

**THE POLITICS OF FEDERAL ENVIRONMENTAL POLICY:  
AN ANALYSIS OF SIX WEST VIRGINIA COUNTIES**

A Master's Thesis

Presented to

The Graduate College of  
Missouri State University

In Partial Fulfillment

Of the Requirements for the Degree  
Master of Public Administration

By

Hannah O'Keefe

May 2019

# **THE POLITICS OF FEDERAL ENVIRONMENTAL POLICY:**

## **AN ANALYSIS OF SIX WEST VIRGINIA COUNTIES**

Political Science

Missouri State University, May 2019

Master of Public Administration

Hannah O'Keefe

### **ABSTRACT**

The prevalence of politics in federal environmental policy has been evident for decades, and this thesis will seek to identify the impact of implementing rival policies at the county level. The two federal policies being examined are the Clean Power Plan that was devised by the presidential administration under Barack Obama, and the Affordable Clean Energy Rule created by the presidential administration under Donald Trump. The county selection was chosen in the state of West Virginia because of the state's high economic dependence on extracting and exporting coal, a current source of domestic and foreign electric power. The study area will include a total of six counties, two with current mining operations, and four contiguous counties without current mining operations. These counties provide a more encompassing picture of any potential spillover impacts. A variety of economic metrics will assist in analyzing how these policies, with opposing objectives, have affected an area that is historically greatly dependent on coal. Based on a review of the literature and initial survey data, the variables of population, coal production in short tons, employment rate, poverty rate, and per capita personal income are the chosen variables to determine the impact of the policy on the rates of change for those parameters within each county. Analyzing how these policies affect counties within other coal producing states will hopefully generate knowledge that may inform federal policy making and implementation by future federal administrations.

**KEYWORDS:** coal, West Virginia, Clean Power Plan, pollution, politics, Obama, emissions

**THE POLITICS OF FEDERAL ENVIRONMENTAL POLICY:  
AN ANALYSIS OF SIX WEST VIRGINIA COUNTIES**

By

Hannah O'Keefe

A Master's Thesis  
Submitted to the Graduate College  
Of Missouri State University  
In Partial Fulfillment of the Requirements  
For the Degree of Master of Public Administration

May 2019

Approved:

David E. A. Johnson, Ph.D., Thesis Committee Chair

Mark C. Ellickson, Ph.D., Committee Member

Toby Dogwiler, Ph.D., Committee Member

Julie Masterson, Ph.D., Dean of the Graduate College

In the interest of academic freedom and the principle of free speech, approval of this thesis indicates the format is acceptable and meets the academic criteria for the discipline as determined by the faculty that constitute the thesis committee. The content and views expressed in this thesis are those of the student-scholar and are not endorsed by Missouri State University, its Graduate College, or its employees.

## TABLE OF CONTENTS

Introduction	Page 1
Literature Review	Page 3
Coal	Page 3
Influence of Mining Companies	Page 6
Clean Power Plan	Page 7
Politics	Page 10
Methods	Page 12
Selection of State and Counties	Page 12
Collection of Data	Page 15
Methodology	Page 17
Analysis	Page 21
Population	Page 21
Unemployment Rate	Page 24
Poverty Rate	Page 29
Per Capita Personal Income	Page 32
Coal Production	Page 35
Employees in Coal	Page 39
Discussion	Page 42
Summary	Page 42
Data Limitations	Page 42
Applications	Page 43
References	Page 45

## LIST OF TABLES

Table 1. Population Means Comparison	Page 25
Table 2. Unemployment Rate Means Comparison	Page 30
Table 3. Poverty Rate Means Comparison	Page 34
Table 4. Per Capita Personal Income Means Comparison	Page 37
Table 5. Cost of Living Adjustment Means Comparison	Page 37
Table 6. Coal Production Means Comparison	Page 39
Table 7. Employees in Coal Means Comparison	Page 41

## LIST OF FIGURES

Figure 1. Population	Page 22
Figure 2. Population Outlier Removed	Page 23
Figure 3. Unemployment Rate	Page 29
Figure 4. Poverty Rate	Page 32
Figure 5. Per Capita Personal Income	Page 35
Figure 6. Per Capita Personal Income Outlier Removed	Page 36
Figure 7. Coal Production	Page 38
Figure 8. Employees in Coal	Page 41

## INTRODUCTION

The implementation, or proposal, of a federal policy can potentially have varying effects on a region, and these effects can have inferences indicating the success or necessity of a policy. This study looks at six counties in West Virginia to determine the potential implications of a federal environmental regulation, the Clean Power Plan, at the county level. Of the six counties, two coal producing counties were selected, and four counties, which are contiguous to the coal producing counties not one another, without coal production facilities were selected. The counties were selected in the mid-northern region of West Virginia, which is more rural by nature, and would not be directly influenced by the larger mining operations found in the southern portion of the state. By looking at the variables of population, coal production in short tons, unemployment rate, poverty rate, and per capita personal income; it assists in demonstrating a larger pattern of what occurs after a policy is implemented. Specifically, the Clean Power Plan proposed by the Obama administration in 2014. By identifying potential periods of fluctuation or stagnation within the above-mentioned variables, it lends to the broader understanding of the Clean Power Plan and how it affected the region. The policy itself is a subset of the Clean Air Act, and is overtly geared towards the reduction of harmful pollutants, which are primarily emitted from coal fired power plants. However, these regulations have been criticized for bringing economic harm to a region whose economy is primarily based on the production and exportation of coal. By looking at variations in the data, it can be determined if this policy has in fact harmed the region economically, or if the claims are unfounded for an industry that is already in decline. An examination of the data will assist in determining what effects occurred in the selected counties after the proposal and implementation of the Clean

Power Plan. Specifically, all fluctuations within the selected variables will be examined, and positive, negative, or stagnant effects will be identified. With West Virginia being one of the poorest states in the nation, an analysis such as this could lend itself to understanding the impacts of federal environmental policy implementation at a county level.



## LITERATURE REVIEW

The central focus of this study is a review of the county level impacts of the Clean Power Plan, as well as potential impacts for the mid-northern region of West Virginia. Therefore, a review of the relevant literature on the Clean Power Plan, federal environmental policy, and the historical implications of the coal fields of West Virginia is needed.

### Coal

The presence of federal government influence in the coal fields of West Virginia has been present for an extensive amount of time. As Lewis-Beck & Alford (1980) touches on in his innovative application of a time series analysis to mining safety; historically, citizens and miners alike in Appalachia have viewed the federal government's presence in the region as ineffective. It wasn't until the passage and subsequent regulations implemented by the Occupational Safety and Health Act (OSHA) in 1970 that many residents began to believe in the regulatory abilities of the federal government (Lewis-Beck & Alford, 1980). Specifically, in West Virginia, the passage of OSHA, signified a substantial shift in the perception of the federal government's reach that was directly experienced in the mines (Lewis-Beck & Alford, 1980). It was the first time in history since the discovery of coal, and its extraction methods, that the government was attempting to implement safety measures for those working in the mines (Lewis-Beck & Alford, 1980). When discussing the region that has been termed 'Appalachia', it is important to note that West Virginia lies at the geographic center of the region (Hale, 1971). Historically, the occurrences in West Virginia related to coal have mirrored similar patterns that have occurred in the Appalachian region, but it is not an exact replica of the other areas that comprise Appalachia

(Hale, 1971). In addition to the federal implementation of OSHA, the region of Appalachia, specifically West Virginia, experienced another federal regulation that also had an effect on how things were done in the coal fields. The Surface Mining Act, implemented in 1977, was created to combat and federally control environmental degradation that had occurred in the Appalachian region because of surface mining practices (Schlottmann & Spore, 1976). It was with the implementation of the Surface Mining Act that the state was required to work in tandem with the federal government to regulate surface mining practices, a newer practice compared to traditional underground mining (Hedge, Menzel, & Williams, 1988). This implementation was an example of state and federal duality in regards to regulating surface mining within the state (Hedge, Menzel, & Williams, 1988). In other words, it created a system in which regulatory members of the state would work to implement a federal regulation within their own area, but there would still be uniformity among the states in regards to mining standards (Hedge, Menzel, & Williams, 1988). It is noticeable that historically, West Virginia has dealt with the implementation of federal policies at the state level in terms of coal production, and has typically managed to continue its practices. As mentioned above, underground mining practices were coordinated with OSHA to regulate safety, and the evolution to surface mining practices were coordinated with the Surface Mining Act (Lewis-Beck & Alford, 1980; Hedge, Menzel, & Williams, 1988). The next progression of coal mining practice, known as mountain top removal (MTR), has been met with harsh criticism and many attempts for deregulation of the practice (Woods & Gordon, 2011; Strobo, 2012). Woods & Gordon (2011) cite the push for MTR practices in Appalachia to stem from advances in mining technology that in recent years have drastically increased the quantity of coal that can be extracted, as the national drive to be 'energy independent' from overseas energy sources. MTR involves the removal of significant amounts of land to expose coal seams

that are typically buried deep within the earth (Woods & Gordon, 2011). Proponents of this type of coal extraction argue that it makes the region competitive with other contributors to the energy sector, and argue that it is a huge contributor to local economies that employ the practice (Woods & Gordon, 2011). For example, Wyoming has 7 of the 10 top producing coal mines in the country, all of which are surface mines (U.S. Energy Information Administration, 2018). Of the total production in the state, 78 percent comes from underground mining (U.S. Energy Information Administration, 2018). With West Virginia's underground reserves continuing near total depletion, it further pushes the state towards other methods of extraction in an attempt to keep the coal energy relevant (Woods & Gordon, 2011). Unfortunately, claims of contributions to local economies are met with criticisms from MTR opponents who say that with modern advances in technology, this practice does not provide a significant future source of employment (Woods & Gordon, 2011). These technological advances have already impacted the industry within West Virginia. Additionally, with its substantial environmental impact in local mining communities, it has already begun to negatively affect the quality of life of Appalachian residents (Woods & Gordon, 2011). As has been demonstrated above, the Appalachian region has been the source of federal policy intervention for decades. Regulatory intervention within the region is sometimes met with criticism, simply because of the long-established business interests that are deeply embedded in coal, but these attempts to regulate coal practices have had positive intentions for those who live in Appalachia (Wordland, 2017; Woods & Gordon, 2011). From safety in the mines to safe effective surface mining practices, federal regulations can have positive, lasting impacts for the states in Appalachia (Lewis-Beck & Alford, 1980; Hedge, Menzel, & Williams, 1988).

