The Beacon Hill Institute

The Economic Effects of the New EPA Rules on the United States

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JANUARY 2015

Executive Summary

Through the Environmental Protection Agency (EPA), the Obama administration has unveiled an unprecedented scope of regulation. The new regulations include CO_2 emission limits on new and existing electricity power plants and new lower limits on mercury emissions from electricity power plants.

The new rules for existing plants would limit CO_2 emissions to 1.1 pounds (lbs.) per kilowatt hour (kWh) of electricity production.[1] This is less than half of the current average of 2.14 lbs. per kWh.[2] The rule on existing coal plants would set the goal of reducing CO_2 emissions per kWh of energy produced by 30 percent below the 2005 levels by 2030. The mercury rule for emissions limits would range from between 0.0002 lbs. per gigawatt hour (1,000,000 kilowatt hours) to 0.04 lbs. per gigawatt hour.[3]

The EPA contends that many of these regulations will provide tens of billions of dollars in benefits that will more than offset enormous costs. The EPA's cost and benefit estimates have come under criticism from a number of observers. The EPA calculations of cost tend to be much lower than industry estimates and the benefit calculations are inflated.[4] The EPA analysis suffers from the following:

1. The use of decades-long amortization schedules for capital expenditures obfuscates the full financial burden that will be imposed over a short time period;
2. The misidentification of source reduction; most of the benefits derive from co-benefits from other pollutants regulated under different rules while the primary pollutant is reduced only minimally.[5]

In this paper, the Beacon Hill Institute at Suffolk University (BHI) estimates the costs of these new EPA rules. We report the dollar values in 2012 Net Present Value dollars using a 3 percent discount rate. Table 1 displays the results.

Table 1: The Cost and Economic Impact of new EPA Rules

Net benefits (cost)	**(billions, 2012 $)**
CO_2 Rule for New Power Plants	(8.957)
CO_2 Rule for Existing Power Plants	(16.026)
Utility Mercury Emissions	(21.494)
Total net cost to the United States	(46.477)

[1] U.S. EPA. "Regulatory Impact Analysis for the Proposed Standards of Performance for Greenhouse Gas Emissions for New Stationary Sources: Electric Utility Generating Units (September 2013), http://www.epa.gov/ttnecas1/regdata/RIAs/EGUGHGNewSourceStandardsRIA.pdf, accessed May 8, 2014.
[2] U.S. EPA, "How much carbon dioxide is produced per kilowatt-hour when generating electricity with fossil fuels." http://www.eia.gov/tools/faqs/faq.cfm?id=74&t=11, accessed January 12, 2015.
[3] U.S. EPA. "Regulatory Impact Analysis for the Final Mercury and Air Toxics Standards," (December 2011), 1-6.
[4] Ibid.
[5] Nam D. Pham and Daniel J. Ikenson, "A Critical Review of the Benefits and Costs of EPA Regulations on the U.S. Economy," NDP Consulting, http://www.nam.org/~/media/423A1826BF0747258F22BB9C68E31F8F.ashx (November 2012).

We estimate that the new EPA rules on new power plants would cost the United States $8.957 billion in 2030; the rule for existing plants would cost $16.026 billion and the mercury emissions rule would cost $21.494 billion. In total the three regulations would cost $46.477 billion dollars. The regulations would drive up electricity prices in the United States by 1.34 cents per kWh, or 12.8 percent by 2030.

Introduction

Through the Environmental Protection Agency (EPA), the Obama administration has unveiled an unprecedented scope of energy regulation. The new regulations include Carbon Dioxide (CO_2) emission limits on new and existing electricity power plants and new lower limits on mercury emissions from electricity power plants. The EPA aims the new rules directly at coal-fired electricity power plants, which provide 28.3 percent of the electricity generation in the United States.[6] The EPA rules are risky since coal is a dispatchable, exceptionally reliable electricity source and provides the bulk of base load electricity to the nation's electric grids.

The new rules for existing plants would limit CO_2 emissions to 1.1 pounds (lbs.) per kilowatt hour (kWh) hour of electricity production.[7] This is less than half of the current average of 2.14 lbs. per kWh.[8] The rule on existing coal plants would set the goal of reducing CO_2 emissions per kWh hour of energy produced by 30 percent below the 2005 levels by the year 2030. The mercury rule for emissions limits would range from between 0.0002 lbs. per gigawatt hour (1,000,000 kilowatt hours) to 0.04 lbs. per gigawatt hour.[9]

The EPA rules will force utilities to close coal-fired generation plants or adopt expensive and unproven technologies, such as carbon capture and storage. The EPA contends that many of these regulations will provide tens of billions of dollars in benefits that will more than offset these enormous costs. Most of these benefits are in terms of improved health.

The EPA's cost and benefit estimates have come under criticism from a number of observers. The EPA calculations of cost tend to be much lower than industry estimates and benefit calculations are inflated.[10] The EPA analysis suffers from the following:

1. The use of decades-long amortization schedules for capital expenditures obfuscates the full financial burden that will be imposed over a short time period;
2. The misidentification of source reduction; most of the benefits derive from co-benefits from other pollutants regulated under different rules while the primary pollutant is reduced only minimally.

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[6] U.S. Energy Information Administration, "United States Electricity Profile 2012 ," May 1, 2014 http://www.eia.gov/electricity/state/unitedstates/index.cfm,
[7] U.S. EPA, RIA: New Stationary Sources.
[8] U.S. EPA, "Frequently Asked Questions: How much carbon dioxide is produced per kilowatt-hour when generating electricity with fossil fuels," http://www.eia.gov/tools/faqs/faq.cfm?id=74&t=11,
[9] U.S. EPA. "Regulatory Impact Analysis for the Final Mercury and Air Toxics Standards." (December 2011), 1-6.
[10] Nam D. Pham and Daniel J. Ikenson.

The new EPA rules will further reduce, if not eliminate, the use of coal over the next 15 years and could send electricity prices soaring even higher and destabilize the electricity grid causing rolling blackouts.[11] In this paper, the Beacon Hill Institute at Suffolk University (BHI) estimates the costs and benefits these new EPA rules.

Utility Maximum Achievable Control Technology

Since the Clean Air Act of 1990, the EPA has been responsible for the creation and enforcement of standards to reduce toxic air emissions. In 2004, the EPA began proposing regulations on the amount of mercury emissions produced during power generation. Many lawsuits followed this initial attempt, cumulating with the publication of the Mercury and Air Toxics Standards (MATS) in late December 2011.[12] Additional comment periods and court challenges have changed the wording of the final rule, leading to the current attempted regulation.[13] The 2011 announcement of the MATS, whose general direction and implementation has not changed greatly, provides a short but informative glimpse of the EPA's methodology for reviewing the costs and benefits of a Mercury regulation. Lisa P. Jackson, then Administrator of the EPA, summarized the agency's case for Mercury regulation:

> Mercury is a neurotoxin that is particularly harmful to children, and emissions of mercury and other air toxics have been linked to damage to developing nervous systems, respiratory illnesses and other diseases.

