Job Impacts in the Coal Industry: What Can We Expect from the Natural Gas Boom and Environmental Regulations?

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ABSTRACT

Until recently, coal provided nearly half of the electricity generated in the United States. Plummetering natural gas prices combined with a threatening regulatory climate has caused the decline of coal as the primary domestic energy source. In 2012, generation from coal fell below 40 percent – for the first time since the government began collecting data in 1949. Electric utilities are retiring or idling coal units, repowering with natural gas, and dispatching their existing gas units more. The change has been spurned by hefty retrofit costs to comply with a suite of environmental regulations and historically low natural gas prices. Proposed new regulations on carbon emissions could effectively preclude the ability to permit new coal units. This paper presents an overview of recent and projected changes to the coal-fired generating fleet. How these changes translate to employment impacts is discussed, including the relationship between direct, indirect, and induced job losses; community impacts; and distributive effects. A survey of recent jobs impact studies related to the coal-fired industry is examined, and shows how differences in input data and assumptions produce conflicting employment results. Most of these studies focused on the impacts of environmental regulations, and did not consider displacement of coal power by natural gas generation or the effects on related business sectors, such as coal combustion products recycling. As a result, knowledge gaps remain, which are identified. Potential policy and technological game changers are discussed in light of the 2012 election results.

INTRODUCTION

In April 2012, for the first time since the U.S. Energy Information Administration (EIA) began collecting data, coal and natural gas-fired generation were virtually equal, each representing 32 percent of total generation (see Figure 1).1 This occurrence was significant because it reflected the decline in coal generation due to the economic pressures of environmental regulations and falling natural gas prices. Historically coal has provided about 50 percent of the electricity generated in the U.S., but utilities have recently been dispatching gas units over coal. This is particularly true for combined cycle gas plants, which have seen increased utilization at the expense of coal. Further, estimated expenditures for compliance with environmental regulations have led to the announced retirement of significant numbers of coal generating units. According to EIA,
almost 27 gigawatts (GW) of coal-fired capacity from 175 generating units have already planned to retire by 2016 (see Figure 2). Although the coal unit retirements through 2010 were less efficient units with heat rates exceeding 12,000 British thermal units per kilowatt-hour (Btu/kWh), the average heat rate for retiring units in 2015 is approximately 10,700 Btu/kWh.

**Figure 1:** Coal and gas electric power generation were equal for the first time ever in April 2012. Source: U.S. Energy Information Administration (EIA)

**Figure 2:** Coal unit retirements from 2005 through 2016. Source: U.S. Energy Information Administration (EIA)
Several analytical studies have been performed to assess the scope and economic impact of coal generating unit retirements into the future. Several of the studies attempted to quantify how changes in the electric generating fleet, from compliance cost perspective as well as retirements, would impact employment economy-wide. Despite these studies, the economic outlook for the coal combustion products (CCP) industry remains uncertain, and significant data gaps remain.

REGULATORY CLIMATE

The coal industry is facing a suite of environmental regulations that will affect the economic sustainability of some generating units. Due to the combined costs of compliance with multiple regulations, generating unit owners are considering retiring or repowering many units that lack the necessary pollution controls to remain in compliance. Because of low natural gas prices, repowering with gas can be a financially attractive option over extensive retrofits. Some of the regulations promulgated by the U.S. Environmental Protection Agency (EPA) also affect coal-fired industrial and commercial boilers.