In recent years, specifically ranging from 2008-2016 the production of coal has fallen by close to half of its total reported volume in the state of West Virginia (Lego & Deskins, 2018). There has been a temporary resurgence of production in the state, beginning in mid- 2016 to mid-2018, but this is in large part due to exportation demands from countries overseas (Lego & Deskins, 2018; Wordland, 2017). Wordland (2017) also discusses the momentary boom in coal production that was experienced in 2016 by West Virginia, when “the price of a key type of coal used to make steel doubled” because of increased demand from China (p. 40). This increased demand for coal in China, as well as other overseas demands, have helped to assist the state in increasing their exportation of coal, thus continuing its relevancy in the state (Lego & Deskins, 2018; Wordland, 2017). However, domestic production for the state of West Virginia continues to decline from year to year, and the total coal production within the state is predicted to continue to decline as the energy sector continues to switch to natural gas in the coming decades (Lego & Deskins, 2018; Wordland, 2017). With the cost effectiveness of natural gas, and renewable energy following its footsteps, coal is predicted to be in its final hours (Lego & Deskins, 2018). As the coal reserves continue to become more and more depleted, due in large part to more than a century of mining in the state of West Virginia, it becomes very expensive for mining operations to gain access to reserves, as well as search for more, that are located substantially deeper in the earth (Wordland, 2017).

### **Influence of Mining Companies**

Coal has a had historical presence in West Virginia, however, coal production is in decline as natural gas and renewable energy become more cost effective, low-cost reserves of coal become more depleted, and more stringent environmental regulations are implemented

(Strobo, 2012; McIlmoil & Hansen, 2010). To some, that would mean businesses would make way for the transition to different, more economically profitable energy sources, but in the state of West Virginia, that has not been the case. Strobo (2012) discusses the vast influences of mining companies within the Appalachian region, and their unwillingness to do what is in the best interest of the region. Bell (2009) also acknowledges the exploitation of the region and the destruction of ‘social capital’ that is ultimately the result of strong influence by mining companies (Strobo, 2012; McIlmoil & Hansen, 2010). Strobo (2012) focuses on a particular incidence in which the mining companies are interfering in a large way that is affecting communities in West Virginia. It is known as the “Coal River Mountain Controversy”, named after the Coal River mountain in Raleigh county West Virginia, which is very suitable for renewable wind energy, but whose mineral properties are owned by mining companies who wish to destroy the mountain to extract coal that lies within it (Strobo, 2012). The state could intervene on behalf of the mountain by either rescinding mining permits, or declaring the unsuitability of the mountain for mining, but previous relationships between state government officials and mining companies could make this problematic (Bell 2009; McIlmoil & Hansen, 2010; Strobo, 2012). Situations such as this demonstrate a disconnect between ideals within the state. It seems as if there has been a metaphorical ‘line in the sand’ drawn between those who wish to transition the economy, and those who believe that coal is still the answer to the problems of the state.

### **Clean Power Plan**

The Clean Power Plan is a federal plan that was proposed by both President Barack Obama, and the Environmental Protection Agency (EPA) on August 3, 2015 (Environmental

Protection Agency, 2017-2018). This plan is an extension of section 111(d) of the Clean Air Act, and is solely focused on the reduction of harmful carbon pollutants that have been determined to have negative consequences on both public health, and the environment in which most Americans work or reside (Environmental Protection Agency, 2017-2018; Union of Concerned Scientists, 2018; Carbonell, 2015). From a global perspective, this federal plan is considered to be “the most significant step the U.S. has ever taken toward reducing the pollution that causes climate change” (Environmental Defense Fund, 2019; p.1). As a whole, one of the plan’s overarching goals is to take initial, modest steps towards mitigating anthropogenic climate change in the U.S (Environmental Protection Agency, 2017-2018). While the Clean Power Plan (CPP) was heavily supported by some, it has been the source of harsh criticism by mining states, fossil fuel companies operating within those states, and other interest groups (Wordland, 2017; Union of Concerned Scientists, 2018).

As a global society, it is evident that climate change and those who actively choose not to assist in mitigating it, are moving towards a “tipping point” (Rosner, 2017). Reaching a global “tipping point” for climate change is characterized by the inability of any human action or intervention to reverse the damage that has been previously (and presently) done by climate change (Rosner, 2017). Without the mitigation of these harmful pollutants being released into the atmosphere, many facets of humanity are directly threatened; such as public health concerns and public infrastructure (Carbonell, 2015). Therefore, as a westernized society that is a massive emitter of harmful carbon pollutants, which directly contribute to climate change, it was and is essential that the United States take federal action (Environmental Protection Agency, 2017-2018). With fossil-fuel-fired power plants easily being the largest emitter of carbon pollutants in the U.S., and even emit more than some small countries, their regulation is essential to

combatting climate change (Carbonell, 2015). Even though the CPP has been met with a lot of criticism, many still consider it to be an admirable example of a federal environmental intervention that can be both effective, as well as low in cost (Gillingham & Stock, 2018; Carbonell, 2015). In fact, many cost-benefit analyses on the CPP have even showed a ‘net economic gain’ for the nation upon its implementation (Union of Concerned Scientists, 2018). One specific cost-effective measure in the plan was utilizing current coal-fired power plants by transitioning them to a new energy operation, and not having to entirely rebuild and retrofit a new plant for more efficient operation (Gillingham & Stock, 2018). Carbonell (2015) touches on the transformations of some current mining operations that have taken place, but the CPP wants to continue with modest steps forward towards a new, cleaner energy sector in the U.S. In addition to the transformation of current power plants, the plan allows for the trading of emissions permits, which would imply that plants who generate low levels of greenhouse gases would be constructed in places where it would be most economically profitable to do so (Gillingham & Stock, 2018). Emissions trading is an explicit cost-effective measure of the CPP that could be used to incentivize states to make reductions quickly and efficiently (Environmental Protection Agency, 2017-2018). States are allowed, and even encouraged, to submit their own reduction plan that would adhere to the guidelines put forth in section 111(d) of the Clean Air Act (Environmental Protection Agency, 2017-2018). If states fail to submit their own plan, or fail to receive approval from the EPA of their plan, then a federal standard will be placed on the state (Environmental Protection Agency, 2017-2018). However, the federal plan placed on them state is not permanent. States could have a federal plan placed on them, but contingent on the approval of a state submitted plan, would be allowed to ‘exit the federal plan’ (Environmental Protection Agency, 2017-2018). Therefore, while some states were initially

resistant to the implementation of the CPP, it was still in their best interest to prepare for implementation, so as to not further hinder energy operations, which could in turn take a negative toll on individual state economies. It is important to note that while this federal intervention does directly affect the coal industry, it is not the only subset of U.S. energy producers that is affected. The plan also places stringent pollution emission regulations for natural gas production, as well as other facets of the energy industry (Gillingham & Stock, 2018).

## **Politics**

Since taking office, President Trump has pledged that one of his first steps in office would be ending “the war on coal,” thus repealing Obama-era environmental regulations, which includes the aforementioned Clean Power Plan (Wordland, 2017). Federally, the election of Donald Trump as President in 2016 was antithetical to the election of Barak Obama in 2008. Donald Trump’s vision for the future of energy in the United States is considered to be opposite of Obama administration. Politics play a clear and present role federally and at a state level. The political situation at the state level in West Virginia is unique, in that the election of coal billionaire Jim Justice as governor of the state, happened to coincide with the election of Donald Trump as President of the United States (Wordland, 2017). Wordland (2017) also points out that since their election, “both men have wooed West Virginia voters with the promise of more mining jobs and fewer regulations” (p. 40). With a substantial portion of West Virginia’s economy depending on the production and exportation of coal, these promises were taken very seriously. Bell (2009) discusses not only the influence of politics in the region, but how they have paved the way for powerful entities to do whatever they want when it comes to the bottom



line of coal mining. Coal has embedded itself in both the state and federal politics, which has led to the advocacy for “unjust mining practices that have destroyed the health, safety, and livelihoods of many residents living in the southern coal-producing region of the state” (Bell, 2009; p. 633). This political involvement has created a dangerous dynamic within the state of West Virginia, one that has created an uphill battle for residents of the state to contest, especially with a large portion of the state’s residents living below the national poverty line.

## METHODS

### Selection of State and Counties

The selection of West Virginia as the state to utilize for this study was singularly contingent on its coal production standing in the United States. While second to Wyoming in total coal production, West Virginia was determined to be the most suitable state for this study (Paterson, 2016) because the state has a specific historical, economic dependence on coal. Its suitability comes from its standing in terms of coal production, and the study's generalizability to other energy producing states. After the state of West Virginia had been selected, the county selection within the state was dependent on different factors. It was decided that a total of six counties in the mid-northern region of the state would provide enough data to see any noticeable effects caused by the development, and potential implementation, of the Clean Power Plan. Within each state, there are typically sociocultural differences between the north and south regions, and that was considered when selecting the counties (Bell, 2009). It is important to note that the capital of West Virginia, Charleston, is located in the southern region of the state in Kanawha county, which has one of the largest populations in the state, as well as a substantial mining operation (West Virginia Office of Miners' Health, Safety and Training, 2019). It was essential to this study to choose smaller more distant counties from Kanawha county to better reflect the potential impact on the whole state, rather than one influenced by its proximity to Kanawha which, in turn, could have a substantial impact on both the data collection process and conclusions drawn from the study. The northern part of West Virginia is home to smaller counties that are more rural in nature, which are, in a way, more extricated from the economic outputs that are seen in the larger counties. This extrication found in the more rural counties is

due to the fact that there is typically not a lot of additional sources of economic activity outside of mining operations and smaller business operations. Therefore, the county selection was driven towards these smaller, more rural counties in order to determine any potential effects of the policy.

