NATURAL GAS AND THE ENVIRONMENT: THE EFFECT OF THE NEW EPA MATS/MACT REGULATIONS

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Abstract

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In late 2011, the EPA promulgated regulations (MACT/MATS) to reduce toxic air emissions from coal and oil fired electric utility steam generating units and industrial boilers. Some groups believe the regulations "encourage" fuel switching from coal or petroleum liquids to NG and a number of utility companies have already announced plans to switch. Utility commissions east of the Mississippi River were surveyed to determine if the MACT/MATS regulations have played a significant role in future compliance planning. Also, data obtained from EIA was analyzed to determine the cost of converting a set percentage of existing coal-fired plants to NG and clean coal technology. Of the surveys returned (6:24), only four commissions indicated that some of the planned conversions to NG were driven by regulatory compliance. The remaining stated that MATS was one of many issues impacting possible changes at facilities. Analysis of the EIA data indicated that it was significantly cheaper to convert to NG than clean coal. The projected cost of NG (currently low) over the next 10 to 20 years will play a role in the fuel switching decision. The economics and possible fuel cost savings associated with NG maybe the driving force in the utility companies' decision to fuel switch, rather than switching as a method of compliance. The undetermined consequence of MATS/MACT regulations is whether the switching to, and the resultant increase in demand for NG, will ultimately lead to a transfer of environmental contaminants from one environmental media (air) to others (soil, water) in the drive to reduce air emissions.

Biography

Karen Trimberger has been the Manager of Environmental Programs at Duke University and Duke University Health Systems (Duke) for 15 years. Prior to that, she worked in the environmental consulting field on a variety of projects ranging from hazardous waste remediation to compliance audits for major industries. Since coming to Duke, she has developed and implemented a number of programs such as fluorescent light recycling, ballast management, laboratory waste management compliance program, laboratory TSCA compliance program, and the pharmacy waste program. Karen is also the coordinator of the Duke University Spill Team and a Certified Hazardous Materials Manager.

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Abbreviations and Acronyms

Area Source – area sources of HAP pollutants that are not major sources

CAA – Clean Air Act

DSCM – Dry Standard Cubic Meter

EIA – US Energy Information Administration

EPA – United State Environmental Protection Agency

EGU – Coal and oil-fired electric utility steam generating units

GW - GigaWatt

HAP – Hazardous Air Pollutants

Hg – Mercury

Henry Hub Spot Price – NG pipeline located in Erath, Louisiana that serves as the pricing point for NG futures for the New York Mercantile Exchange.

IGCC – Integrated gasification combined cycle units

Low Rank Virgin Coal - Virgin coal having a calorific value of 8,300 Btu/lb or less

MACT – Maximum Achievable Control Technology

Major Source - major source of HAP Pollutants is a stationary source that emits or has the potential to emit any single HAP at a rate of 10 tons or more per year or any combination of HAP at a rate of 25 tons or more per year

MATS – The National Emission Standards for Hazardous Air Pollutants for Coal and Oil-Fired Electric Utility Steam Generating Units and Standards of Performance for Fossil-Fuel-Fired Electric Utility, Industrial-Commercial-Institutional, and small Industrial-Commercial-Institutional Steam Generating Units.

Mcf –million cubic feet

MWh – MegaWatt-hour. A watt-hour is a unit of energy used in electrical measurements, equal to the energy converted or consumed at a rate of 1 watt during a period of 1 hour, or to 3600 joules.

NAAQS – National Ambient Air Quality Standards (40 CFR Part 50) were developed to protect public health and welfare with an adequate margin of safety.

Natural gas (NG) – fluid mixture of hydrocarbons composed of at least 70% methane by volume or that has a gross calorific value between 35 and 41 megajoules per dry standard cubic meter (900 and 1,100 Btu per dry standard cubic foot). Does not included the following gaseous fuels: landfill gas, digester gas, refinery gas, sour gas, blast furnace gas, coal-derived gas, producer gas, coke oven gas, or any gaseous fuel produced in a process which might result in highly variable sulfur content or heating value.[1]

NERC – North American Electric Reliability Corporation – International corporation created to evaluate the reliability of the North American power grid

NESHAPs – National Emission Standards for Hazardous Air Pollutants (40 CFR Part 61 and 63) are standards for hazardous air pollutants (HAPs) that are known or suspected to cause cancer or other serious health effects or adverse environmental effects.[2]

NO_2 – Nitrogen Dioxide

NSPS – New Source Performance Standards (40 CFR Part 60) are technology based standards which apply to specific stationary source categories.[3]

PM- Particulate Matter

PSD – Prevention of Significant Deterioration

SO_2 – Sulfur Dioxide

SIPS – State Implementation Plans are general plans developed by states and local air quality management agencies to attain and maintain the NAAQS and include a specific plan to attain the standards for each area designated nonattainment for a NAAQS. These plans must be submitted to EPA for approval.[4]

Tcf- trillion cubic feet

US – United States

[1] 40 CFR 60.41 Definitions
[2] http://www.epa.gov/compliance/monitoring/programs/caa/neshaps.html [Accessed March 3, 2013]
[3] http://www.epa.gov/compliance/monitoring/programs/caa/newsource.html [Accessed March 3, 2013]
[4] http://www.epa.gov/air/urbanair/sipstatus/overview.html [Accessed March 3, 2013]

Introduction

The US Congress began researching to determine the sources and scope of air pollution with the 1955 Air Pollution Control Act[5] and regulated pollution control for the first time with the Clean Air Act (CAA) of 1963. In 1967, the US Congress passed the Air Quality Act that authorized enforcement proceedings in areas of interstate air pollution transport. However, it wasn't until the CAA of 1970 that the EPA developed regulations that set emission limits for mobile and stationary sources. The 1970 CAA established the NAAQS[6], SIPs[7], NSPS[8], and NESHAPs[9] programs that regulate emissions from stationary sources and expanded the EPA's enforcement authority. Amendments to the 1970 CAA in 1977 and 1990 authorized 1) conditions for PSD[10] determinations, 2) provisions for sources in non-attainment areas for NAAQS, 3) new programs for the control of acid rain, 4) issuance of stationary source permits, 5) provisions for the protection of stratospheric ozone, 6) expansion of toxic air pollutant control program with NESHAPS incorporation, and 7) expanded EPA's enforcement authority.