The significant EPA regulations affecting the coal industry are:

- **Mercury and Air Toxics (MATS) / Boiler Maximum Achievable Control Technology (MACT) Rule**: Sets emissions limits for hazardous air pollutants from utility and industrial/commercial coal-fired boilers, respectively.
- **Revised Effluent Limitation Guidelines (ELGs)**: Standards that govern steam electric wastewater treatment and discharges.
- **Cross-State Air Pollution Rule (CSAPR)**: Replacement rule for the Clean Air Interstate Rule (CAIR) governing NOx and SOx emissions in eastern states was vacated by the DC Circuit Court of Appeals in 2012 and remanded back to EPA for revision.
- **Coal Combustion Residuals (CCR) Rule**: Two regulatory options were proposed, but the timeline for final rule promulgation is uncertain.
- **Section 316(b) of the Clean Water Act**: Sets standards for the location, design, and capacity of cooling water intake structures based on best technology available.
- **Revised National Ambient Air Quality Standards (NAAQS)**: Sets 1-hr, 8-hr, and annual emissions limits for carbon monoxide (CO), particulate matter (PM), lead (Pb), nitrogen dioxide and sulfur dioxide.
- **Carbon Pollution Standards for new power plants**: Sets carbon emissions limits for new coal power plants that can only be met with carbon capture and sequestration (CCS). This rule effectively precludes the construction of new coal-fired generating units without CCS. It is unclear whether the Obama administration will pursue similar standards for existing plants, which would make the cost of coal power too high to compete with natural gas.
The various EPA rules are at different stages of promulgation, with some finalized while others are in the proposal stage, resulting in a high level of uncertainty. Although discussion of the technologies required for compliance and their associated costs is beyond the scope of this paper, the reader is referred to several studies (see Economic Impacts, below) that have been undertaken to quantify these costs. Summary studies conclude that EPA regulatory cost estimates are significantly lower than industry assessed costs.  

The potential for overlapping compliances deadlines and ambiguity over requirements of the final rules (the CCP rule being a prime example) poses additional risks for coal generating unit owners. Further, future carbon policy could make coal power even more expensive.

COMMODITY COMPETITION

Projections of low natural gas prices present an opportunity for generating unit owners to reduce these risks. Although natural gas has had price volatility in the past, improvements in horizontal drilling and hydraulic fracturing technologies have supported shale gas development in areas that previously would have been inaccessible. The abundance of shale plays in the U.S. has transformed the long-term outlook for natural gas production and prices. EIA forecasts natural gas prices at the Henry Hub to remain around or below $4 per million Btu (MMBtu) through July 2014 (see Figure 3).  

![Henry Hub Natural Gas Price](source: Short-Term Energy Outlook, March 2013)

Note: Confidence interval derived from options market information for the 5 trading days ending March 7, 2013. Intervals not calculated for months with sparse trading in near-the-money options contracts.

Figure 3: Projections for Henry Hub gas prices through 2014.
Source: U.S. Energy Information Administration (EIA)
Market analysts predict that Powder River Basin (PRB) coal becomes competitive with gas above $3/MMBtu, Illinois Basin coal becomes competitive when gas reaches $3.50-$4 while Appalachian coal becomes competitive at natural gas price of $5.

ECONOMIC IMPACTS

Numerous studies have been undertaken over the last few years to evaluate the economic impacts from EPA regulations. Some studies also considered natural gas prices. These studies are summarized in Table 1 and listed chronologically by release date.\(^5\)–\(^{14}\) Table 1 lists the focus of the study (EPA rules analyzed) as well as projected economic impacts in terms of coal unit retirements and/or employment. The assumptions, scenarios, and methodology utilized differ widely across studies. However, comparison of the studies is useful for discerning the uncertainty in predicted impacts. The predicted range of coal-fired capacity retirements is consistent across studies, with approximately 50 – 70 GW predicted to retire by 2019 depending on regulatory and gas price scenarios. These retirements include the 27 GW of planned retirements catalogued by EIA in the baseline (without future regulation), plus additional retirements due to economic and regulatory influences.

Employment impacts are more difficult to evaluate, however. This is due to the which EPA regulations were analyzed (and expected form of pending regulations) as well as study methodology. Some studies analyzed coal generating unit retirements but did not address job impacts, including studies by The Brattle Group\(^6\), Bipartisan Policy Center\(^7\), and the North American Electric Reliability Corporation (NERC).\(^8\) The Portland Cement Association\(^12\), MAPI\(^13\), and IHS Global Insight\(^14\) studies were specific to manufacturing sectors and did not include impacts in the electric generating industry.

