

# 2013 Bluegrass Energy Report

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## The EPA's Economic Impact on Kentucky

**Justin Yeary**

**Philip Impellizzeri**

In conjunction with John Garen,  
Ph.D., and the Bluegrass Institute  
Board of Scholars





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Authors: Justin Yeary, Philip Impellizzeri

In conjunction with John Garen, Ph.D., and the Bluegrass Institute Board of Scholars

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## Introduction

Since the “American Clean Energy and Security Act” was defeated in the U.S. Senate in 2009, the Environmental Protection Agency (EPA) has proposed multiple regulations which have especially large effects on Kentucky’s coal industry, including its coal-fired power plants. Research suggests that these regulations could result in significant industry job loss and higher energy costs for Kentucky’s citizens and businesses.

Although the EPA’s new policies directly impact Appalachia’s coal industry, evidence also suggests that other industries could be impacted through higher energy and operating costs. The National Association of Manufacturers reports that Kentucky’s energy intensive manufacturing sector would – like the automotive and metallic products industries – experience significant decreases in output due to an increase in energy costs.<sup>1</sup>

Other research focuses on the health and environmental benefits of the EPA’s new regulations. Kentucky power plants release a certain quantity of coal combustion residuals (CCR) into the atmosphere that potentially result in respiratory or other diseases. Another concern is that debris from certain forms of mining can result in a loss of biodiversity and wildlife. Such debris can also contaminate waterways, further affecting the health of nearby human populations.

The purpose of this study is to assess some of the effects of these new EPA regulations on Kentucky’s economy. In the first section, we identify specific regulations that impact the commonwealth’s economy through higher energy costs and industry job loss. In the next section, we demonstrate the effects of these higher costs on the average Kentucky family. In the third section, we show how the increased

energy prices will affect Kentucky’s overall economy through industry job loss, a decrease in the rate of employment growth and a decrease in State Domestic Product (SDP) growth. Finally, in the last section we investigate the extent to which the environmental regulations specifically affecting Kentucky’s coal industry will reduce negative pollution externalities and contribute to the increased health of Kentuckians and our wildlife.

Overall, independent analyses of the EPA’s new regulations imply that the environmental benefits gained by Kentucky are quite small and are much lower than the costs they impose. The ensuing increases in energy costs will not only impact the average family in the Bluegrass State, but also will result in a loss of jobs since cheap energy is one of the commonwealth’s comparative economics advantages.

Further, most of the environmental harms that the EPA’s new regulations are supposed to solve already are addressed by previous regulations. In fact, the data show that existing regulations have been increasingly effective at reducing toxic emissions. Therefore, we conclude that the EPA’s recent regulatory initiatives dealing with the coal and coal-related industries have not been, on net, beneficial.

## Section 1 - An overview of the EPA regulations and their costs

In a research paper recently published by the U.S. Department of Energy, Elliott, Neubauer and Patrick (2011) propose a model to forecast how the price of energy in Kentucky will change over the next 10-year period given the two most likely scenarios to occur in our energy sector.

The first scenario describes a situation in which the status quo – where coal provides the overwhelming majority of Kentucky’s energy – continues for the foreseeable future.<sup>2</sup> The second

describes a situation in which the use of coal is slowly replaced by the use of natural gas to generate Kentucky's energy needs.<sup>3</sup>

According to the authors' calculations, during the 2010-2020 period under the first scenario, electricity prices will increase at an average rate of 1.89 percent per year. Under the second scenario, electricity prices will increase at an average rate of 2.02 percent per year.<sup>4</sup>

What this translates to during the next decade is an 18.9 percent price increase under the first scenario and a 20.2 percent price increase under the second. Either way, Kentuckians will be looking to pay about 20 percent more in electricity costs. These costs are in real terms, meaning the numbers have been adjusted for expectations of inflation. In nominal terms, the price increase would be even higher.

Although there are many causal relations at play in these price increases, one of the main factors is EPA regulation. According to the Department of Energy report, "energy prices will continue to rise regardless of demand- and supply-side investments, but the magnitude of the rate of increase is predicated by a number of factors, such as federal air, land, and water quality regulations and their impact on the energy industry."<sup>5</sup>

In fact, soon after the EPA spelled out its new policies, seven coal-fired power plants announced that their operations would shut down within the next three decades.<sup>6</sup> This is further evidence of the EPA's impact on energy prices.