Historically, regulations have been difficult to finalize and implement due to 1) technical regulatory jargon that has been hard to understand, 2) resistance from the regulated body, 3) lawsuits brought against regulations by the regulated communities and environmental groups, and 4) a lack of enforcement or the power to enforce the regulations. Therefore, it is not surprising that the newer regulations are experiencing some of the same issues. For instance, the

[5] http://epa.gov/air/caa/caa_history.html [Accessed March 3, 2013]
[6] http://epa.gov/air/criteria.html [Accessed March 3, 2013]
[7] http://www.epa.gov/air/urbanair/sipstatus/overview.html [Accessed March 3, 2013]
[8] http://www.epa.gov/compliance/monitoring/programs/caa/newsource.html [Accessed March 3, 2013]
[9] http://www.epa.gov/compliance/monitoring/programs/caa/neshaps.html [Accessed March 3, 2013]
[10] http://www.epa.gov/NSR/psd.html [Accessed March 3, 2013]

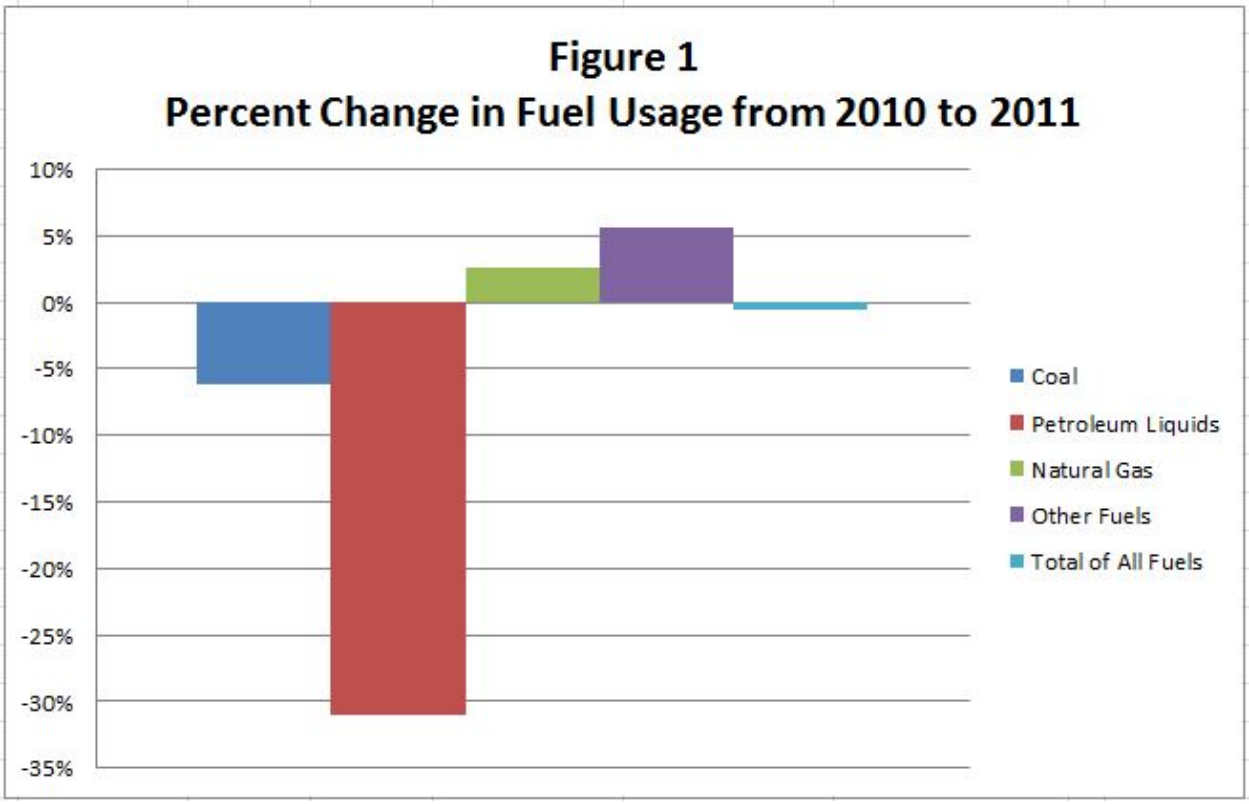
1990 CAA gave EPA the authority to regulate hazardous air pollutants[11] by source category by using technology based standards referred to as MACT but several regulations have been mired in the court proceeding for years. Several MACT standards[12] have been issued for various source categories such as boat manufacturing, fabric printing, and lime manufacturing. EPA has been working on MACT regulations for industrial/commercial boilers and EGUs for a number of years.

After years of revisions based on industry comments, finally, on February 16, 2012, the EPA published the final MATS rule to regulate mercury, acid gases, and other toxic air pollutants from EGUs and IGCC units. After a few modifications, the final MACTs for major and area sources for industrial, commercial, and institutional boilers and process heaters to regulate HAP emissions were published in January and February 2013.

Each of these regulations set emission limits for certain pollutants for each type of fuel (i.e. coal, oil, natural gas) fired in the EGUs or boilers. Potentially, units that burn coal and oil would need major modifications to comply with the rules while natural gas fired units would not need as many modifications (in some cases are exempt) to meet the requirements of the rules. Retiring or retrofitting older less efficient units and installing newer units that fire natural gas is a time consuming and expensive proposition to industries. The EPA regulatory impact analyses state that modifications to existing machinery or replacing machinery could cost a significant amount of money initially. However, the long term impact of lower toxic emissions from these units on the cost to public health, healthcare infrastructure, and the environment far outweigh the cost of compliance.

[11] http://www.epa.gov/ttn/atw/188polls.html [Accessed March 3, 2013]
[12] http://www.epa.gov/airtoxics/mactfnlalph.html [Accessed March 3, 2013]

As companies and industries determine the cost of compliance, some may choose to comply with the rules by moving away from the more restrictive coal emission limits and retrofit or install new units to burn natural gas. The American Natural Gas Association believes that the new EGU MATS and boiler MACT will "encourage" fuel switching to NG[13] and result in an increase demand of NG by 7.6% to 16.2%. As illustrated in Figure 1 below, data collected by the EIA indicate a decrease in the use of coal and petroleum liquids and an increase in the use of NG from 2010 to 2011.



Currently, the US has an abundant supply of NG and NG reserves. The price for NG is relatively low making the conversion appealing to industries and the cost of compliance favorable when

[13] American Natural Gas Association. April 3, 2012. Boiler MACT: Opportunities for Natural Gas Utilities. Boiler Mact Webinar.

compared to coal. Table 1 summarizes some public announcements by utility companies detailing their plans to convert all or part of specific plants from coal to NG.

Table 1
Summary of Conversion Press Releases by Utility Companies[14]

State	Company	Plant	Affected MW	Converted to NG
Alabama	Alabama Power	Gaston Steam Plant	1000	2015
Delaware	City of Dover	Dover Municipal Power Plant	18	2012
Georgia	Georgia Power	McDonough Steam Generating Plant	840	2013
Indiana	Citizens Energy Group	Perry K Steam Plant	15	2014
New Jersey	Pepco Holdings	Deepwater Generating Station	82	2010
North Carolina	Duke Energy	H.F. Lee Plant	920	2012
Kentucky	American Electric Power	Big Sandy Plant	640 (replaces 1078 MW units)	2015
Virginia	American Electric Power	Clinch River Plant	470	2014
Wisconsin	Madison Gas & Electric	Blount Street Station	188	2011

If and when companies convert to or install NG fired units, the increased demand for NG will affect the long term supply and cost of NG. With the increased demand, riskier NG extraction techniques may be employed to increase supply to meet the demand and to build up NG reserves. These extraction techniques need to be studied to determine the impacts on the environment and if those environmental impacts are greater than the effects of burning coal or oil.

