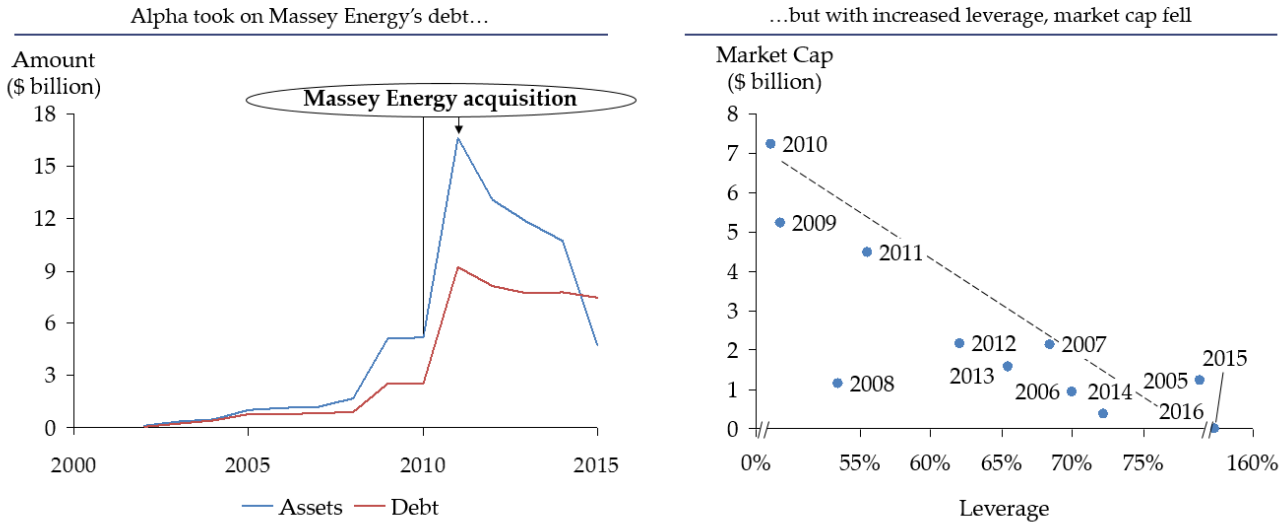
$4.5 billion in debt out of $6.5 billion from Arch's balance sheet (10). Arch's existing stock will be canceled and senior lenders will receive the substantial majority of the new stock in the reorganized company. Mining operations will continue as normal, but the company may close its unprofitable Central Appalachian mines and focus on the Powder River Basin in Wyoming.

Case Study: Alpha Natural Resources Inc.

Alpha Natural Resources' story also reflects the coal industry's trend of bad investment decisions taken at the wrong time. Founded in 2002 and publicly listed in 2005, Alpha Natural Resources focuses on the production of metallurgical coal and low-sulfur thermal coal in eight U.S. states.

In 2011, Alpha Natural Resources acquired coal producer Massey Energy for $7.1 billion, making it the second biggest coal miner by market capitalization (11) and one of the largest Appalachian coal producers. Massey Energy had about 2.8 billion short tons of reserves, of which 1.3 billion were comprised of metallurgical or coking coal. After the merger with Massey, the company owned 150 coal mines, more than double from the original 65 mines at the end of 2007. The merged company (54% owned by Alpha Natural Resources) became the leading producer of metallurgical coal in the U.S. and had the second largest reserves of coal (5.1 billion short tons) (12). Merging operations with Massey was estimated to reduce combined operating costs by $150 million. However, the acquisition also increased Alpha's debt by $3 billion as it took on Massey Energy's existing liabilities (13).

Fig 2.4: ALPHA NATURAL RESOURCES ASSET ACQUISITION AND STOCK PERFORMANCE



Source: Company Annual Reports (2002-2015), Market Data (2016)

Almost immediately following the acquisition, coal prices started falling. To make matters worse, the demand for thermal coal increased while metallurgical coal demand remained flat – dealing an extra blow to Alpha's business strategy. In 2012, Alpha began a wave of layoffs and mine closures, particularly in the Appalachian region where production costs were the highest. In August 2015, after four years of losses, Alpha filed for Chapter 11 bankruptcy, citing "a multi-year fall in demand for coal—in particular, metallurgical coal used for steel production—amid a deepening slump in the global economy." (14) Due to its bankruptcy, the company was delisted from the New York Stock Exchange (NYSE) on July 16, 2015. Alpha is currently undergoing restructuring and negotiations with its lenders, while its mines remain in operation due to a $692 million financing package arranged by Citigroup.

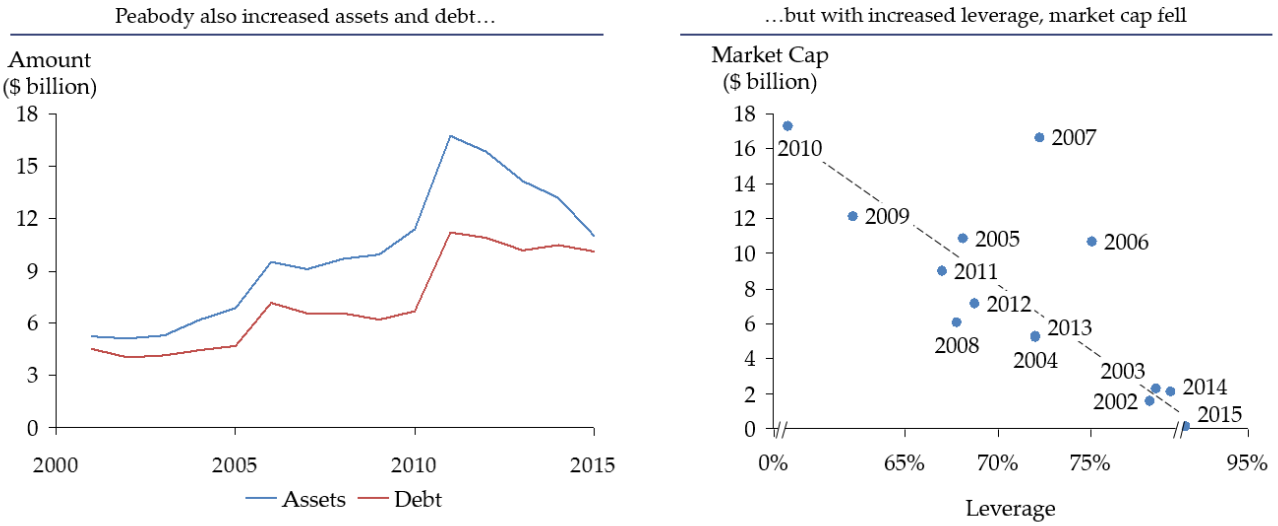
Case Study: Peabody Energy

The clearest indicator of the coal industry's current woes occurred on April 13, 2016, when Peabody Energy—the largest U.S. coal company—filed for Chapter 11 bankruptcy. As with its competitors, an optimistic outlook assessment for coal spurred Peabody to complete its acquisition of Macarthur Coal (in Australia) in 2011 for $5.2 billion (15).

Peabody's debt increased almost two-fold from around $6.3 billion in 2010 to around $11 billion in 2011 due its need to finance its new acquisitions. Following the drop in coal prices, its "debt-

laden capital structure became unsustainable as cash flows worsened and access to capital markets evaporated." It is expected that its shares will stop trading on the NYSE, but Peabody will continue to operate its mines during the restructuring. The operations in Australia were not included in the Chapter 11 filing.

Fig. 2.5: PEABODY ENERGY
ASSET ACQUISITION AND STOCK PERFORMANCE

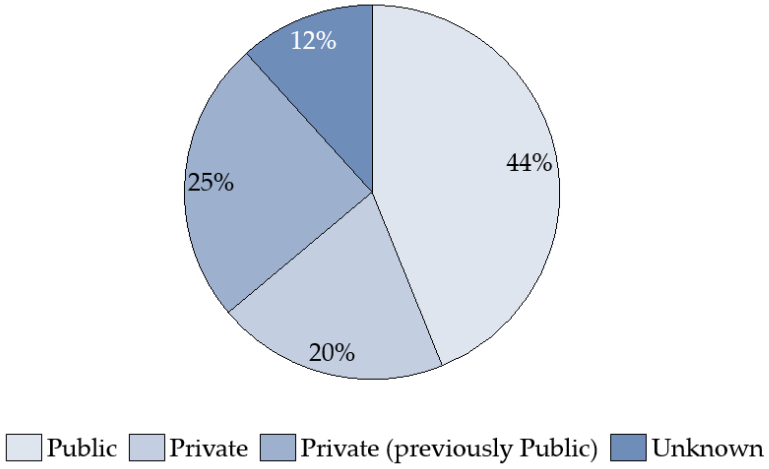


Source: Company Annual Reports (2001-2015), Market Data (2016)

Financial restructuring necessitates streamlining operations.

Although each company will emerge from its bankruptcy differently, a coal industry shakeout would likely not result in the collapse of coal mines and the coal industry. The IEA estimates that the United States will still get almost 30% of its energy generation mix from coal in 2030 (16), and many coal mines will remain operationally profitable. As companies seek to restructure their debt, heavy organizational changes will be expected as new financial terms are being negotiated with lenders. Furthermore, there is likely to be a larger number of small and unlisted mining companies, as the mining industry becomes increasingly privatized alongside an emergence of alternative sources of capital, especially from private equity.

Fig. 2.6: U.S. COAL PRODUCTION BY OWNERSHIP OF TOP 20 COMPANIES



Source: EIA (2016), Market Data (2016)

Part of the financial restructuring process necessitates changing company operations in order to decrease cash burn and streamline operations. This process may involve layoffs, closing or idling mines to reduce supply, and reducing exports. As companies cut costs in order to reduce debt and liabilities, we can expect a higher number of mine sales and closures as well as more layoffs and lower wages for workers.

Such an outcome will have resounding negative social effects for mining employees and communities, many of which have already been economically devastated by the large number of layoffs in recent years. Such impacts will be further discussed in Section III of the report. The following are some examples of how companies have attempted to streamline operations and cut costs.

Bankrupted companies' shedding of liabilities has led to societal problems.

One result of bankruptcy filings that has incurred negative public consequences has been the shedding of certain environmental and labor obligations. For example, the bankruptcy of Walter Energy has had devastating effects on current and former employees. In late 2015, a federal judge granted approval for the company to reject its labor agreements and end retiree benefits. This has left many union employees and retirees facing an uncertain future, even after the federal agency Pension Benefit Guarantee Corp. announced that it would pay retirement

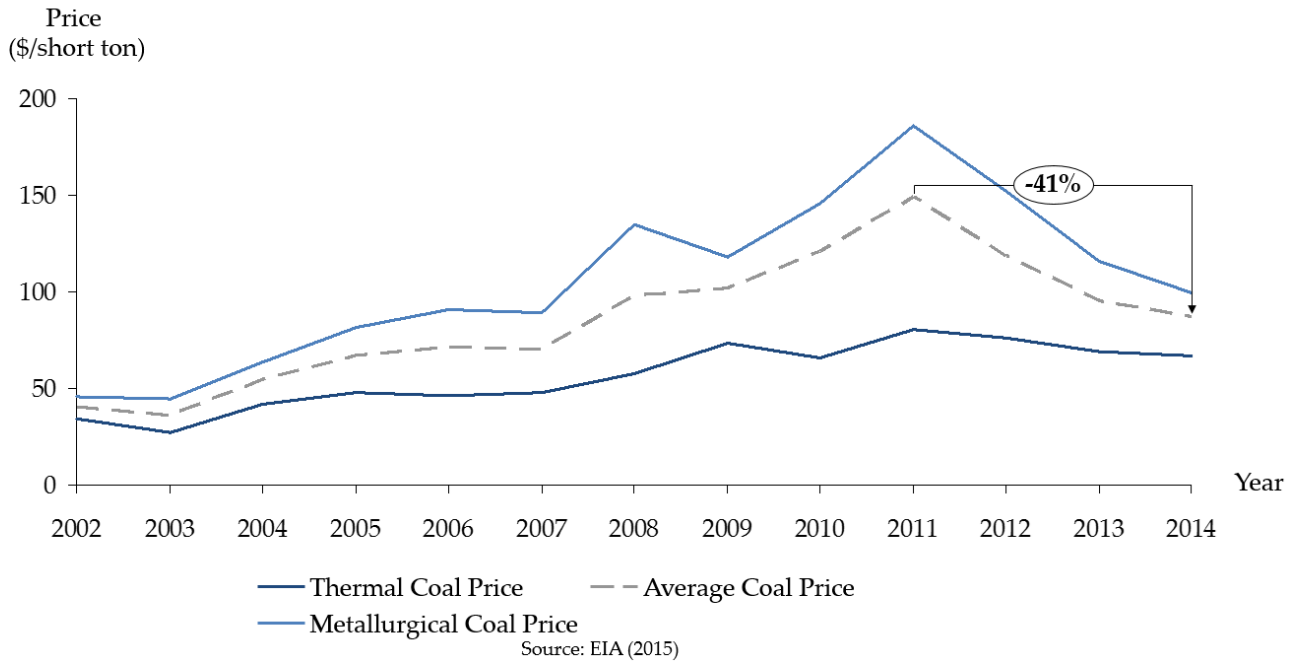
benefits for more than 2,700 current and future retirees of Walter Energy (17). Alpha Natural Resources is also currently seeking permission to amend its retiree and labor obligations.