A number of EPA regulations particularly affect Kentucky's coal industry and contribute to the predicted increase in energy prices. One of the most significant contributors is the Utility Maximum Available Control Technology (MACT) regulation that establishes the Mercury

and Air Toxics Standards (MATS). This rule will require existing plants to meet the average emissions standards of the "cleanest" 12 percent of power plants. Newly established plants would have even stricter standards.

The MACT rule will require existing coal-fired power plants to retrofit themselves with equipment to achieve a 91-percent reduction in pollutants like sulfur dioxides (SO<sub>2</sub>), various nitrous oxides (NO<sub>x</sub>) and fine particulate matter that cause airborne mercury pollution.<sup>7</sup> The EPA claims the MACT rule will be the most costly of their regulations: "The EPA projected the annualized cost of compliance with the proposed rule at \$10.9 billion in 2015, remaining at \$10–11 billion annually through 2030."<sup>8</sup>

Further, plants are expected to begin compliance with these rules within three years. Such a short time frame adds to the costliness of the Utility MACT regulation.

Another regulation the EPA is pushing to establish is the Cross-State Air Pollution Rule (CSAPR), which is designed to reduce the amount of power-plant emissions crossing state lines.

CSAPR specifically targets sulfur dioxide (SO<sub>2</sub>), various nitrous oxides (NO<sub>x</sub>), carbon dioxide (CO<sub>2</sub>) and ozone (O<sub>3</sub>). Of particular concern to Kentucky's coal industry is the new CO<sub>2</sub>, NO<sub>x</sub> and SO<sub>2</sub> standards. Like Utility MACT, these regulations require Kentucky coal plants to install Selective Catalytic Reduction (SCR) machines and "scrubbers" in order to remove NO<sub>x</sub> and SO<sub>2</sub> emissions, respectively.

According to the EPA's conservative estimates, the cost of installing such machinery would total \$7.2 billion. However, the American Legislative Exchange Council (ALEC) estimates the cost of such machines could be as high as \$120 billion

by 2015.<sup>9</sup> Given that many Kentucky coal plants already are outfitted with such equipment<sup>10</sup>, the EPA's estimate of \$7.2 billion by 2015 likely is the more realistic prediction.

As of January 2013, the United States Court of Appeals for the District of Columbia Circuit has denied a request for a rehearing of the 2012 decision to vacate the CSAPR.

The EPA also has enacted policies to crack down on coal combustion residues (CCRs). According to the EPA, "Coal combustion residuals (CCRs), commonly referred to as coal ash, are the materials that remain after burning coal for electricity. CCRs include: fly ash, bottom ash, boiler slag and flue gas desulfurized gypsum."<sup>11</sup> These regulations are set to cost Kentuckians an estimated \$1.5 billion per year. Some estimates put the cost as high as \$20 billion.<sup>12</sup>

According to the EPA's own testimony, "CCRs typically contain a broad range of metals, including arsenic, selenium, and cadmium; however, the leach levels, using EPA's Toxicity Characteristic Leaching Procedure rarely reach the Resource and Conservation Recovery Act hazardous waste characteristic levels."<sup>13</sup> In other words, the EPA admits that CCRs contain an insignificant amount of toxins, rendering them non-toxic.

Though some CCRs are disposed of in landfills and other areas that pose a potential threat to the environment, a significant quantity of CCRs are recycled into useful products such as bowling balls and concrete mix. These operations have created a \$2 billion per year industry based on the market demand for goods created from these recycled materials. However, the EPA is currently proposing regulations that would classify CCRs in the same category as radioactive nuclear waste. Such a classification would drastically increase compliance costs and effectively destroy the CCR recycling industry.<sup>14</sup>

## Section 2 - Costs to individual Kentucky households

In this section, we analyze the costs that the above regulations and ensuing increases in energy prices likely will place on the average Kentucky household. Using data from the 2010 U.S. Census and the 2011 Kentucky Energy Profile, we calculate that the average household in Kentucky spends \$1,425.65 per year on energy costs.<sup>15</sup>

Given the forecasted 20 percent price increase in residential electricity costs during the next decade with the current regulatory scheme<sup>16</sup>, the average Kentucky household's annual electric bill will total \$1,710.78 by 2020, approximately a \$285 increase in costs. These additional costs amount to three months of car insurance, four months of vehicle maintenance, one month of gasoline, two months of phone bills or six months of public transportation costs.<sup>17, 18</sup>