This paper is organized into four parts. The first section discusses the MATS and Boiler MACT regulations and the possible economic impacts from implementation of these regulations. The second section details the methodology used to determine if these regulations will have a significant impact on electric utility sector. The third section discusses the actual data collected

[14] Information obtained from utility company's website and sourcewatch.org

as part of this study. The last section discusses the conclusion drawn from the analysis and the impact of the study.

Background

As with any new regulation, the proposed emission standards for power plants and industrial boilers have been met with resistance from the regulated entities and from environmental groups. The regulated entities believe the regulations are too restrictive and environmental groups do not believe that they have gone far enough to protect the environment.

In 2000, the EPA issued a scientific and legal determination stating that data indicates that regulating mercury emissions from power plants was appropriate and necessary. The determination found that EGUs were the largest domestic source of Hg emissions and that HAP emissions could be easily controlled with pollution control devices. Once the EPA determines that a source category requires regulation, they are required by law to establish technology based emission standards[15] referred to as the MACT standard.

In December 2011, the EPA promulgated the final MACT rule (called MATS) to reduce mercury, acid gases, and other toxic air pollutant emissions from existing EGUs and IGCC units with a minimum size of 250 MMBtu/hr input. At the same time, the EPA was also reviewing the data on emissions from industrial and commercial boilers and developing emission standards for this sector as required by the 1990 CAA amendments. After many proposals and changes, the final MACT standards were published in early 2013. Each of these rules will be discussed in the following paragraphs.

[15] CAA Section112(d)

The MATS Rule

The MATS[16] rule establishes Hg emission standards along with proven technological and operational tools to reduce the percentage of Hg emissions by approximately 90%. The rule also establishes emissions reductions of acid gases and toxic metals through installation of pollution controls. The MATS rule applies to EGUs larger than 25 MW that burn coal or oil for the purpose of distributing electricity through the national energy grid. The EPA estimates that there are approximately 1,100 coal-fired and 300 oil-fired EGUs affected by the rule. Existing steam generating natural gas-fired electric utility boilers were not included in this rule. This rule also includes revisions to the NSPS for fossil-fuel fired EGUs with new PM, SO_2, and NO_2 standards. The NSPS will pertain to any new boiler that burns coal, oil, and natural gas to produce steam to produce electricity or provide heat including boilers at industrial, commercial, and institutional facilities. The MATS segregates each EGU by fuel class (coal, oil, solid oil) and subdivides each class into subcategories with emission limits for each specific subcategory. Numerical emission limits were established in the rule for PM (toxic non-metals surrogate), Hg and HCL (toxic gases surrogate) for all existing or new coal-fired EGUs. The rule established for all existing or new oil-fired EGUs emission limits for PM (toxic non-metals surrogate), HCL, and HF. Note that the rule also establishes alternative emission limits for total non-Hg metal air toxics (alternate for PM), SO2 (alternate to HCL), and individual non-Hg metal air toxics (alternate to PM). Work practice standards were included in the MATs to limit the emissions of organic air toxics including dioxins and furans for existing and new coil-fired and oil-fired EGUs. If a plant implements the work practices standards, an annual performance test program must be executed for each unit that includes inspections, equipment adjustments, and/or

[16] EPA. Federal Register. *National Emission Standards for Hazardous Air Pollutants from Coal and Oil-Fired Electric Utility Steam Generating Units and Standards of Performance for Fossil-Fuel –Fired Electric Utility, Industrial-Commercial-Institutional, and Small Industrial-Commercial-Institutional Steam Generating Units.* February 2012. 77/33 9304

maintenance and repairs as required ensuring optimal performance and combustion in each EGU. The emission limits and testing requirements for existing and new EGUs are included in Tables 2 and 3 below.

Table 2
Emission Limits for Existing EGUs

EGU Category	Pollutant	Emission Limits	Testing Requirements
Coal-fired unit (not low rank virgin coal)	PM SO2 Hg	0.03 lb/MWh 1.5 lb/MWh 0.013 lb/GWh	Collect a min of 1 dscm/run SO2 CEMS LEE Testing for 30 days with 10 days max/Method 30b or Hg CEMS or sorbent trap monitoring system only
Coal-fired unit (low rank virgin coal)	PM SO2 Hg	0.03 lb/MWh 1.5 lb/MWh 0.013 lb/GWh	Collect a min of 1 dscm/run SO2 CEMS LEE Testing for 30 days with 10 days max/Method 30b or Hg CEMS or sorbent trap monitoring system only
IGCC unit	PM HCL Hg	0.4 lb/MWh 0.005 lb/MWh 0.03 lb/GMWh	Collect a min of 1 dscm/run Sample collection depends on EPA Sample Method LEE Testing for 30 days with 10 days max/Method 30b or Hg CEMS or sorbent trap monitoring system only
Liquid-fired unit – continental (excluding limited use)	PM HCL	0.3 lb/MWh 0.002 lb/MWh	Collect a min of 1 dscm/run Sample collection depends on EPA Sample Method

EGU Category	Pollutant	Emission Limits	Testing Requirements
	HF	0.00005 lb/MWh	Sample collection depends on EPA Sample Method
Liquid-fired unit – non-continental (excluding limited use)	PM	0.3 lb/MWh	Collect a min of 1 dscm/run
	HCL	0.002 lb/MWh	Sample collection depends on EPA Sample Method
	HF	0.0005 lb/MWh	Sample collection depends on EPA Sample Method
Solid oil-derived fuel fired unit	PM	0.09 lb/MWh	Collect a min of 1 dscm/run
	SO2	0.3 lb/MWh	SO2 CEMS
	Hg	0.002 lb/GWh	LEE Testing for 30 days with 10 days max/Method 30b or Hg CEMS or sorbent trap monitoring system only

Table 3
Emission Limits for New or Reconstructed EGUs

EGU Category – New	Pollutant	Emission Limits	Testing Requirements
Coal-fired unit (not low rank virgin coal)	PM	0.007 lb/MWh	Collect a min of 4 dscm/run
	SO2	0.4 lb/MWh	SO2 CEMS
	Hg	0.0002 lb/GWh	Hg CEMS or sorbent trap monitoring system only
Coal-fired unit (low rank virgin coal)	PM	0.007 lb/MWh	Collect a min of 4 dscm/run
	SO2	0.4 lb/MWh	SO2 CEMS
	Hg	0.04 lb/GWh	Hg CEMS or sorbent trap monitoring system only
IGCC unit	PM	0.07 lb/MWh	Collect a min of 1 dscm/run
	SO2	0.4 lb/MWh	SO2 CEMS