The study by NERA Economic Consulting (NERA) was the most recent and complete study, and included the impact of coal unit retirements under two regulatory scenarios and a higher natural gas price scenario.\(^5\) Job losses were estimated from changes to gross domestic product (GDP) and resulting labor income loss. These employment impacts were economy-wide, and job losses in specific industries were not evaluated.

The study by Veritas Economic Consulting (Veritas) evaluated job losses in specific industries using an economic linkage model called IMPLAN.\(^10\) This model evaluates an economic ripple effect of direct job losses/gains in specific industries, and indirect and induced job changes across economy sectors as a result of direct job losses. The relationship between direct, indirect, and induced job losses is graphically presented in Figure 4. Induced job impacts can be envisioned as community impacts. Job losses and reductions in income will affect spending at local businesses in the retail, hospitality, and other consumer sectors.

IHS Global Insight also used IMPLAN to model downstream employment impacts from the Boiler MACT rule. Direct employment impacts of nearly 70,000 jobs lost under one scenario was estimated to result in 337,000 job losses when indirect and induced impacts were modeled.\(^{14}\)
Table 1: Recent Studies of Economic Impacts from EPA Regulations

<table>
<thead>
<tr>
<th>Study</th>
<th>Date</th>
<th>Focus</th>
<th>Retirements</th>
<th>Job Impacts</th>
</tr>
</thead>
<tbody>
<tr>
<td>NERA5 (for ACCCE)</td>
<td>October 2012</td>
<td>MATS, NAAQS, CCR, CSAPR*, 316(b)</td>
<td>52 – 69 GW</td>
<td>544,000 – 887,000 job losses annually</td>
</tr>
<tr>
<td>The Brattle Group6 (independent)</td>
<td>October 2012</td>
<td>MATS, CSAPR</td>
<td>59 – 77 GW</td>
<td>Not evaluated</td>
</tr>
<tr>
<td>Bipartisan Policy Center7</td>
<td>July 2012</td>
<td>MATS, CSAPR, 316(b)</td>
<td>56 GW</td>
<td>Not evaluated</td>
</tr>
<tr>
<td>NERC8</td>
<td>November 2011</td>
<td>MATS, CCR, CSAPR, 316(b)</td>
<td>36 – 59 GW</td>
<td>Not evaluated</td>
</tr>
<tr>
<td>Stockholm Environment Institute9</td>
<td>October 2011</td>
<td>CCR</td>
<td>Not evaluated</td>
<td>28,000 job gains</td>
</tr>
<tr>
<td>Veritas10 (for USWAG)</td>
<td>June 2011</td>
<td>CCR</td>
<td>Evaluated, not reported</td>
<td>183,900 – 316,000 job losses</td>
</tr>
<tr>
<td>Ceres/PERI11</td>
<td>February 2011</td>
<td>MACT, CAIR</td>
<td>Not evaluated, other studies referenced</td>
<td>1,460,000 job gains</td>
</tr>
<tr>
<td>Portland Cement Association12</td>
<td>January 2011</td>
<td>Boiler MACT, NAAQS, CCR, GHG Tailoring Rule</td>
<td>N/A</td>
<td>80,000 job losses</td>
</tr>
<tr>
<td>MAPI/Manufacturers Alliance13</td>
<td>September 2010</td>
<td>NAAQS ozone</td>
<td>N/A</td>
<td>7,277,000 job losses by 2020</td>
</tr>
<tr>
<td>IHS Global Insight14 (for CIBO)</td>
<td>August 2010</td>
<td>Boiler MACT</td>
<td>N/A</td>
<td>152,500 – 798,250 job losses</td>
</tr>
</tbody>
</table>

* NERA evaluated a regional haze rule in place of CSAPR because it was vacated by the D.C. Circuit Court of Appeals. The regional haze rule modeled assumed best available retrofit technology similar to CSAPR.