## Section 3 - Impacts on the Commonwealth

Kentucky's coal industry is a \$5 billion per year business<sup>19</sup> and provides more than \$30 million in tax revenue.<sup>20</sup> Kentucky borders the Appalachian Mountains – one of the world's richest coal sources – on its eastern side and is home to the Cumberland Plateau and Mountains. This region of Kentucky is commonly referred to as the "Eastern Kentucky Coal Field" due to its rich natural deposits of coal. A significant portion of western Kentucky is referred to as the "Western Coal Fields," also for its plentiful coal deposits.

Coal mining is responsible for 1 percent of total employment in Kentucky, but contributes much more in specific regions.<sup>21</sup>

Coal-mining communities primarily are found in the eastern Appalachian region and the western regions near the Illinois Basin. In these less densely populated regions, coal mining contributes much more to total employment than for the rest of the Bluegrass State as a whole.

In those counties closest to coal reserves, more than 10 percent of total employment is directly attributed to coal mining.<sup>22, 23</sup> Wages provided by coal mining jobs in these counties account for an average of 30 percent of total earned wages.<sup>24</sup> Particularly noteworthy is Knott County, where 23 percent of all employment is directly attributed to coal mining – the highest percentage in the commonwealth – and where mining wages account for 60 percent of residents' income.<sup>25</sup>

The EPA's new policies will directly affect these regions of the commonwealth. One of the EPA's new techniques for regulating coal mining in Kentucky is to reject mining permits necessary to continue operations by "halting already approved permits, holding back and unnecessarily delaying permits, and even revoking previously issued permits."<sup>26</sup>

A 2006 Bluegrass Institute report entitled "Environmental regulation of surface mining and land development in Kentucky: The Role of the U.S. Army Corps of Engineers," details specifically how federal courts' interpretations of legislation such as the "Clean Water Act" has expanded EPA authority.<sup>27</sup> The new interpretation of existing regulatory language has resulted in altering the standards by which the EPA can intervene in mining operations and reject mining permits.

For example, the regulatory criteria have shifted the burden of proof from regulators to the regulated by changing the requirements from showing actual environmental harm to demonstrating the mere *possibility* of harm.<sup>28</sup>

Now, instead of the EPA having the burden of demonstrating that some mining operation is posing a reasonable environmental threat, coal companies must prove their activities will not cause any environmental harm. Though less environmental harm may result in Kentucky, this shifting discourages beneficial economic activities and threatens industry jobs.

On June 8, 2012, Alpha Natural Resources Inc. ceased operations at four of its Kentucky coal mines, resulting in a loss of 150 jobs.<sup>29</sup> A further 600 jobs were lost due to layoffs from Arch Coal, which closed operations in Pike, Marin and Knott Counties. Gov. Steve Beshear "called the rejection of 11 permits that were approved by the Kentucky Division of Water as 'arbitrary and unreasonable,' citing that it risked up to 18,000 mining jobs."<sup>30</sup>

The loss of mining jobs in Kentucky disproportionately affects those Appalachian coal communities discussed above. The poverty rate in seven out of the eight counties where the coal industry provides more than 10 percent of total employment is more than *twice* the national average.<sup>31</sup> A significant loss of coal-related employment in those communities seems particularly harsh.

If the EPA continues its disproportionate efforts to address Kentucky's environmental outlook by using the current regulatory framework, the poverty level in these Appalachian communities – where coal mining represents one of only a few opportunities to enjoy a comfortable lifestyle – can only worsen.

Coal plays a direct and crucial role in the above-mentioned local economies, but its indirect benefits make the industry economically significant statewide. For example, 92 percent of Kentucky's electricity is generated from the combustion of coal, 93 percent of all energy produced in Kentucky is generated by coal and

49 percent of energy consumed in Kentucky is generated from coal.<sup>32</sup>

Because of Kentucky's natural abundance of coal, it has some of the cheapest electricity prices in the entire United States: "In 2010, the average price of electricity across economic sectors in Kentucky was \$0.0675 per kilowatt-hour. This overall average price ranked Kentucky fourth-lowest in the Country ... The Industrial Sector faced a much lower price of electricity, paying on average \$0.0507 per kilowatt-hour of consumption."<sup>33</sup> Since so much of the Bluegrass State's energy needs are satisfied by coal, the operating costs of coal-fired power plants significantly affect the price of electricity for all Kentucky consumers.