This proclamation of danger was followed with assertions about the huge benefits that the MATS would yield. "Between $37 and $90 billion in health benefits," followed by a list of various ailments that would be prevented. But in truth, the gains to reducing mercury are very small relative to the announced costs of the policy. The benefit of placing standards on mercury itself carries a projected annual benefit of between $500,000 and $6.1 million. The other 99.99 percent of the benefits come from the reduction of Particulate Matter 2.5, an emission already regulated by the EPA to safe levels (in its own words). The only mention by the EPA of any potential costs in saying the policy will "provide health benefits that far outweigh the costs of compliance."[14] In reviewing the Regulatory Impact Analysis (RIA) the potential costs are listed as $9.6 billion annually, making it the most expensive regulation the EPA has issued. However the EPA only considers a narrow view of costs to the power generation sector.[15]

Industry studies suggest that even this limited view of costs is underestimated, projecting that annual compliance costs will exceed $17 billion annually, when reviewing the same narrow view of costs.[16] Due

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[11] Roger Bezdek and Frank Clemente, "Protect the American People: Moratorium on Coal Plan Closures Essential," http://instituteforenergyresearch.org/wp-content/uploads/2014/06/Protect-the-American-People.-Moratorium-on-Coal-Plant-Closures-Essential.pdf (June 2014).

[12] U.S. EPA, "Cutting Mercury and Protection America's Children," December 21, 2011, http://blog.epa.gov/blog/2011/12/cutting-mercury/.

[13] U.S. EPA, "Final Mercury and Air Toxics Standards (MATS) for Power Plant" (December 19, 2014) http://www.epa.gov/mats/actions.html.

[14] U.S. EPA, "Cutting Mercury and Protecting America's Children, (December 21, 2011) http://blog.epa.gov/blog/2011/12/cutting-mercury/,

[15] U.S. EPA, "Regulatory Impact Analysis for the Final Mercury and Air Toxics Standards." December 2011.

[16] NERA Economic Consulting "Proposed CATR + MACT," (May 2011).

to the questions about what was included, or excluded, in the costs and benefits, as well the magnitude of the projected costs and benefits, the Beacon Hill Institute has undertaken its own review of the net benefit calculation found in the Regulatory Impact Analysis supplied by the Energy Information Administration (EIA).

History

The road to the current mercury standards has been long, and with many bumps along the way. As early as 1994, the EPA entered into an agreement saying it would determine if it was "appropriate and necessary" to regulate the mercury emissions of the power industry. This deadline was extended numerous times until December 2000 when it determined that it was indeed appropriate and necessary. This determination led to the issuance of the Clean Air Mercury Rule in March of 2005 based on a cap and trade system to reduce mercury emissions.

The first major legal challenge to the Rule soon followed. In February 2008, the District of Columbia Circuit Court unanimously vacated the Rule, mainly because the EPA rule attempted to remove oil and coal power plants from the rule. This ruling led to the Mercury Minimum Available Control Technology (MACT) that is the basis for this study. The MATS was proposed in March 2011 and suspended in August 2012 while the EPA reviewed the policy.[17] Many lawsuits, factsheets, letters and comments later, the details about regulation of Mercury from power sources are still up in the air.

One of the many documents submitted by the EPA was the RIA, a form of cost benefit analysis (CBA) mandated by law. A CBA is the gold standard of comparing polices to help social decision making. By accounting for all related costs and benefits of a policy, it enables lawmakers to determine if a policy is worth pursuing. A CBA allows for the comparison between policies, so that the one that is more cost-effective or the best cost-benefit ratio can be chosen.

Writing that the "American people deserve a regulatory system that works for them, not against them," President Clinton signed Executive Order 12866 in 1993.[18] The order required that all executive branch agencies, including the EPA, "shall assess both the costs and the benefits of the intended regulation and, … propose or adopt a regulation only upon a reason determination that the benefits of the intended regulation justify its costs."[19] The EPA presents its RIA as fulfilling the obligations of the executive order.

Upon a thorough review, we believe that the RIA does not fully assess both the costs and benefits of the regulation. In claiming that "benefits outweigh costs by between 3 to 1 or 9 to 1," the EPA compares overstated estimated benefits to a very narrow set of cost estimates, biasing the outcome of the RIA. A CBA should "try to consider *all of the costs and benefits to society as a whole*," but by considering benefits

[17] U.S. EPA, "Mercury and Air Toxics Standards: History," (April 4, 2012) http://epa.gov/airquality/powerplanttoxics/history.html.
[18] *Federal Register*, Executive Order 12866 of September 30, 1993, http://www.archives.gov/federal-register/executive-orders/pdf/12866.pdf.
[19] Ibid. Section 1 (b) 6.

to society as a whole but limiting the range of costs, the EPA produces a document that is not useful to determining the true value of the regulation.

Benefits

The EPA assigns the benefits of the policy to two categories. The first are the benefits of the policy, which is related to reducing the level of mercury in the air. Mercury causes the most harm when it deposits itself in waterways, leading to its accumulation in the food chain, especially fish. When pregnant women consume fish, they can introduce unhealthy amounts of mercury to unborn children, which can reduce neurological development. Fortunately, due to an effective education campaign, many women are aware of these harmful side effects.

The EPA attempts to quantify the effects of reducing mercury by estimating the averted negative effect using the Intelligence Quotient (IQ) in the 48 contiguous states as a measuring stick. They determine that with the implementation of the MATS policy, IQ would be 0.00209 points higher in 2016 than a baseline without the policy. This higher IQ would lead to "total nationwide benefits estimated between $0.5 and $6.1 million."[20] Although, this benefit is relatively small, they are still worth a second look. First, benefits are being estimated based on a calculated change in average IQ of 0.00209 points. This is far more precise then IQ can be measured. The Supreme Court recently ruled that a standard error of measurement of 5 IQ points must be taken into account in relations to a case it recently reviewed.[21]

Secondly, the studies referenced for the IQ benefit calculation state that a 1 point increase in IQ would lead to between a 1.76 percent and 2.38 percent change in lifetime earnings, were done for the effects of lead. These changes were much more pronounced, expected IQ changes of between 2.2 and 4.7 points were used in the studies. To interpolate the IQ changes down to a size that would be considered a rounding error is bold assumption that could certainly benefit from further study.

This benefit amount seems overstated, as it assumed an unreasonably instantaneous effect of the policy. That is, the policy will have immediate effects on reducing Mercury exposure to unborn children, but because Mercury levels slowly builds up in the food chain, a time line of 2016 is overly optimistic for improved health outcomes. Moreover, the children that would presumably accrue the 0.00209 points in IQ benefits from MATS would not begin to realize any earnings advantage until they entered the workforce, approximately between 2030 and 2035. This could have been accounted for in the RIA using their stated discount rates, but this is not made clear.

The second types of benefit quantified in the RIA are those referred to as 'co-benefits'. These co-benefits are attributed to the ancillary reduction of the amount of atmospheric Particulate Matter smaller than 2.5 micrometers ($PM_{2.5}$). These co-benefits are projected by the EPA to be between $33 and $90 billion, meaning they will account for over 99.99 percent of all benefits attributed to the Mercury standards. If the costs and benefits of the MATS are directly compared, excluding co-benefits and co-costs, then the policy would spectacularly fail a cost benefit analysis. Benefits of between $0.5 and $6.1 million would be offset by the expected $9.6 billion cost, resulting in an approximate 1 to 2,909 benefit to cost ratio.

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[20] U.S. EPA RIA: Mercury, 4-3.

[21] Debra Cassens Weiss, "Another error by a SCOTUS justice? Alito's statistics questioned," *ABA Journal*, May 29, 2014, http://www.abajournal.com/news/article/another_error_by_a_scotus_justice_alitos_statistics_questioned/.

Due to the large magnitude of the co-benefits and their direct impact on whether or not the policy passes the cost-benefit test, a critical review of the co-benefits is paramount. Particulate Matter is currently regulated under the National Ambient Air Quality Standards (NAAQS). The NAAQS sets standards "based on such criteria and allowing an adequate margin of safety, are requisite to protect the public health."[22] These standards are reviewed every five years to confirm that they are up to date with the most recent scientific research available.[23] This begs the question: Is it justified to spend $9.6 billion to reduce mercury when 99.99 percent of the benefits come from the reduction of an already regulated to safe level pollutant? If the NAAQS is doing such a poor job, would it not be better to fix its regulations of $PM_{2.5}$, in the most cost efficient manner possible?

