

**WASTED ENERGY:
RE-DIRECTING INVESTMENT INTO RENEWABLES THROUGH
ENVIRONMENTAL POLICY**

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ABSTRACT

The Clean Power Plan (CPP) was the first ever regulation to limit carbon dioxide (CO₂) emissions from both new and existing power plants under the Clean Air Act (CAA) and is recognized as one of the most monumental steps towards taking action on climate change and investing in renewable energy. The policy is, however, commonly denounced by some for its detrimental impact to the U.S. coal manufacturing and production sectors and grouped with other policies for waging a ‘War on Coal.’ This paper analyzes whether the CPP was an effective policy at swaying investor mindsets in energy capital markets and decarbonizing investor portfolios. This analysis differs from previous literature through its focus on an event study of specific brown and green energy indices and exchange traded funds (ETFs) at the time of the CPP’s proposal on June 2, 2014 and final announcement on August 3, 2015. The presence or lack of discontinuities in the market in the 100-day trading window surrounding both events serves as a measure for understanding investors’ reactions to the policy and its implications for future profits. This paper also describes the legal and political pushback to the policy as well as instances of disinformation spread by the coal industry to compensate for a bleak cashflow outlook. Discussion on the implications of using policy as a government intervention to create greener and cleaner markets concludes this paper, arguing that environmental policy can serve as an effective tool to decrease investment in carbon-intensive energy sources, as climate change poses an increasing risk to the planet and public health.

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Introduction

The coal industry has experienced rampant decline in the last decade as mounting scientific evidence shows that greenhouse gases are inducing climate change, competition grows from cheap natural gas, Americans become increasingly environmentally conscious, businesses embrace Corporate Social Responsibility, and regulation stimulates the growth of renewable energy (“RE”). Countries around the world have adopted environmental policies to regulate polluting industries and promote the adoption of green technologies to reduce the impacts of climate change. The U.S has followed this trend by setting renewable energy targets and subsidizing solar and wind energy costs. President Barack Obama and the Environmental Protection Agency’s Clean Power Plan (CPP) remains, to this date, the most comprehensive U.S. government climate action taken to reduce carbon-polluting power plants and support the trend towards cleaner energy. This is because the CPP brought about the first-ever national standard for states to monitor both new and existing power plants’ carbon dioxide (CO₂) emissions, in addition to accelerating the growth of energy efficient technologies through rewarding early adopters and providing credits to low-income communities (EPA, 2016).

Previous research has examined the effects of environmental catastrophes and information on polluting and non-polluting firms’ individual stock performance (Hamilton, 1993; Konar & Cohen, 1995; White, 1969; Ferstl, 2012; Griffin, 2015). Within the literature focused on both U.S. and non-U.S. environmental regulation, disagreement exists about whether carbon-intensive firms experience negative returns (Kahn, 2003; Bushnell, 2011; Manchiraju, 2015; Ramiah et al., 2015). Existing event studies concerning the Obama-era environmental policies attribute the lack of significant abnormal returns for specific coal sector firms to President Barack Obama’s incumbency and publicly assumed anti-coal stance (Coglianese & Walters, 2019; Datsenko, 2019). However, little is known about how much the proposal versus

the finalized legislation due to changes in the policy's building blocks altered investor decision-making. And even less is known about the regulation's relative effect on comparable coal and renewable market indices.

This thesis determines whether the CPP in its initial or finalized form caused significant changes to investor behavior. Using an event study setup, I evaluate investors' responses to the perceived effects of the CPP using energy-specific stock market indices, measuring potential abnormal returns in the 100-day trading window surrounding the release of the CPP proposal and final legislation. Though information regarding impending policies may be leaked ahead of time and stakeholders from the coal industry viewing the policy negatively may engage in tactics to undermine it, how the market responds to the policy's announcement given the information available serves at the forefront of my inquiry. My findings contribute to the scholarship related to environmental policies as event studies by clarifying how and if certain policy agendas can explain shareholders' altered outlooks.

Research Question

Was the Clean Power Plan an effective environmental policy at changing U.S. energy investors' investment behavior?

Theoretical Framework

The idea that environmental regulation may be linked with public stock performance has attracted considerable academic research due to the fact that regulatory changes have implications across various economic sectors. Performance has typically been quantified through abnormal returns analysis using prices from stock market indices. Abnormal returns measure the

difference between the actual return of a security and expected return. The event study design assumes that security prices will reflect all available information and uses those prices to measure the extent to which under efficient market conditions, the market reacts to a specific event. Publicly traded stock prices reflect the expected value of future cash flows, thus should regulation create uncertain liabilities on earnings, prices may decline (Schwert, 1981, p.123). If regulation has an effect on security prices, the price should change the moment when shareholders acquire the information and can react accordingly. It is important to consider if the information actually created a shock or if it was already incorporated into prices by investors. Even though regulation takes time to be enforced and affect a company's bottom line, investors anticipate the impact on future earnings potential and proactively redirect their capital.