Further, this cheap coal-fired electricity has attracted considerable manufacturing and industrial business to Kentucky. Manufacturing jobs comprise 14.1 percent of all employment in Kentucky, making it the commonwealth's second-largest industry.<sup>34</sup> A significant portion of these jobs are in the steel, aluminum and automobile industries – industries that affect the economy of the entire nation.<sup>35, 36</sup> For example:

- In 2011, 7.3 percent of all cars and trucks produced in the United States were made in Kentucky, employing more than 68,000 full-time workers.
- Kentucky ranks No. 5 among states in light-vehicle production, No. 4 in car production and No. 8 in truck production.
- Kentucky is America's biggest aluminum supplier, shipping \$4.5 billion of primary aluminum products every year.

- Aluminum accounts for 15,000 jobs in the commonwealth; the average salary for primary metal industry workers is \$52,336.

According to the Kentucky Cabinet for Economic Development, "low business costs" and "electrifying utility rates" are some of the main competitive advantages that entice heavy industry, including automobile manufacturers, to base operations in Kentucky. The industrial sector consumes 48 percent of all electricity generated in Kentucky, making it the largest single user of electricity.<sup>37</sup> Also, as stated previously, Kentucky has the fourth-lowest electricity costs in the entire nation – a significant asset to industries like heavy manufacturing that require high quantities of electricity.

However, because of the EPA's new regulatory framework, Kentucky's competitive advantage of cheap coal-fired energy could soon be a thing of the past. As stated in Section 1, if the EPA's regulations remain in their current form, the average real price of energy in Kentucky would rise 20 percent by 2020. Such an increase would be extremely painful for both energy consumers and manufacturing and related industries.

Given the importance of cheap energy in Kentucky, just how would the predicted increases in energy prices affect state aggregate economic measures like state Gross Domestic Product (GDP) and the commonwealth's employment level? According to a report by University of Kentucky economists (Garen, et. al. (2011)), a 20-percent increase in energy prices during the next decade would cause Kentucky's annual employment growth rate to decrease from 1 percent to 0.685 percent and cause the state GDP annual growth rate to decrease from 3 percent to 2.437 percent.<sup>38, 39, 40</sup>

“The estimates show that, for every 10% increase in the price of electricity, state GDP growth is cut by three-tenths of 1% in the long run,” Garen, et. al. (2011) report. “This actually is quite large since GDP normally grows at about 3% per year. Thus, a 20% hike cuts state GDP growth by six-tenths of 1%. If 3% is the baseline, this cuts it to 2.4%. We lose a fifth of our growth. This can add up. Twenty years growth at 3% increases GDP by a factor of 1.81. At 2.4%, GDP rises by a factor of 1.61.”

For state employment growth, the Garen, et. al. (2011) projections are equally pessimistic: “The estimates show that, for every 10% increase in the price of electricity, state employment growth is cut by 1.6 tenths of 1% in the long run. This, too, is quite a lot since employment grows normally at about 1% per year. Thus, a 20% hike cuts state GDP growth by 3.2 tenths of 1%. If 1% is the baseline, this cuts it to 0.68%. We lose a third of our growth. This can add up. Twenty years growth at 1% increases employment by a factor of 1.22. At 0.68%, employment rises by a factor of 1.14.”

To illustrate how much this will impact the commonwealth, let's take Kentucky's \$164.8 billion GDP in 2011 as a baseline figure.<sup>41</sup> We see that 3 percent growth compounded over a period of 20 years results in a state GDP of \$297.65 billion, an increase of \$132.8 billion by 2031. Compare that to what results from the reduced expected growth rate of 2.437 percent: Over a 20-year period, state GDP would grow to only \$266.74 billion, \$30.9 billion less than with a 3 percent rate.

## Section 4 - Weighing the environmental benefits

As shown above, a certain degree of economic costs are inevitable when transitioning to cleaner forms of energy for the sake of a healthier environment. Though coal is not the cleanest

form of energy available to us, the question remains: Do the benefits of converting to cleaner energy sources outweigh the inevitable costs? Sound environmental regulations should minimize the costs of their enforcement and maximize the benefits to human health and wildlife.