The question of the validity of including the co-benefits to justify a policy is not limited to the MATS. These same benefits are also accounted for in many other RIAs, in addition to the actual NAAQS. In a letter to Cass R. Sunstein, Administrator of the Office of Information and Regulatory Affairs, Rep. Harris and Rep. Broun point out that "of the 28 CAA RIAs for rules proposed or finalized since 2004 that monetized benefits, 25 of them claimed more than 50 percent of total benefits from $PM_{2.5}$-related benefits."[24]

Even if it is determined that these co-benefits should be included in the RIA of MATS, there is then strong evidence that the overall amount is overstated for two reasons. Firstly, "a large fraction of the $PM_{2.5}$-related benefits associated with this rule occur below the level of the National Ambient Air Quality Standards."[25] As a result, a portion of the co-benefits derive from the reduction of $PM_{2.5}$ from its current level to the NAAQS standards. This benefit should not be included in the RIA, and instead should be considered part of the baseline. The NAAQS are already responsible for this portion of the reduction of $PM_{2.5}$, and the subsequent health benefits associated with this reduction. Therefore, the future reduction of $PM_{2.5}$ from current levels to the NAAQS levels and subsequent benefits should be attributed solely to the NAAQS and not to other policies, including the MATS.

The remainder of the benefit from reducing the level of $PM_{2.5}$ below what the NAAQS deems safe. Therefore, this portion of the benefit is questionable. By counting the reduction of the $PM_{2.5}$ below the NAADS, the RIA implies that the relationship between the reduction in $PM_{2.5}$ levels and the health benefits is constant and linear. In other words, a reduction of $PM_{2.5}$ by one unit to meet the NAAQS level has the same health benefit as a reduction from 1 unit to zero. Since, the EPA deems to NAAQS level to be safe, we know that a reduction below that level must confer a lower health benefit. Consequently, $PM_{2.5}$ reductions are likely subject to diminishing marginal returns: the reduction of the first particle provides a higher health benefit than the last particle.

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[22] U.S. Code § 7409 - National primary and secondary ambient air quality standards. http://www.law.cornell.edu/uscode/text/42/7409

[23] U.S. EPA, "Process of Reviewing the National Ambient Air Quality Standards, http://www.epa.gov/ttn/naaqs/review.html.

[24] Letter to Cass R. Sunstein from Rep. Andy Harris and Rep. Paul Broun, November 15, 2011, http://science.house.gov/sites/republicans.science.house.gov/files/documents/hearings/Sunstein%20Letter.pdf.

[25] U.S. EPA, RIA: Mercury, 23.

Secondly, there have been questions raised about the overall validity of the size of the benefit of reducing $PM_{2.5}$. As Dr. Anne E. Smith explains in her 2011 Technical Comments on the MACT, the EPA has high— to the point of non-credibility—levels of risk attributed to $PM_{2.5}$. According to Dr. Smith's calculations the EPA's calculation for deaths from "the act of breathing ambient levels of fine particles on a daily basis was a contributing factor in over 20% of *all* deaths in parts of the US."[26]

In reviewing the co-benefits attributed to this policy, we believe that they should not be considered in the net benefit calculation of the MATS. The inclusions of co-benefits in this manner are an attempt to create unnecessarily complex regulatory structure and are used to justify desired policies. The RIA makes it quite clear. At a cost of $9.6 billion dollars to the electricity generation industry in the lower 48 states, at most $6.1 million in benefits will be accrued from the reduction of mercury.

[26] Anne E. Smith, Ph.D. 'Technical Comments on the Regulatory Impact Analysis Supporting EPA's Proposed Rule for Utility MACT and Revised NSPS (76 FR 24976), August 3, 2011, http://www.nera.com/67_7412.htm.

Costs

The EIA determined that the regulated electricity industry will have $9.6 (in 2007 dollars) billion in higher costs due to this policy, making it the most expensive EPA policy ever. These costs are broken down into three different categories. First, $9.4 billion will be expended by non-oil fired units in 2015 and is considered the incremental cost of complying with the MATS regulations. A further $158 million will be spent on monitoring and record-keeping while the final $56 million in costs is included as the compliance costs for oil-fired units. According to the EPA these are the only quantifiable costs of this policy.

The total benefits of the policy are limited in size, but they are broad in standing. Standing, with regards to a cost benefit analysis, determines whose costs and benefits should be included in the calculation. For benefits the EPA takes the broad view of including all individuals in the 48 continental states. For an unexplained reason, when considering costs, the EPA limits it scope to the electricity generating industry alone. While calculations are made about the percent change in electricity costs and fuel prices these calculations but do not take the logical next step to determine the cost to *all* individuals in the 48 continental states.

Cost to electricity consumers:

National Economic Research Associates (NERA) has made additional estimates of compliance costs, projecting compliance costs to be 10.4 ($ 2010) billion in 2015.[27] Due to the different base years between the two different estimations of compliance costs, it is useful to consider then in the same year. In this case growing both to a base year of 2013 results in $11.30 billion in compliance costs per the EPA and $12.02 billion according to NERA.[28]

While the EPA maintains that these are the costs that will be borne by the regulated electricity industry, in truth the industry will pass these costs along to consumers in the form of higher electricity prices. According to the EPA, the retail electricity prices in the contiguous US states will increase by 3.1 percent compared to no policy in 2015, lowering to 2 percent in 2020 and 0.9 percent in 2030. These percentage change depending on the region, with the Southwest Power Pool likely to experience increases of 6.3 percent in 2015 and California region experiencing the lowest increase of 1.3 percent in 2015.

In a review of the combined effects of the Clean Air Transport Rule (CATR) and MACT, NERA finds much larger retail electricity price increases.[29] NERA's modeling of the policies concludes that average

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[27] NERA, "NERA Analysis of the Final Utility MACT Rule," May 7, 2012, http://m.americaspower.org/sites/default/files/may-issues-policies/Federal/NERA-Modeling-of-Utility-MACT-summary.pdf.

[28] U.S. EPA: 9.6*(244.409/207.723). NERA: 10.4*(244.409/211.449). The CPI for Energy was used. http://www.bls.gov/cpi/.

[29] The NERA explains their reasoning of modeling the two policies together as "NERA modeled the Clean Air Transport Rule (CATR) and MACT in combination because the rules will require the installation of similar emission control

retail electricity prices will increase by 11.5 percent in 2016, 9.5 percent in 2020 and 8.5 percent in 2025.[30] While not directly comparable to the EPA price increase, due to the inclusion of the CATR, some estimates and comparisons can be made. In a later paper NERA states that compliance costs will be $10.4 billion for the MATS alone, while estimating that CATR and MACT combined compliance costs will be $17.8 billion, or that 58.4 percent of the projected compliance costs are due to the MACTs. Therefore, we assume that the share of the price increase due to the MACTs follows the same ratio, resulting in a 6.72 percent increase in 2016, 5.55 percent increase in 2020 and 4.96 percent increase in 2030.