**Acronym list for Table 1:**
ACCCE: American Coalition for Clean Coal Electricity
NERC: North American Electric Reliability Corporation
USWAG: Utilities Solid Waste Activities Group
PERI: Political Economy Research Institute
CIBO: Council of Industrial Boiler Owners
This multiplier effect depends on linkages between economic sectors. Specificity in which industry sectors see increased revenues and which experience depressed revenues is necessary to produce credible results. Evaluating job gains in industries that would benefit from regulation must be complemented by evaluating job losses in industries that would be adversely affected by regulation. For example, a Subtitle C coal combustion residuals regulation would likely result in job gains in the hazardous waste management industry, but decreased employment in the CCP recycling industry. Therefore, a reporting of net job impacts (employment losses subtracted by employment gains) is most useful for assessing economy-wide changes. The Stockholm Environment Institute analysis which also utilized the IMPLAN model fails to include direct job losses in the electric generating industry or indirect losses in the CCP recycling, coal mining, and rail transport industries as a result of EPA regulations. The Ceres/PERI study included job losses from coal plant retirements, coal transportation, and parts manufacturing but did not consider mining or electricity price changes. Failure to include these relevant indirect impacts significantly skews the estimated job impacts in favor of regulation.

Further, timing of employment impacts can be important. While some of the studies evaluated a net change over a period of years, the NERA study evaluated annual job losses occurring as result of the timing of coal unit retirements and compliance costs. However, modeling the timing of compliance expenditures and retirements introduces additional uncertainty in results until EPA rules are finalized.

KNOWLEDGE GAPS

Despite the number of studies, specific impacts to the CCP industry remain only partially quantified. While the Veritas study quantified indirect impacts to the construction industry due to CCR regulation as hazardous waste, the cumulative impact
of multiple EPA regulations and low gas prices have not been evaluated. Conversely, although the NERA study is the most complete in terms of analyzing multiple regulatory impacts and gas prices, employment losses are aggregated, and not specific to particular industries. Job impacts are calculated using a reduction in GDP, rather than an examination of the economic linkages between industry sectors.

Regional and local impacts can also tell a much different story than the national picture. Because coal use and characteristics of the coal-fired generating fleet (age, capacity, pollution controls) exhibit regional variations, coal retirements can exacerbate existing economic challenges in some communities. This is particularly true in Appalachia, where mining communities that are already facing economic hardships may be significantly affected by depressed coal demand. The evaluation of distributive impacts on communities within the hardest hit regions has not been quantitatively assessed.

It is important to note that several of the EPA regulations modeled have not been finalized, so compliance requirements and timelines remain unknown. The studies also did not consider potential carbon regulations on existing sources. Should the current administration pursue a more aggressive carbon policy, coal unit retirements and employment impacts will be exacerbated.

CONCLUSIONS

There remain significant uncertainties and risks for the coal industry, including potential carbon regulations on existing coal-fired generating units or other policy mechanisms, as well as the economic viability of technologies that can be used to reduce carbon emissions from coal combustion. While promising technologies such as oxy-combustion and direct chemical looping are under development, they are years away from achieving utility scale. Carbon capture technology, while well demonstrated, remains economically impractical for existing coal-fired power plants given current natural gas prices.

Multiple studies have concluded that approximately 50 – 70 GW of coal-fired generating capacity is expected to retire within the next six years. These retirements will present economic implications for industries that rely on coal, which are often overlooked in studies analyzing employment impacts. Studies estimate that changes in the electric generating industry will cause ripple employment impacts up to 887,000 job losses annually across all sectors. Job losses in the industrial and manufacturing sectors from the Boiler MACT rule alone can reach nearly 800,000, although this estimate does not account for increased electricity prices which would also adversely affect manufacturing. The extent of job losses specific to the CCP industry from the suite of environmental regulations and natural gas competition has not been quantified.
REFERENCES