The stated purpose for the EPA's Cross-State Air Pollution Rule (CSAPR) is to minimize the power-plant emissions of SO<sub>2</sub> and NO<sub>x</sub>. Though completely reasonable for the EPA to regulate emissions of such dangerous pollutants, these regulations should only be enforced in regions where dangerous quantities of the gases threaten the well-being of neighboring communities.

It may be true that these sorts of emissions are contributing significantly to air pollution in other states, but they have been declining in Kentucky.

Since 1990, SO<sub>2</sub> emissions have decreased by 72 percent and NO<sub>x</sub> emissions are down by 75 percent within the commonwealth. These reductions are a result of the increasing prevalence of low-sulfur coal and the installation of scrubbers and SCR machines as a response to increased public awareness regarding environmental issues. Further, since 2008, SO<sub>2</sub> emissions are down by 28 percent and NO<sub>x</sub> emissions are down by a surprising 49 percent.<sup>42</sup>

This demonstrates that not only are emission levels of these dangerous pollutants decreasing with time, but the decrease is accelerating. Since these emissions continue to decrease at an accelerating pace, the EPA's claim that the benefits of the CSAPR in Kentucky outweigh the costs to the commonwealth seems to be a dubious one.

As discussed in Section 3, another way the EPA seeks to attain environmental improvement is by



using the Clean Water Act of 1990 to deny or halt mining permit applications. The EPA justifies its increasing impediments to mining permits in recent years with a 2008 study that shows mayfly populations were absent at ponds located near certain mining locations.<sup>43</sup> Despite the fact that mayfly populations are sensitive to any changes in the environment, the EPA declared as a result of this study that mountaintop mining operations pose a threat to biodiversity.

The denial and halting of mining permits for purposes of biodiversity have primarily affected states like Kentucky in the eastern U.S. and Appalachia. Although biodiversity is certainly an important factor for a healthy environment, to bring billions of dollars' worth of economic activity to a halt and cause the elimination of hundreds of jobs should require harder evidence than a questionable causal relationship regarding mayfly populations. The fact that the EPA does not even provide a monetary figure to estimate the benefits of these mining impediments calls into question its veracity.

The most costly of the EPA's new regulations affecting Kentucky coal-fired power plants, Utility MACT and its MATS rules, are meant to reduce mercury and air toxics emissions. In a December 2011 report on the economic benefits of such regulations, the EPA cited reduced levels of methylmercury, a toxic substance found in waterways that affects developmental and cognitive capacities of children. The EPA assigns a monetary value between \$500,000 and \$6.2 million per year for these specific benefits.

The EPA claims that Utility MACT and MATS rules overall will add anywhere from \$33 to \$90 *billion* per year to our nation's productive output. However as stated above, the miniscule reduction in mercury pollution is the only economic benefit that can be directly attributed to these new regulations – and that's \$6.2

million annually according to the EPA. Where then does the rest of this value come from?

In her testimony before the Senate Subcommittee on Clean Air and Nuclear Safety, Susan E. Dudley, director of George Washington University's Regulatory Studies program, explained that:

EPA goes on to argue that its rule will generate additional “co-benefits” that more than make it worthwhile ... co-benefits that arise not directly from reducing toxic emissions, but from other things EPA's models predict will happen as beneficial side effects of the controls that will be required by the rule.

Ninety-nine percent of the benefits attributed to the MATS rule are derived by assigning high dollar values to reductions in emissions of fine particles (PM2.5), which are not the focus of this regulation and which are regulated elsewhere.<sup>44</sup>

So, 99 percent of the value created by MATS regulations is derived from “co-benefits” already addressed under existing EPA regulations. Still, Utility MACT will force all power plants in the commonwealth to install costly emission controls, although Kentucky has reduced these emissions – and at an accelerating rate – since 1990. As a result, the MACT rule might be a good idea for other states, but for Kentucky it would be an extremely costly rule that would achieve little to no observable benefit.

Further, if it were somehow desirable to decrease fine particle (PM2.5) emissions more than is required for human health, the EPA should enact regulations that directly address these particles, not mercury pollutants. After all,

as Dudley stated, “we would expect a PM2.5 standard to achieve PM2.5 reductions more cost-effectively than a standard directed at some other pollutant.”<sup>45</sup>

By the EPA’s own calculations, the costs of the proposed MATS regulations amount to \$9.6 billion annually.<sup>46</sup> The only economic benefits directly attributed to these rules – reductions in greenhouse gases and ethylmercury pollution – amount to \$6.2 million per year. Therefore, the net value of these regulations is a *loss* of \$9.594 billion annually.