Table 2: Electricity Cost Effects ($m 2012)

	2015	2020	2030
EPA			
Percent Change	3.10	2.00	0.90
Change ($m)	(11,543)	(8,048)	(4,042)
NERA			
Percent Change	6.72	5.55	4.96
Change ($m)	(25,022)	(22,333)	(22,276)

Utilizing EIA data, as detailed in the Appendix, we translated these percent electricity cost increases into the amount that consumers would see their electricity spending increase. In 2015 the EPA projects that consumers in the United States will see electricity costs that are 3.1 percent higher due to the rules, decreasing to a 0.9 percent increase in 2030. This would result in customers paying $11.5 billion more to purchase the same amount of electricity in 2015, and $4 billion more in 2030. Utilizing the NERA projections, customers would pay 6.72 percent more in 2015, decreasing to 4.96 percent in 2030 or a total higher electricity bill of more than $25 billion in 2015, or $22 billion in 2030.

Cost of other fuels:

One example of the understated costs is the failure to include the full cost of higher natural gas and coal prices. A large share of this cost is accounted for in the assessment of the cost of higher utility prices, but natural gas and coal are also used in other ways. Natural gas alone is utilized to heat 51 percent of U.S households, in addition to its usage in stoves, vehicles and as an input into manufacturing.[31] Coal is mainly used for the production of electricity, but is also used in steel and cement manufacturing, and as a heat source. The EPA projects the weighted average Henry Hub natural gas price will increase by 0.6 percent and the average mine mouth coal price will increase by 3.3 percent.[32]

technologies – in particular, scrubbers – by many coal-fueled power plants over approximately the same time frame." http://www.publicpower.org/files/CustomerConnections/ACCCEModelingQ%26A.pdf.

[30] NERA, "Proposed CATR + MACT" May 2011.

[31] American Petroleum Institute, "Natural Gas and Its Uses," http://www.api.org/oil-and-natural-gas-overview/exploration-and-production/natural-gas/natural-gas-uses.

[32] U.S. EPA. RIA: Mercury. Tables 3-13 and 3-14.

According to NERA projections, the combined CATR and MACT impacts on Henry Hub natural gas price is an increase of 17.3 percent. Assuming the same 58.4 percent share of the impact to the MACT as discuss above, then an increase of 10.1 percent would be expected. There is no projection of the changes to coal price attributed to the policies.[33]

Table 3: Higher Fuel Costs ($m 2012)

	2015	2020	2030
EPA - Coal	120	140	180
EPA - Natural Gas	350	430	610
NERA - Natural Gas	5,960	7,150	10,260
Total EPA	470	570	790

Using the increased costs of mine mouth coal and natural gas we utilized EIA projections of the consumption to estimate the possible costs to those outside the regulated electric power industry. This includes consumption of natural gas and coal by residential, commercial and industrial users in addition to the consumption of natural gas by the transportation sector and use of coal by producers of coke.

While this methodology is not a perfect calculation of the cost of higher natural gas and coal prices outside the electric generation sector, it does provide insight into the magnitude of the costs. If price changes are as the EPA projects, then the RIA ignored roughly half a billion dollars of costs. If the policy results in price changes more in line with our approximation of NERA's predicted price changes, then $7 billion worth of costs in 2020 are not taken into account.

Job Creation Myth

As the RIA states "a standalone analysis of employment impacts is not included in a standard cost-benefit analysis," but goes on to state that such analysis is important due to current economic conditions.[34] For this reason, the RIA examines employment effected in the regulated electric generation industry. Again, there is no explanation of why such a narrow view of the employment effects is considered.

The RIA references a 2000 study by Morgenstern et al. of environmental policies on four industries (none of which are electricity generation) between 1979 and 1991. Across these industries for every $1 million ($1987) spent due to environmental regulation, 1.5 jobs are created, with a standard error of 2.2 jobs. As Morgenstern et al state in its abstract.

> We find that increased environmental spending generally does *not* cause a significant change in industry-level employment. Our average across all four industries is a net gain

[33] NERA. "Proposed CATR + MACT," May 2011.
[34] U.S. EPA RIA: Mercury, 6-1.

of 1.5 jobs per $1 million in additional environmental spending, with a standard error of 2.2 jobs—an insignificant effect.[35] (italics original)

The paper was testing the idea that when industries have environmental regulations placed on them, the burden results in lower employment in that industry. On average the paper found that this is not true, that employment change in the industry due to regulation was not statistically different from zero. The correct conclusion that should have been drawn in the RIA is that the regulation will not have a statistically significant effect on the regulated industries. But more importantly, the question that the RIA should have asked, if they were concerned about employment, is "what is the overall employment effect of this policy?"

BHI estimated the cost and benefits and the effect on utility rates based on the projections in the RIA. We attempt to correct for some of the limitations that are contained in the RIA including expanding the scope to all people living in the lower 48 states.

Results

BHI adjusted the RIA calculations to measure the true cost of the MACT policy. Table 4 displays the results.

Table 4: The EPAs New Utility Mercury Levels on All Power Plants

	Net Present Value (3% discount rate) 2012$	
	Base	**Range**
Benefits	*($ millions)*	
2015	5	4 - 6
Costs		
Value of coal generated electricity		
2015	(21,499)	(12,019) – (30,980)
Benefits – (Costs)		
2015	(21,494)	(12,015) - (30,974)

When we strip the co-benefits out of the RIA calculation, the benefits total a mere $5 million, within a range of $4 million to $6 million. This is a fraction of the benefits of $37 billion to $90 billion presented in the RIA.

The BHI estimate of the cost of the Mercury MACT policy differs materially from the RIA, but not nearly as dramatically as the benefits. The cost of the policy is $21.499 billion, within a range of $12.015 billion and $30.974 billion. Nonetheless, our cost estimate is double the $10 billion estimated by the EPA.

[35] R.D. Morgenstern, W. A. Pizer, and J. S. Shih.," Jobs versus the Environment: An Industry-Level Perspective," *Journal of Environmental Economics and Management* 43(3):412-436 (2002).

CO_2 Rule for New Power Plants

On March 27, 2012 the EPA proposed the first Clean Air Act standard for carbon pollution from new power plants. After considering more than 2.5 million comments from the public about the 2012 proposal and consideration of recent trends in the power sector, EPA changed some aspects of its approach. On September 20, 2013, the EPA issued a new proposal for carbon pollution from new power plants.[36]

The primary directive of this rule is to limit the CO_2 emissions of applicable new electric power plants to 1100 pounds of CO_2 per megawatt-hour of electricity generation for sources that include carbon capture and storage (CCS) technology and a separate standard of 1000 lbs. CO_2 per megawatt hours (MWh) for large power plants using natural gas combined cycle technology and 1100 lbs. CO_2/per MWh for smaller units using this technology. The previous rule proposed to limit the emissions to 1000 tons for all such power plants.

As is customary, the EPA issued a report on January 8, 2014 titled "Regulatory Impact Analysis for the Proposed Standards of Performance for Greenhouse Gas Emissions for New Stationary Sources: Electric Utility Generating Units."[37] This document is divided into six sections. Part 1 is the Executive Summary. Part 2 is Introduction and Background. Part 3 is the rationale for limiting Carbon Dioxide, which consists of various harms associated with climate change. The basis for this section is the 2009 Endangerment Finding of the EPA.[38] Part 4 is an Electric Power Sector Profile. The presentation of costs and benefits is given in Part 5, and Part 6 is devoted to compliance with several statutory requirements.

According to the Clean Air Act, the proposed regulation should be reviewed every eight years. Therefore, the RIA primarily focuses on projected impacts for the next eight years. The conclusion of the analysis is that no new coal-fired power plants will be built in the next eight years and beyond, so there are no projected costs or benefits that will result from this rule.[39]

However, the EPA does provide a hypothetical cost-benefit analysis for what they consider the unlikely scenario that new coal-fired power plants become economically unviable within this time frame.