After determining which region of the state would be most suitable, the next step in the county selection process was locating two counties with past and current mining operations, each with two bordering counties that did not have mining operations (four in total without operations). It is important to note that the selection process for counties with these parameters was somewhat limited. For instance, Bell (2009) conducted a county study in West Virginia, and notes the difficulty of finding suitable counties. They note from the West Virginia Office of Miner's Health, Safety, and Training (2005) that at that point in time, "43 of West Virginia's 55 counties have minable coal reserves, so more than three-quarters of the state were ineligible from the start" (Bell, 2009; p. 637). This study faced similar challenges, with the data collection time line beginning in 2008 and ending in 2017. It was essential to identify counties with coal mining operations in 2008, which continued operating into recent years. Additionally, the selection of bordering counties continued to limit the county selection because of most of the counties in the state have operations, just as Bell (2009) pointed out. By identifying and choosing bordering counties without mining operations, it allows the study to account for potential spillover effects from the counties with mining operations, if any, to become evident during the analysis process. In regards to the timeline selected for the study, it was important to create a broad enough timeline so that the data analysis would not be limited from a time or collection standpoint, but still be concise enough to determine what has occurred within the selected counties. Upon examination of each of the two county's production of coal, it could be seen that each one had

active coal operations in 2008, the year Barak Obama took office, which is the year that was selected to begin gathering data (West Virginia Office of Miners' Health, Safety and Training, 2019).

The coal production data did taper off for both counties in the past two or three years, but the presence of operations in subsequent years still made each county suitable for the study (West Virginia Office of Miners' Health, Safety and Training, 2019). This lapse in operations is not specific to the state, and has not been an uncommon finding. According to the U.S. Energy Information Administration (2019), more than half of the nation's coal mines that were operating in 2008 have closed. The selection of the remaining four counties without mining operations was entirely dependent on the initial selection of the two counties with mining operations. Once Harrison and Braxton counties were chosen as counties with mining operations, the surrounding areas of each county were analyzed for which counties did not have past or current mining operations. Harrison county, which has a northern location within the state, is bordered by surrounding counties on all sides, but there are only three suitable options for this study: Lewis, Doddridge, and Wetzel counties (West Virginia Office of Miners' Health, Safety and Training, 2019). After further consideration, the counties of Wetzel and Doddridge were chosen because of their more appropriate fit within the study. The argument could be made that Wetzel county's border with Harrison is too minimal to be included, but in comparison to the location of Lewis county, it is more appropriate. Lewis county, while largely bordered with Harrison county, also shares a substantial border with Braxton county (West Virginia Office of Miners' Health, Safety and Training, 2019). Therefore, utilizing Lewis county as a 'bordering county' in the selection of counties for either Harrison or Braxton county could prove to be problematic when comparing the data. If any 'spillover effects' did become apparent, it would not be clear which county

would be the primary cause of the effects. Braxton county was the other county that was selected with a past and somewhat current mining operation. It has a middle to northern location in the state, but is still mostly rural in nature. The three options for the selection of bordering counties without mining operations were: Calhoun, Gilmer, and Lewis counties. The same argument made for Wetzel county's narrow border could also be made for Calhoun county. Calhoun county's border with Braxton is small, and it could be argued that it is too minimal to be included in the study. However, the same issues with Lewis county remain, in that it borders both Harrison and Braxton counties and any present spillover effects could not be casually distinguished (West Virginia Office of Miners' Health, Safety and Training, 2019). Therefore, because of the location of each of the coal producing counties (Harrison and Braxton) the selection of the subsequent bordering counties without mining operations (Doddridge, Wetzel, Gilmer, and Calhoun) was somewhat limited, but there were still enough suitable counties available for data collection for the study.

### **Collection of Data**

The determination of which variables to use for this study was centered on finding data that would most accurately represent what was happening in the chosen counties, during each year of the study (2008-2017). The chosen years also coincide with the presidential term of Barack Obama, and his enactment of the Clean Power Plan which eventually lapsed into the presidential administration of Donald Trump (Wordland, 2017). The main objective of the study is to demonstrate any economic impacts in the selected counties that would have potentially been caused by the creation and implementation of the Clean Power Plan. Therefore, the variables chosen for this study were essential in demonstrating what was truly happening in the region

throughout the entirety of the Obama administration. The first set of variables selected were population, rate of unemployment, and production of coal in short tons per county. Population numbers for each county would demonstrate if residents were moving out of the county, or staying put. Any drastic increase or decrease in population could be indicative of an outside influence within each individual county. The next variable of unemployment rate was an obvious choice for each county. With the coal industry occupying such a large portion of the economy in West Virginia, any changes in unemployment rate per county would be especially informative (Bureau of Labor Statistics, 2008-2017). Any consistent variations in the unemployment rate during the brief period of implementation of the Clean Power Plan could help demonstrate any effect present in the counties. Overall, these variables were thought to be encompassing, but after examining the data, two additional variables were added in an effort to further validate results derived from the study. Poverty rate and per capita personal income were identified as two factors that would be influential accompaniments to the existing variables in the study. As one of the poorest states in the nation, high poverty rates in West Virginian counties would not be unexpected (U.S. Census Bureau, 2009-2017). Therefore, poverty rate was added to the variable list in an effort to determine if there were any patterns in the fluctuations, if any, in poverty for each county. Additionally, per capita personal income was also added because it provides information on the individual level per each county. Increases and decreases in per capita personal income also lends to the understanding of what the economic situation is, or has been, for the selected counties. With the addition of these two variables, it not only helped broaden the scope of the study, but adds supplementary data that better represents the region.

## **Methodology**

In terms of a methodology, the initial approaches considered were an application of punctuated equilibrium theory, or a time series analysis. For this particular study, it is important to demonstrate any changes that occurred in the designated variables from 2008-2017 in each of the selected counties. The necessity to demonstrate change over time was paramount to the study, so a methodological approach that can accurately show this change was needed. By simultaneously showing both the year and the coinciding data in tandem, it could assist in answering the research question of if there was an effect in the chosen counties that could have been caused, or coincided with the implementation of the Clean Power Plan.

**Punctuated Equilibrium.** Punctuated equilibrium theory is typically used to demonstrate ‘punctuations’ in the status quo, or equilibrium, over a long period of time (Weible & Sabatier, 2014). These punctuations in the status quo provide vital insight about conditions both before and after the punctuation, and the subsequent ramifications, if any, that occur as a result (Weible & Sabatier, 2014). This study is looking at a federal environmental policy, the Clean Power Plan, which could technically be termed a ‘punctuation’ in the application of this theory (Weible & Sabatier, 2014). The equilibrium or status quo it would be considered to punctuate in terms of this study would be the six selected counties in West Virginia. In these terms, it would be beneficial to view the stasis before the ‘punctuation’ as well as after in order to see what effects occurred in the counties. The application of the punctuated equilibrium theory could hypothetically work for this study, however, there is an issue with the period of time that has been selected for this study (2008-2017) and the application of this specific theory. While close to a decade could be considered a lengthy amount of time in some methodological applications, in terms of the length of time needed for punctuated equilibrium to be applied, it appears to be

too short (Weible & Sabatier, 2014). Past applications of punctuated equilibrium have spanned half a century, and sometimes even further back than that (Weible & Sabatier, 2014). After the realization that the length of time chosen for this study was too short for the punctuated equilibrium approach, it was decided another form of analysis would be more appropriate.

**Time Series Analysis.** At the initial onset of this study, the methodological approach of time series analysis was selected based on its relevancy and applicability to the data collected, as well as the research question this study seeks to answer. A time series analysis approach proved to have the best fit all with the above criteria, as well as the time frame selected, which eliminated the need for a punctuated equilibrium approach. A time series is defined as “a sequence of observations taken sequentially in time” (Box, Jenkins, & Reinsel, 2008; pg. 529). While time series analysis as a whole is a useful methodological tool, a branch or subset of a time series approach known as an intervention analysis was determined to lend more of an understanding of the variables in this study (Box, Jenkins, & Reinsel, 2008). By being able to statistically analyze all of the variables simultaneously, it would not only demonstrate the noticeable decline in the coal production and the industry itself, but the influxes in the other variables that were a result of the intervention. In terms of this study, the intervention is considered to be the proposal and implementation of the Clean Power Plan. It was after the determination of the study’s variables, as well as the collection of the data, that a time series was determined to be an ineffectual analysis tool for this study. With four of the counties having four different variables, and two counties having five variables, the level of comparison needed was beyond the scope of a time series approach for the relatively number of cases being utilized in the study. Technically, the time series analysis could still have been applied, but the same conclusion would have been reached: more specificity for each county before and after the



implementation of the Clean Power Plan was needed, but with such a small number of cases, would have been hard to receive from a time series analysis. Therefore, the analysis was not applied, and it was determined that the use of inferential statistics was not needed, but rather, descriptive statistical approach instead.