## Conclusion

Correctly interpreting the EPA’s own estimates indicates that the costs to retrofit Kentucky’s power plants with the necessary equipment mandated by the EPA far outweigh the benefits for each of the EPA’s newest proposed regulations. Further, the 20-percent rise in energy rates predicted during the next decade – for which new EPA regulations are in no small part responsible – have the potential to eliminate one-fifth of the growth in Kentucky’s employment and GDP. Why put that sort of burden on Kentuckians when the environmental benefits evidently are *de minimus*?

Kentuckians do stand to benefit from a marginally cleaner environment with fewer greenhouse gas emissions and lower mercury pollutants. Further, new competition facing coal from sources like natural gas and the development of hydraulic fracturing could mitigate the increase in Kentucky’s energy costs due to overregulation. Unfortunately, as the current technology and data stand, when compared to the tremendous economic costs these regulations will impose, the marginal benefits they promise do not come close to matching the economic sacrifices asked of Kentuckians.

Further, our analysis suggests the EPA is failing to carry out its duty of maximizing benefits and minimizing costs of its regulatory authority. As noted in Section 4, overlapping regulations such as the MATS rules and Clean Air Act can skew the benefits of new regulations and lead to a significant overstatement of their added value. Without judiciously considering how proposed regulations fit the current regulatory framework, the EPA will continue to make costly mistakes that translate into lost jobs and stunted economic growth.

Though Kentucky’s energy sector does suffer from negative economic externalities, we have seen that the commonwealth has taken effective and cost-efficient steps towards regulating its own pollution during the past 20 years.

As previously discussed, nitrous oxide and sulfur dioxide emissions both decreased by about 75 percent during the past two decades – a trend that continues to this day. Since these emissions already are decreasing at an accelerating rate, we suggest that there is no dire situation calling for such severe regulations.

This is not to deny the important role of environmental regulations, nor to suggest that pollution externalities are something we can afford to ignore. The Bluegrass State is home to a plethora of beautiful rolling hills and blue-green prairies. Kentuckians take great pride in the natural beauty of their state and believe that its wildlife, waterways and picturesque sceneries are natural marvels worth protecting.

However, just because Kentucky’s environment is worth protecting doesn’t mean it should be done so recklessly or at any cost. The methods in which the EPA is attempting to invoke its new policies in the commonwealth are costly, arbitrary and ineffective. Bureaucrats should take into consideration the economic – as well as environmental – impacts of each regulation.

Justin Yeary, who lives in Warren, Mich., was a 2012 Koch Summer Fellowship Program intern with the Bluegrass Institute. He is in the process of applying to get his Masters of Teaching degree in secondary mathematics education.

Philip Impellizzeri is policy coordinator for the Bluegrass Institute.

John Garen, Ph.D., is Gatton Endowed Professor of Economics at the University of Kentucky, and chairman of the Bluegrass Institute Board of Scholars.

## ENDNOTES

<sup>1</sup> National Association of Manufacturers, (2010). *Economic impact on the state from the Waxman-Markey bill, H.R. 2454*

<sup>2</sup> Neubauer, M., Elliott, R. N., & Patrick, A. U.S. Department of Energy, Technical Assistance Program (2011). *Kentucky electricity and natural gas price and consumption forecasts to 2035* .Pg. 3

<sup>3</sup> *Ibid*, Pg. 4

<sup>4</sup> *Ibid*, Pg. 12

<sup>5</sup> *Ibid*, Pg. 15

<sup>6</sup> Keisling, J. ALEC, Energy, Environment and Agriculture Task Force. (2012). *Economy derailed: State-by-state impact of the EPA regulatory train wreck*. Washington, DC: American Legislative Exchange Council. Pg. 44

<sup>7</sup> U.S. Environmental Protection Agency, (2012). *Controlling power plant emissions: Control technology* . Retrieved from website: [http://epa.gov/mercury/control\\_emissions/technology.htm](http://epa.gov/mercury/control_emissions/technology.htm)

<sup>8</sup> Keisling, J. ALEC, Energy, Environment and Agriculture Task Force. (2012). *Economy derailed: State-by-state impact of the EPA regulatory train wreck*. Washington, DC: American Legislative Exchange Council. Pg. 11