Coal companies also have liabilities tied to environmental claims that can be shed during a bankruptcy, and this pushes the burden of reclamation and restoration to taxpayers and the state (18).

For example, Arch Coal and Alpha Natural Resources have both assured that some, but not all, of their reclamation obligations will be covered. In the case of Arch Coal, its lenders have agreed to cover up to $75 million in cleanup and other regulatory obligations in connection with its bankruptcy loan. However, around $410 million of its obligations still remain to be taken up by Wyoming (19). Hence, these cases illustrate that states and taxpayers may end up with the ultimate responsibility for retirees and the environmental clean-up.

Some coal companies have reduced exports in an effort to survive.

Fig. 2.7: U.S. ANNUAL COAL EXPORT PRICES, 2002-2014



Source: EIA (2015)

From Section 1, the disappointing outlook of the global demand for coal and the drop in U.S. coal export prices has also led several internationally exporting companies to temporarily halt exports as they become unprofitable. One example of such company is Cloud Peak Energy.

The company is considered the third largest U.S. coal producer, selling approximately 86 million short tons annually. (20). It operates surface mines in the Powder River basin, making it one of the lowest-cost producers in the United States. Originally using a take-or-pay contract with Westshore Terminals Limited Partnership, Cloud Peak decided that the money it was losing by shipping to Asia would be greater than what it would lose by paying Westshore not to ship it.

In October 2015, Cloud Peak announced that it would halt exports through Westshore Terminals for the period 2016 to 2018, instead opting for an undisclosed payment and further undisclosed quarterly payments throughout the period (21).

2.2 Diversification and Divestment from Coal

Although diversifying revenue streams can be a viable strategy, success often relies on geographical advantages and good timing.

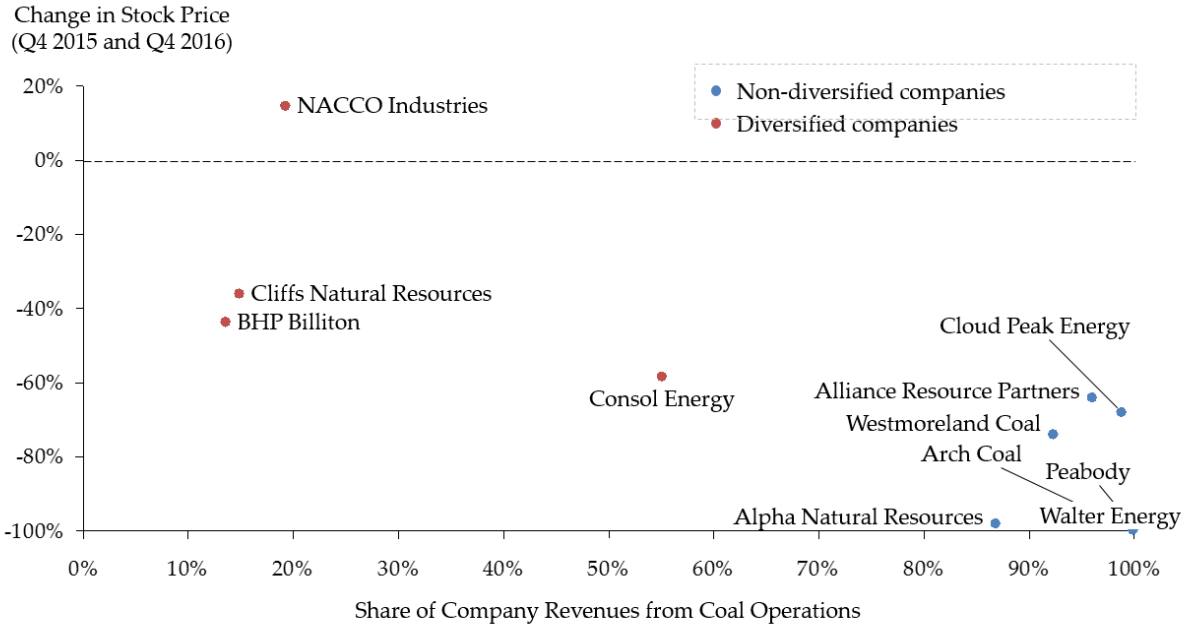
The second major trend is that of diversification. We investigated whether companies have pursued diversification to stem off the coal industry decline, but few have done so. Some companies have moved to diversify their operations away from coal and towards other resources such as natural gas and coal mine methane in order to hedge their risks and bolster revenues. Diversification of revenues has proven to be a relatively successful strategy for companies struggling with decreasing sales from their core coal business.

Based on our research, the lower the reliance on coal revenues, the lower the fall in stock price in the previous 12 months (April 2015 - April 2016) (22). However, this is a difficult strategy for coal mining companies to adopt as they have historically only focused on one revenue stream.

Our analysis of thirteen public-listed companies' annual reports shows that most (around eight) did not attempt to diversify their revenue streams. In addition, the few companies that did attempt to do so, such as CONSOL, already had natural gas assets when the coal sector started to experience difficulties.

According to Fig. 2.8, while most companies saw a decrease in stock price following the decline in coal prices in 2011, those with diversified revenue sources fared slightly better than those that did not. The success was measured by the change in stock price over the last twelve months (22).

Fig. 2.8: STOCK PERFORMANCE VS. REVENUE DIVERSIFICATION

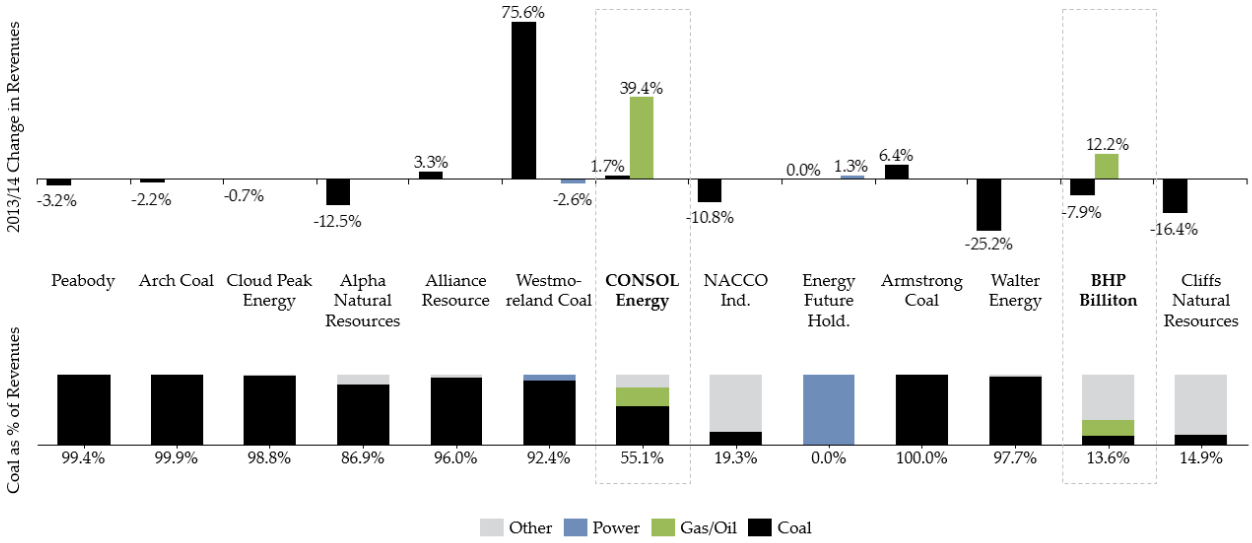


Source: Company Annual Reports (2014-2015), Market Data (2016)

Diversification has been difficult for a number of reasons. First, companies have to stick to their core competencies. As Sergej Mahnovski, former Director of Utility of the Future for Con Edison suggested, *"Companies can typically only transition 1 degree outside of their core business model."* Second, even if they do not diversify, they may still face external challenges as investors may not believe in them. Investors often prefer to diversify their own portfolio of companies, rather than staying with a company that is attempting to diversify outside of its core business, given the various risks involved. The former CEO of utility company NRG, David Crane, suggested this when he claimed that *"Wall Street has difficulty digesting the idea of a conventional company going green"* (23).

Naturally, the relationship between stock prices and a company's reliance on coal will vary according to market conditions. For example, Cliffs Natural Resources, which sells both coal and iron ore (24), would be negatively impacted if the iron ore market faltered. Conversely there have been times when pure coal companies have benefited from focusing on certain core profitable assets, a strategy discussed further in Section 2.3.

Fig. 2.9: REVENUE CHANGE AND BREAKDOWN AMONG TOP U.S. COAL COMPANIES



Source: Company Annual Reports (2013-2014)

Eight out of thirteen publicly listed companies (Peabody, Arch Coal, Cloud Peak Energy, Alpha Natural Resources, Alliance Resource Partners, Westmoreland Coal Company, Armstrong Energy and Walter Energy) control 58% (25) of U.S. production and have not exhibited any substantial attempts to divest from coal or to make parallel investments in new activities (26).

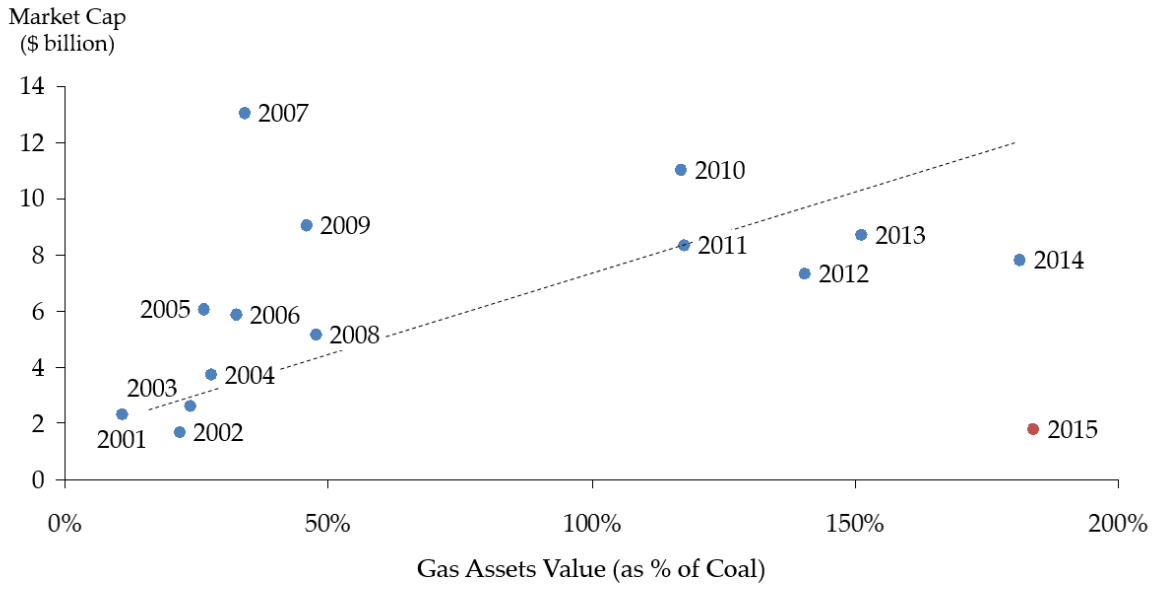
BHP Billiton pursues mining activities around the globe (27), and coal only accounts for 14% of its revenues (although we note that its coal mining activities are primarily taking place outside of the United States.). NACCO is a holding company (28) which has a diverse portfolio of businesses (such as kitchen appliances) and Cliffs Natural Resources operates primarily in the iron-ore mining sector (24). Such companies are continuing to operate with a business-as-usual approach, without significant efforts to further diversify or change their strategy.

Coal companies with diversified revenues do exist (Energy Future Holdings, NACCO Industries, BHP Billiton, and Cliffs Natural Resources), but most of their diversification is the result of a long-term strategy as opposed to a strategic reaction to current market conditions. Before filing for bankruptcy in 2015 (29), the integrated utility Energy Future Holdings earned revenues from power generation in addition to owning twelve lignite coal mines as a source of fuel (30).

Case Study: CONSOL Energy

The only company that has significantly changed its business model is CONSOL Energy. CONSOL is a coal company that also generates a significant portion of its revenue from producing natural gas. This has been possible due to its coal assets that are co-located with natural gas reserves, allowing the company to shift its focus to producing natural gas instead of coal as part of its long-term strategy (31). CONSOL's diversification strategy benefitted from its prior experience in the natural gas sector, as well having low-cost, high-quality coal assets in the Marcellus and Utica regions. This favorable positioning has helped the company to ramp up the production of its natural gas to offset decreased coal demand.