**Means Comparison.** As mentioned above, this study needed a statistical analysis that employed descriptive statistics instead of inferential (Frankfort-Nachmias, Nachmias, & DeWaard, 2015). With the use of descriptive statistics, each variable and its coinciding data could be described in an effort to lend to the overall understanding of what was happening in each county, and help to determine if any changes coincided with the Clean Power Plan (Frankfort-Nachmias, Nachmias, & DeWaard, 2015). With the chosen variables and collection of data, a method of comparing each county and its variables before and after the implementation of the Clean Power Plan was needed. Many other statistical tests are utilized to refute a null hypothesis, but for the case of this study's data, a refutation of a null hypothesis was not needed, nor would it have been beneficial to any results (Frankfort-Nachmias, Nachmias, & DeWaard, 2015). It was determined that a means comparison, while a more rudimentary analytical approach than the above methodological options, would provide the most constructive analysis for the study (Frankfort-Nachmias, Nachmias, & DeWaard, 2015). By utilizing this type of parametric approach, the numerical data could be analyzed in a more effective way that would give the study and its results more validity. Each county variable would therefore be divided into two groupings: group 1 was data from 2008-2014 and group 2 data from 2015-2017. With the implementation phase occurring in 2015, this was the best way to see what had happened before and after the policy. The mean for both groupings was configured, the group 1 mean was subtracted from the group 2 mean, and the remaining number was divided by the group one

mean to determine the percentage of change that had occurred before and after 2015. County variables with high percentages of change were examined to determine what type of change (positive or negative) was occurring, and how that contributed to the knowledge of what had been occurring in each county.

## ANALYSIS

As was briefly discussed in the methodology section, a time series analysis approach was the chosen method of analysis for this data set, but after further examination, proved to be unnecessary. After the gathering of all of the data for the variables included in the study, the means of group 1 (years 2008- 2014) and group 2 (2015-2017) of the variables were configured, along with the percentage of change between groups, which were then analyzed and compared. Additionally, each variable has been graphed and analyzed individually in order to demonstrate and explain any visible patterns, or lack thereof, that occurred in the data beginning in the year 2008 and ending in the year 2017. For the applicable variables (population and per capita personal income), outliers in the data were analyzed and then removed to provide a more accurate picture of what has occurred in each county. Below is a discussion and analysis of each variable, and its relation to the findings of the study.

### **Population**

The economy of West Virginia has historically been largely dependent on coal, but with recent declines in production, it will be necessary for the state to transition to other avenues that will support the declining economy (Wordland, 2017; Woods & Gordon, 2011). In theory, when jobs in the coal industry are no longer available, or as plentiful as they once were, residents may permanently relocate from their chosen county of work or residence in search of opportunities elsewhere. Therefore, any drastic increases or decreases in population numbers could be indicative of something larger having an influence within the counties. After examining population data from the *U.S. Census Bureau* beginning in 2008 and ending in 2017, a clear

picture presented itself. As can be seen in Figure 1, none of the counties have experienced drastic increases or decreases in population numbers for close to a decade. It can be seen that five of the counties have very similar numbers of population, which is beneficial in that most of the selected counties resemble each other in that regard. By examining the data in Figure 1, an almost straight line on the graph for each of the counties demonstrates a stasis in population numbers. With no indicators in the data of extreme fluctuations in population for any of the counties, it was then important to remove the outlier in the data, Harrison county, and reexamine the population numbers.

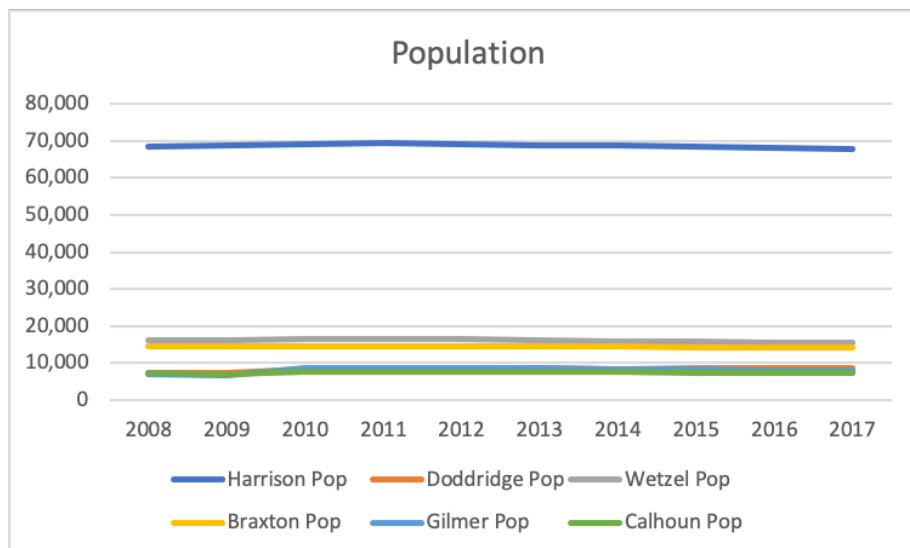


Figure 1. Population

Harrison county is considered to be an outlier in the data because of its higher population. The population consistently sat around 70,000 residents from 2008 to 2017, but as a coal producing county, a higher population number is not unexpected (U.S. Census Bureau, 2000a; 2010a). As can be seen in Figure 2, Harrison county as an outlier has been removed, but the data still does not demonstrate any drastic fluctuations in the counties. Gilmer and Doddridge county

both experienced an increase in population from 2009 to 2010, but the numbers tapered off in subsequent years. These increases appear to be a standard population influx that is frequently seen in most counties. Calhoun and Braxton county both exhibit population numbers that are very consistent from 2007 to 2018 (U.S. Census Bureau, 2000a; 2010a). Both show an almost straight line between the data points, which from the standpoint of the variable of population, demonstrates that there has not been any change in Calhoun and Braxton county in that regard. Finally, Wetzel county shows a general decrease in population numbers beginning in 2010, and trending downward to 2017 (U.S. Census Bureau, 2000a; 2010a). This ‘downward trend’ is visible, but is not very substantial. Which means that Wetzel county also does not display any type of fluctuation in population that would be indicative of outside influence within the county. Even after removing the outlier of Harrison county, it is still evident that there were not any drastic variabilities in the population data. In effect, this demonstrates that there was nothing affecting the counties from 2008 to 2017 in a way that would positively or negatively alter their population numbers.

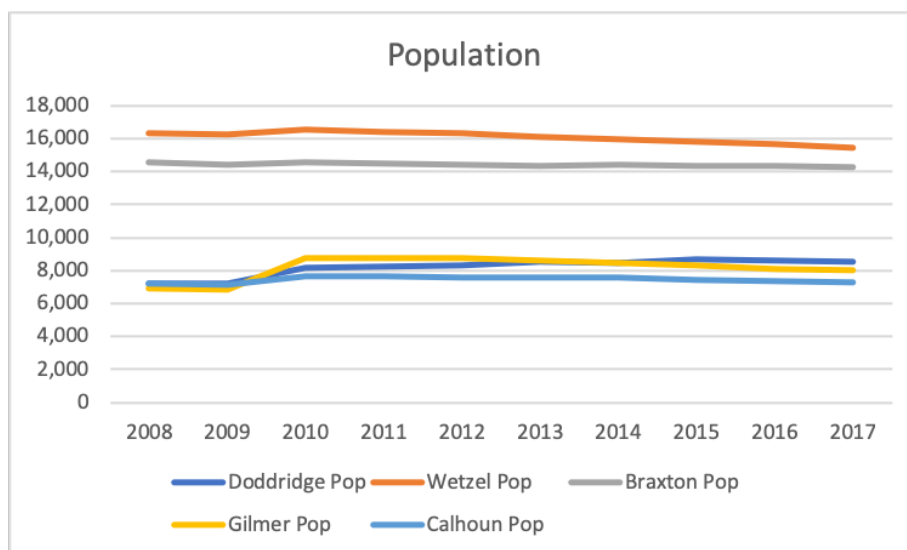


Figure 2. Population Outlier Removed

In Table 1, the percentage change in population for each county is displayed. As can be seen, the numbers have been divided into group 1 (2008-2014) and group 2 (2015-2017) to demonstrate the change that occurred before and after the implementation of the Clean Power Plan. Doddridge county has the largest percentage of change with an average increase of around 7 percent before and after implementation. This increase, while more substantial than the average fluctuations of the other counties, does not appear to contribute to a pattern of change in population occurring in the counties. Therefore, rates of change in the variable of population appear to be consistent with typical population fluctuations that could be experienced by any county in the U.S. These changes are not indicative of outside influence. After arriving at this conclusion with the variable of population, it was essential to move to next variable of unemployment rate.

### **Unemployment Rate**

The unemployment rate comparison for each county showed much more variation than was seen in the population data, and is demonstrated in Figure 3. One of the largest, most visible variations in unemployment can be seen in Calhoun county, where there was a substantial spike in 2009, and an additional increase and high of 14 percent in 2010 (Bureau of Labor Statistics, 2008-2017). These increases in the unemployment rate within the county do not coincide with the coal production data collected for the bordering county of Braxton. In fact, Braxton county exhibited a substantial increase in production of coal between 2009 and 2010 (over 100,000 short tons) (West Virginia Office of Miners' Health, Safety and Training, 2019). However, the number of people employed by the coal operation in Braxton showed a decline from 2009 to 2010, where the number of employees dropped from 89 to 61 (West Virginia Office of Miners' Health, Safety

and Training, 2019). This correspondence between employment and coal production seems to be inverse of what has previously been suggested about the region. The unemployment rate gradually began to decrease in Calhoun county in the years preceding, and eventually got down to 9.8 percent in 2014 (Bureau of Labor Statistics, 2008-2017). Unfortunately, this was only a temporary low for the county, and the unemployment rate spiked back up to 12.5% the following year, and only just reached 10.5 percent in 2017.