Some event studies have selected environmental hazards such as oil spills or the Japanese 2011 earthquake and nuclear disaster to study the impact on publicly traded coal stocks (White, 1969; Ferstl, 2012). Firms with stronger, more established environmental management practices appear to have higher stock returns than those with poor protocol in place (White). The cumulative abnormal returns in Exxon's stock following the Valdez oil spill reflects shareholders' concerns for future liabilities, oil prices, and impending safety regulations (White, p.12). Green firms' positive performance following the oil spill suggests the slightest transformation in investors' priorities towards environmental concerns (White). Following the danger at Japan's Fukushima-Daiichi, France, Germany, and Japan saw negative abnormal returns in their respective nuclear utility sectors but the U.S. did not (Ferstl, p.30). The three countries' RE public markets saw the inverse effect, suggesting expectations towards a change in RE policy everywhere but the U.S. (p.33). Both studies illustrate the impact environmental hazards or general fear on loss of profits can have on shareholder preferences.

Other researchers have examined the impact of scientific news and data releases on individual stock prices. Cautionary climate change news about the risks of “unburnable carbon” from existing oil, gas, and coal reserves caused firms that disclose their reserves on their balance sheet to fall more than non-disclosing firms (Griffin, 2015: p.2). Similarly, the EPA’s Toxic Release Information (TRI) data release generally caused polluting firms significantly negative abnormal stock returns with more significant losses for firms that the market did not anticipate being “big polluters” (Hamilton, 1993; Konar & Cohen, 1995: p.110). The negative abnormal returns are indicative of the new compliance cost, clean-up, and other liabilities that shareholders anticipate (Hamilton). The fact that scientific data creates an incentive structure in the market for both the shareholder and the firm confirms that direct regulation is not always necessary (Konar & Cohen). In this case, firms were incentivized by the news to comply and become “better environmental actors,” rather than solely pursuing financial profits (Konar & Cohen, p.111). These studies emphasize the importance of developing community “right-to-know” laws under the 1986 Emergency Planning and Community-Right-To Know Act in order to hold firms accountable and mitigate environmental externalities.

Measuring the impact of regulatory events in the context of an event study can be more challenging due to the bureaucratic legislative process involving various announcements and public debate. Nonetheless, many studies have analyzed the effects of regulation on the political and economic landscapes in the European Union, China, India, Australia and the U.S. The EU’s Emission Trading System for CO₂ is a cap-and-trade program that regulates electricity and carbon-intensive industries (Bushnell, 2011). Abnormal returns were correlated with a firm’s number of emission permits – when allowance prices fell, higher polluting firms in the energy

sector outperformed other industries (Bushnell, p.18) The opposite was true for when allowance prices increased.

Under the Clean Air Act Amendment (CAAA), President George H.W. Bush created acid rain sanctions that required electricity generating firms owning “phase I power plants to lower polluting emissions within five years” (Kahn, 2003, p.3). While both electricity and coal mining companies expected losses from the CAAA, electricity firms owning power plants showed increased returns and coal mining companies decreased (Kahn). These results suggest that investors expect new costs associated with regulating power plants to increase for companies without price controls (Kahn). The Chinese coal industry appeared to have a negative abnormal return to China’s National Environment and Health Action Plan (Ramiah et al., 2015). The Chinese 12th Five-Year-Plan adopted in 2011 aimed to increase non-fossil energy as a percentage of total energy use and appeared to have positive abnormal returns for coal companies. This unexpected result illustrates the importance of the coal industry, making it somewhat immune to environmental regulation (Ramiah et al., 2015).

Similar to the effect of the TRI release, India’s mandatory Corporate Social Responsibility (CSR) activities in the Companies Act caused declines in stock prices for firms forced to spend on CSR (Manchiraju, 2015). CSR imposes sufficient restrictions on business activities that shareholders anticipate and react to accordingly (Manchiraju). Some research has focused on the effects of green policies on various sectors – in contrast to solely carbon-intensive industries (Ramiah et al., 2013). 19 of Australia’s green policies only produced an observable abnormal stock return for some of the largest polluting industries when regulation was coupled with pricing regulation that prohibited passing costs to customers (Ramiah et al, 2013).