Fig. 2.10: CONSOL ENERGY
MARKET CAPITALIZATION VS. GAS ASSETS



Source: Company Annual Reports (2001-2015), Market Data (2016)

CONSOL has significantly increased its natural gas asset base. In 2001, this amounted to just 11% of coal assets but by 2015, this portion had increased to 184%. The strategy appeared to be successful up until the end of 2014, where a growth in market capitalization was correlated with an increase in gas assets. Tthis trend was disrupted in 2015 and CONSOL experienced a precipitous drop in its stock price. From December 2014 to February 2016, CONSOL's stock price fell from between $34-36 to between $7-9 (22).

The reason for such a drastic fall in CONSOL's stock price may be two-fold. First, the company could have been hit by falling natural gas prices. Second, as market analysts such as David

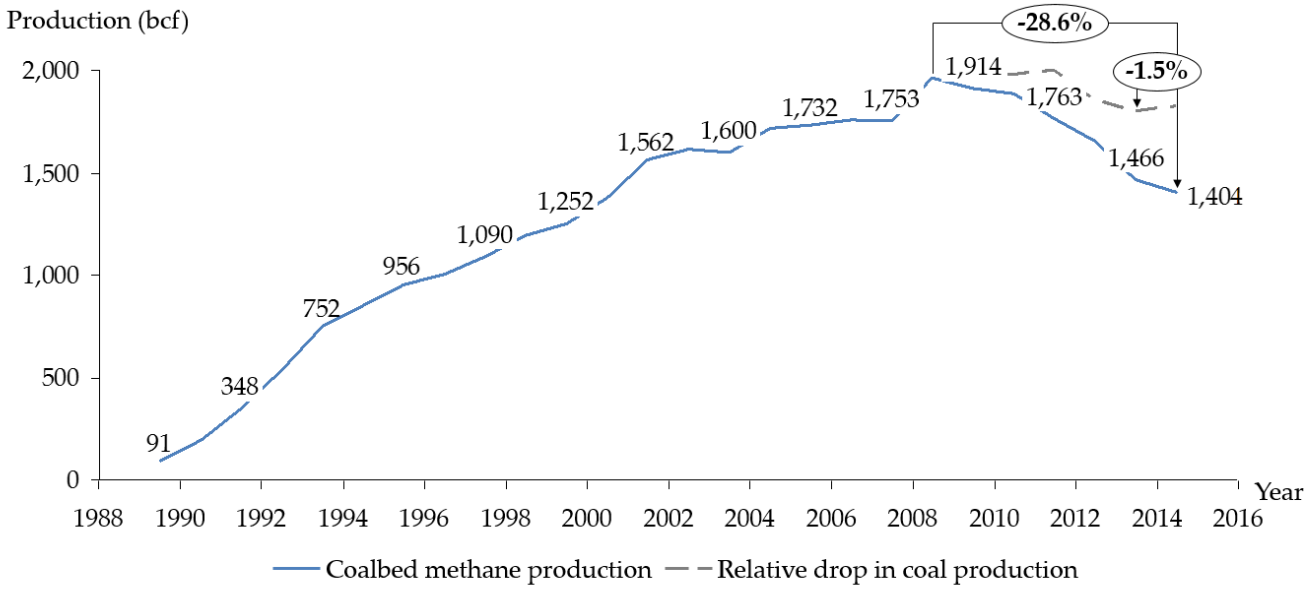
Einhorn suggest, investors perceive CONSOL predominantly as a coal company, and therefore attribute a risk profile that is more appropriate for a coal company than for a natural gas company (32). Due to these reasons, there is a possibility that CONSOL's stock performance will deviate from that of the coal industry once the market and investors are comfortable with the shifting focus of the company and acknowledge the 39% growth in its natural gas revenues from 2013 to 2014.

Coal mine methane production is not considered to be a viable investment opportunity.

According to industry trends, coal mine methane production closely matches coal production. Data suggests that until now, coal mine methane has been treated as a by-product revenue, and not necessarily as a separate revenue stream. There has been virtually no company involvement in coal mine methane resource development in recent years.

Referring to chart below, its production has been falling since its peak in 2009, mirroring the overall decline in coal production. (33). Major coal players do not seem to be considering reversing this trend. This became apparent after evaluating recent annual reports and press releases of coal companies, where coal mine methane has not been distinguished as a separate line item. In many instances, coal mine methane is described merely as a safety liability, with no reference to its revenue potential.

Fig. 2.11: U.S. COALBED METHANE PRODUCTION, 1989-2015



Source: EIA (2016)

2.3 Focus on Core Profitable Operations

A conservative business strategy and focusing on operational efficiency may be the best path forward, but does not ensure success in today's troubled coal market.

Within the U.S. coal mining sector, a third theme that arose during our research is the consolidation that has occurred within the sector. As discussed earlier, many coal companies are experiencing financial distress and have undergone or are currently facing bankruptcy. Despite the bleak outlook, other companies are taking this opportunity in the market downturn to concentrate their coal positions and focus on core profitable operations.

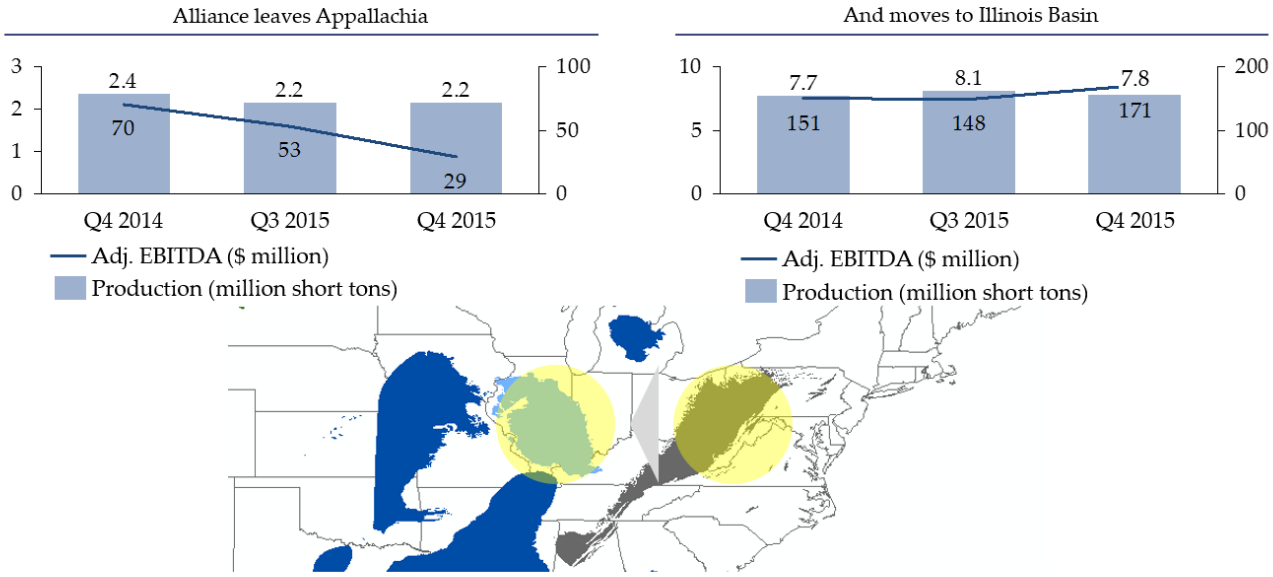
The three types of focus strategies are: operational efficiency, geographic concentration, long-term contracts.

A common method of concentration within the coal sector is the focus on operational efficiency and reduction of operating costs. One such efficiency boosting measure is operational refocusing: selling off metallurgical coal assets in favor of exclusively producing thermal coal, or vice versa. This approach usually involves a company like Walter Energy (which has historically produced both metallurgical coal and thermal coal) selling off their thermal coal assets in favor of producing metallurgical coal exclusively. Unfortunately as discussed earlier in the report, such a strategy has not prevented Walter Energy from bankruptcy after metallurgical coal prices and demand dropped significantly.

Case Study: Alliance Resource Partners

A second potential approach is geographic concentration, where a company with national operations consolidates their operations into one particular coal mining region and focuses on mining the company's most profitable reserves. An example of this approach is Alliance Resource Partners, who originally mined coal in the Appalachian coal region, and acquired assets in the Illinois Basin to become a national producer. In response to falling coal prices, Alliance has focused on their Illinois Basin operations, as the Appalachian assets have become less profitable.

Fig. 2.12: ALLIANCE RESOURCE PARTNERS
REVENUES BREAKDOWN



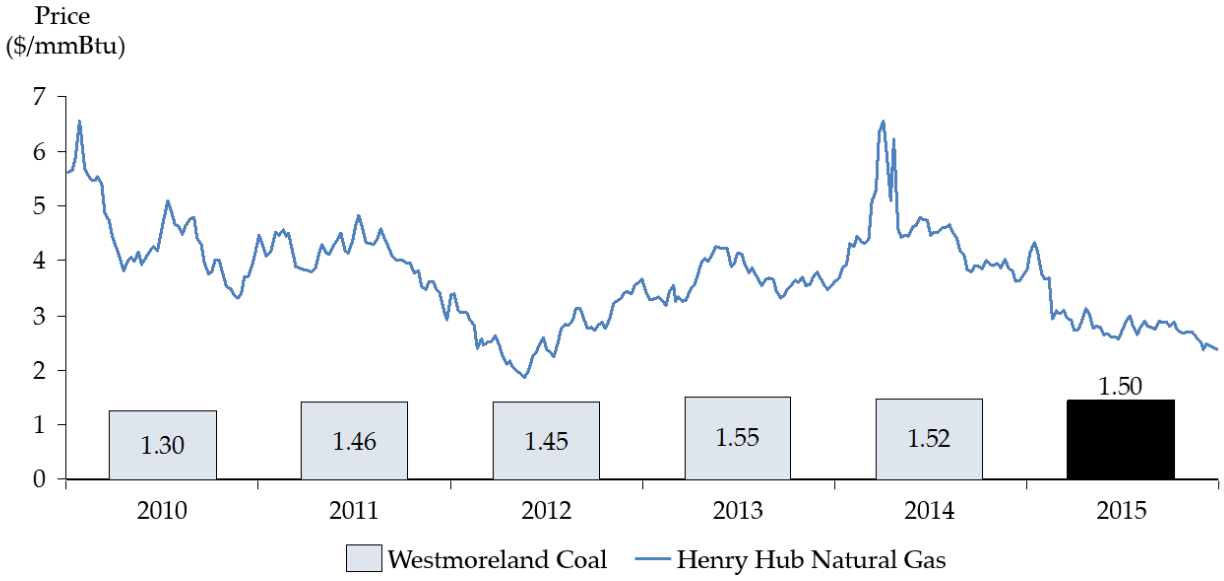
Source: Company Annual Reports (2014-2015)

Case Study: Westmoreland

A third approach is adopting a cautious growth strategy while focusing on operational efficiency and stable long-term contracts. Coal companies who have taken this approach, due to their conservative business strategy, are better able to weather coal price shocks than their highly-leveraged peers. An example of this approach is Westmoreland Coal (26), whose successful avoidance of bankruptcy can be attributed to the conservative approach of its long-term strategy. It has focused on selling high quality coal into niche markets strategically located close to power plants and customers, thus reducing transportation costs. Westmoreland also benefits from long-term, cost-protected "take-or-pay" contracts with those nearby customers, further securing stable revenue streams.

In addition to its operational concentration, Westmoreland also shifted geographically early on, selling off its east coast assets in 1995 in order to concentrate on lower-cost mines in Western U.S., Canada, and the Powder River Basin. These tactics have enabled them to keep their operating costs low enough to weather the recent downturn within the coal sector.

Fig. 2.13: WESTMORELAND COAL
PRICE OF COAL VS. HENRY HUB GAS



Source: EIA (2016), Company Annual Reports (2010-2015)

These three approaches: eliminating non-core operations, geographical concentration (as done by Alliance Resource Partners), and streamlining operations (as done by Westmoreland Coal), have allowed certain coal companies to survive the bankruptcies that have plagued the rest of the coal sector.

Nevertheless, these strategies have not entirely shielded these companies from the coal sector shakeout. All of these companies have suffered steep drops in their stock prices (of more than 50%) in the past year. At best, the case studies demonstrate that even the best practices of efficient coal companies cannot ensure success in this troubled coal market.