EGU Category – New	Pollutant	Emission Limits	Testing Requirements
	Hg	0.04 lb/GWh	Hg CEMS or sorbent trap monitoring system only
Liquid-fired unit – continental (excluding limited use)	PM	0.07 lb/GWh	Collect a min of 1 dscm/run
	HCL	0.0004 lb/MWh	Sample collection depends on EPA Sample Method
	HF	0.0004 lb/MWh	Sample collection depends on EPA Sample Method
Liquid-fired unit – non-continental (excluding limited use)	PM	0.2 lb/GWh	Collect a min of 1 dscm/run
	HCL	0.002 lb/MWh	Sample collection depends on EPA Sample Method
	HF	0.0005 lb/MWh	Sample collection depends on EPA Sample Method
Solid oil-derived fuel fired unit	PM	0.02 lb/MWh	Collect a min of 1 dscm/run
	SO2	0.4 lb/MWh	SO2 CEMS
	Hg	0.002 lb/GWh	Hg CEMS or sorbent trap monitoring system only

The MATS rule does include a number of different strategies including work practices, dry sorbent injection, activated carbon injection systems, and fabric filters that can be used to achieve and maintain compliance. Facilities have three years (with a possible 1 year extension) after rule finalization to modify their operations to be in compliance with the rule. The EPA believes that compliance to this rule will cost approximately $9.6 billion and raise US electricity prices by 3.1% in 2015. They also believe that the health benefits costs (savings from a reduction in the number of hospital visits, sick days, heart attacks, etc.) from the reduced emissions are valued at approximately $37 to $90 billion dollars. The utility industry argues that this rule is too expensive and will trigger the premature closing of a large number of coal-fired

EGU plants[17]. According to the NERC, a total of 576 to 677 coal-fired units (234 to 258 GW) would need to retrofit to meet the MATS standard by 2015 at a significant cost to the utilities ($116 to$ 354 million)[18]. The total cost of the retrofit would depend on the type of compliance equipment installed at each facility. Based on data from EIA, the average operation and maintenance cost for existing flue gas desulfurization units have increased from $1.51 million/kW-hr in 2007 to $1.94 million/kW-hr. The capital costs for the same equipment have increased from $135.41 per kW in 2007 to $240.34 per kW in 2011 a 56% increase. If the cost increase trend continues, it could possibly drive more utilities to retire older plants. This could present a grid reliability problem if new production capacity is not built to replace them.

In addition, a number of units will have been retired (11.4 GW) due to a combination of MATS and the Cross State Air Pollution rule. Also, a number of units (3.6 to 24.4 GW) will be economically vulnerable due to a variety of reasons such as the low price of NG or unit retirement due settlement agreements reached with government agencies that specify the installation of air pollution control devices to comply with a assortment of environmental regulations. The large number of GWs taken out of service could reduce reserve margins and destabilize the power grid in the US. Review of the NERC data by the Congressional Research Service found that while two regions of the country (Texas and New England) would fall below the NERC planning reserve reference level of 15% it was not due to MATS. The low margins would exist even without the standard.[19]

[17] Neville A. February 2012. Debate Heats Up over New Mercury and Air Toxics Rule. http://www.powermag.com/issues/departments/legal_and_regulatory/4326.html.
[18] NERC. 2011. 2011 Long-Term Reliability Assessment
[19] McCarthy JE. January 2012. EPA's Utility MACT: Will The Lights Go Out?. Congressional Research Service. 7-5700/R42144

An economic impact analysis by NERA[20] suggests that not only would MATS have an economic impact on the utilities but would also result in a loss of income equivalent to 180,000 full time jobs. EPA estimates 46,000 short term and 8,000 long term jobs would be created in the utility sector due to the rule.[21] An analysis by Bivens 2012 indicated an approximate 84,500 to 117,000 jobs would be created due to the MATS regulation.[22] Bivens believes that more jobs will be created in industries supporting the implementation of the rule than are lost due to the cost to the utility industry.

While the cost to retrofit or replace coal burning units to meet the standards can be a significant cost to utilities, utility commissions grant rate increases to allow the utilities to recover their compliance costs. It is possible that the utility industry is using the conversion costs as a tool to delay implementation or to pressure the EPA to change the promulgated regulations. It is also unlikely that utilities would close a coal burning plant without having a plan to generate replacement MWs from another location. For example, Duke Energy recently closed down two older coal fired plants in Charlotte and Rowan County in North Carolina rather than retrofit them for compliance with the new standards. These units had been operating infrequently over the recent years due to age and inefficiency as Duke Energy transitions over to NG fired units. The lost MWs will now be generated at a NG fired plant which began operating in 2011.

In addition, Duke Energy also stated that they will try to find jobs within the company for the employees displaced by the closing plants. Therefore, NERC's argument of large job losses

[20] Smith AE et al. March 2012. An Economic Impact Analysis of EPA's Mercury and Air Toxics Standards Rule. NERA Economic Consulting.
[21] EPA. December 1011. Regulatory Impact Analysis for the Final Mercury and Air Toxics Standards. EPA-452/R-11-011
[22] Bivens J. February 2012. The "Toxics Rule" and Jobs: The job-creation potential of the EPA's new rule on toxic power-plant emissions. Economic Policy Institute. 325

could also be an attempt to slow the implementation of the standards using economic hardship. Utilities closing coal units will continue to need workers to operate the replacement plants built to maintain the power grid.

The MACT Standards

The MACT for industrial, commercial, and institutional boilers and process heaters established emission limits for major[23] (i.e. chemical plants, refineries) and area[24] sources (i.e. hospitals, hotels) of HAP. The boilers covered by this rule fire a variety of fuels such as coal, oil, natural gas, and biomass. According to the EPA, of the approximately 1.5 million boilers in the US, approximately 2,300 (1%) would need to meet the numerical emission limits and approximately 197,000 (13%) would be required to follow the work practice standards to be in compliance with the boiler MACT. Approximately 1.3 million NG boilers located at area sources are not covered by the rule because they are exempt from the MACT. Existing major sources will have until early 2016 to comply with the MACT standard while existing area sources have until March 21, 2014. The EPA estimates that for every dollar spent to reduce emissions under these standards, $13 to $29 of health benefits (including fewer premature death, asthma attacks, trips to the hospital, etc.) will be seen by the public. The total emissions reductions projected for both area and major sources are summarized below in Table 4. In some cases, the boiler MACT emissions increase for certain substances.

[23] EPA. January 2013. *National Emission Standards for Hazardous Air Pollutants for Major Sources: Industrial, Commercial, and Institutional Boilers and Process Heaters.* February 2012. 78/21 7138-7213
[24] EPA. February 2013. *National Emission Standards for Hazardous Air Pollutants for Area Sources: Industrial, Commercial, and Institutional Boilers.* Federal Register. 78/22 7488-7522

Table 4
Summary of Pollutant Emission Reductions[25]

Pollutant	Current Standards (tons per year)	Final Standards (tons per year)
Mercury	1.6	2.0-3.0
Non-mercury Metals	3,000	2,100
Hydrogen Chloride	30,500	40,500
Particulate Matter	30,000	18,000
Sulfur Dioxide	450,000	580,00

Major source boilers are segregated in 19 subcategories depending on the type of boiler or process heater in use at the facility with numerical emission limits for CO (surrogate for organic HAP), HCL (surrogate for acid gas HAP), Hg, and PM or TSD (surrogated for non-Hg metal HAP) established for most categories. Depending on the category, facilities may be able to use work practice standards to demonstrate compliance with the MACT.