Within the literature, disagreement remains about whether environmental regulation can lead to long-term loss in coal firms' value and shift investment towards RE. Fewer event studies have examined the more recent instances of power sector regulation, including the Obama administration's CPP. The 'war on coal' narrative suggests that the Obama era's Cross-State Air Act Pollution Rule (CSAPR), Mercury and Air Toxics Standards (MATS), and the CPP have been detrimental to the coal industry (Coglianese & Walters, 2019). However, the lack of abnormal stock market returns for the three environmental regulations can be explained by ongoing competitive lower natural gas pricing that drove down coal demand "such that any additional (regulatory) wound did not make much if any difference to investors" (Coglianese & Walters, p.45). Since Coglianese & Walters (2019) find negative abnormal returns at the final announcement under an event study but not under a difference-in-difference estimation for nine publicly traded coal firms, the results suggest that there is stronger evidence that Alpha Natural Resource's bankruptcy on the same day of the final announcement influenced the market. Since the Company's share price underwent large declines, it is likely that the Company drove the abnormal returns at the final announcement. In this way, environmental regulation may not always create abnormal price changes in the market, but industries may inaccurately scapegoat certain regulation for causing ongoing sectoral declines. Since elections are strong indicators of changes in government policy, they see considerable impact on stock prices (Datsenko, 2019). The 2012 US presidential election signaled positive returns for RE stocks but negative returns for fossil fuel companies (Datsenko). In contrast, the 2016 U.S. presidential elections signaled changes in priorities from RE to fossil fuels, leading to positive returns for fossil fuels and negative on RE firms (Datsenko). The change in an incumbent president and the number of policies that come with him or her caused market participants to anticipate a shift in

environmental policies, leading them to be more favorable towards one type of power generation over another.

While news and events can elicit concerns for investors and cause them to realign their investment theses, it remains unclear, in the context of U.S. energy policy, whether individual and institutional investors respond to and understand specific regulatory changes. Within the existing literature, it remains unanswered whether the CPP stimulates a shift in investment behavior within respective brown and green indices, rather than firms.

Hypotheses and Observable Implications

The data collected on stock market indices inform the following hypotheses:

- Hypothesis #1: Following the proposal of the CPP, green indices had positive abnormal returns, while brown and coal related mining sector indices experienced negative abnormal returns.
- Hypothesis #2: Due to more lenient heat rate improvements under Building Block #1 in the final CPP, brown indices experienced positive abnormal returns.
- Hypothesis #3: Due to the two-fold increase for projected annual increases in RE generation under the final CPP's Building Block #3, I hypothesize that green indices experience positive abnormal returns.

If Hypothesis #1 is true, there is reason to believe that investors were aware and concerned about the impending energy legislation and reacted by directing investments towards RE.

Although this portfolio re-allocation may not reflect a genuine concern for climate change, the capital outflows from coal may represent an effective decarbonization tool. Due to differences in the four building blocks of the CPP in the proposal versus the final plan, there are reasons to expect the opposite returns after announcing the final proposal. Under Building Block #1 in the proposal the EPA required a heat rate improvement of 6% to coal fired EGUs and the final rule required only a 2.1-4.3% improvement. If Hypothesis #2 is true, I expect to observe that

investors closely adhere to energy policy and favor more lenient regulation of coal power plants for coal investments. In order to observe a positive abnormal return at this isolated event, investors would have to be knowledgeable about added leniency in the legislation. However, Hypothesis #2 may be proven false by the ‘war on coal’ narrative that influenced shareholders more than the actual outlined rules of the finalized legislation (Coglianese & Walters, 2019). If Hypothesis #3 is true, investors are similarly knowledgeable about how increasing annual RE targets will affect the RE market demand and their return on investments. Should Hypothesis #1 and #3 prove true, it’s reasonable to conjecture that the CPP – a broader environmental policy – can promote RE through increased capital inflows as a result of redesigned investment theses.

Methodology

2.1 Research Design

Should investors be incentivized to decarbonize their investment portfolio as a result of the CPP, they are likely to direct their attention and capital towards green concentrated stocks and indices. I evaluate this by measuring the potential abnormal returns in energy focused stock market indices before and after the EPA’s proposal and final CPP. A regression discontinuity design (RDD) is a suitable way to identify evidence of a treatment effect, like the passage of a policy, at a certain cutoff time-period. RDD exploits the fact that treatment can have unpredictable components, affecting some and not others in a group. The research design recognizes discontinuities between those affected and unaffected and can estimate the measure of such treatment. Using RDD, I measure the effect of the EPA’s regulation on general energy sector, green, and brown indices by estimating the change in total returns produced on the dates that the legislation was proposed and finalized. RDD answers the question of whether