According to the EPA's analysis, "existing and anticipated economic conditions will lead electricity generators to choose new generation technologies that meet the proposed standards without the need for additional controls."[40] So for the eight-year period from 2014 to 2022, there will be no impact on the price of electricity, or the economy as a whole. Nonetheless, the rule would require all new coal-fired power plants to implement partial CCS, which would theoretically encourage research and development into new technology for converting and storing the CO_2 generated by new coal-fired

[36] U.S. EPA, RIA: New Stationary Sources.
[37] Ibid, 1-1.
[38] EPA, Federal Register. http://www.gpo.gov/fdsys/pkg/FR-2009-12-15/pdf/E9-29537.pdf, accessed May 12, 2014.
[39] EPA (2013), 1-2.
[40] Ibid, 1-3.

power plants. Furthermore, the passage of this rule is a prerequisite for imposing similar limits on existing power plants.[41]

The Executive Summary states that, "This rule is consistent with the Climate Action Plan announced by the President in June 2013 ***to cut the carbon pollution that causes climate change and affects public health. [BHI emphasis]***"[42] Yet, on the very next page the document says,

> As explained in detail in this document, energy market data and projections support the conclusion that, even in the absence of this rule, existing and anticipated economic conditions will ***lead electricity generators to choose new generation technologies that meet the proposed standard without the need for additional controls [BHI emphasis]…***even in the absence of this action, new fossil-fuel fired capacity constructed through 2022 and the years following will most likely be natural gas combined cycle capacity.[43]

The authors conclude,

> Therefore, based on the analysis presented in Chapter 5, the EPA anticipates that the proposed ***EGU New Source GHG Standards will result in negligible CO_2 emission changes, energy impacts, quantified benefits, costs, and economic impacts by 2022 [BHI emphasis].*** Accordingly, the EPA also does not anticipate this rule will have any impacts on the price of electricity, employment or labor markets, or the US economy. Nonetheless, this rule may have several important beneficial effects described below.[44]

This is an extraordinary series of statements. According to the EPA, the rule is consistent with President Obama's Climate Action Plan to "cut carbon pollution," yet, the agency asserts that the rule will "result in negligible CO_2 emission changes." The inherent contradictory statements lead to the absurd conclusion that the rule will have no cost or benefits impact on energy markets, electricity prices, or economic impacts. To use an analogy, the effect of the rule would be the equivalent of Congress enacting a minimum wage of $0.05 per hour. If RIA analysis is correct, what is the point of enacting, let alone implementing and administering the rule?

EPA bases its entire finding of zero cost on the assumption that natural gas-combined cycle technology will remain more efficient and less expensive than any future coal technology absent CCS. Projecting future price and demand for anything commodity, good or service is tenuous at best. The future coal and natural gas prices are subject to unforeseen events and technological changes, such as the Arab oil embargo in the 1970s and the invention of the new drilling technologies that recently unlocked vast

[41] Ibid, 1-4
[42] Ibid, 1-2.
[43] Ibid, 1-3.
[44] Ibid, 1-4.

new natural gas reserves in shale rock formations. To demonstrate the nature of these changes, one simply needs to look at past projections of coal and natural gas prices and use.[45]

It was only in 2008 that the U.S. Department of Energy's EIA wrote that "coal consumption is projected to grow at a faster rate toward the end of the projection period, particularly after 2020, as coal use for new coal-fired [electricity] generating capacity grows rapidly."[46] According to EIA projections, utility companies, in their long-term planning were looking to add new coal. With natural gas prices rising in the reference case, coal-fired plants account for the largest share of capacity additions through 2030, given the assumption that current environmental policies are maintained indefinitely.[47] Seven years later the energy market in the United States has been turned on its head by the new drilling technologies and the recent dramatic decline in prices prompted by Middle Eastern producers.

There is significant uncertainty about future coal and natural gas prices, as well as about future growth in electricity demand, which determines the need for new generating capacity. Alternative cases with higher and lower coal and natural gas prices and variations in the rate of electricity demand growth are used to examine the potential effects of those uncertainties. The alternative cases illustrate the influence of fuel prices and demand on dispatch and capacity planning decisions.[48]

The RIA does provide an illustrative analysis that contains two fundamental flaws in its methodology. First, the RIA uses an EIA "reference case" projection scenario that includes a Climate Uncertainty Adjustment (CUA) that increases the capital costs for coal-fired capacity. Second, the RIA analysis only covers the period from 2015 and 2022, too short a period to reflect the full impact of the rule on the coal fired electricity production.

The short time period is due to the requirements of the Clean Air Act as noted above. However, giving the long lead times for planning a new power plant, it is very likely that all new coal-fired power plants would have been already in the works out to 2022. The more important issue for analysis is the effect the proposed rule would have on the power sector in the years after 2022. During this period any new coal power plant would not be in the planning stage yet.

The EIA includes the CUA in its reference case to account for the uncertainty around potential regulation or legislation addressing CO_2 emissions. However, this is not appropriate for policy analysis, as noted in the Electric Energy Research Institute's comments on the RIA,

> "It is important to note here that both the EIA and the EPA apply a climate uncertainty adder (CUA) – represented by a three percent increase to the weighted cost of capital – to certain Coal-fired capacity types. The EIA developed the CUA to address the

[45] U.S. Energy Information Administration, *Annual Energy Outlook 2008: With Projections to 2030*, AEO 2008, (June 2008) http://www.eia.gov/oiaf/aeo/pdf/0383(2008).pdf.
[46] Ibid, 7.
[47] U.S. Energy Information Administration, *Annual Energy Outlook 2008*, 69.
[48] U.S. Energy Information Administration, *Annual Energy Outlook 2013:*, http://www.eia.gov/todayinenergy/detail.cfm?id=10831

> disconnect between power sector modeling absent GHG regulation and the widespread use of a cost of CO_2 emissions in power sector resource planning."[49]

The EIA calculated the Climate Uncertainty Adjustment (CUA) by adjusting the cost of conventional coal without CCS upward until no new (unplanned) coal was deployed in its reference case. EIA's intent in developing its reference case was to mimic company decision making given regulatory and legislative uncertainty about climate policy. Including the CUA in EIA's reference case is an exception to their usual approach of assuming only existing regulations, but for the purpose of creating a projection of the future that reflects industry realities, there is some rationale for doing so.[50] However, it bias the EIA "reference case" project for new coal power plants down due to the higher costs associated with the CUA. As a result the RIA cost estimates are pushed down.

The Beacon Hill Institute makes the adjustments suggested by the Electric Energy Research Institute to correct error in the EPA's analysis of the rule. We use the "no GHG concern" forecast in EIA's Annual Energy Outlook 2013 (AEO 2013) as the baseline of our analysis. To simulate the effect of the rule we use the level of coal plant construction in the "no GHG concern" scenario. Table 5 displays the results.

Table 5: The EPAs New Rule Limiting CO_2 Emissions from New Coal Power Plants

	Net Present Value (3% discount rate) 2012$	
	Base	**Range**
Benefits	*($ millions)*	
CO2 Emissions reduced (social cost of carbon)		
2040	491	229 - 754
2015 - 2040	3,516	1,660 - 5,453
Costs		
Carbon Capture and Storage		
2040	8,957	4,673 - 15,179
2015-2040	47,450	37,073 - 77,818
Benefits – Costs		
2040	(8,465)	(4,444) - (14,425)
2015-2040	(43,933)	(35,413) - (72,365)

The BHI estimate of the benefits of the CO_2 Rule for New Power Plants would total $491 million in 2040, within a range of $229 million to $754 million. This differs from the illustrative benefits of $7.5 billion to $21 billion presented in the RIA. We estimate of the cost of the policy is $8.957 billion, within a range of $4.673 billion and $15.179 billion. As a result we find the net cost of the policy $8.465 billion, within a range of $4,444 billion and $14,425 billion.