<sup>9</sup> *Ibid*, Pg. 16

<sup>10</sup> Patrick, A., & Waddell, A. Kentucky Department for Energy Development & Independence, Kentucky Energy & Environment Cabinet. (2011). *2011 Energy Profile*. Pg. 46

<sup>11</sup> U.S. Environmental Protection Agency, (2012). *Coal combustion residuals*. Retrieved from website: <http://www.epa.gov/osw/nonhaz/industrial/special/fossil/coalashletter.htm>

<sup>12</sup> Keisling, J. ALEC, Energy, Environment and Agriculture Task Force. (2012). *Economy derailed: State-by-state impact of the EPA regulatory train wreck*. Washington, DC: American Legislative Exchange Council. Pg. 19

<sup>13</sup> *Ibid*, Pg. 19

<sup>14</sup> Keisling, J. ALEC, Energy, Environment and Agriculture Task Force. (2012). *Economy derailed: State-by-state impact of the EPA regulatory train wreck*. Washington, DC: American Legislative Exchange Council. Pg. 19

<sup>15</sup>

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<sup>16</sup> Neubauer, M., Elliott, R. N., & Patrick, A. U.S. Department of Energy, Technical Assistance Program.(2011). *Kentucky electricity and natural gas price and consumption forecasts to 2035*.Pg. 12

<sup>17</sup> U.S. Department of Labor, Bureau of Labor Statistics. (2011). *Size of consumer unit: Average annual expenditures and characteristics*

<sup>18</sup> Our method for these calculations was to take the mean value of the two-person and three-person columns for each entry in order to approximate expenditures for a 2.48 person household, which is the Kentucky average. I then divided that number by 12 to determine monthly expenditures. It is also worth noting that these numbers are based on a national average of expenses, and the cost of living in Kentucky is lower than the national average. **Therefore these numbers should be interpreted as a conservative estimate of Kentuckian household expenditures.** This means that for the average Kentuckian, they could purchase additional goods and services with their savings.

<sup>19</sup> Kentucky Coal Association, (2010). *Kentucky coal facts*. Retrieved from website: [http://www.kentuckycoal.org/documents/Coal\\_Facts\\_2010--11th\\_Edition.pub.pdf](http://www.kentuckycoal.org/documents/Coal_Facts_2010--11th_Edition.pub.pdf). Pg. 1

<sup>20</sup> *Ibid*, Pg. 15

<sup>21</sup> Mountain Association for Community Economic Development, (2009). *The economics of coal in Kentucky: Current impacts and future prospects*. Retrieved from MACED website: [http://www.maced.org/coal/documents/Economics\\_of\\_Coal.pdf](http://www.maced.org/coal/documents/Economics_of_Coal.pdf). Pg. 4

<sup>22</sup> *Ibid*, Pg. 4

<sup>23</sup> Allen, S. N., Dr. Berger, M. C., Roenker, J. M., & Dr. Thompson, E. C. Center for Business and Economic Research, Gatton College of Business and Economics. (2001). *A study on the current economic impacts of the Appalachian coal*

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<sup>24</sup> Mountain Association for Community Economic Development, (2009). *The economics of coal in Kentucky: Current impacts and future prospects*. Retrieved from MACED website: [http://www.maced.org/coal/documents/Economics\\_of\\_Coal.pdf](http://www.maced.org/coal/documents/Economics_of_Coal.pdf). Pg. 5

<sup>25</sup> Ibid, Pg. 4

<sup>26</sup> Keisling, J. ALEC, Energy, Environment and Agriculture Task Force. (2012). *Economy derailed: State-by-state impact of the EPA regulatory train wreck*. Washington, DC: American Legislative Exchange Council. Pgs. 26-27

<sup>27</sup> Dr. Edgens, J. G., Reynolds, B. E., & Dr. Staley, S. R. Bluegrass Institute for Public Policy Solutions, (2006). *Environmental regulation of surface mining and land development in Kentucky: The role of the U.S. Army Corps of Engineers*. Pg. 5