SECTION III
SOCIETAL IMPACT

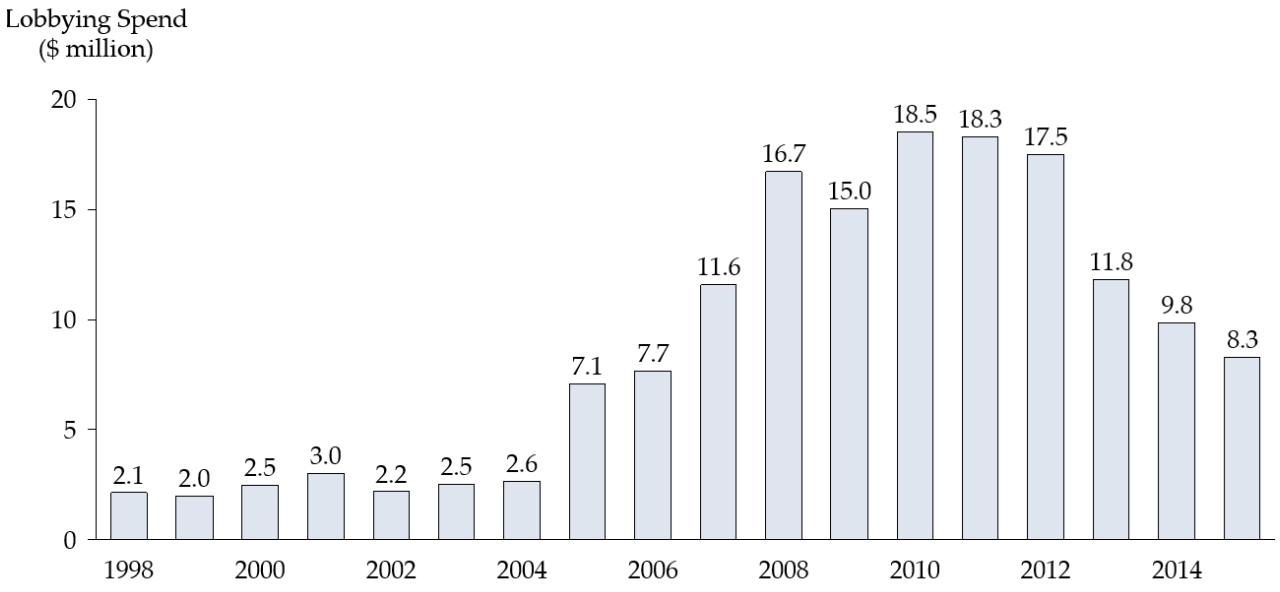
In addition to the economic challenges facing the coal industry, the social tide has shifted against coal, due to climate change and environmental and health concerns. While the coal mining industry continues to wield influence in U.S. politics, that influence is waning, especially in areas where natural gas production has taken off. Furthermore, at the regional and local level, there are major concerns among politicians and the general public regarding the economic and social implications of the loss of employment opportunities for industry workers. This section outlines both the changing U.S. political landscape as it relates to the coal industry, and the repercussions of coal industry's decline on coal mine employees and their communities. It also provides an overview of policies designed to mitigate the impact of this decline.

3.1 POLITICAL INFLUENCE

The coal-mining lobby remains politically relevant in the United States., but is no longer as financially or politically influential as it used to be.

The U.S. coal mining industry's collective lobbying and campaign contribution dollars skyrocketed when President Obama came into office in 2008, reaching an apex of $16 million in campaign contributions, and more than $18 million in lobbying expenditure during the first term of his presidency. This dramatic increase in political spending signals opposition to the Obama administration's stricter environmental regulations, and also suggests a struggling industry grasping for a lifeline. After 2012, spending fell as coal companies began to falter financially.

Fig. 3.1: U.S. COAL INDUSTRY TOTAL LOBBYING SPEND, 1998-2015

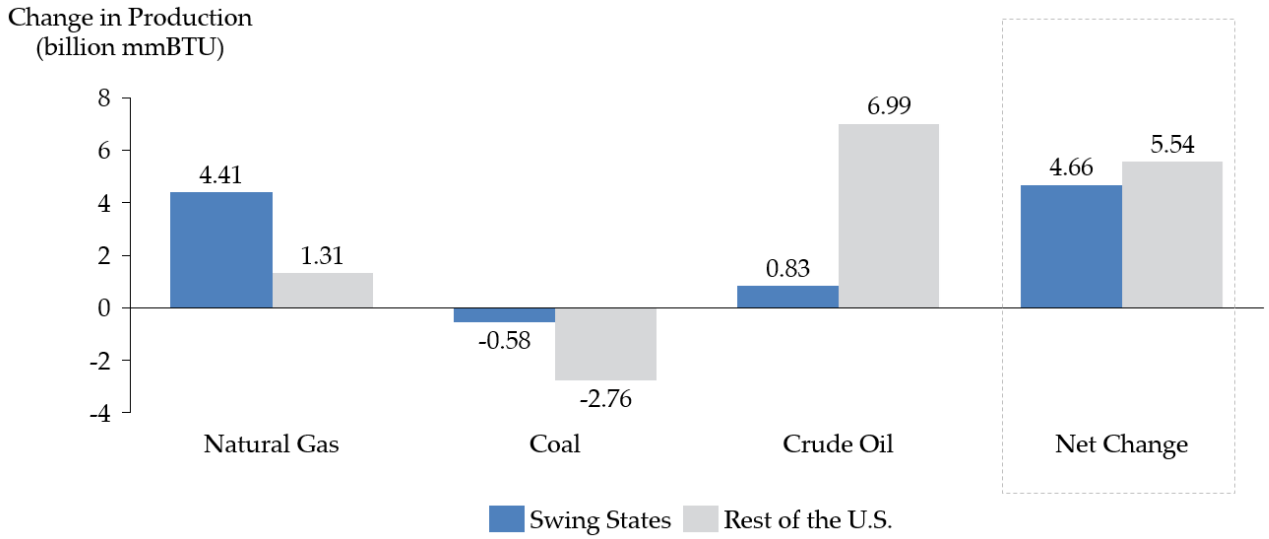


Source: Center for Responsible Politics (1998-2015)

Despite the increase, the coal industry spent, on average, only 15% relative to what the oil and gas sector spent on political contributions since the Obama administration came to power in 2008 (34). Over the same period, the coal mining industry has lost political leverage as key regions have benefited from the shale gas revolution. In the U.S., because of the Electoral

College[3] system of elections, presidential contests are typically won based on how well a candidate performs in 'swing states'[4]. For this reason, swing states have a disproportionate amount of political influence.[5]

Fig. 3.2: CHANGE IN ENERGY PRODUCTION, 2008-2014



Source: EIA (2008-2014)

Coal and natural gas production were roughly equivalent, on a Btu basis, both in the United States and in swing states in 2008 (35). By 2014, natural gas production was more than 2.5 times that of coal production in swing states, and exceeded coal production nationally by approximately 36% (36).

Today, about 18% of U.S. coal is produced in swing states, similar to trends over the last 25 years (35). But the percentage of natural gas produced in swing states grew to 29% in 2014, from 16% in 2008 and 9% during the 1980s. These economic trends have diminished the coal industry's political influence in the United States.

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3 The Electoral College is a process where voters select electors who then vote for the President of the United States on behalf of the electorate. Most states in the U.S. have a "winner-take-all" system that awards all electors in a given state to the winning presidential candidate.

4 In presidential politics of the United States, a swing state is a state in which no single candidate or party has overwhelming support in securing that state's electoral college votes. Such states receive a large share of the attention and campaigning of political parties in presidential elections, since winning these states is the best opportunity for a party to gain electoral votes.

[5]Swing states include Pennsylvania, Ohio, Colorado, Florida, Michigan, Nevada, New Hampshire, New Mexico, North Carolina, Virginia, and Wisconsin.

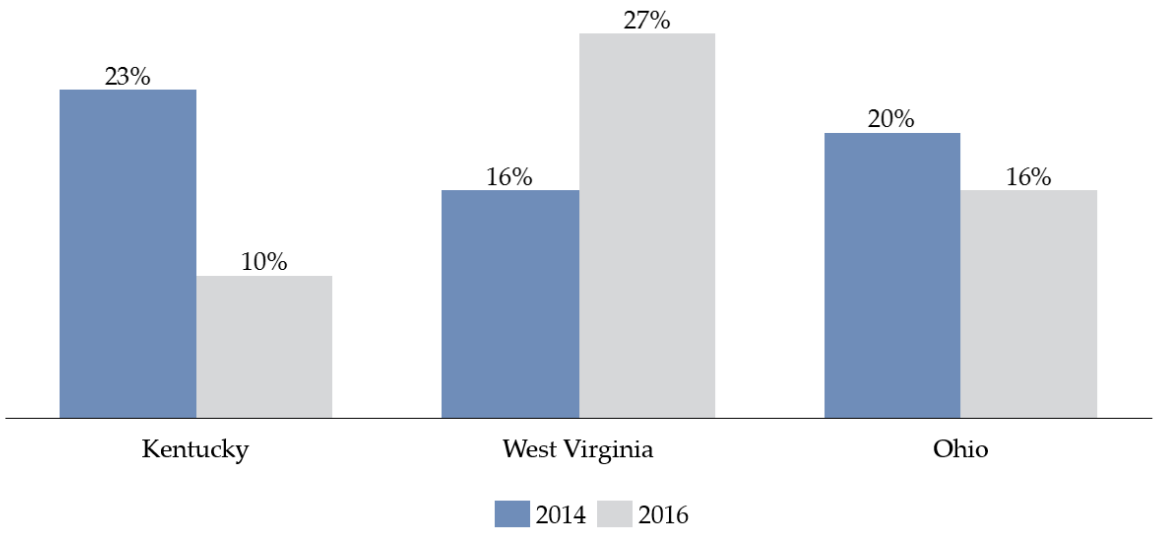
U.S. public sentiment for coal is divided along party lines and geographic location.

The coal industry's political spending is targeted, fostering public support among certain political groups. The industry has supported the Republican Party in the last 13 election cycles and enjoys significantly more support from Republicans than from Democrats (34). In 2014, 96% of campaign contributions from the industry were directed to the Republican Party.

Democratic states—as well as wealthier states—are more likely to support stricter environmental regulations over continued coal production (37). When asked in a recent Gallup poll if environmental protection or U.S. domestic energy development should be given priority, Democratic respondents widely prioritized environmental concerns, while Republicans prioritized domestic energy production.

While the industry mostly supports conservative coalitions and the Republican Party, it also targets its campaign contributions to representatives from traditional coal mining regions, like Kentucky and West Virginia (34). By strategically spending on the Republican Party, and on elected officials from coal producing counties, the industry has managed to maintain some influence in U.S. politics despite economic woes.

Fig. 3.3: SHARE OF TOP 20 CONGRESSIONAL CAMPAIGN CONTRIBUTIONS BY RECIPIENT



Source: Center for Responsive Politics (2016)

Since 2011, a majority of Americans have favored the development of alternative renewable energy sources over the increased production of fossil fuels (38). Furthermore, most Americans

are in favor of stricter regulations on greenhouse gas emissions from power plants, citing that these regulations are "worth the cost" (39).

While public sentiment is moving away from coal and toward alternative energy, and as coal companies are struggling to survive, coal miners and coal mining communities are finding themselves in a difficult situation and in need of support.

3.2 EMPLOYMENT

Bankruptcies and economic woes threaten employment opportunities in coal mining.

The loss of employment opportunities in mining and its associated industries has been a longstanding problem for many communities in the United States. In the past several years, top-producing U.S. coal companies, including Peabody, Arch Coal, and Alpha Natural Resources, have filed for bankruptcy, deciding to restructure and cut costs—leading to a further decline in coal miner employment. This trend is likely to continue as several other top coal producers face potential bankruptcy in the coming years. Together, Peabody, Arch Coal, and Alpha Natural Resources contribute more than 40% of total U.S. coal production (25). These companies have all cut down the number of workers during the past three years, with more layoffs likely, given Peabody's bankruptcy filing in the first quarter of 2016.

Overall, the total number of employees at U.S. coal mines has been declining since 2011, reaching a low of around 75,000 employees in 2014, a decrease of 7% from 2013 (40).

In areas where there are few alternatives for work, coal mining job losses can be particularly difficult for workers, their families, and their communities.

The primary reasons can be summarized as follows:

- Some coal communities are built around the coal industry and coal mining jobs, and other industries have failed to develop (41).
- Coal miners often lack the transferable skills and education that would make them desirable employees in other industries (42).
- Mining industry wages are significantly higher than wages for other low-skilled work, and higher than the average wage in the United States. In 2014, according to the National Mining Association, the average wage for all U.S. coal mine workers was $82,000, while the average wage for all U.S. workers was approximately $50,000 (43). The pre-tax wage for full-time work at minimum wage in the U.S. is $15,000.
- Mine closures strip coal communities of vital tax revenues, including those from income tax, corporate tax, and severance tax, which enable them to provide the social services that are in greater demand after a negative shock to the local economy (44).

Negative impacts from job losses are particularly challenging in mining communities that are traditionally low income, as is the case in Central Appalachia. On average, income in Central Appalachia is 64% of the average U.S. family income, the percentage of people living in poverty

is almost double that of the general U.S. population, as is the percentage of people living with a disability (45).