Approximately 183,000 area source boilers would be covered by the area source boiler MACT with 182,400 boilers required to conduct periodic tune-up. A few of the 182,400 boilers would also be required to perform a one-time energy assessment. Therefore, approximately 600 area source boilers (less than 1%) would be required to meet the emission limits.

[25] EPA. 2011 and 2012. *Regulatory Impact Analysis: National Emission Standards for Hazardous Air Pollutants for Industrial, Commercial, and Institutional Boilers and Process Heaters at Major Sources.*

The categories and subcategories for major and area source MACT boilers are too numerous to be summarized in this paper. The specific emission limits for each category of boiler from major and area sources can be found at 40 CFR Part 63 subparts DDDDD and JJJJJJ, respectively.

Methodology

In order to determine if the MATS regulation will have a significant impact on the electric utility sector, a survey was utilized to determine future planning for compliance. Based on a review of the map (Figure 2) of utilities in the United States generated by the EPA, it was decided to deploy the survey only to the East Coast facilities as the greatest concentrations of coal-fired EGUs are located east of the Mississippi River. The utility commissions were contacted in each state and asked to complete a simple questionnaire about the MATS impact of utility operations. Since Vermont has no coal or gas-fired utilities, they were not included in this analysis. Follow-up with additional agencies occurred when recommended by the state's utility commission. The Department of Energy, the Tennessee Valley Authority, and the EPA (MATS NESHAP contact) were also contacted and asked to complete the same questionnaire. The attached Table 5 lists the utility commissions and additional agencies contacted and contains a summary of the data received from each state. Information and data obtained from the EIA Electric Power Annual was also used in the data analysis.

Data Summary

Response to the questionnaire was very weak (average survey response is 20 to 40%) with only 6 out of 24 utility commissions responding with a completed questionnaire. A number of commissions responded suggesting that other agencies be contact to complete the survey; however, those contacts did not yield additional information. In a majority of the cases, a

positive or negative response was never received from the suggested contacts. Of the states that answered the questionnaire, only Alabama and Mississippi stated that the planned shift to NG was driven by the MATS regulations. According to representatives from Georgia and Indiana, 14 and 17 -19, respectively, coal and/or petroleum oil plants were going to be retired due to the MATS regulation. Alabama, Georgia, Mississippi and Indiana indicated that a small number of facilities planned to switch fuel sources as a means of complying with MATS. The remaining states indicated that while MATS was a factor in future planning it was one of a number of issues impacting possible changes at facilities. Alabama, Indiana, and North Carolina stated that some plants in the state were already in compliance with the standard. Table 5 (Attached) contains a summary of the information received from the commissions.

Mr. William Maxwell, the NESHAPS contact at the EPA for the MATS rule, was contacted to determine if he knew of any additional sources that could be used to obtain the information requested in the questionnaire. He stated that utility companies consider that information proprietary and will probably not make that type of information public until the 2015 compliance date. According to the Electric Power Annual[26], the utility sector planned capacity changes by 2016 will net a loss of 149 coal and 40 liquid petroleum units while NG boilers will have a net gain of 120 units.

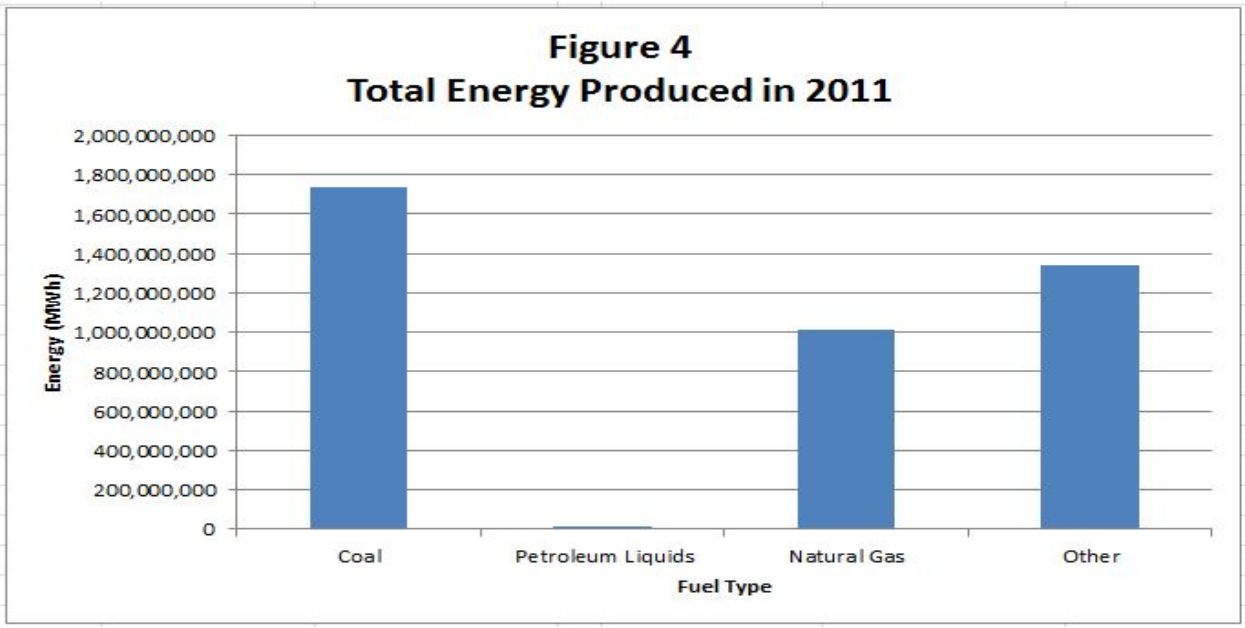
Due to the low response rate of the utility commissions and Mr. Maxwell's response, data was downloaded from EIA's Electric Power Annual Report for 2011and from Form 923 on the types and amounts of fuel used by the electricity utility sector for each state in the study area. A snapshot of the information included in Form 923 is included below as Figure 3.