<sup>28</sup> Ibid, Pg. 6

<sup>29</sup> James, S. (2012, June 08). Update 2-Alpha to curtail coal output, cut 150 jobs. *Chicago Tribune*. Retrieved from [http://articles.chicagotribune.com/2012-06-08/news/sns-rt-alphanatural--update-211e8h82nl-20120608\\_1\\_coal-output-analyst-lucas-pipes-powder-river-basin](http://articles.chicagotribune.com/2012-06-08/news/sns-rt-alphanatural--update-211e8h82nl-20120608_1_coal-output-analyst-lucas-pipes-powder-river-basin)

<sup>30</sup> Keisling, J. ALEC, Energy, Environment and Agriculture Task Force. (2012). *Economy derailed: State-by-state impact of the EPA regulatory train wreck*. Washington, DC: American Legislative Exchange Council. Pg. 28

<sup>31</sup> Mountain Association for Community Economic Development, (2009). *The economics of coal in Kentucky: Current impacts and future prospects*. Retrieved from MACED website: [http://www.maced.org/coal/documents/Economics\\_of\\_Coal.pdf](http://www.maced.org/coal/documents/Economics_of_Coal.pdf). Pgs. 6-7

<sup>32</sup> Patrick, A., & Waddell, A. Kentucky Department for Energy Development & Independence, Kentucky Energy & Environment Cabinet. (2011). *2011 Energy Profile*. Pg. 9 Though 93 percent of power produced in Kentucky comes from coal-fired power plants, Kentucky exports out of state part of this export, and also consumes alternative power imported from out of state. Of all the power Kentucky consumes (not produces), 49 percent is from coal-fired power plants.

<sup>33</sup> Ibid, Pg. 47

<sup>34</sup> U.S. Census Bureau, (2010). *Selected economic characteristics: 2006-2010 American Community Survey 5-year estimates* (DP03). Retrieved from website: <http://factfinder2.census.gov/faces/tableservices/jsf/pages/productview.xhtml?src=bkmk>

<sup>35</sup> Kentucky Aluminum Network. Aluminum Facts. Retrieved from website: [http://www.kentuckyaluminum.com/index.php?option=com\\_content&view=article&id=5&Itemid=3](http://www.kentuckyaluminum.com/index.php?option=com_content&view=article&id=5&Itemid=3)

<sup>36</sup> Kentucky Cabinet for Economic Development, Office of Research and Public Affairs. (2012). *2012 Kentucky Automotive Industry*

<sup>37</sup> Patrick, A., & Waddell, A. Kentucky Department for Energy Development & Independence, Kentucky Energy & Environment Cabinet. (2011). *2011 Energy Profile*. Pg. 9

<sup>38</sup> Dr. Garen, J., Dr. Jespen, C., & Saunoris, J. Kentucky Department for Energy Development and Independence, (2011). *The relationship between electricity prices and electricity demand, economic growth, and employment*. Lexington, KY: Center for Business and Economic Research (CBER). Tables 9 & 11

<sup>39</sup> We assume 3 percent and 1 percent as baseline growth rates for state GDP and employment, respectively.

<sup>40</sup> The CBER report does not list the effects of a 20% energy price increase, but using the same methodology for a 20% increases yields the number reported.

<sup>41</sup> U.S. Department of Commerce, Bureau of Economic Analysis. (2012). *Gross domestic product by state*. Retrieved from website: <http://www.bea.gov/iTable/iTable.cfm?ReqID=70&step=1&isuri=1&acrdn=1>

<sup>42</sup> Patrick, A., & Waddell, A. Kentucky Department for Energy Development & Independence, Kentucky Energy & Environment Cabinet. (2011). *2011 Energy Profile*. Pg. 46

<sup>43</sup> Keisling, J. ALEC, Energy, Environment and Agriculture Task Force. (2012). *Economy derailed: State-by-state impact of the EPA regulatory train wreck*. Washington, DC: American Legislative Exchange Council. Pg. 29

<sup>44</sup> Dudley, S. E. (2012, April). *Prepared statement of Susan E. Dudley*. Statement presented at United States Senate Committee on Environment and Public Works; Subcommittee on Clean Air and Nuclear Safety. *Hearing on review of mercury pollution's impacts to public health and the environment*, Washington, D.C.

<sup>45</sup> Ibid, Pg. 5

<sup>46</sup> U.S. Environmental Protection Agency, (2011). *EPA fact sheet: Benefits and costs of cleaning up toxic air pollution from power plants*. Retrieved from website: <http://www.epa.gov/mats/pdfs/20111221MATSImpactsfs.pdf>



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