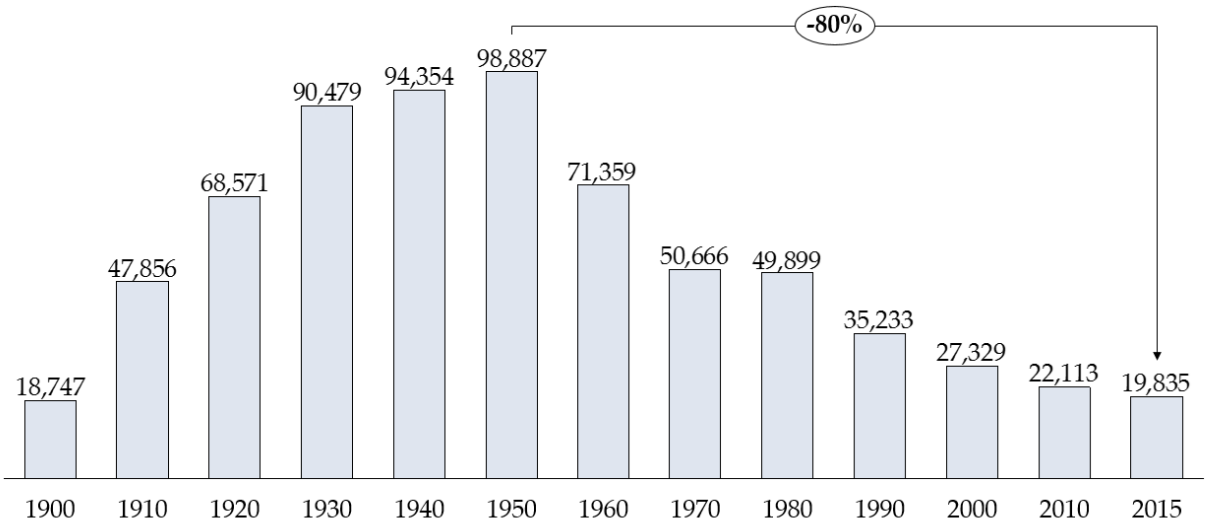
McDowell County, West Virginia, demonstrates the perils of relying primarily on coal mining.

McDowell County was a traditional coal mining community in southern West Virginia that thrived in the middle of the twentieth century. In the 1930s, it was the top producer of coal in West Virginia, and for years the region led the U.S.'s production of the renowned Pocahontas Smokeless Coal (46).

For years, the county's production averaged from 20 to 26 million short tons of smokeless coal a year, and attracted the highest prices in the market (46). By 1932, McDowell County had produced 530 million short tons of coal, and had further reserves of almost 5 billion short tons (46). Once the top coal-producing county in the United States, in 2014 the county produced just 3 million short tons of coal (40). More than one-third of county residents live below the poverty line (47). The county claims the highest drug overdose death rate in West Virginia, along with very high rankings in binge drinking and suicide (45).

"Locals reminisce about how there were once three movie theaters in the county and the population swelled to more than 100,000. It was a dependence that would prove unsustainable. By the 1980s, a bust was well underway throughout the region's coal hills. Mining mechanization eroded jobs, and the steel industry — coal's main buyer — was in sharp decline." – Al Jazeera America Report (47)

Fig. 3.4: POPULATION IN MCDOWELL COUNTY, 1900-2015



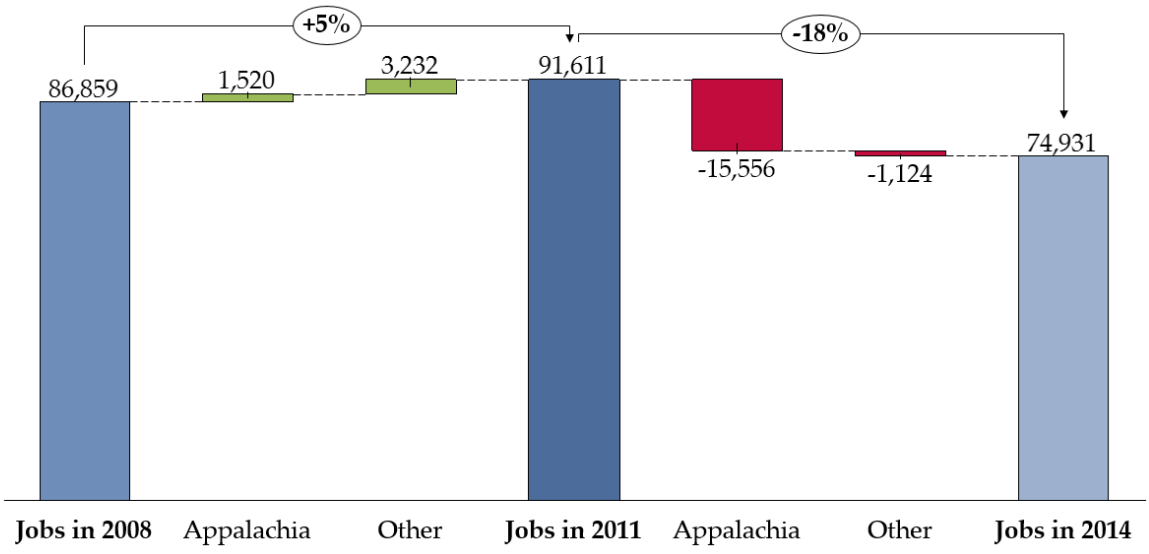
Source: U.S. Census (1900-2015)

The impact of the loss of jobs in coal mining has been devastating for the region. According to locals and local officials, the county desperately needs more housing, better roads, more jobs, a rehab center, and a stable food bank (47). Although McDowell County thrived for decades in the mid-century, it has struggled for many more decades, and has never recovered from the loss of coal jobs during the U.S. steel industry's downturn and beyond. Federal and local efforts to revive the area have had little effect. McDowell County proves that economic development for coal-mining communities is vital, and incredibly challenging.

Job losses in Central Appalachia have been disproportionately steep due to lower productivity and higher costs compared to other coal producing regions.

Central Appalachia has been particularly affected. For decades, the coal communities of the Appalachian region have struggled amid declining domestic coal consumption, and today the trend is worsening. Of the roughly 17,000 U.S. coal-mining jobs lost in the past five years, 83% were in the Central Appalachian region, whereas other coal producing regions have experienced relatively stable employment.

Fig. 3.5: COAL EMPLOYMENT CHANGE, 2008-2014

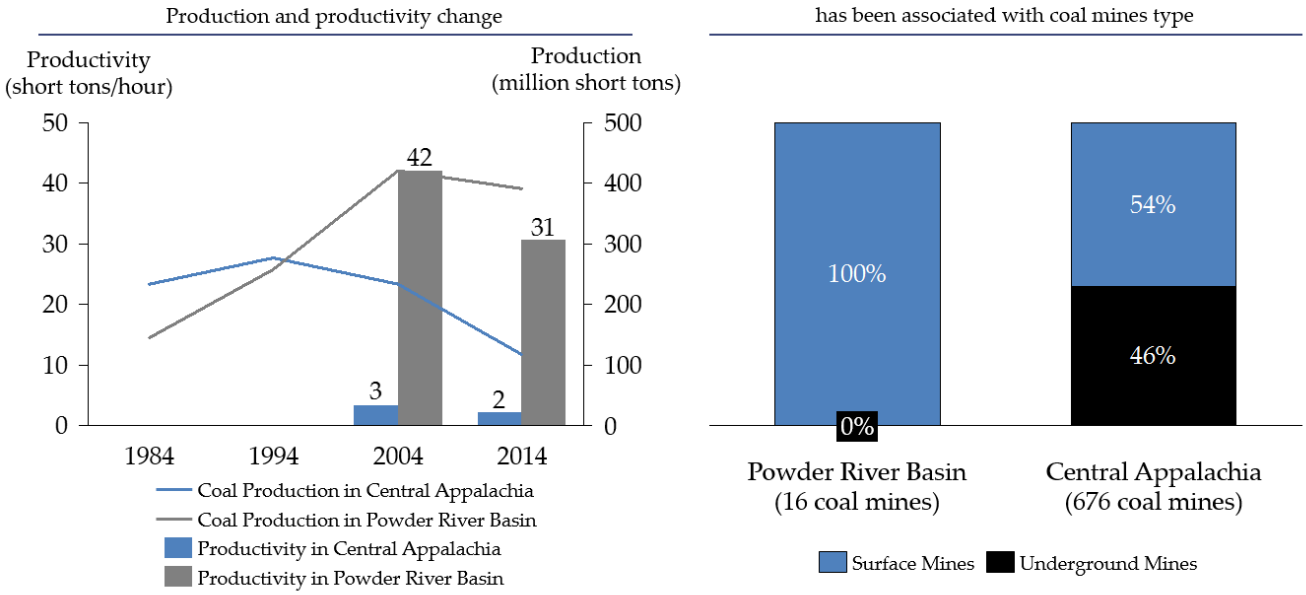


Source: EIA, U.S. Bureau of Labor Statistics (2007-2014)

From 2013 to 2014, approximately 5,500 coal-mining jobs were lost across the United States. Of those, around 4,100 were lost in Central Appalachia, and another 1,100 from the rest of Appalachia (48). More than 50% of job losses took place in West Virginia and Kentucky.

The primary reason that Central Appalachia has been hit so hard relative to other coal producing regions is a lack of productivity relative to other basins and the costs associated with needing more workers per level of output. In Central Appalachia, one labor hour produces approximately 2 to 3 short tons of coal, while coal miners in the Powder River Basin can produce 30 to 40 short tons of coal in one labor hour.

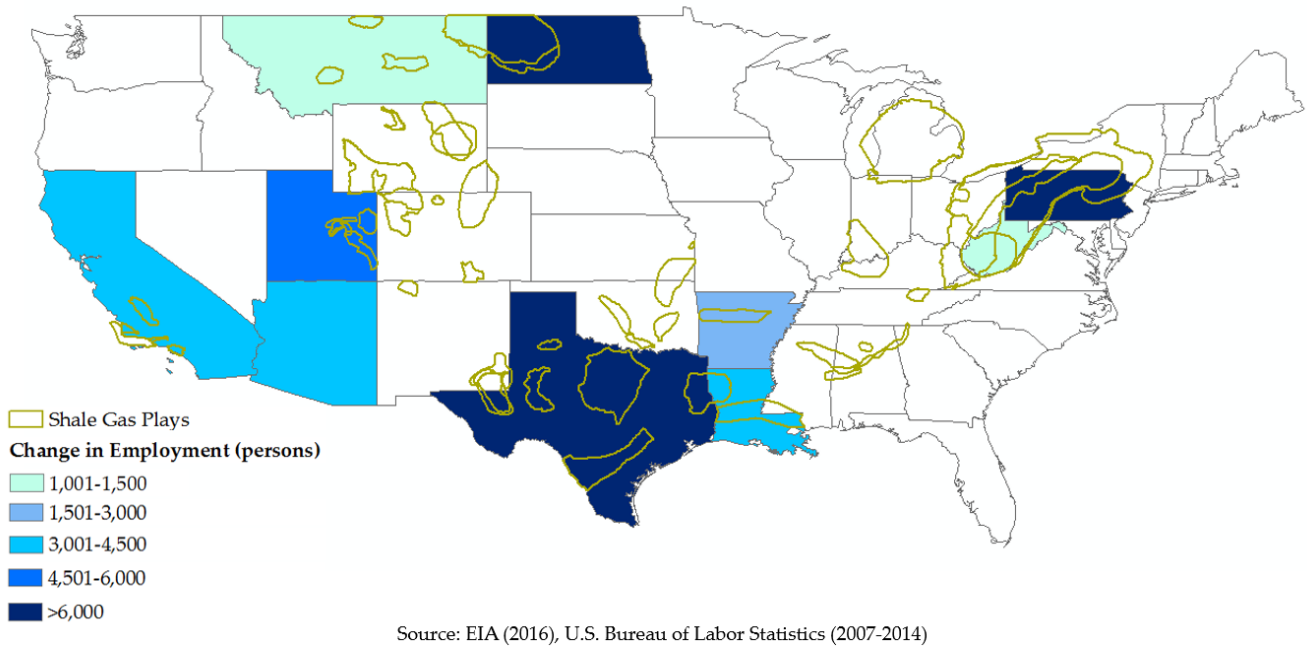
Fig. 3.6: COAL MINING PRODUCTION AND PRODUCTIVITY BY TYPE



Source: EIA (2014)

This discrepancy is directly related to the type of coal mines operated in each region. In the Powder River Basin, all coal mines are surface mines, which render coal cheap and easy to produce. In Central Appalachia, operations are split more evenly between surface and underground mines. Underground mines have been closing in recent years, as it becomes more challenging and costly to mine for smaller amounts of coal.

Fig. 3.7: OIL AND GAS EMPLOYMENT CHANGE, 2007-2012



Source: EIA (2016), U.S. Bureau of Labor Statistics (2007-2014)

Job losses are less painful in regions that are experiencing the shale gas boom.