[49] See *Federal Register* 79(5): 1477. As cited in The Electric Energy Research Institute, "Comments of the Electric Energy Research Institute on the Standards of Performance for Greenhouse Gas Emissions from New Stationary Sources: Electric Utility Generating Units," May 9, 2014, http://op.bna.com/env.nsf/id/avio-9k2trf/$File/EPRI%20comment.pdf.
[50] U.S. EPA, RIA: New Stationary Sources. We note that the RIA does strip out CUA in its Levelized Cost of Electricity calculation.

We find that between 2015 and 2040 the policy would produce net costs of $43.933 billion, within a range of $35.413 billion and $72.365 billion. This compares to the RIA illustrative estimate of between $21 billion in net benefits and $38 billion in net cost from 2015 to 2022. However, the RIA officially estimates that there are no costs or benefits.

CO_2 Rule for Existing Power Plants

In April 2007, the Supreme Court ruled in *Massachusetts v. the Environmental Protection Agency* that greenhouse gases (GHGs) meet the definition of an "air pollutant" under the Clean Air Act (CAA). This ruling clarified that the authorities and requirements of the CAA apply to GHGs. As a result, the court forced the EPA to decide whether to regulate GHGs under certain provisions of the CAA.

The EPA is currently proposing standards to address CO_2 emissions from reconstructed and modified stationary power plants and existing power plants. The purpose of the rule is to reduce GHG emissions from the electric power sector by 30 percent below levels in 2005.[51]

The EPA developed "emission guidelines" that the states must develop plans to meet the GHG reductions. The emission guidelines include state-specific rate-based goals for carbon dioxide emissions from the power sector. This rule, as proposed, would set in motion actions to lower the carbon dioxide emissions associated with existing power generation sources in the United States.

The EPA is using the four categories to set the state-specific goals:

1. Reducing the carbon intensity of generation at individual coal power plants through efficiency improvements.
2. Substituting natural gas generation in place of coal plants.
3. Substituting "expanded low- or zero-carbon generation" (wind, solar, nuclear) for coal.
4. Using demand-side energy efficiency to reduce the amount of generation required.

The proposed rule contains emission guidelines for states to use in developing plans that set their standards of performance. The rule sets separate emissions reduction targets for each state based on an EPA calculation of the Best System of Emission Reduction. Therefore, the EPA not only sets emission target, but also prescribes the best way to achieve the target.

States are required to file emission reduction plans with the EPA for approval. The plans must include the standards of performance and measures to implement and enforce those standards. The emission reduction targets vary depending on the approach and timeframe of the reduction. If states adopt regional plans, the emissions targets are lower than if states go it alone. If states accept an emissions target date of 2025 instead of 2030, then the emission reduction target is lower. This very "flexibility" makes an accurate analysis of costs and benefits of the proposed challenging. As the EPA states in its RIA, "Given the flexibilities afforded states in complying with the emission guidelines, the benefits, cost and economic impacts reported in this RIA are not definitive estimates, but are instead illustrative of compliance actions states may take."[52]

In other words, the ability of the states to each take a different approach makes any analysis of the proposal extremely difficult. Nonetheless, the RIA estimates that the rules would bring about a net benefit to the United States and that the propose rule would provide net benefits ranging from $20 billion to $79 billion.[53] The RIA categorizes the costs of the rule into compliance costs and administrative costs and the benefits into climate benefits and health co-benefits. It also translates net benefits into an economic impact on jobs for illustrative purposes and projects that energy efficiency programs would produce between 76,200 new job years in 2025 and 112,000 new job years in 2030. This is balanced against the loss of job years in the "Engineering" industries of between 49,200 and 80,400.

The RIA distorts the likely real net cost and benefit of the rule by again overstating the benefits of the rule and likely understating the cost of the program. The RIA contains the same analytical flaws describes in the utility MACT rule described in previously in this paper. Specifically,

- limiting their analysis to compliance and administrative costs within the directly affected industries and not the cost of higher energy prices;
- the use of co-benefits of reductions in PM that are already regulated to safe levels using the latest available scientific evidence; and
- use of a Social Cost of Carbon (SCC) that is simply too high and not reflective of the potential climate effects.

The flaws identified by the first two points are described in Utility MACT section of this report and will not be reviewed here.

The RIA uses a SCC of $13, $46, $68 and $137 per metric ton of CO2 for the year 2020 discounted to 2011 dollars using different discount rates. The RIA also increases the SCC over time.[54] These SCC estimates net "climate" benefits ranging from $5.4 billion to $94 billion depending on the SSC, discount rate and timeframe used.[55] However, the RIA does not provide an estimate of the actual drop in global temperature that the policy would provide.

The Cato Institute fills the void. Cato analysts used a climate model emulator called MAGICC (in part developed through support of the EPA) to estimate that the proposed rule would reduce global

[51] U.S. EPA, RIA: Existing Power Plants, 1.1
[52] Ibid,
[53] Ibid, ES-21 to ES-23.
[54] Ibid, ES-14.
[55] Ibid, ES-18 -ES-19.

temperature by 0.018 °Celsius (°C).[56] This is less than 0.486 percent to 0.375 percent of the expected range of the 3.7 °C to 4.8 °C that the Intergovernmental Panel on Climate Change expects global temperatures to increase by 2100 in the absence of mitigation steps.[57] That is a lot of expense, time and effort to effect almost no change to global temperature increase. If the effect of the proposed rule on climate change negligible, then why does the RIA use such large values for CCS?

BHI attempts to correct for some of the limitations contained in the RIA.

Results

BHI adjusted the RIA calculations to measure the true cost of the proposed rule. Table 6 displays the results.

When we strip the co-benefits and use a market-based SCC, the benefits total $3.528 billion, within a range of $1.647 billion to $5.41 billion. This is a fraction of the benefits of $20 billion to $79 billion presented in the RIA.

We estimate of the cost of the policy is $19.554 billion, within a range of $17.307 billion and $21.801 billion. As a result, we find the net cost of the policy $16.026 billion, within a range of $15.660 billion and $16.391 billion. We find that between 2015 and 2030 the policy would produce net costs of $284.572 billion, within a range of $268.866 billion and $300.277 billion.

Table 6: The EPA's New Rule Limiting CO_2 Emissions from Existing Coal Power Plants

	Net Present Value (3% discount rate) 2012$	
	Base	**Range**
Benefits	*($ billions)*	
CO_2 Emissions reduced (social cost of carbon)		
2030	3.528	1.647 - 5.410
2015 - 2030	35.931	16.768 - 55.094
Costs		
Higher electricity prices		
2030	19.554	17.307 - 21.801
2015-2030	320.503	285.634 - 355.371
Benefits – Costs		
2030	(16.026)	(15.660) - (16.391)

[56] Paul Knappenberger and Patrick J. Michaels,"0.020C Temperature Rise Averted: The Vital Number Missing from the EPA's "By the Numbers" Fact Sheet," Cato at Liberty Blog, June 11, 2014, http://www.cato.org/blog/002degc-temperature-rise-averted-vital-number-missing-epas-numbers-fact-sheet.

[57] Intergovernmental Panel on Climate Change, 2014, *Summary for Policymakers, In: Climate Change 2014, Mitigation of Climate Change. Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* [Edenhofer, O., R. Pichs-Madruga, et al (Eds.)]. (Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA) 9.

2015-2030	(284.572)	(268.866) - (300.277)

Conclusion

The EPA is using its rulemaking authority under the Clean Air Act to effectively force coal to either shutdown or adopt expensive and untested technologies. These policies will have grave effects on the cost or the reliability of the national electricity supply.