**Table 1. Population Means Comparison**

County	Mean Group 1	Mean Group 2	Percentage of Change
Harrison	68967.86	68925.33	-0.06%
Doddridge	8023.43	8613.00	7.35%
Wetzel	16275.86	15635.67	-3.93%
Braxton	14470.14	14304.67	-1.14%
Gilmer	8147.14	8140.00	-0.09%
Calhoun	7477.86	7379.67	-1.31%

The Clean Power Plan was in the works by 2014, and was officially announced by the EPA in 2015, which does coincide with this specific increase in the unemployment rate (Bureau of Labor Statistics, 2008-2017). Wetzel county had a similar range to Calhoun in that there was a large initial spike from 2008 to 2009 from 7.2 to 11.7 percent which lowered until around 2013, which showed another slight increase from 9.1 to 10.3 percent, and then tapered off again

(Bureau of Labor Statistics, 2008-2017). This also did not coincide with either the coal production or the number of reported employees working in coal of its bordering county of Harrison (Bureau of Labor Statistics, 2008-2017). From 2008 to 2009, when Wetzel saw its greatest increase in unemployment, Harrison county saw both an increase in production, and reported coal employees (Bureau of Labor Statistics, 2008-2017). This comparison potentially negates spillover effects in regards to unemployment. Harrison and Gilmer counties were similar to Wetzel and Calhoun in their fluctuations of employment rates, but had lower numbers overall. Harrison county's unemployment rate reached its highest in 2010 at 7.6 percent after gradual increases in subsequent years (Bureau of Labor Statistics, 2008-2017). Comparatively, in 2010, Harrison county had a noticeable increase in coal production, as well as a decrease in coal employees (West Virginia Office of Miners' Health, Safety and Training, 2019). This dynamic could be contributable to increased use of technology in mining production as well, which has been noted by opponents to MTR mining (Woods & Gordon, 2011). The unemployment rate then fell slightly by about 2 percent (5.4 percent) by 2014, increased to 6.3 percent in 2014, and then fell back down to 4.8 percent in 2017. Gilmer county had its largest escalation in unemployment rate from 2008 to 2010 when it significantly increased from 3.8 to 8.9 percent (Bureau of Labor Statistics, 2008-2017). It borders Braxton county, a coal producer, who experienced a decrease in coal production from 2008 to 2009, but had a reported increase in coal employees (West Virginia Office of Miners' Health, Safety and Training, 2019). This provides an inverse conclusion than the other counties, and also demonstrates a discrepancy in a possible pattern. The unemployment rate in Gilmer then declined in subsequent years, lowering to 6.5 percent in 2014, rose to 7.8 percent in 2015, 8.2 percent in 2016, and slightly declined to 7.1 percent in 2017 (Bureau of Labor Statistics, 2008-2017).



Braxton county, one of the two coal producing counties being examined, was the only county that saw an increase in the unemployment rate that unceasingly lowered over time without other abrupt increases. The county saw a quick rise in the unemployment rate that continued from 2008 to 2010 which was a high for the county at 11.1 percent, and continued at a high rate through 2012 (Bureau of Labor Statistics, 2008-2017). Unlike the before mentioned counties however, there was no decline and eventual spike after the initial increase. The numbers continued to slightly decline each year from 11.1 percent in 2011, all the way down to 7.4 percent in 2017 (Bureau of Labor Statistics, 2008-2017). Their unemployment rate did not at all coincide with either their coal production or employees in coal. Both of those rates saw substantial increases and decreases while the employment rate did not experience the same. Finally, Doddridge county is comparable to Braxton in that there was such a minimal influx after the initial increase in unemployment rate that it follows a similar pattern. Doddridge county had a significant increase in 2009 when the unemployment rate rose from 4.9 to 7.8 percent (Bureau of Labor Statistics, 2008-2017). From 2009, it began to gradually decrease until it hit a low at 5 percent in 2014 (Bureau of Labor Statistics, 2008-2017). It slightly came back up to 5.5 percent in 2015, lowered to 5.2 percent in 2016, and fell to its lowest at 4.2 percent in 2017 (Bureau of Labor Statistics, 2008-2017).

As can be seen in Table 2 below, all of the counties experienced a noticeable percentage of change from group 1 to group 2. Doddridge had the biggest percentage of change with a decrease in the unemployment rate of around negative 20 percent. This change is substantial, and potentially, a decrease in the unemployment rate of the county would be indicative of an outside influence that is having a positive effect in Doddridge county in terms of unemployment rate. Wetzel, Braxton, and Harrison counties also experienced a negative

percentage change in means compared to group 1 and group 2. Harrison county had a negative percentage of change that was around 7 percent, and Wetzel county's percentage of change was negative 12 percent. With Harrison county being a coal producing county, and Doddridge and Wetzel being its bordering non-producing counties, a negative percentage of change for all three would indicate that the employment rate decreased after the implementation of the Clean Power Plan. Braxton county and its bordering counties did not experience the same effect. While Braxton, a coal producing county, experienced a negative percentage of change of 11 percent, its bordering counties of Gilmer and Calhoun had positive changes from group 1 to group 2. Gilmer had an increase in percentage of around 11 percent, Calhoun had an increase of around 8 percent. An explanation for downturns in employment in Gilmer county during this time could potentially be tied to former mine reclamation projects awaiting funding (Marema, 2015). Reclamation efforts provide new economic opportunities for former mining communities, but can be costly, which is why federal funding is needed, especially in poorer states such as West Virginia (Marema, 2015). In terms of identifying spillover effects, for Braxton, Gilmer, and Calhoun, there appear to not be any consistent spillover effects. For Harrison, Doddridge, and Wetzel counties, and with all of them experiencing negative percentage changes, the argument could be made that there are present spillover effects for these counties. Overall, 4 of the 6 counties appear to have experienced a mean percentage decrease in unemployment rate before and after the implementation of the policy. For the variable of unemployment rate, it appears that there could have potentially been an outside influence in the counties that could have potentially affected the unemployment rate, but after the means analysis, it appears as if this change could have had a positive effect in 4 of the counties.

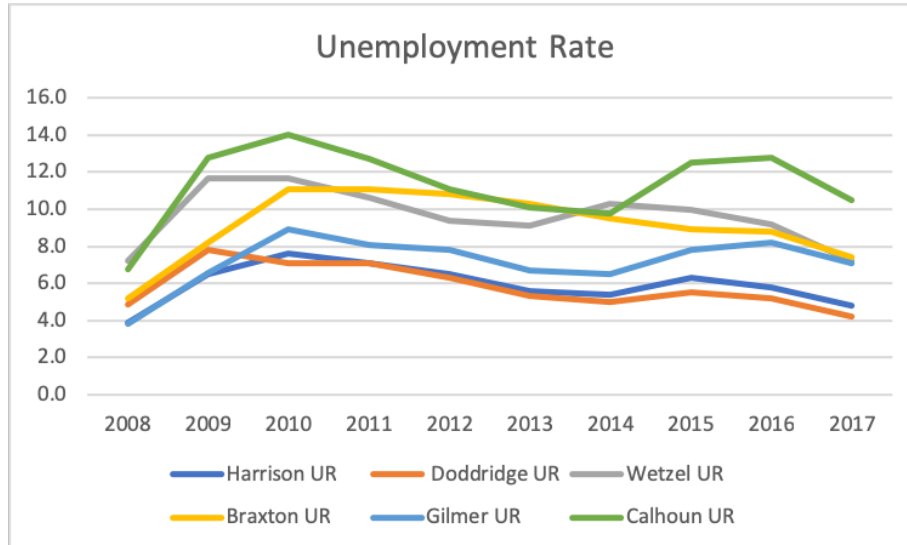


Figure 3. Unemployment Rate

### Poverty Rate

The variable of poverty rate has been included in this study to examine if there were patterns in the rates of poverty for each county, and to see if these patterns demonstrated any type of consistency with each other. It is noted that poverty rate data for each of the counties was not available for the year of 2008, and therefore, the data collection began with the year 2009 for this specific variable. In terms of the means comparison of percentage of change seen in Table 3 below, the group 1 mean ranges from 2009-2014, and the group 2 mean ranges from 2015-2017.

The contrasts between each county seen in Figure 4 showed a lot of variation, but none that was indicative of any specific action taking place within the counties. In fact, there were multiple counties that had opposite fluctuations to each other when compared; specifically, Gilmer and Calhoun counties. Gilmer county presented an increase in poverty rate in 2011 at 28.2 percent, which grew to 31.5 percent in 2012, and eventually began to decrease in the preceding years (U.S. Census Bureau, 2009-2017). In comparison, Calhoun county's poverty rate began to steadily decrease in 2011 from 25.8 percent, after a cited increase in past years (U.S.

Census Bureau, 2009-2017). This decrease continued throughout 2012 until 2015, which as stated, is opposite of Gilmer county’s increase that occurred during a similar time frame.