[26] US Energy Information Administration. January 2013. *Electric Power Annual*. http://www.eia.gov/electricity/annual/ [Accessed March 2013]

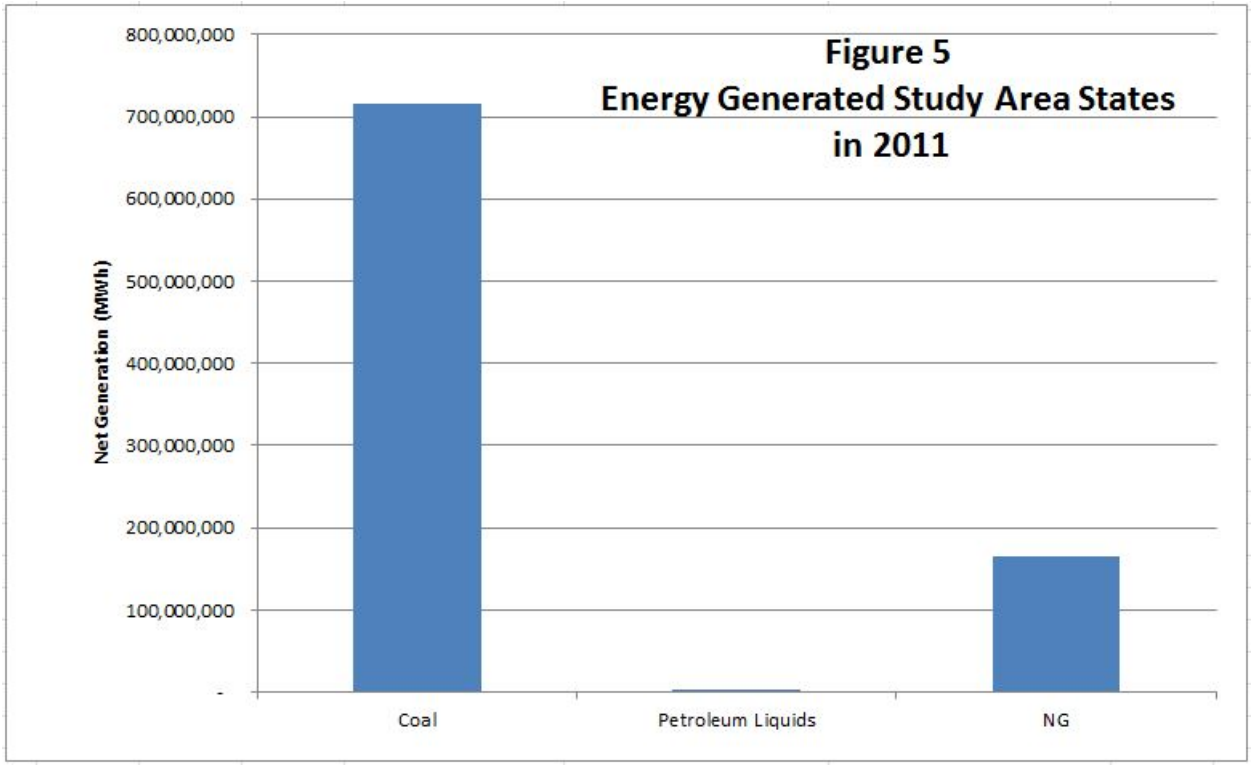
Figure 3 – Snapshot of EIA Form 923

Plant Name	Operator Name	State	NERC Region	EIA Sector Number	Sector Name	Reported Fuel Type Code	AER Fuel Type Code	Physical Unit Label	TOTAL FUEL CONSUMPTION QUANTITY	ELECTRIC FUEL CONSUMPTION QUANTITY	TOTAL FUEL CONSUMPTION MMBTUS
Barry	Alabama Power Co	AL	SERC	1	Electric Utility	NG	NG	mcf	640,125	640,125	652,416
Barry	Alabama Power Co	AL	SERC	1	Electric Utility	NG	NG	mcf	54,361,491	54,361,491	55,405,154
Barry	Alabama Power Co	AL	SERC	1	Electric Utility	NG	NG	mcf	1,377,674	1,377,674	1,405,818
Greene County	Alabama Power Co	AL	SERC	1	Electric Utility	NG	NG	mcf	1,091,120	1,091,120	1,103,880
Greene County	Alabama Power Co	AL	SERC	1	Electric Utility	NG	NG	mcf	137,850	137,850	139,371
Colbert	Tennessee Valley Authority	AL	SERC	1	Electric Utility	NG	NG	mcf	49,876	49,876	50,799
McWilliams	PowerSouth Energy Cooperative	AL	SERC	1	Electric Utility	NG	NG	mcf	124,526	124,526	126,518
McWilliams	PowerSouth Energy Cooperative	AL	SERC	1	Electric Utility	NG	NG	mcf	24,162,268	24,162,268	24,540,704
James H Miller Jr	Alabama Power Co	AL	SERC	1	Electric Utility	NG	NG	mcf	2,769,345	2,769,345	2,800,389
McIntosh	PowerSouth Energy Cooperative	AL	SERC	1	Electric Utility	NG	NG	mcf	0	0	0
McIntosh	PowerSouth Energy Cooperative	AL	SERC	1	Electric Utility	NG	NG	mcf	1,948,636	1,948,636	1,979,981
Theodore Cogen Facility	Alabama Power Co	AL	SERC	1	Electric Utility	NG	NG	mcf	294	294	297
Theodore Cogen Facility	Alabama Power Co	AL	SERC	1	Electric Utility	NG	NG	mcf	9,874,821	9,874,821	9,964,946

Data summarizing the total net generation of energy by power source for the last ten years was obtained and reviewed. Figure 4 illustrates the total energy produced by the utility sector in the United States using coal, NG, petroleum liquids, and other sources (renewable energy sources – wind, solar, etc.) in 2011. The data illustrates that coal was the most used fuel to produce energy with other sources (renewable energy sources – wind, solar, etc.) and natural gas being the next most used fuel sources. Since the amount of petroleum liquids burned was so low, coal will be used to determine the impact of fuel switching on NG supplies. This data will be used to determine the cost of conversion from coal to NG.



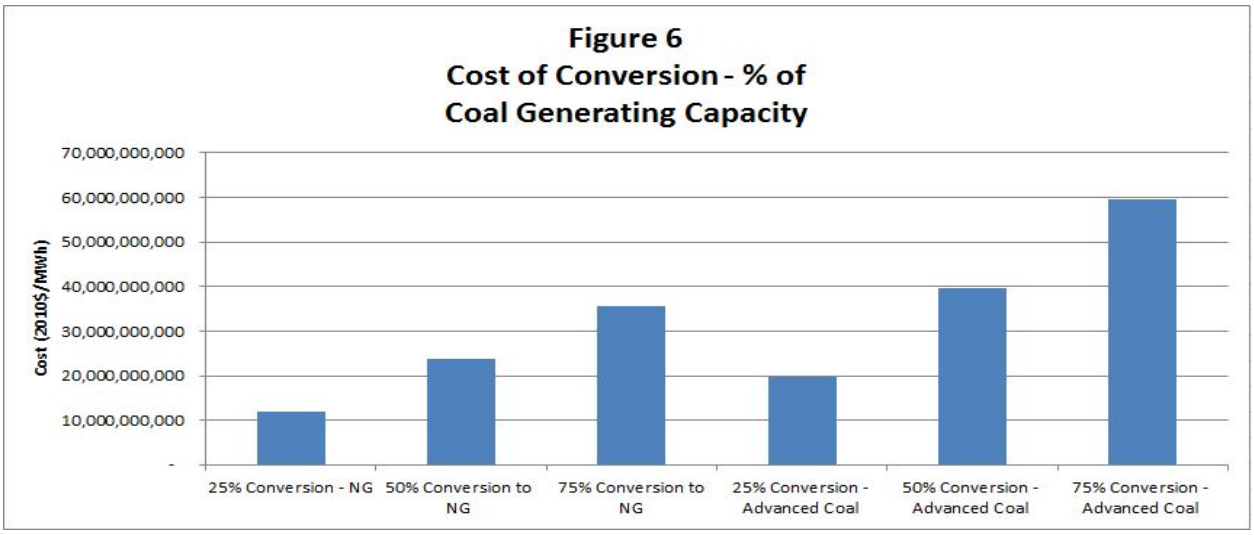
The data from Form 923 was sorted by study area states and fuel type code (coal, petroleum liquids, and NG). The energy produced by fuel type in the study area states in 2011 is illustrated in Figure 5.