The impact of the loss of coal mining jobs was more significant in certain states. In traditional coal communities that are located on top of shale plays, layoffs have been less hard hitting, as job creation has taken off in tandem with the shale gas revolution. For example, in Pennsylvania, which is situated in the Appalachian region, 444 coal mining jobs were lost in 2014, but many more were created as hydraulic fracturing took off along the Marcellus Shale.

Workers in both the coal and natural gas industries earn significantly higher salaries than the average U.S. worker. While coal miners earn $82,000 per year on average, the American Gas Association cites that the average natural gas industry salary is $71,000 (49). Regions in Appalachia, such as southern West Virginia and Kentucky, have not been as lucky, and have not benefited from significant employment opportunities in the natural gas industry.

3.3 Opportunities for the Future

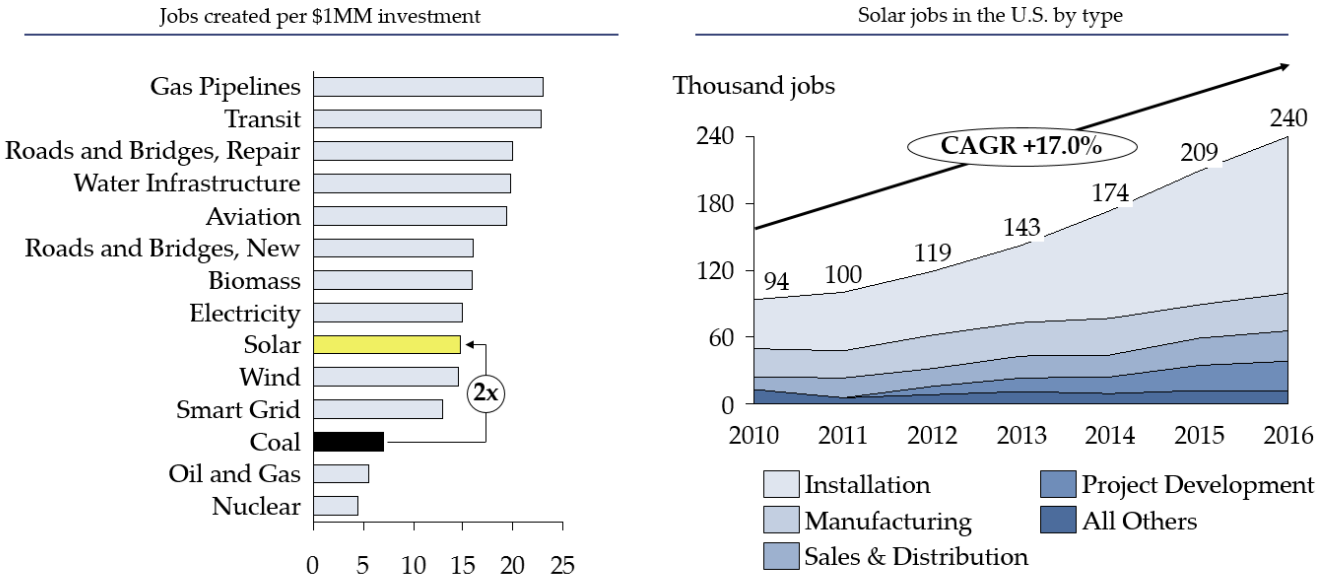
Through this research, strategies have been identified to counter the negative impact of job losses in the coal mining industry. Strategies outline below include investing in new sector job training, focusing on new industry development, and the implementation and use of severance taxes and permanent funds.

Invest in new sector job training and incentivize new industry development.

The coal industry in the United States is a difficult sector for job creation. In addition to the financial troubles that plague the industry, coal today is produced with more mechanized processes and utilizes the fewest union workers in decades (48). According to an analysis by the University of Massachusetts Political Economy and Research Institute, coal ranks poorly in job creation potential when compared to most other infrastructure industries. Fortunately, there are alternatives.

In areas where communities are traditionally dependent on coal mines for income, there is a need for training in other sectors that can provide well-paying jobs, as well as for incentives to develop new industry. Coal mining workers make up a very small percentage of the total labor force in the United States, but layoffs can nonetheless gravely affect whole communities and regions. Fortunately there are growth industries that provide well-paid jobs and which are less capital intensive than the coal industry. According to research conducted at the University of Massachusetts Political Economy and Research Institute, infrastructure investments in the natural gas sector as well as physical infrastructure investments in train transit, roads and bridges, and water can lead to approximately three times the level of job creation over investments in the coal industry for the same level of spending (50), (51).

Fig. 3.8: U.S. JOBS STATISTICS



Source: The Solar Foundation (2015)

These jobs are generally a good fit for coal mine workers, because pay for construction and energy sector work tends to be relatively high, and there is a need for manual labor in line with coal mining workers' experience.

Renewable energy is another popular area for development and retraining. The solar industry in particular boasts extraordinary job growth patterns and decent wages. In 2015, the solar industry employed about three times the number of workers as the coal industry, and the gap will likely continue to grow (52).

Where appropriate, retraining in solar makes sense, because of the long-term growth potential of the industry and because wages are high. The median hourly wage for solar workers is more than $10 more than the average U.S. hourly wage (52). Additionally, solar jobs are local with 80% of solar installations are performed by in-state companies (52).

Redirect severance taxes back to coal communities and create permanent funds.

Severance taxes are those that tax the extraction and production of non-renewable natural resources such as coal. In the United States., more than 36 states have enacted severance taxes, although not all severance tax revenues are directed back to the communities that are involved in extraction (53). One approach to revitalizing an area is to redirect revenues from severance

taxes back to the communities that are engaged in extractive industry. This is what Kentucky decided to do in 1992, after 30 years of distributing the revenues statewide. The money earned from direct severance taxes can be significant. In Kentucky in 2013, the tax per ton of coal extracted was $65, which raised $298 million in revenue for the local community, a significant sum for the region (53).

Because coal severance tax revenues are reliant on coal production, and decline over time in the case of industry downturns, some states have created permanent funds. Permanent funds are a protected percentage of funds collected from severance taxes that are invested for future economic development. By creating permanent funds, coal communities can protect themselves against future negative economic shocks. In the United States, Alaska, Montana, Wyoming, and New Mexico have long-standing funds, and two other states recently created their own (44).

New and ambitious federal programs have been proposed to support coal industry employees and communities, but have only been partially funded.

The Federal POWER + Plan is a proposal put forth in President Obama's national budgets. The plan provides funds to federal agencies and departments, including the Department of Labor, the Dislocated Workers National Reserve, the Appalachian Regional Commission, and the Environmental Protection Agency's Brownfields Program, in order to revitalize U.S. coal communities. The plan provides dedicated new resources for **economic diversification, job creation, job training, and other employment services for workers and communities** impacted by layoffs at coalmines and coal-fired power plants.

The program includes investments in the health and retirement security of mineworkers and their families, and the accelerated cleanup of hazardous abandoned coal mine lands.

As part of the plan, new tax incentives have also been proposed to support continued technological development and the deployment of carbon capture, utilization, and sequestration technologies, including a refundable sequestration tax credit of $50 per metric ton of CO_2 permanently sequestered and not beneficially reused (e.g., for enhanced oil recovery) or $10 per metric ton for CO_2 that is permanently sequestered and beneficially reused. The credit would be allowed for a maximum of 20 years of production. The plan has yet to be fully funded.

The Federal POWER Initiative, on the other hand, has been funded, and is being called a stepping stone to the POWER + Plan, given the immediacy of the economic need in coal country. The POWER Initiative is a multi-agency plan that targets federal resources to help communities and regions that have been affected by job losses in coal mining, coal power plant operations, and coal-related supply chain industries due to the changing economics of America's energy

production. The plan aims to cultivate economic diversity, enhance job training and re-employment opportunities, create jobs in existing or new industries, and attract new sources of investment.

Economic and workforce development components of the POWER+ Plan have been implemented using existing funds, including: **$45 million** for **POWER implementation grants** in 2016, with grants expected to range between **$0.5 and $1.5 million**, as well as **POWER technical assistance (TA) grants** to communities and regions for economic development planning, assessment, and capacity-building activities in Appalachia; **$1.2 million** is available for these grants in 2016.

Regional efforts are also essential to economic revival.

Regional efforts such as Shaping Our Appalachian Region (SOAR), in Kentucky, a bipartisan collaboration that encourages government partnership with the private sector and civil society to help communities diversify their economies, have also attempted to address labor challenges. SOAR is also in its beginning stages, and utilizes POWER Initiative resources to fund its work. Reconnect McDowell in McDowell, West Virginia, is an example of another local organization attempting to improve outcomes for the local community.

Overall, there are clear impacts on society that needs to be considered, but because these public sector efforts are so new, it is not yet possible to assess their potential impact.

SECTION IV
LESSONS FOR EUROPE

This section outlines how the U.S. and European markets are becoming increasingly similar and discusses the applicability of lessons from the U.S. coal transition for European countries.

4.1 OVERVIEW

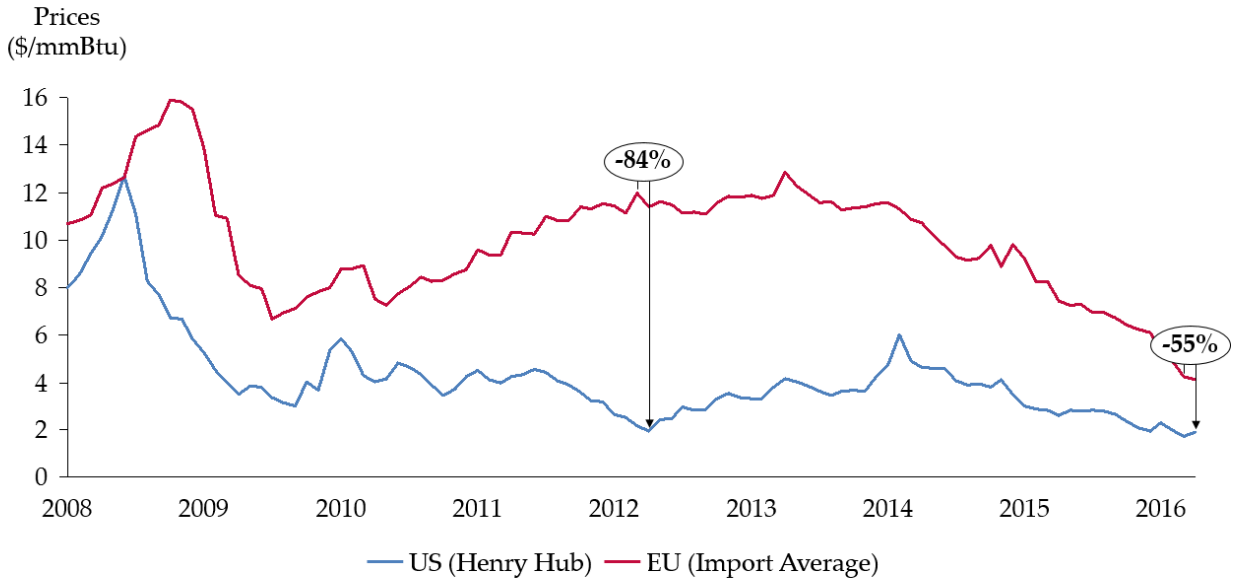
U.S and European energy markets are becoming more similar.

The U.S. and European energy landscapes were quite different until recent years. While market forces have primarily shaped the U.S. energy landscape, Europe's has been more policy-driven, historically.

Strong environmental policies such as the EU Emissions Trading System (54) coupled with ambitious renewable energy policies and a high dependence on expensive energy imports used to set Europe apart from the United States. Importantly, the U.S. shale gas revolution created a substantial gap between the prices of natural gas in the two regions.

The shale gas revolution has been the primary driver of the coal substitution phenomenon in the United States. Due to technical, political and environmental factors, a similar shale gas boom has not taken off in Europe and it is unlikely that domestic shale gas resources will play a significant role in European natural gas markets in the near future.

Fig. 4.1: U.S. VS. EUROPEAN MONTHLY NATURAL GAS PRICES, 2008-2016



Source: EIA (2016), Market Data

More recently, however, Europe has adopted a new natural gas strategy, developing its gas pipeline system and increasing the deployment of LNG terminals (55). As a result of increased

supply and heightened competition among producers in recent years, natural gas prices in the United States and in Europe have converged. In this way, natural gas prices have created conditions that made coal more comparable between the United States and Europe.

Meanwhile, the United States has become more closely aligned with the policy positions of Europe as it has taken steps to adopt a more ambitious climate change agenda and corresponding emission reduction instruments, such as the CPP.

Although they differ in their approach, both the EU and the United States have achieved emission reductions in recent years and maintain ambitious targets for the future. While the EU has a comprehensive legislative framework of common targets in combination with a Union-wide cap and trade system (EU ETS), the United States has diverse local, state and federal-level regulations with varying levels of ambition. These regulations include state-wide emission trading schemes such as the Regional Greenhouse Gas Initiative in the Northeast and the California Cap and Trade program in the West, as well as emission limits and technology requirements.