**Table 2. Unemployment Rate Means Comparison**

County	Mean Group 1	Mean Group 2	Percentage of Change
Harrison	6.09	5.63	-7.43%
Doddridge	6.21	4.97	-20.08%
Wetzel	10.00	8.80	-12.00%
Braxton	9.46	8.37	-11.53%
Gilmer	6.91	7.70	11.36%
Calhoun	11.04	11.93	8.06%

Harrison, Doddridge, and Braxton counties all had different points of origin beginning in 2009, but by the year 2012, they all essentially had the same poverty rate. Harrison county began with a poverty rate of 17.8 percent, which had risen to 20.2 percent by 2012 (U.S. Census Bureau, 2009-2017). Doddridge county initially reported a poverty rate of 20.1 percent, which had only slightly fluctuated to 20.6 percent by 2012, and Braxton county actually witnessed a reduction in poverty rate with the initial report in 2009 being 23.3 percent, and 20.7 in 2012 (U.S. Census Bureau, 2009-2017). The different points of departure for each of these three counties, with one being a coal producing county, demonstrates that there was no evident point of increase or reduction of poverty rate. Finally, Wetzel county began with a similar, but slightly

higher, poverty rate than Harrison county at 18.7 percent in 2009 (U.S. Census Bureau, 2009-2017). It did not have any real cohesion with any of the other counties in regard to numbers or significant increases or decreases. The poverty rate for the county fluctuated between 17 and 19 percent for most of the time period examined, and hit a new high at 20 percent in 2015 (U.S. Census Bureau, 2009-2017). It had modest increases and decreases with no real indication of something larger happening in the county. Consequently, what has been perceived as a coal dependent economy does not appear to be the case in terms of this specific variable, and it seems that other factors are responsible for influencing the poverty rate in the counties. While the variable of poverty rate does demonstrate more fluctuations in data than some of the other examined variables, it still isn't indicative of what could be causing disparities in the data. Therefore, it is recommended that the variable of poverty rate requires further study beyond the scope of this paper.

As mentioned in the above section, there was not any consistency in the counties for the variable of poverty rate, and each of the counties seemed to experience fluctuations that were independent of each other. This finding was further validated when comparing the percentage of change between group 1 and group 2, which is seen in Table 3. The percentage of change was different for each county, and some experienced negative changes while others were positive. There were 2 counties, Doddridge and Braxton, who each had less than a percentage of change between groups, but Doddridge was negative while Braxton was positive. Calhoun county had the next smallest percentage of change at negative 3 percent. Harrison and Gilmer counties both had negative percentages of change around 7 percent, but are not located near each other geographically. Finally, Wetzel county experienced the highest percentage of change at around 8 percent, which also did not coincide with its bordering counties. Therefore, it can be concluded

that the variable of poverty did not have any consistency in fluctuations of numbers, and it appears that there are individual county factors that influence the poverty rate in each county.

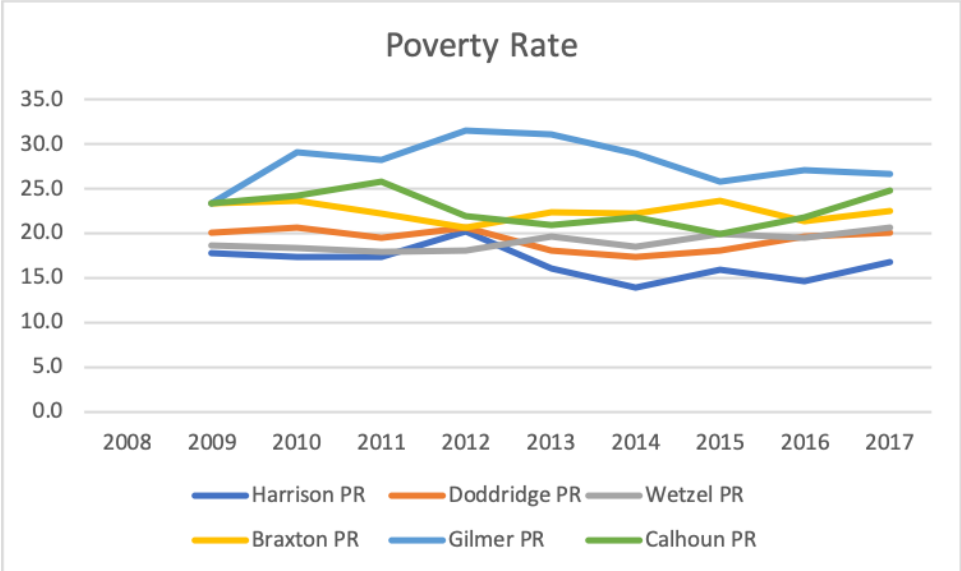


Figure 4. Poverty Rate

**Per Capita Personal Income**

Per capita personal income was an additional variable added to the study in hopes of demonstrating individual earning fluctuations in each county. By seeing rates of individual earning, it would assist in rounding out the data collection, as well as demonstrating any consistent changes happening within each county.

As can be seen in Figure 5, there only a slight variation in five of the counties from 2008-2017. Although, it is noted that this lack of variation could potentially be caused by the outlier in the data: Gilmer county, who had considerably higher reported per capita personal income numbers. In Figure 5, it can be seen that Harrison, Doddridge, Wetzel, Braxton, and Calhoun counties sit on what appears to be an almost a straight line with a barely visible increase over time. All 5 of the counties have similar per capita figures ranging from 23,000 dollars to 44,000

dollars, with Doddridge coming in slightly lower starting at around 15,000 dollars and ending at 23,000 dollars (U.S. Bureau of Economic Analysis, 2019). Gilmer county, much unlike the other five counties, has a much higher per capita income starting at around 164,000 dollars in 2008, and ending at 220,000 dollars in 2017 (U.S. Bureau of Economic Analysis, 2019). Which demonstrates a very high increase in per capita income for the county. These figures are substantially higher than the other counties, which could be accounted for by a number of different variables. For instance, if there are a high number of wealthy residents reporting their residence within the county, it could cause the per capita personal income for the county to be much higher than the surrounding counties. Additionally, by including the outlier of Gilmer in the data, it appears to be the only county that shows a steady, but substantial increase in per capita income up until 2015 at 227,715 dollars (U.S. Bureau of Economic Analysis, 2019). It because of Gilmer county's much higher per capita income, that the county as a whole could be considered unrelated to the activity of per capita personal income in the other five counties.

In terms of demonstrating what type of change was truly occurring in the other 5 counties, it was essential to remove the outlier from the data set, and then reexamine what change, if any, was occurring. As can be seen in Figure 6, with the outlier removed, the remaining 5 counties all show an increase in per capita personal income over time. This increase seems to be somewhat adverse in comparison to the unemployment rate and poverty rate for each county. This could be contributable to a number of factors, but overall appears to have fluctuations that are independent of the other variables in this particular study. The means for group 1 and group 2, and their percentages of change can be seen in Table 4 below. As expected after examining the graphed data, each county experienced a substantial percentage of increase after the implementation of the Clean Power Plan, with the exception of Calhoun county who

only saw an increase of around 3 percent. While this does bode well for the implementation of the CPP, the supplemental graphed information in Figures 5 and 6 demonstrate that all counties were gradually seeing increases in per capita personal income without regard to potential policy influences. In addition to percentages of change the national Cost of Living Adjustment is displayed in Table 5. This further shows that all 6 of the counties experienced increases in per capita personal income that were outside of what would be expected based on the national trend. In addition to this information, the recession experienced in the U.S. from the crash of the housing market could have also caused data in 2008 to be exceptionally low, and the increase in subsequent years is simply a demonstration of each county's per capita personal income returning to what had been a normal level before the recession. Regardless, it can be concluded that the implementation of the CPP in 2015 did not have a substantial impact in any of the counties in regards to their per capita personal income.

**Table 3. Poverty Rate Means Comparison**

<b>County</b>	<b>Mean Group 1</b>	<b>Mean Group 2</b>	<b>Percentage of Change</b>
Harrison	17.12	15.80	-7.69%
Doddridge	19.38	19.30	-0.43%
Wetzel	18.53	20.03	8.09%
Braxton	22.38	22.50	0.52%
Gilmer	28.70	26.50	-7.67%
Calhoun	23.02	22.20	-3.55%



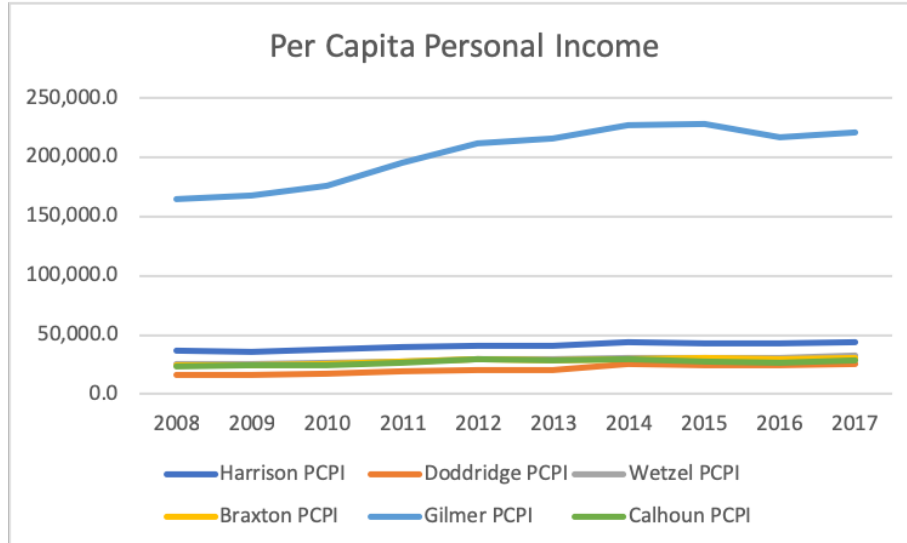


Figure 5. Per Capita Personal Income

### Coal Production

Finally, the variable of coal production for Braxton and Harrison county was an obvious and essential variable for the study. As a whole, the data presented a noticeable decline over time (2008-2017) in coal production in both counties. The data showed notable increases and decreases in production, with production falling to absolute zero for both counties by 2017. This loss of production is potentially attributable to many different factors outside of federal environmental intervention. With the falling prices of natural gas prices and renewable energy, coal production has been on its way out for some time (Lego & Deskins, 2018; Wordland, 2017). A 2010, increase in production for both counties can be seen in Figure 7. This increase was short lived however, and both counties experienced a significant decline moving into 2011. Braxton county managed to increase their production in 2012, but this increase still fell below the experienced high in production in 2010 by close to 37,000 short tons of coal (West Virginia Office of Miners' Health, Safety and Training, 2019). The production fell substantially again in 2013 to 247,246 short tons of coal, one of its lowest production numbers in recent years, but

began a resurgence in 2014 and 2015 (West Virginia Office of Miners’ Health, Safety and Training, 2019). This resurgence led Braxton county to produce 458,960 short tons of coal, higher than its 2010 production, but the county suffered a major blow in the following year when production dropped to only 38,982 short tons, and down to zero short tons in 2017 (West Virginia Office of Miners’ Health, Safety and Training, 2019). The increase in production in 2014 and 2015 coincides with the proposal and implementation of the Clean Power Plan. Which could have potentially been an attempt within the county to produce as much coal as possible before more stringent pollutant restrictions were imposed. While coal did manage to make its way back to production during some years, the years of decline are telling of a larger story of what is really happening within the county. The years of high production give hope to all parties involved: the mining company, politicians, and local citizens, but the years of harsh decline are indicative of coals growing irrelevancy to the energy market.