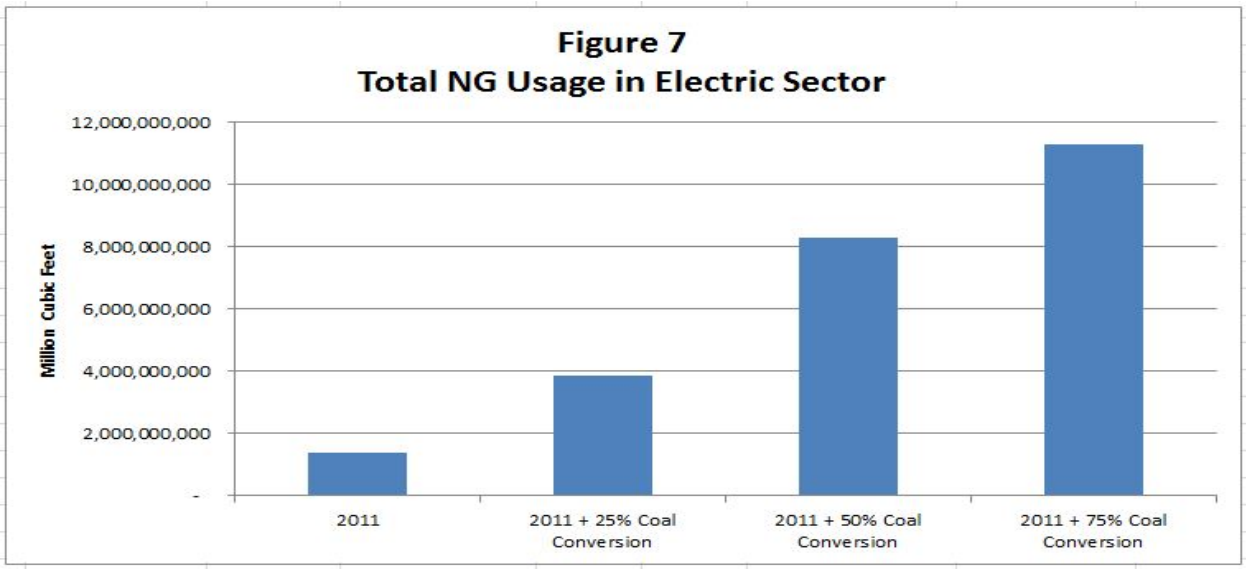
The total fuel consumption, and net generation was then summarized by state. Using the net generation data for each state for the coal fuel type, a percentage (25, 50, and 75) by MWh was calculated for conversion to another fuel type (NG and clean coal) for compliance with the MATS. The cost for converting each percentage was then determined using estimated levelized cost for new generation resources as determine by the EIA[27]. As shown below in Figure 6, conversion to NG per MWh is significantly cheaper than converting to clean coal technology. It should be noted that the assumption was made for this calculation that all the units were too old to upgrade and would have to be replaced to comply with the regulations and to maintain electric grid capacity. Newer utility and industrial units may have additional options available such as scrubbers and co-firing of fuels that may be used to comply with the regulations.

As an example, a local industrial/commercial coal fired steam plant recently converted three coal boilers to natural gas. The project included the removal of all coal equipment (boilers, bag houses, and lime injection system), installation of three new NG boilers, use of temporary NG boilers to keep the plant online during the renovation, and a total building renovation. The building renovation included a new fire suppression system, new wiring and control systems, a new 3000 KV generator, an additional 300,000 gallon fuel oil tank, and the removal of the smoke stacks. The project will be completed in September 2013 and cost $40 million. The conversion enabled this facility to move from a major to area source of HAPs under the MACT standard.

[27] US Energy Information Administration. July 2012. *Levelized Cost of New Generation Resources in the Annual Energy Outlook 2012.*

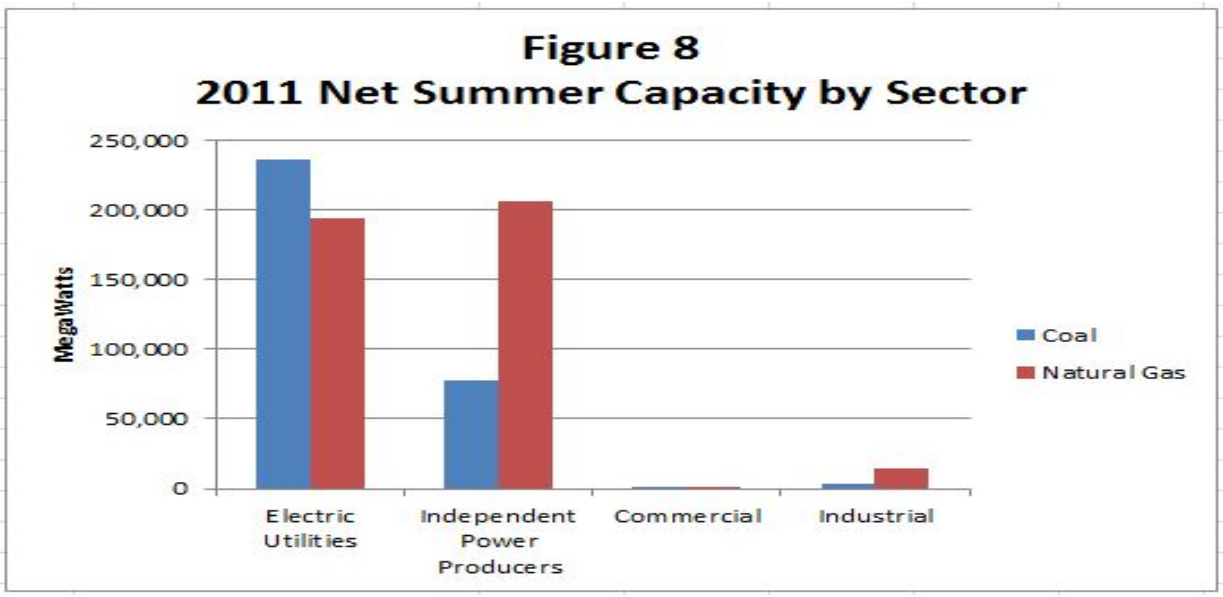


In 2011, the total production (including dry production, imports, and withdrawals from storage) of NG in the US was 29.43 Mcf and consumed 24.38 Mcf with the utility sector using approximately 34%. If only 25% of the plants convert to NG, the use of NG in the utility sector would increase by approximately 180% (Figure 7).