Internationally, both the EU and the United States are Parties to the United Nations Framework Convention on Climate Change (UNFCCC) and although the United States has not signed any new agreements that include binding emission reductions, the recent bilateral agreements achieved with major developing countries such as China and Brazil show continued commitment to GHG emission reductions. As such, the impact of more ambitious climate regulation, insofar as it affects the current economics and future prospects of coal, will, *ceteris paribus*, be very similar on both sides of the Atlantic.

The ability of the EU to achieve its climate commitments will likely ride on the success of the EU ETS. Since its trial period, which ended in 2008, the EU ETS has struggled with a considerable over-supply of allowances that has kept the price on carbon low and damaged the credibility of and interest in the system. A combination of poor economic outlooks, cheap carbon offsets, and a dramatic rise in renewable energy capacity, followed by inadequate policy responses, has almost completely eroded the effectiveness of this system. Whereas carbon allowances had traded at around 30 Euros in 2008, by 2013 they were worth just 5 Euros. The financial penalties for utilities' use of coal have thus become less onerous, further enhancing coal's competitiveness vis-a-vis gas during that period.

In light of the low cost of carbon in recent years, the EU has agreed to implement drastic regulatory and market adjustment mechanisms by 2018 that will result in carbon prices sufficiently high to achieve a targeted reduction of GHG emissions. The exact price of a carbon allowance will depend mostly on fossil fuel prices in Europe, but are likely to level out around 30 Euros per ton and therefore negatively impact the European coal sector.

The Renewable Energy Directive (RED) is another major European policy instrument, as it establishes an overarching policy for the production and promotion of energy from renewable sources in the EU. It requires the EU to fulfill at least 20% of its total energy needs with renewables by 2020 to be achieved through the attainment of individual national targets that take into account each country's starting point and overall potential for renewables.

These ambitious policies have significantly advanced the deployment of renewables in Europe. Electricity produced from renewable sources increased by 171% between 1990 and 2013 at an average annual rate of 4.4%. Since 2005, the rate has been considerably higher, at 7.5% per year following European directives and the significant and rapid decline in the cost of renewable energy technologies. While this move has been largely policy-driven, much like in the U.S., some mature renewable energy technologies, such as on-shore wind, have already become competitive with coal and natural gas on an LCOE basis.

Similarly, the market for distributed generation and storage is, much like in the United States, seeing the proliferation of small-scale and modular devices designed to provide electricity in locations close to consumers. Rapid growth of distributed generation in combination with rapidly expanding renewable energy capacity in countries like Germany have already caused concerns for utilities who fear being relegated to suppliers of last resort.

Unlike in the United States., the coal sector in Europe tends to be closely tied with government.

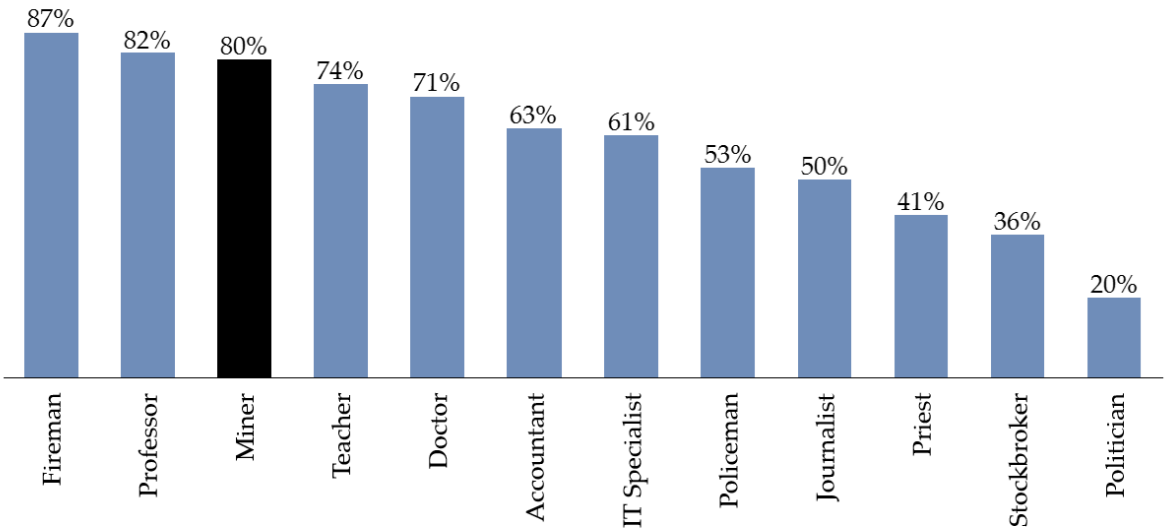
One of the most striking examples of state intervention in the coal-mining sector is found in Poland. Coal mining in Poland has become a difficult and highly politicized topic due to: state control over the majority of coal mining assets, the location of the majority of coal mines in one region (Silesia), and the relative high number of people employed in this sector.

As of 2015, 171,000 people were employed in the mining sector (56). This means there were approximately 445 coal miners for every 100,000 Polish citizens, six times more than in Germany (77). Despite the size of the sector, employment in coal mining has fallen in Poland. In 1989 when Poland started its transformation towards a free-market economy there were 416,000 workers employed in the coal mining sector and a total of 70 coal mines. Today there are 30.

Coal mining is supported by society and unemployment prevails after mine closures.

Because states own many coal assets and there is strong public approval for the practice of coal mining, eliminating coal mining jobs is not an easy task. According to polling agency CBOS (one of the most renowned in Poland), 80% of Poles highly approve of coal miners (57).

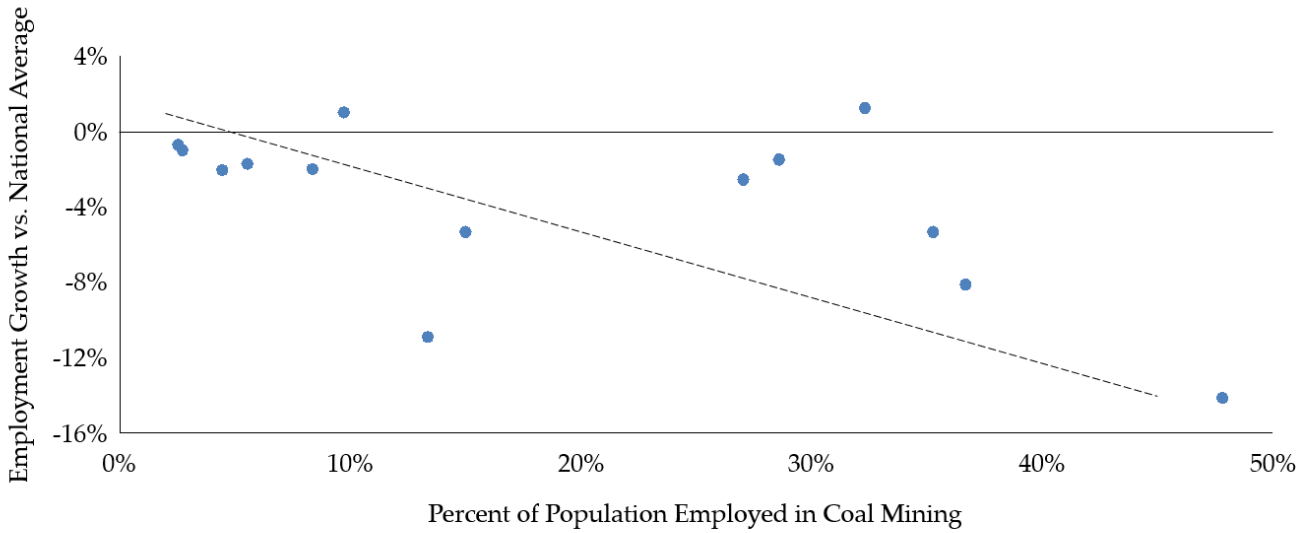
Fig. 4.2: PUBLIC APPROVAL FOR MINING JOBS IN POLAND



Source: CBOS (2013)

Coal has become a highly politicized topic due to its regional concentration. Silesia, which is one of the wealthiest regions in Poland (58) is tied with coal mining operations. Currently, in this region, 60 out of 167 counties engage in coal mining and, according to the data, these counties have suffered from coal mine closures (59).

Fig. 4.3: EMPLOYMENT GROWTH IN COUNTIES VS. POLAND AVERAGE (5 YEARS AFTER CLOSING A MINE)



Source: WISE Europe (2015)

As Fig. 4.3 shows, the counties that were most reliant on jobs in coal mining have lagged in terms of employment growth (versus the national average) even 5 years after the closure of a coal mine. This suggests that socio-economic challenges can persist a long time, and may have adverse effects on local societies, similar to the trends identified in the U.S. context (59).

The potential loss of employment has always been a major concern for governments that face coal mining sector downturns. The large majority of the coal infrastructure on both sides of the Atlantic is situated within low-income areas, where entire communities have been dependent on coal for generations. These regions tend to be politically sensitive and, particularly in the case of Poland, retain a lot of influence in the political process, making lessons learned relevant for countries in transition.

In Germany, the transition away from hard coal mining is more advanced than in the rest of Europe and indeed the United States. Subsidies for coal mining in Germany have been falling since 1996, and the sector is supported primarily to retain jobs, and not in pursuit of energy security or economic growth.

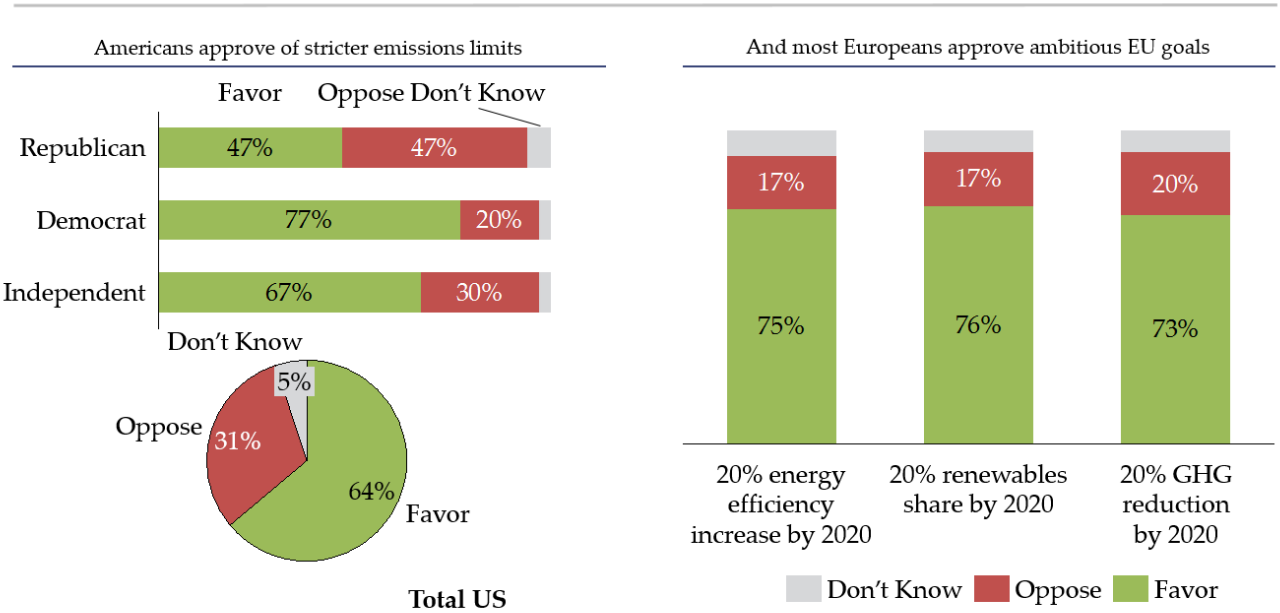
In 1997, 2003 and 2007, the German government signed agreements with mining organizations envisaging a reduction of output and a gradual retirement of the mines, culminating in a recent agreement that will close all German hard coal mines by 2018.

10,000 coal miners working in Germany have been offered early retirements, re-training in other industries, and comparable energy jobs. In Germany's Ruhr Valley, its traditional coal producing region, an economic transformation has taken place, exemplified by the town of Gelsenkirchen. Germans have not yet identified, however, a plan for the closure of their lignite coal mines. Unlike hard coal, German lignite reserves are vast and cheap to extract. Germany's lignite mines employ 20,000 people are not expected to close before 2045.

Although there is a clearly positive public sentiment associated with coal mining in Poland, there is also data which suggests that Europeans generally favor policies that support the deployment of renewable energy and the reduction of GHG emissions (60).

The same applies to the United States where, especially among Democrats, there is a clear preference for imposing stricter GHG emissions limits (39). This trend seems to be growing over time as people recognize the need to address climate change, and they observe that economic growth and energy consumption can be decoupled.

Fig. 4.4: ENVIRONMENTAL VIEWS OF U.S. AND EU CITIZENS



Source: European Commission (2012), Pew Research (2014)

4.2 LESSONS FOR EUROPE

Low productivity is a key challenge plaguing European coal mining.