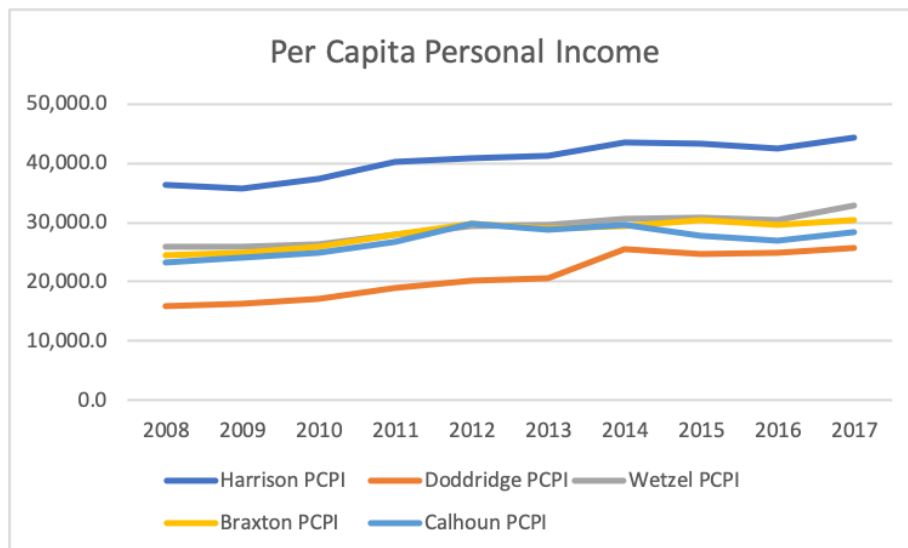


Figure 6. Per Capita Personal Income Outlier Removed

Table 4. Per Capita Personal Income Means Comparison

County	Mean Group 1	Mean Group 2	Percentage of Change
Harrison	39326.71	43394.67	10.34%
Doddridge	19227.00	25144.33	30.78%
Wetzel	27972.71	31340.33	12.04%
Braxton	27313.57	30139.33	10.35%
Gilmer	193680.86	221679.00	14.46%
Calhoun	26713.71	27692.33	3.66%

Table 5. Cost of Living Adjustment Means Comparison

Mean Group 1	Mean Group 2	Percentage of Change
2.04	0.77	-62.47%

Harrison county has a similar pattern to Braxton county, but instead of having a later year of high coal resurgence, production hit an all-time high in 2010, and then never managed to recover in the county. Production in 2010 was 598,791 short tons, but had fallen to 386,925 by the year 2012, a discrepancy of almost 200,000 short tons of coal (West Virginia Office of Miners’ Health, Safety and Training, 2019). It rose slightly to 453,132 in 2013, remained somewhat constant to that production number in 2014, but fell tremendously in 2015 to 145,287

short tons (West Virginia Office of Miners' Health, Safety and Training, 2019). From there, the county could not recover, and reported producing zero short tons of coal for both 2016 and 2017 (West Virginia Office of Miners' Health, Safety and Training, 2019). Harrison county's production pattern could be indicative of outside influence of the Clean Power Plan because of its reported numbers from 2014 to 2015. However, when compared to Braxton county, this is not the case for both counties, which both would in theory experience a similar phenomenon to indicate influence from policy implementation. Braxton county inversely experienced its biggest production year in 2015, with climbing production experienced in 2014 as well. This provides an opposite conclusion of Harrison county when just looking at the graphed data. It is obvious that the coal industry is declining as a whole, but by testing the means and percentage of change before and after implementation, it provided more information about how coal was changing in each county.

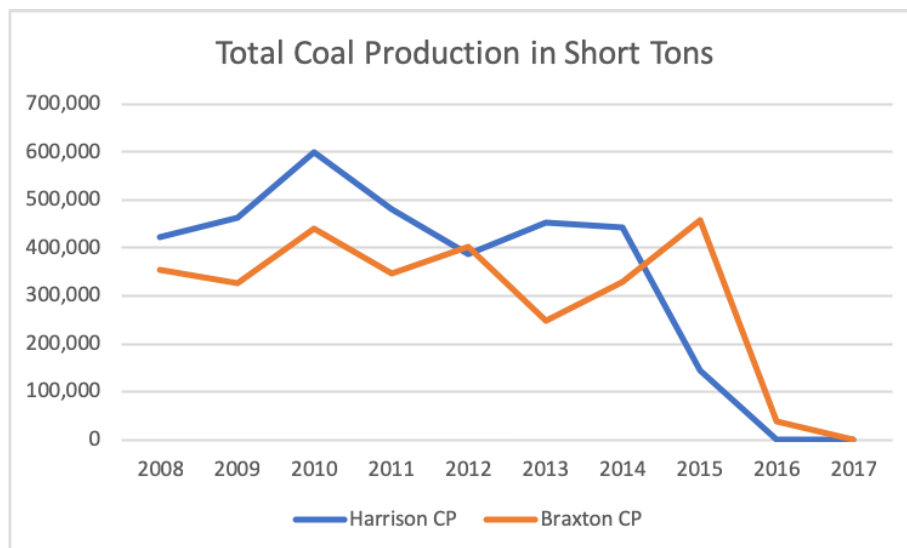


Figure 7. Coal Production

Table 6 demonstrates the percentage of change for Harrison and Braxton counties before and after implementation of the Clean Power Plan. As can be seen, both counties had an extremely high negative percentage of change in coal production between groups 1 and 2. Harrison county saw a negative change of almost 90 percent, while Braxton county was around negative 52 percent. This enforces the idea that the CPP potentially impacted the counties. However, with the already existing information about the coal industry, it seems to be much more likely that there is a general decline in the industry that is being experienced by both counties. As was mentioned earlier in the Methods section, more than half of the nation’s coal mines that were operating in 2008 have closed (Energy Information Administration, 2019). Which enforces the idea that other factors such as cheaper energy sources are influencing the overall decline of the industry, not federal environmental initiative to reduce emission levels.

**Table 6. Coal Production Means Comparison**

<b>County</b>	<b>Mean Group 1</b>	<b>Mean Group 2</b>	<b>Percentage of Change</b>
Harrison	464223.71	48429.00	-89.57%
Braxton	349412.00	165980.67	-52.50%

**Employees in Coal**

Employees working in coal was not an initial variable for the study, but it has been added to the analysis section to provide further context to the variables of coal production and unemployment rate. In comparison to coal production, there are similarities that coincide with a

reduction in force for coal companies. However, this could potentially be caused by factors other than the first round of emission controls employed by the Clean Power Plan, which were handed down by the EPA in 2015 (Environmental Protection Agency, 2017). As can be seen in Figure 8, both Harrison and Braxton county experienced increased production of coal in 2010, the number of employees in coal inversely fell for both counties (West Virginia Office of Miners' Health, Safety and Training, 2019). Which, as has been mentioned previously, could be attributed to increases in the use of mining technology (Woods & Gordon, 2011). In 2011, when the production of coal was beginning to fall for both counties, the number of employees increased for both counties, which is opposite of what would be expected for the industry (West Virginia Office of Miners' Health, Safety and Training, 2019). However, the one evident conclusion that can be taken from the comparison of coal production, and employees working in coal in each county, is that both groups have experienced a decline from 2008 to 2017. Specifically, from 2015-2017 Harrison county went from employing 87 workers in coal, to employing 1 (West Virginia Office of Miners' Health, Safety and Training, 2019). Similarly, Braxton county employed 105 workers in coal in 2015, and reported employing zero in coal in 2017. This data is very important to the conclusion, in that it demonstrates a relationship between the reduction in the coal workforce, and the production of coal. However, in 2017 when both counties reported employing 1 worker and zero workers, the unemployment rate for all counties was on the decline. Which indicates that these coal operations might not have had as big of an effect on these rural counties as could have been reported.

Table 7 further validates the conclusion above that both Harrison and Braxton counties have experienced an overall reduction in coal employees over time. When breaking down the means for group 1 and group 2, before and after implementation of the CPP for each county, it is

clearly evident that there has been a negative percentage of change for each county. Harrison county had a much higher change that came in around negative 71 percent, while Braxton county's percentage of change was almost negative 30 percent. While this overall change does coincide with the timeline of implementation for the CPP, it is most likely contributable to both the overall decline of the coal industry, as well as the implementation of mining technology that creates less jobs for individuals.