The rules are aimed at reducing CO_2 emissions from producers of coal power plants by either shutting them down or making their cost uncompetitive in the market place. If the electricity production from coal is eliminated, the diversity of the electricity supply sources will fall and become more dependent of natural gas and its price fluctuations. If the new expensive and untested carbon capture and sequestration technology is adopted electricity prices will increase.

Methodology

Utility Maximum Achievable Control Technology

Cost to consumers:

To calculate the cost to consumers based on the supplied predictions of increases to electricity costs, we utilized EIA projections of the cost and retail sales of electricity in the contiguous United States. The cost of future electricity for the United States is based on the Annual Energy Outlook for 2014 end-use electric power price projections was used as the baseline cost of electricity.[58] The EPA report looks at costs for just the 48 contiguous states (excluding Alaska and Hawaii), while the NERA study does not specifically state if it includes all 50 states, so for consistency we also looked at the retail sales for just the 48 contiguous states. To calculate the projected total retail sales, we took the national total and subtracted out Alaska and Hawaii, resulting in the 2012 total retail sales.[59] This number was then grown at the projected rate of total electricity sales for the United States.[60]

Natural Gas Cost:

To calculate a static estimate of the cost of higher Henry Hub price of natural gas, we first utilized projections of consumption and delivered price of natural gas by sector.[61] Multiplying the two together, we determined a baseline spending amount on natural gas. For the purpose of this exercise, we excluded the cost to the Electric Power sector, as we assume this is accounted for in the cost to regulated industries.

To calculate the spending in the change scenario, we looked at cost of projected delivery price compared to the predicted Henry Hub spot price for the same year, by sector.[62] The Henry Hub price was in dollars per million British Thermal Units while price of delivered natural gas was per thousand cubic feet, so a conversion of 1.025 was used.[63] We held this amount constant while increasing the Henry Hub price by the 0.6 percent that the RIA estimated. This step was repeated for the NERA estimate of a 10.1 percent increase in Henry Hub price.

Coal Cost:

To calculate the state estimate of the cost of higher mine mouth coal prices we can expect, we first utilized projections of consumption and delivered price of coal by sector.[64] The EIA's Annual Energy Outlook report supplies consumption for Residential and Commercial, but does not supply a price. For

[58] Annual Energy Outlook 2014, Table 95, http://www.eia.gov/forecasts/aeo/tables_ref.cfm, AEO 2014.
[59] State Electric Profiles, http://www.eia.gov/electricity/state/.
[60] AEO 2014, Table 95: "Forecasts," http://www.eia.gov/forecasts/aeo/tables_ref.cfm.
[61] Ibid, Tables 135 and 136.
[62] Ibid. Table 132.
[63] EIA, Frequently Asked Questions, "What are Ccf, Mcf, Btu, and therms? How do I convert natural gas prices in dollars per Ccf, or Mcf to dollars per Btu or therm?" May 19, 2014, http://www.eia.gov/tools/faqs/faq.cfm?id=45&t=8. $ per MMBtu multiplied by 1.025 = $ per Mcf.
[64] AEO 2014, "Analysis and Projections," http://www.eia.gov/analysis/projection-data.cfm#annualproj. Table A15.

the extent of this exercise we applied the "Average" price to Residential and Commercial consumption of coal. Baseline spending on coal was calculated by multiplying price by sector by consumption by sector.

To calculate the spending in the change scenario, we looked at cost of projected delivered price compared to the projected mine mouth price by year and sector. We held this difference constant while increasing the mine mouth price by 3.3 percent.

Methodology for New Coal Plants

The Beacon Hill Institute makes the adjustments suggested by the Electric Energy Research Institute to correct error in the EPA's analysis of the rule. We use the "no GHG concern" forecast in EIA's Annual Energy Outlook 2013 (AEO 2014) as the baseline of our analysis. The "no GHG concern" scenario projects that utilities would add 1.89 gigawatts of unplanned coal plants in 2031, compared to 0.33 gigawatts under the reference case. To simulate the effect of the rule we use compare the level of coal plant construction in the reference case to the level in the "no GHG concern" scenario.

The planned coal plants do not differ from the two scenarios, however under the new rule the new power plants will need to use CCS. Therefore, all new coal power plants will either not be built or will be built with CCS. The use of CCS will increase the costs associated with the construction of any new coal plants. For the purpose of this paper we assume that all new plants will be built with CCS versus non-CCS. Building new coal plants with CCS technologies will significantly increase the construction and operational costs.

In an April 2012 report, the EIA updated its estimates of the difference between new units of advanced Pulverized Coal (PC) plants with and without CCS. The updated overnight capital cost estimates for single unit PC with CCS were 61 percent higher than the same plant without CCS. The fixed and variable operations and maintenance costs were 113 percent higher with CCS than without.[65]

Since the AEO 2013, the Kemper plant currently being constructed by Southern Corporation in Mississippi has again reported $25 million in cost increase, on top of $380 million in 2014, and the plant will not be completed until 2015. The company now estimates that plant will cost $6.1 billion, or a staggering 305 percent higher than its original estimated cost of $2 billion.[66]

We need to adjust for these new costs increases. Obviously, the Kemper plant is unique in that it is the first attempt to be a commercial scale coal to gasification combine cycle plant with carbon capture and sequestering. In the future costs overruns like Kemper plant will be minimized since construction firms will learn from the greater experience of building more plants. Nevertheless, we feel that the final cost of these plants will be higher than current EIA estimate, and as a result we add 75 percent to the

[65] U.S. EIA, "Forecasts," 6, at http://www.eia.gov/forecasts/capitalcost/pdf/updated_capcost.pdf.
[66] Paul Hampton, "Kemper County power plant price rises $25 million more," *SunHerald.com*, http://www.sunherald.com/2015/01/02/5997422_kemper-plant-price-rises-another.html?rh=1

current EIA estimates (36 percent represents the cost difference from the RIA estimates for CCS and non CCS plants, plus 41 percent to account for unanticipated future cost overruns). Given the lack of experience of firms in building and operating the new CCS technology, it is likely new projects will incur significant cost overruns. The future cost overruns represent the 305 percent from the Kemper plant adjusted downward by 15 percent per year through the middle of our analysis time frame, or 11 years.

To compare the construction of coal plants with CCS with those without we use the EIA's estimate of Levelized Cost of Electricity (LCOE) from the AEO 2014. We compare the LCOE for conventional coal, which would be built with no threat of GHG emissions rules with our estimate of conventional coal with CCS. Before doing so, we need to make a couple of adjustments to both estimates.

First, the conventional coal LCOE estimate contains the cost of capital adder of 3 percent mentioned above. The EIA estimates that the adder is "similar to that of an emissions fee of $15 per metric ton of carbon dioxide (CO_2) when investing in a new coal plant without CCS."[67] The EIA also provides the number of pounds of CO_2 per kilowatt hour (kWh) of electricity produced by different types of coal used by the plants.[68] We averaged the three numbers to obtain our estimate that convention coal produces 2.14 pounds of $C0_2$ per kWh of electricity, or 2,140 lbs. per megawatt (MWh) of electricity or 97.1 percent of a metric ton (2,204 lbs). We multiply the 97.1 percent by the $15 capital cost adder (CCA), which reduces the adder to $14.56 per MWh and we subtract it from the $60 capital cost in the LCOE estimate, which reduces it from $60 per MWh to $45.43 and the overall LCOE for conventional coal to $81.14 per MWh. This matches almost identically to the LCOE calculation in the RIA.[69]

Second, the estimate the LCOE for conventional coal with CCS technology, we multiply the $81.14 by our cost adjustment factor of 76 percent to get $142.8 per MWh. Now we can compare the construction of future conventional coal plants with those with CCS technologies required under the new rule.