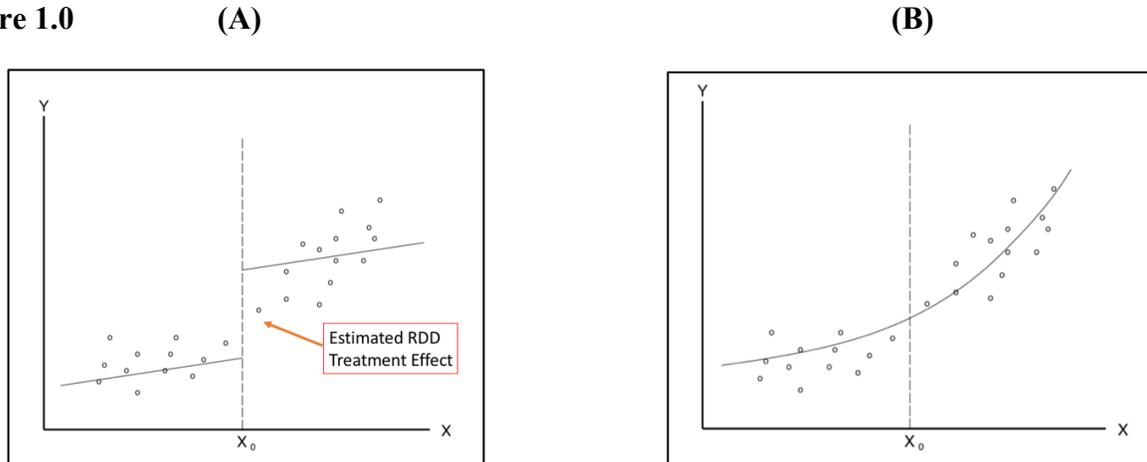
environmental policy can incentivize investors to decarbonize by measuring the intervention of the CPP through a pretest-posttest design. A potential discontinuity indicates an unnatural jump or drop in the market regression at the cutoff value.

Several assumptions are made under the research design. Firstly, at the cutoff time-period (X_0), nothing besides the treatment status changes. In this way, all existing trends in the energy market remain constant across the RDD. Therefore, I do not consider the effects of RE technological development or declining natural gas prices, because these variables are continuous at the cutoff. The regressor of interest (D_i) is not correlated with any unobservables. I assume that the function before and after the cutoff value are continuous at X_0 . Such that:

$$E[y_{i0}[X_i]] = E[y_{i1}[X_i]]$$

RDD considers a very narrow window in order to isolate the effects of the policy on the day of the event. In the case of a stock market index's total returns, there is only one observation every trading day before and after the cutoff value. It is important to include observations from a range of values around X_i to determine the curvature of a flexible function. This range of values must be close to the cutoff value because within a wider time interval, confounding variables may be introduced. The flexible function can be different on both sides of the cutoff value. Allowing for flexibility in the equation leading up to the cutoff value and after the cutoff value is necessary in order to avoid mistaking nonlinearity for discontinuity. For instance, Figure 1.0A. shows how fitting two straight lines would create the following estimated treatment effect, however figure 1.0B. shows how the sharp or steep turn may be mistaken as a jump from one regression to another.

Figure 1.0



For this reason, I use a time series variation in indices pricing, where time is the independent variable and the ‘total returns index’ is the dependent variable. The two conditional expectation functions (CEFs) are used to predict the fitted value at the cutoff. RDD creates a projection at the cutoff value in order to evaluate the expected performance had there been no shock event of information to the market. The two nonlinear functions will use t or time, as the unit of observation, where h is some positive value that determines the size of the time window (e.g., $h = 50$ trading days). Meaning that $X_0 - h \leq X_i \leq X_0 + h$. The following fitted regression includes the flexible functional form of the equation $f(X_i)$, the regressor D_i , a deterministic function of X , p , the causal effect of interest, and n_i the residual error term:

$$Y_i = f(X_i) + pD_i + \eta_i \quad \begin{cases} D_i = 1 \text{ if } X_i \geq X_0 \\ D_i = 0 \text{ if } X_i < X_0 \end{cases}$$

The dummy variable, D , explains whether the treatment of the CPP regulation is on (i.e., $D_i = 1$ when $X_i \geq X_0$) and when the treatment is off (i.e., $D_i = 0$ when $X_i < X_0$). Since there is no other variation in D , it cannot be correlated with any other factor. The next step, is to model the equations as a function of $\tilde{X}_i = X_i - X_0$, which measures the distance to the threshold, in order to ensure that $\frac{dY_i}{dD_i} = \rho$ at X_0 . Modeling $f(X_i)$ as a K^{th} -order polynomial regression would look like the following:

$$Y_i = \alpha + \beta_1 \tilde{X}_i + \beta_2 \tilde{X}_i^2 + \dots + \beta_K \tilde{X}_i^K + \rho D_i + \gamma_1 D_i \tilde{X}_i + \gamma_2 D_i \tilde{X}_i^2 + \dots + \gamma_K D_i \tilde{X}_i^K + \eta_i$$

Interacting the dummy variable with $f(x)$ in Stata provides me with p-values for all the coefficients in the equation. The coefficient, p , represents the treatment effect's impact at the cutoff point and can be measured in standard deviations.