According to McKinsey & Company, one of the main issues associated with European coal mining is the low productivity. Poland's coal mining operations are 84% less productive than American operations on average, but Poland is not the only country lagging behind the United States. In 2012, the average productivity of Polish, British, German, and Spanish coal mines was lower than the lowest 20 percent of coal mines in terms of productivity in the United States. (61). This clearly signals that there is room for improvement.

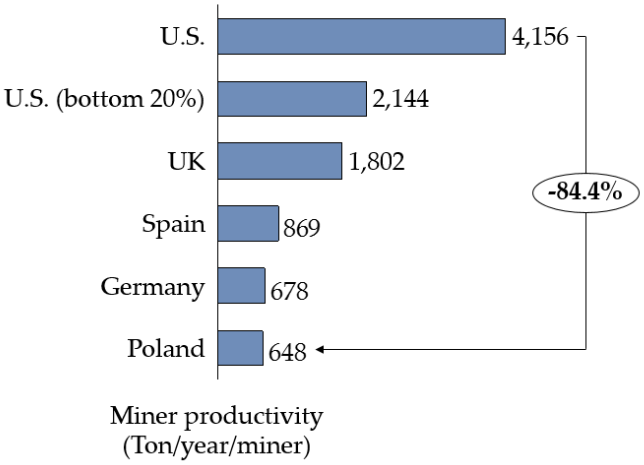
There are several levers that can be pulled in order to improve productivity of coal mining and they can be associated with two areas: concentration on profitable assets, and operational excellence.

Westmoreland and Alliance Resource Partners provide examples of how concentration on profitable assets can materialize, and that it is possible for coal mining companies to move to different regions and to focus on their most profitable assets. The same can be done in Europe.

According to the presentation prepared in 2015 by the Polish Ministry of Economy, almost 54% of coal reserves in Poland are not yet utilized and some of them (especially those in Zagłębie Lubelskie) are characterized by more favorable geological conditions (62) than those that are currently mined. Another opportunity for improving productivity of coal mining in Europe is the deployment of the most modern mining technologies and the optimization of the labor force.

Fig. 4.5: COAL MINING PRODUCTIVITY IN U.S. VS. EU

Labor is lagging in terms of productivity



But there are clear areas for improvement

	Poland	U.S.
Work hours/day	6-8	8+
Work hours/year	1 623	2 314
Year-end bonus	Mandatory	Optional
Free coal allowance	✓	×
Mining days/year	256	365
Extra holidays	✓	×
Extra vacation time	✓	×

Source: WISE Europe (2015), McKinsey & Company

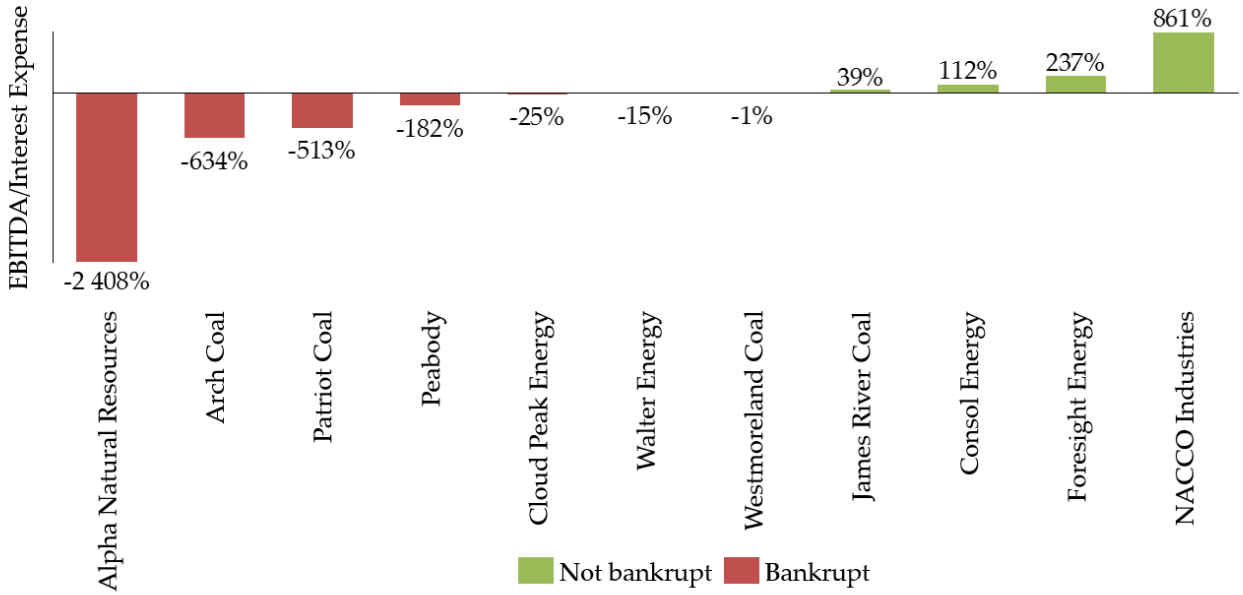
According to McKinsey, the average number of hours worked in a year is 1,623 for Poland which is much lower than in the United States where the number is well above 2,000 hours (61). Additionally, there is a clear gap not only in the hours worked by miners but also in terms of the days in operation. This can be solved by increasing the number of shifts and reducing the number of days off for the whole crew.

Conservative investment profiles will help coal companies to remain on the market.

Low productivity is not the only challenge the sector faces. Coal mining has been struggling financially both in the United States and Europe in recent years. As discussed in this report, there have been several companies in the United States that were unable to avoid bankruptcy despite their market position and production size. Overinvestment in coal assets during a period of high coal prices hurt the financial standing of several companies when the coal prices fell.

For many American companies, more assets and more debt led to higher interest expense, which became too large a burden when profitability suffered. This is why all of the companies with a negative EBITDA (earnings before interest, tax, depreciation and amortization) to interest expense ratio filed for bankruptcy.

Fig. 4.6: EBITDA TO INTEREST EXPENSE RATIO FOR TOP U.S. COAL COMPANIES



Source: Company Annual Reports (2014-2015)

These lessons can serve as a warning for coal mining companies in Europe. Although circumstances may differ, and there may be fewer acquisitions in the future, the financial discipline of companies will be crucial.

As was discussed in the presentation of the Polish Ministry of Economy, coal companies have continued to increase costs while revenues have been falling. Between 2004 and 2014 costs grew from 157 to 309 PLN/ton while revenues grew from 188 to only 279 PLN/ton. This in turn led to the replacement of an operating profit of 29 PLN/ton with an operating loss of 30 PLN/ton (62).

Although concentration on the most profitable resources and improved operational excellence of the coal companies may be the most successful strategies for the coal mining sector in Europe, there are also other opportunities that should be considered. One is diversification of revenues, which may help mining companies to decrease their sales of coal. Unfortunately, this strategy has had limited success to date in the U.S. and there are no viable examples that can be used as a source of best practices.

CONSOL, which diversified its revenues into natural gas sales, had the preexisting advantage of location (located in the heart of the Marcellus shale play) and developed expertise in natural gas extraction well before the crisis hit the U.S. coal industry (31). Diversification into natural

gas extraction may not be feasible for European companies due to the different regulatory framework and the fact that shale gas resources have not yet been developed there (63).

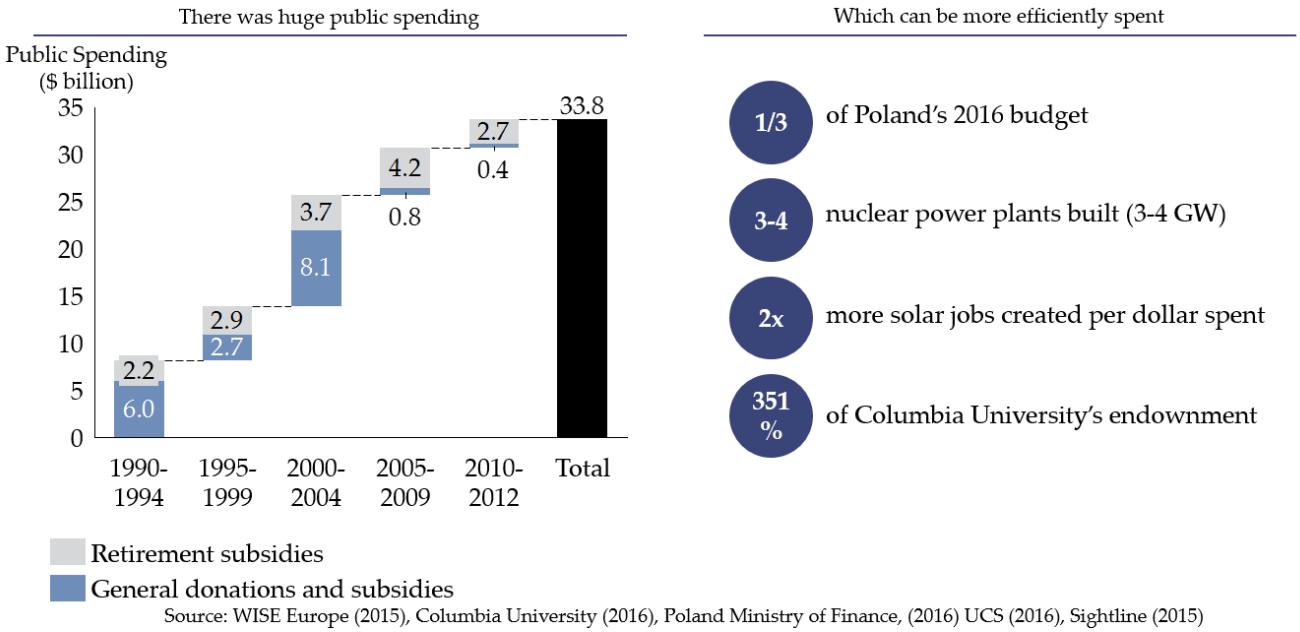
Additionally, the case of Energy Future Holdings, which filed for bankruptcy, is an example that shows that integrated utility service providers can fail (29) and merging utilities with coal mining companies may not be successful.

European can find opportunities in transition.

U.S. coal mining is currently experiencing a very difficult period, resulting in many companies going bankrupt. As a market driven industry, American coal mining is a good benchmark for other regions and illuminates market trends that might exist in the case of limited government intervention.

There are clearly significant differences between Europe and the United States, but there are also common themes and converging market trends. Europe is becoming more like the United States, thanks to higher natural gas import capabilities, and the United States is likewise becoming more like Europe due to increased regulations targeting fossil fuel deployment. Therefore, there are lessons to be drawn from the U.S. coal mining sector that are applicable to Europe. The European coal mining sector would benefit from increasing its productivity and concentrating on its most profitable assets. Operational excellence and financial responsibility will similarly be keys for success for European coal mining companies.

Fig. 4.7: PUBLIC SPENDING ON COAL MINING IN POLAND, 1990-2012



Source: WISE Europe (2015), Columbia University (2016), Poland Ministry of Finance, (2016) UCS (2016), Sightline (2015)

There may be difficult decisions to be made regarding closures of less profitable coal mines or cost cutting. On the other hand, if these measures are not taken into consideration, and in the instance of financial hardship, the burden of subsidizing coal companies that would otherwise file for bankruptcy could be even higher than the costs of closing mines and cutting costs.

From 1990 to 2012, Poland spent $33.8 billion on subsidies and donations targeted at the coal mining sector (59). The same number of public dollars could be used to build 3 to 4 nuclear power plants (64), to fund over 3 universities with endowment equal to that of Columbia University's (65), or to create twice the number of jobs if the same money were channeled into the solar industry (51). Moreover, this public spending can increase over time. According to the projections of the Ministry of Economy, further coal mining sector losses in Poland may reach an additional $6.5 billion through 2020 (62). Therefore, the key question for policymakers should be whether or not these losses are justifiable for the society as a whole.

There is no question that coal will remain a major energy source in the coming years. Most of the projections both for the United States and for Europe suggest this. Although coal's share of the energy mix will decrease, it is not expected to be entirely phased out. Therefore, the goal for existing coal mining companies should be to focus on fostering operational excellence and financial responsibility.

For further exploration into this issue, policymakers might ask the following questions:

- Could the Group of Experts on Coal Mine Methane leverage the expertise of the Group of Experts on Cleaner Electricity Production from Fossil Fuels and work together to address the challenges facing the coal industry?
- How would a future carbon tax further reduce coal demand?
- What policies might the next U.S. President enact to support former coal mining communities, and how might those policies be implemented in UNECE member states?
- How might the impact of coal mining job losses on communities be measured, and similarly, what metrics can be used to track the effectiveness of policies that aim to support ex-coal mine workers and their communities, including retraining for new industry roles?
- As the global temperature approaches the 2^0 C threshold, and minimizing further environmental damage becomes the top priority in both Europe and the United States, and as the level of environmental regulation rises to reflect this change focus, how would the mining sector respond to a drastic decline in thermal coal profitability?

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