The data presented in Figure 8 shows that the other sectors burning fuel to generate power or steam used more NG than coal in 2011. The use of NG increased in the electric power (0.6%

increase), industrial (0.6% increase), and commercial (2% increase) sectors from 2010 to 2011 and this trend is expected to continue[28].



The demand for energy is expected to continue to increase over the next 20 to 30 years. The number of producing NG well in the US increased from 487,627 in 2010 to 514,637 in 2011, a 5.5% increase. According to EIA, the storage capacity of NG increased 3% from 2011 to 2012.

EIA estimated in the 2011 Annual Report that demand for NG across all sectors could increase to 26.55 Tcf by 2035[29]. However, this estimate was made without consideration to the impact on fuel consumption due to the MATS and MACT regulations. A number of groups, including the EIA, estimate that the US has an approximate 100 year supply (1,400 to 2,600 Tcf) of recoverable NG.

[28] US Energy Information Administration. July 2012. *Natural Gas Year-in-Review*.
[29] http://www.naturalgas.org/business/demand.asp [Accessed March/April 2013]

Conclusions

The MATS and MACT regulations are complex with emission limits based on the type of boiler and fuel used. Deciding on the best avenue for compliance with these regulations along with the other pertinent EPA regulations can be a complicated and expensive process. Companies have three choices in determining the best approach for compliance with the MATS/MACT regulations:

- Continue to use coal and retrofit the facilities with the necessary and/or required control equipment and implement work practices;
- Fuel switch to NG and comply with the regulations pertinent to NG-fired units; or
- Chose not to comply with the regulations and risk a non-compliance finding and fines by the EPA.

Most companies consider the decision on the method of compliance an extremely sensitive subject and they consider their methods of compliance to be proprietary information which resulted in a poor utility commission survey response. However, the majority of utility commission respondents stated that the new regulations only play a small part in the decision to retire or replace boilers or to switch fuels. Changes to equipment especially boiler retirement and/or replacement could impact 1) network capacity (amount MW available for use), 2) company profit margins (can they pass the cost of compliance onto consumers or is it a cost of doing business), and 3) on-site operations with possible loss of jobs. As such, the utility companies were not willing to share information on how and when they will be compliant with the MATS and MACT regulations. Two of the utility commission survey respondents did state that utilities planned to retire or fuel switch a number of coal fired boilers to comply with the regulations.

Every year the EIA compiles data on fuel usage by sectors (utility, independent power producers, commercial, and industrial). In 2011, the electric utility was the only sector that burned more coal than NG to generate power. With the implementation of MATS over the next few years, the percentage of utility plants burning NG will increase. The actual effect on NG supplies remains to be seen but the analysis conducted in this paper indicates that the potential for significant impact is possible. However, there is a significant cost impact in a switch to NG burning boilers that will impact each facilities compliance planning. The plant's location relative to the coal stores will also play an important role in the cost benefit analysis since transportation costs can add substantially to fuel costs.

As of April 4, 2013, EIA was reporting a Henry Hub spot price for NG price of $4 per MMBTU with the future trend in NG prices is predicted to decrease in mid to late 2013 to less than $3 per MMBTU. The decrease in price is expected due to less demand from residential consumers during the summer months. The projected cost of NG over the next 10 to 20 years will play a role in the fuel switching decision. The economics and possible fuel cost savings associated with NG maybe the driving force in the utility companies' decision to fuel switch rather than switching as a method of compliance.

As the use of NG increases in the electric and commercial/industrial sectors in the US and around the world, the cost of NG is sure to rise based on the law of supply and demand. If NG supplies do become depleted, the economic impact could be significant across all sectors of the US and world economy. At what point does the cost of NG negate the cost of burning coal and the required air pollution controls?

It is unknown if this resource will become scarce or if extraction will increase to meet the demand. Will gas companies employ untested extraction techniques that could potentially harm the environment to meet that demand? The undetermined consequence of MATS/MACT regulations is whether the switching to and the resultant increase in demand for NG will ultimately lead to a transfer of environmental contaminants from one environmental media (air) to others (soil, water) in the drive to reduce air emissions.

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TABLE 5

Table 5
Questionnaire Summary Table

State	Questionaire Response	# Coal Plants			# Oil Plants			# NG Plants							Any plants installing new boilers to meet MATS			
		# of plants	Ave size (MW)	Total coal burned (ton)	# of plants	Ave size (MW)	Total Oil Burned	# of plants	Ave size (MW)	Total NG Burned (MMBTU)	# Compliant with MATS now	# retired due to MATS	# planned Fuel switch	Comments	#	Size of Units (MW)	Planned Fuel	MATS only reason for change?
Alabama	Yes	6	342	17,007,960	1	20	2,036,633	14	80-535	57,161,226	1	none	9	Coal plants adding NG	no			yes
Connecticut	Suggested FOIA request to Department of Environmental Protection																	
Delaware	No Information Sent																	
Florida	No Information Sent																	
Georgia	Yes	39	362.7538	34,437,100	106	13.77453	672,215	123	132.4618	179,311,495	0	14	8	1 Coal to biomass, 6 - coal to NG, 1- change coal	No			No, other EPA Regs & low natural gas prices
Illinois	No Information Sent																	
Indiana	Yes	43 (some with multiple units)	330		22	19		47	80		27	17-19	4		3	~1,219	Coal (IGCC) and NG	No
Kentucky	No Information Sent																	
Maine	No Information Sent																	
Maryland	No Information Sent																	
Massachusetts	No Information Sent																	
Michigan	No Information Sent																	
Mississippi	Yes	2 (4 units)	3@500/1@250	max -5	none			4 (16 units)	68	max - 60 bcf	No	No	Yes	2 dual fuel (coal/gas) converting to NG	No			Yes
New Hamshire	Deleted without reading																	
New Jersey	No Information Sent																	
New York	No Information Sent																	
North Carolina	Yes - sent EIA submittal	See NC Sheet									7	none	none		no			

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Ohio	No Information Sent																	
Pennsylvania	Yes - Did not answer questionaire, general answers about energy																	
Rhode Island	No Information Sent																	
South Carolina	Forward to SC Energy Office - No Response																	
Tennessee	No Information Sent																	
Virginia	Limited Response	30			10			4										
West Virginia	No Information Sent																	
Wisconsin	No Information Sent																	
Department of Energy	Yes - Suggested EIA																	
Tenn Valley Authority	No Information Sent																	
EPA (W. Maxwell)	(Utilities will not release this information until 2015)																	