Using green and brown stock market indices, RDD can measure the abnormal changes in prices to determine whether shareholders reacted to the CPP. For each type of market index, CEFs will be modeled around June 2, 2014 when the CPP was proposed by the EPA and August 3, 2015, when it was finalized over a year later.

2.2 Data Collection

Data for the selected stock market indices can be found in the Factset.net database, Bloomberg Database, and the S&P Dow Jones Indices website. The search function permits downloading historical price and total returns data for selected indices. Total Returns Index (TRI) measures the performance of securities in a given index based on both price appreciation and dividends/distributions. Each of the selected indices tracks a range of energy-related equities including coal, oil and gas, and renewables. The data collected consist of daily total return indices across the energy sector from February 24, 2011 to February 24, 2020 for the following: NASDAQ Clean Edge Green Energy Index (CEXX), NASDAQ Green OMX Solar Index (GRNSOLARX), NASDAQ OMX Renewable Energy Generation Index (GRNREGX), NASDAQ OMX Clean Energy Focused U.S. Index (GRNFOCUSX), First Trust NASDAQ Clean Edge Energy Index Fund (QCLN), iShares Global Clean Energy ETF (ICLN), S&P 500 Energy (SPN), VanEck Vectors Low Carbon Energy ETF (SMOG), VanEck Vector Coal ETF

(KOL), S&P Global Clean Energy Index (SPGTCED), S&P Energy Select Sector (IXE), S&P 500 Coal and Consumable Fuels (CNX), DOW Jones Coal Index (DJUSCL).

Market indices track the performance of a specific group of equities that represent a sector or market in the economy. Index funds and exchange-traded-funds (ETFs) hold various components or equities of a similar nature. Overall, indices provide useful information not only about investors' feelings towards news in the market but the actual trades that take place. They are better for historical perspectives rather than for forecasting, as they show changes in investment patterns and trends in market activity. However, one limitation of using stock indices is that indices' components may change from year to year, adding or removing a company, therefore making it difficult to compare an index across time. In the context of my research, the 100-day event study window makes this limitation less significant.

Composite	Index	Description
Green	CEXX	A market-cap-weighted index tracking the performance of North American manufacturers, developers, distributors, and installers of clean energy technologies.
	ICLN	The fund tracks the S&P Global Clean Energy Index with at least 90% of its assets and the remaining ten are invested in "substantially identical securities." The index is designed to track approximately 30 clean energy related companies.
	QCLN	A market-cap-weighted index of US-listed firms involved in the clean energy industry. Includes manufacturers, developers, distributors, or installers of advanced materials, energy intelligence, energy storage, or renewable generation.
	GRNFOCUSX	A US focused index including companies that are part of the NASDAQ OMX Clean Energy Focused Index but are domiciled in the U.S. Companies included belong to sectors advancing energy generation via non-fossil based sources.
	GRNREGX	A primary sector index of the Global Green Economy index to track companies that produce energy through renewables such as solar, wind, geothermal, wave, and fuel cells.
	GRNSOLARX	A sub sector index of the Global Green Economy Index to track companies that produce energy through solar power.
	SMOG	A market-cap-weighted index of low carbon energy companies deriving 50% of revenue from alternative energy, including solar, wind, biofuel, geothermal, and companies focused on energy efficiency.
	SPGTCED	A global thematic index providing exposure to 30 companies involved in clean energy businesses from production, equipment, and technology.
General	SPN	An index that tracks companies in the S&P 500 that are classified as member of the GICS energy sector.
	IXE	An index that tracks specific companies within the energy sector of the S&P 500 Index including oil, gas, consumable fuels, and energy equipment and services.
Brown	CNX	An index that tracks companies in the S&P 500 that are classified as members of the GICS coal and consumable fuels sector.
	DJUSCL	A sub-index of the Dow Jones U.S. indices that tracks all coal subsector (1771) under the sector classification standard.
	KOL	A market-cap-weighted index of global coal operations, transportation, mining, equipment, storage, and trade. Firms included are required to have 50% of revenue from operations in coal sectors.

Table 1.0 shows the various sub-indices incorporated according to their general category and description. While many of the selected indices track companies only in the U.S., the SPGTCED, GRNSOLARX, GRNREGX, KOL, SMOG, and the ICLN indices are global funds with specific exposure to the U.S. All of the sub-indices are transformed into general composite indices using Principal Component Analysis (PCA) for the purpose of reducing the dimension of my data and simplifying the comparison between the green, brown, and general energy sector.