We apply the above LCOE figures above to the EIA's forecast of "Electricity Generating Capacity" under the "no GHG concern" scenario. First, we convert the gigawatts in the table into MWh by multiplying the annual hours of operation (365 X 24 =8,750) by the capacity factor of 85 percent from the LCOE table. We also adjust for the fact that the new rule only requires the CCS technology to capture a little more than 50 percent of the CO_2. We then subtract the cost calculation for LCOE with CCS from the LCOE without CCS. This calculation is made for each year from 2016 through 2030, then we sum the net cost for each year to calculate the total for the entire period.

Methodology for Existing Coal Plants

As stated above, the complexity and ability of a nation states or regions to choose the methods and timeframe of achieving the emission reductions makes the proposed rule challenging to analyze.

[67] U.S. EIA, "Forecasts," at http://www.eia.gov/forecasts/aeo/electricity_generation.cfm#5 .
[68] U.S. EIA, Frequently Asked Questions, "How much carbon dioxide is produced per kilowatt-hour when generating electricity with fossil fuels?" http://www.eia.gov/tools/faqs/faq.cfm?id=74&t=11
[69] U.S. EPA, RIA: New Stationary Sources RIA, 5-23.

Therefore, by necessity, we make several simplifying assumptions about how the policy will be implemented by the states.

On the benefit side, as noted above, we remove the co-benefits due to the fact that they are already regulated under other provisions of the CAA. We also use a more market-based social cost of capital (SCC) when calculating the benefits of reducing the CO_2 emissions. Although, many would argue that with such a small effect on reducing global temperatures, the social cost of carbon should also be removed from the benefit calculation. If, as we do, take the view that economic actors are willing to pay to reduce emissions and a market price exists then we should use that price.

On the cost side, we assume that the states will choose to take a longer time to reduce emissions in exchange for a lower emissions target. State governments, in general, tend to put off costly or painful adjustments for as long as possible in other policy areas, such as pension and entitlement reform. We also, assume that the states will choose the option of replacing coal-fired power plants with gas fired power plants, since coal provides a dependable base load electricity supply and this cannot be replaced by renewable sources such as wind and solar, which are intermittent technologies. Natural gas is also the least expensive source of electricity and is likely to remain so in the future.

Energy efficiency measures suffer from diminishing marginal returns as more resources are devoted to such programs. It is also difficult to project the future cost and benefits of energy efficiency programs due to the unknown advances in energy efficiency technology, the effect of diminishing marginal returns, and the effect of future energy prices. Energy efficiency also requires upfront investment that yields a small return over a long period of time. Finally, one could argue that the benefits of energy efficiency measures are zero, since households and businesses choose not to make them and thus choose to spend their resources on other items that they value more.

The RIA shows that the goal for regional compliance plans is to reduce CO_2 emissions by 545 million metric tons in 2030.[70]

Again, we use Energy Outlook 2014 (AEO 2014) forecasts as the basis of the analysis. The "no GHG concern" scenario projects that the electric power sector will produce 2.236 billion million metric tons of CO_2 in 2030, compared to 1,809 million metric tons for the scenario with at $10 per ton carbon tax. This is a reduction of 427 million metric tons, or 19 percent from our baseline scenario.[71] However, we are measuring against the emissions from 2005, which were 2,146 million metric tons, which brings our total emissions cut to 607 million metric tons of CO_2, or 25 percent.[72] The EIA emission reduction number is higher than any of the scenarios in the RIA, however the reduction percentages quite closely.

To simulate the effect of the rule we compare average electricity price for all sectors under our baseline scenario "no GHG concern" to the $10 carbon tax scenario. The electricity price difference between the

[70] U.S. EPA, RIA: Existing Power Plants, ES - 6.
[71] U.S. EIA, Energy-Related Carbon Dioxide Emissions by Sector and Source, United Stateshttp://www.eia.gov/oiaf/aeo/tablebrowser/#release=AEO2014&subject=4-AEO2014&table=17-AEO2014&region=1-0&cases=co2fee25-d011614a,ref2014-d102413a

scenarios is 1.03 cents per kWh, or 9.86 percent. We then multiply the 1.03 cent price difference by the amount of electricity produced in that year to get the cost of the GHG reduction. We then discount the cost figures back to 2012 dollars using a 3% discount rate. The discount rate reflects the current low interest rate environment and our best judgment that this will continue into the future.

We use the same $10 cost of carbon, or carbon tax, from the EIA to calculate the benefits of the emissions reduction. We multiply the cost of carbon by the reduction in admissions that takes place between the baseline scenario and the $10 carbon cost scenario. We then discount the cost figures back to 2012 dollars using a 3 percent discount rate to be consistent.

To estimate the economic effects of the policy, we use the increase in electricity prices. First, we adjust our price increase down to reflect the net costs by subtracting the benefits from the costs. This leaves us with a net electricity increase of 9.09 percent.

Distribution to the States

BHI distributed the net costs of the CO_2 regulations on existing and new power plants to the states based on the size of the each states spending on electricity relative to spending on electricity for the United States. In addition, we adjust the net costs to reflect the relative percentage of total electricity produced using coal in each state relative to the national average. For example, North Carolina electricity sales represent 2.91 percent of the total U.S. electricity sales.[73]

We then adjust this figure based on the percentage of electricity generated using coal for each state relative to the United States. For example, North Carolina produces 41.9 percent of its electricity using coal compared to the 40 percent for the U.S. as a whole. We divide the 40 percent by 41.9 percent to get 1.0475 and multiply this by the 2.91 percent to get our adjusted 3.05 percent.

Finally, we multiply the 3.05 percent by the total net cost of the regulation. For example, 3.05 percent of the net cost for new power plants of $8.957 billion is $273 million. We repeated this process for all states.

For the Utility MACT policy we used the EPA distribution of its net costs to the states.[74]

Calculation of the Ratepayer Effects

To calculate the effect of the policy on electricity ratepayers we used EIA data on the average monthly electricity consumption by type of customer: residential, commercial and industrial.[75] The monthly

[72] U.S. EIA, "Environment: Data," http://www.eia.gov/environment/data.cfm#summary.

[73] AEO 2014, "Analysis and Projections," http://www.eia.gov/analysis/projection-data.cfm#annualproj. Table A10. State Energy Profiles, http://www.eia.gov/electricity/state/NorthCarolina/. Table 8.

[74] U.S. EPA. "Regulatory Impact Analysis for the Final Mercury and Air Toxics Standards," (December 2011), 5D3.

[75] Energy Information Administration, "Electric Sales, Revenue, and Average Price," at http://www.eia.gov/electricity/sales_revenue_price/.

figures were multiplied by 12 to compute an annual figure. We inflated the 2012 figures for each year using the regional EIA projections of electricity sales.[76]

We calculated an annual per-kWh increase in electricity cost by dividing the total cost increase by the total electricity sales for each year. We then multiplied the per-kWh increase in electricity costs by the annual kWh consumption for each type of ratepayer for each year. For example, we expect the average Wisconsin residential ratepayer to consume 8,242 kWh of electricity in 2030 and the expected percent rise in electricity to be by 19% percent from the 14.36 cents per kWh in the same year. Therefore, we expect residential ratepayers to pay an additional $225 in 2030.

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[76] Energy Information Administration, "Electric Power Projections for EMM Regions," http://www.eia.gov/oiaf/aeo/tablebrowser/#release=AEO2013ER&subject=0-AEO2013ER&table=62-AEO2013ER&region=3-5&cases=early2013-d102312a.

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