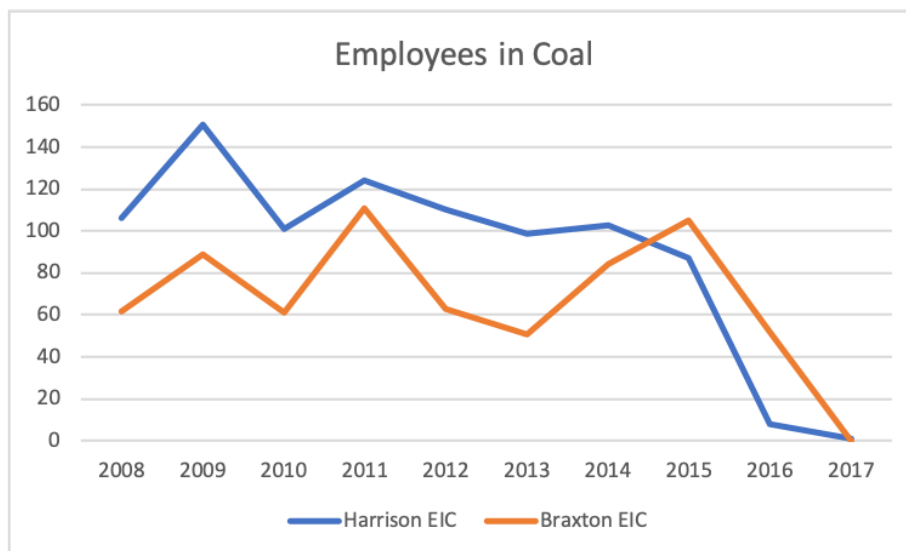


Figure 8. Employees in Coal

Table 7. Employees in Coal Means Comparison

County	Mean Group 1	Mean Group 2	Percentage of Change
Harrison	113.43	32.00	-71.79%
Braxton	74.43	52.33	-29.69%

## **DISCUSSION**

### **Summary**

In summary, the study's results were not overly indicative of the Clean Power Plan having substantial economic influence during its brief period of implementation within the chosen counties. Unemployment rate was the only variable that showed changes that could potentially be contributed to the Clean Power Plan. Its graphed results had a similar pattern, and its means comparison of percentage of change showed negative percentage consistencies among all 6 of the counties. The fluctuations in the other variables displayed the possibility that there are other influences within the counties, or larger influences from the state, that are affecting the rates of the chosen variables. Overall, this case study provides contributable knowledge to the perceived impact of the Clean Power Plan in the State of West Virginia. In 6 of its more rural counties, the coal producing counties, as well as spillover effects in the non-mining counties were analyzed, and it was concluded that there were no overt effects caused by the implementation of the federal policy. After numerous political and media claims that the Clean Power Plan had caused economic ruin within the state, the analysis of the counties in this capacity has revealed that the claimed negative implications of the policy were not as widespread, or existent. County level studies such as this one could not only greatly benefit states and their analysis of policy, but also contribute to federal knowledge of federal environmental policy implementation.

### **Data Limitations**

Limitations to the data in this study are present, and replications of this case study could present its own problems or limitations if applied to other energy producing counties or regions.



To begin, one of the data limitations is the rural nature of the selected counties, as well as their location in the mid-northern part of the state of West Virginia. The southern region of the state is home to the bigger coal operations, as well as larger populations (West Virginia Office of Miners' Health, Safety and Training, 2019). Historically, the southern region has experienced more problems as well, such as labor relations issues between miners, unions, and the coal companies (Bell, 2009; Strobo, 2012). The southern region is also home to larger-scale environmental issues in comparison to the more rural counties (Bell, 2009; Strobo, 2012). The counties for this study were selected based on their rural nature, as well as the availability of bordering counties that were non-coal producing, but this could not be the same case for other states and county locations. In addition, the study's applicability to other states still producing coal could be limited with the overall decline of the industry. However, if a broad timeline is utilized, an approach such as this one could still be used to see the rate of change over time for an area, and what that means in terms of a specific federal policy implementation. In addition to location of the counties, the amount of time selected for this study could also provide data limitations, as well as limitations to the interpretation of the potential impacts of policies. A larger time selection could have been utilized to more accurately demonstrate what changes were occurring within the counties prior to the Obama presidential administration. However, it would have potentially skewed the time frame away from the central focus of the study: the implementation of the of the Clean Power Plan.

## **Applications**

While the findings of this particular case study were not indicative of influence due to the implementation of a federal policy, this knowledge can still be applied to other scenarios, or

situations at the county level. The examination of similar variables used in this study could contribute to further knowledge when examining federal policy implementation. Additionally, an adjustment of variables could potentially be beneficial, depending on the case study and chosen location of analysis. The study could also benefit from an application to other energy markets, such as natural gas, which are predicted to have growing popularity in the coming years, especially as the coal industry continues its decline. Any further application of a case study of this nature would need to be specifically tailored to the region in which is being studied, but would be extremely beneficial when analyzing policy implementation.

## REFERENCES

- Bell, S. E. (2009) "There ain't no bond in town like there used to be:" The destruction of social capital in the West Virginia coalfields. *Sociological Forum*, 24(3), 631-657.
- Box, G. E., Jenkins, G. M., & Reinsel, G. C. (2008). *Time series analysis: Forecasting and control*. Hoboken, NJ: Wiley.
- Bureau of Labor Statistics. (2008-2017). Unemployment rates by county, not seasonally adjusted, West Virginia annual 2008-2017.
- Carbonell, T. (2015). EPA's proposed Clean Power Plan: Protecting climate and public health by reducing carbon pollution from the U.S. power sector. *Yale Law & Policy Review*, 33(2), 403-426.
- Environmental Defense Fund. (2019, March). The Clean Power Plan. Retrieved from <https://www.edf.org/clean-power-plan-resources>.
- Environmental Protection Agency. (2017, May 09) FACT SHEET: Clean Power Plan proposed federal plan and proposed model rules. Retrieved from <https://archive.epa.gov/epa/cleanpowerplan/factsheet-clean-power-plan-proposed-federal-plan.html>.
- Environmental Protection Agency. (2018, June). Complying with President Trump's executive order on energy independence. Retrieved from <https://www.epa.gov/energy-independence>.
- Frankfort-Nachmias, C., Nachmias, D., & DeWaard, J. (2015). *Research methods in the social sciences*. New York, NY: Worth Publishers, a Macmillan Education Company.
- Gillingham, K., & Stock, J. H. (2018). The cost of reducing greenhouse gas emissions. *The Journal of Economic Perspectives*, 32(4), 53-72.
- Hale, C. W., (1971). Factors inhibiting Appalachian regional development: West Virginia, a case study. *The American Journal of Economics and Sociology*, 30(2), 133-158.
- Hedge, D. M., Menzel, D. C., & Williams, G. H. (1988). Regulatory attitudes and behavior: The case of surface mining regulation. *The Western Political Quarterly*, 41(2), 323-340.
- Lego, B., & Deskins, J. (2018). Coal production in West Virginia: 2018 – 2040. *Bureau of Business and Economic Research: West Virginia College of Business and Economics*.
- Lewis-Beck, M. S., & Alford, J. R. (1980). Can government regulate safety? The coal mine example. *The American Political Science Review*, 74(3), 745-756.
- Marema, T. (2015). Plan could support Gilmer co. mine reclamation, economic development. *The Glenville Democrat*, 7.

- McIlmoil, R., & Hansen, E. (2010, January). The decline of central Appalachian coal and the need for economic diversification. 10-19.
- Paterson, L. (2016, December 07). Federal regulations drive the past and future of coal. Retrieved from <http://insideenergy.org/2015/04/18/federal-regulations-drive-the-past-and-future-of-coal/>.
- Rosner, D. (2017). Health, climate change, and the descent of science-based policy. *The Milbank Quarterly*, 95(1), 36-39.
- Schlottmann, A., & Spore, R. L. (1976). Economic impacts of surface mine reclamation. *Land Economics*, 52(3), 265-277.
- Strobo, R. A. (2012). The shape of Appalachia to come: Coal in a transitional economy. *Duke Forum for Law & Social Change*, 4(91).
- Union of Concerned Scientists: Science for a Healthy Planet and Safer World. (2018, November). The Clean Power Plan. Retrieved from <https://www.ucsusa.org/our-work/global-warming/reduce-emissions/what-is-the-clean-power-plan>.
- U.S. Bureau of Economic Analysis. (2019). Per capita personal income for Harrison, Doddridge, Wetzel, Braxton, Gilmer, and Calhoun.
- U.S. Census Bureau. (2000a). Annual estimates of the resident population: April 1, 2000 to July 1, 2009. *American Fact Finder*.
- U.S. Census Bureau. (2010a). Annual estimates of the resident population: April 1, 2010 to July 1, 2017. *American Fact Finder*.
- U.S. Census Bureau. (2009-2017). Small area income and poverty estimates (SAIPE).
- U.S. Energy Information Administration. (2018, November). "Where the United States gets its coal. Retrieved from [https://www.eia.gov/energyexplained/index.php?page=coal\\_where](https://www.eia.gov/energyexplained/index.php?page=coal_where).
- U.S. Energy Information Administration. (2019, January). More than half of the U.S coal mines operating in 2008 have since closed. Retrieved from <https://www.eia.gov/todayinenergy/detail.php?id=38172>.
- Weible, C. M., & Sabatier, P. A. (2014). Chapter 3: Punctuated equilibrium theory. *Theories of the policy process*. New York: Westview Press. 183-223.
- West Virginia Office of Miners' Health, Safety and Training. (2005). West Virginia coal mining facts. Retrieved from <http://www.wvminesafety.org/wvcoalfacts.htm>.
- West Virginia Office of Miners' Health, Safety and Training. (2019). 2008-2017 Statistical report and directory of mines.

Woods, B. R., & Gordon, J. S. (2011). Mountaintop removal and job creation: Exploring the relationship using spatial regression. *Annals of the Association of American Geographers*, 101(4), 806-815.

Wordland, J. (2017) Coal's last kick. *TIMES Magazine*, 40-43.