PCA reduces the dimension of my dataset and standardizes all the variables, so that the mean is centered at 0 with a standard deviation of 1.0. Creating a composite green, brown and general energy index makes it easier to identify relationships and patterns across the different indices. PCA measures the central tendency of the indexed stocks' daily prices across the 100 trading days surrounding the proposal and final CPP announcement.

In order to select the best fit for the flexible function in the regression discontinuity design, I calculate the Bayesian Information Criterion (BIC) for a linear and quadratic fit for each composite index. The Empirical Results section discusses the implications of BIC and the model selection process for each composite index. In addition to reporting the effect size measured in standard deviations, I estimate the daily price change for the sub-indices as a secondary measurement to report in my results. I do this by applying RDD to the sub-indices according to the model selected by the BIC of each respective composite index.

2.3 Data Analysis

The data answers the question of whether investors are incentivized to decarbonize after environmental regulation such as the CPP by evaluating changes in energy sector market indices. Assuming that security prices reflect investors' attitudes, and indices measure a particular set of

securities, the data provided helps to prove whether the CPP in its initial or final form stimulated investment in RE and disincentivized coal investments. To set up the regression, I began with selecting the appropriate neighborhood around the cutoff value, as discussed above using the variable h . I used a ~100 trading day window, when traditional stock exchanges are open, around both cutoff dates. The two windows include 3/19/14 to 8/13/14 and 5/22/15 to 10/12/15. In order for an event study to be successful, it is important to select the exact moment when news of the legislation was released to shareholders in the market. While the market somewhat anticipated the EPA's announcement given the news analysis outlined in Section 4.1 – 4.6, investors were not aware of the specific terms of the regulation prior to the published record. In order to remove the effects of information leakage ahead of the proposal, I removed the observations from the 10 days ahead of June 2, 2014. This allows the RDD analysis to project the value at the cutoff based on the market's prior trends without the price movements in the days leading up to the proposal.

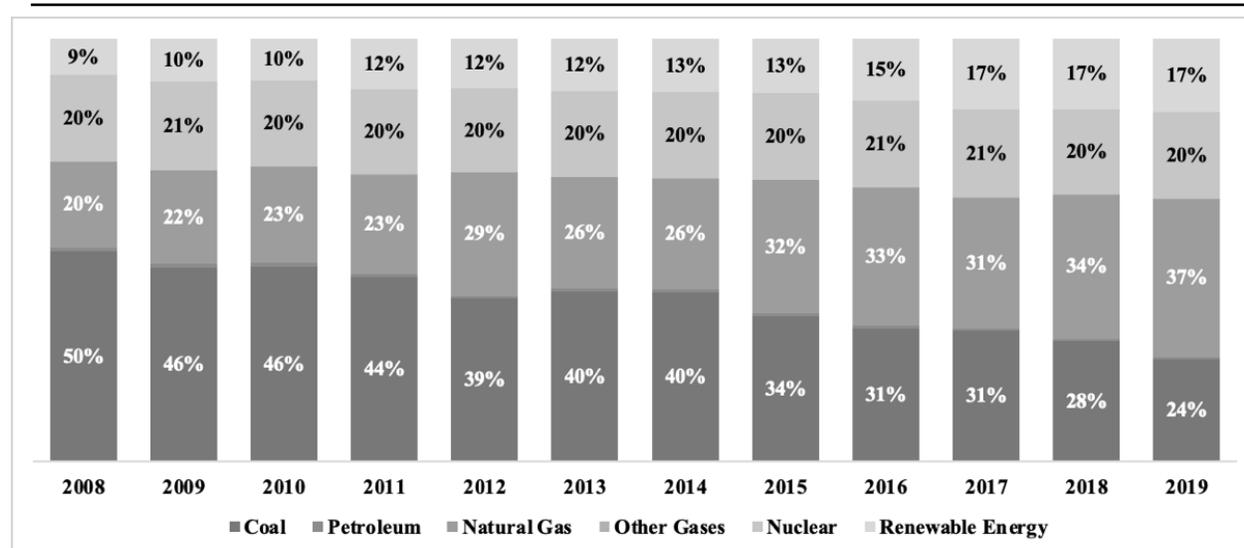
The Case for the Clean Power Plan

3.1 U.S. Energy Outlook

Examining the U.S. electric power sector is crucial to understanding the CPP's attempts to remodel the nation's generation sources towards a cleaner energy future. In 2011, the nation's largest electric power companies contributed 88% of the power industry's total carbon pollution, releasing 2.1 billion tons of carbon pollution into the atmosphere (NRDC, 2014). The nation's electricity generation's capacity directly impacts atmospheric CO₂ concentration since the increased use of coal as a generation source leads to higher CO₂ emissions. The National Oceanic and Atmospheric Administration (NOAA) has tracked CO₂ pollution through the concentration of CO₂, expressed as a mole fraction in the air, since March 1958. According to

data from the Mauna Loa Observatory in Hawaii, from 2000 to 2019, the annual mean concentration of carbon dioxide in the atmosphere has increased by 2.2 parts per million (ppm) per year (Dlugokencky et al., 2020). To slow down the increase in atmospheric CO₂, which ultimately contributes to global warming, the CPP aims to shift generation from carbon-intensive fossil fuels to renewable sources. In 2019, the total net electricity generation fell by 1.5%, and the power sector CO₂ emissions decreased by 8.2%, primarily due to the increasing use of RE (EIA, 2020). There is clear evidence to suggest that the CPP's mission to reduce emissions from existing power plants could influence future concentrations of CO₂ in the atmosphere and the associated severity of climate change.

Figure 1.0 – Net Generation across Electric Power Sector (million kilowatt-hours)



(EIA, 2020)

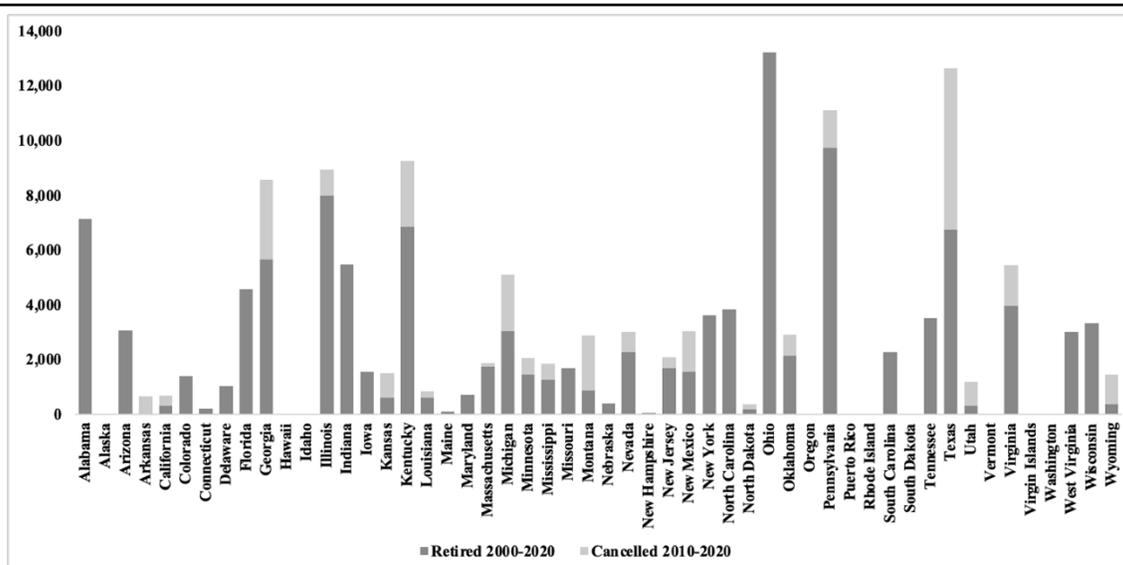
Figure 1.0 illustrates the electric power sector's net electricity generation across different sources from 2008 to 2019. Net electricity generation is the amount of electricity a generator produces for consumer use minus the electricity utilized to operate a power plant. While in 2008, coal represented 50% of total net generation, the growth of the natural gas and renewable energy sectors have contributed to the drop off in coal as a leading energy source. Accordingly, over this

period, the annual total CO₂ emissions from coal energy consumption have declined by 49.7%. With the introduction and spread of alternative forms of energy, the carbon dioxide emissions associated with coal consumption can continue to decline. The CPP's attempt to redistribute energy generation from coal to RE should follow this trend of proportionately reducing the emissions produced from coal consumption.

3.2 Coal

With various technological innovations and growing climate concerns, the U.S. composition of electricity-generating sources has changed dramatically from 2008 to 2019, specifically concerning coal as a percentage of total generation. Electric utilities and independent power producers have consumed the most coal measured in thousands of tons. While coal consumption across all sectors has decreased by 35% from 2012 to 2019, electric utilities' consumption decreased by 45% over this period (EIA, 2020). The CPP intended to further decrease electric utilities' coal consumption by introducing emission standards for existing power plants. The CPP contributed to the broader declining trend for coal, which led to hundreds of coal plant retirements, going from 598 in 2008 to 336 in 2018 and 263 in 2020.

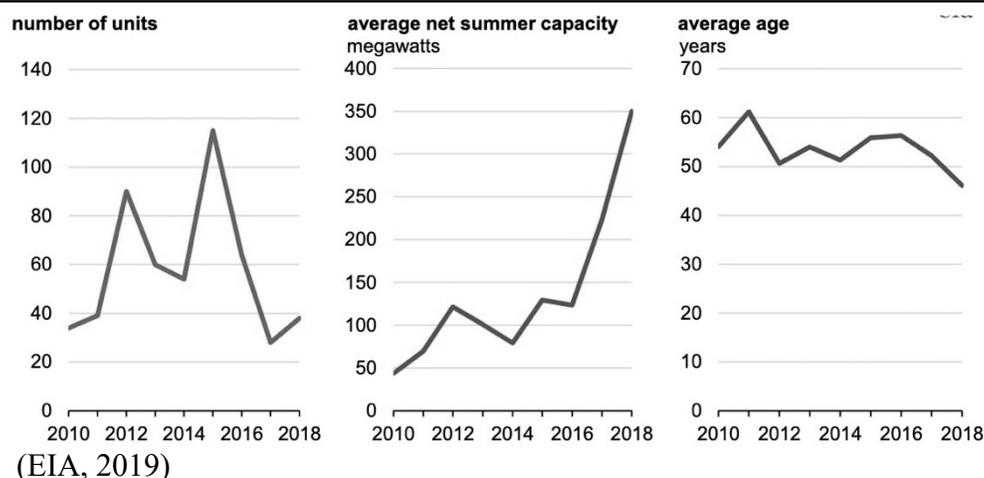
Figure 2.0 – Canceled and Retired Coal-Fired Capacity in U.S. (Megawatts)



(Global Energy Monitor, 2020)

Between 2010 and 2020, the U.S. power sector has retired over 120,000 MW of capacity at 248 power stations and over 646 individual coal-fired units, increasing economic pressures for coal plant owners. (Global Energy Monitor, 2020). According to Figure 2.0, Texas, Pennsylvania, Illinois, West Virginia, Ohio, and North Carolina have the highest total coal operating capacity of all U.S. states (Global Energy Monitor). The Eastern region of the U.S. has had the largest share of capacity retirements due to their larger share of generating capacity than the Western and Texas regions, causing them to be disproportionately affected. Despite Pennsylvania retiring the second-largest amount of coal capacity during the ten-year period, the State still holds the highest number of operating power stations at 17 with 24 units.

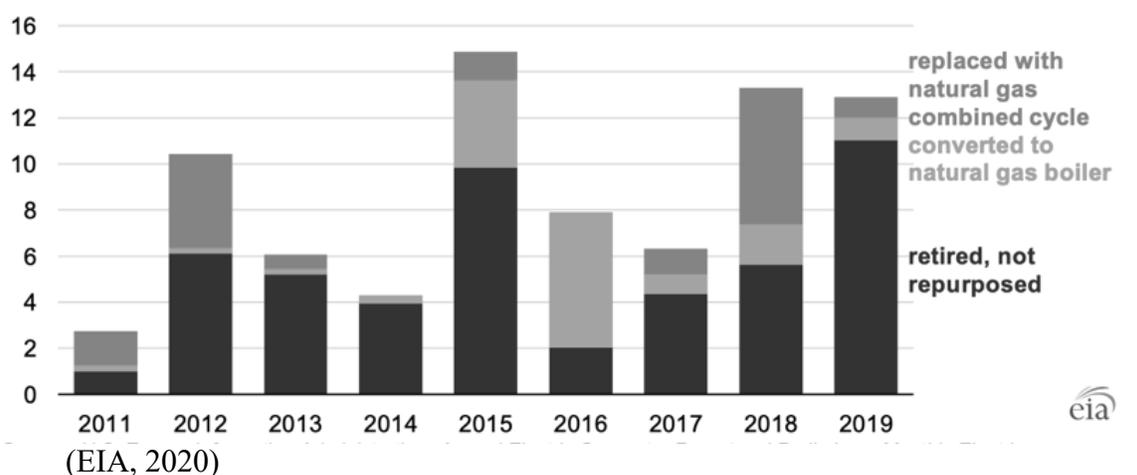
Figure 3.0 – Characteristics of Retired Coal-Fired Units (2010 – 2018)



While historically across the U.S., lower capacity and older units were retired first, even the highest capacity units face retirement today, demonstrating the surmounting pressure on the coal industry. According to Figure 3.0, the U.S. coal-fired units retired in 2018 had an average capacity of 350 MW and an average age of 46 years, while units retired in 2015 had an average capacity of 129 MW and an average age of 56 years. This retirement trend will only continue, as carbon-heavy utilities begin to invest in cheaper renewable alternatives. Though 2015 had the

largest peak in retirements, the U.S. power sector has retired nearly 62,000 MW of capacity since 2014, and another 70,000 MW are deemed to be "economically at risk" due to a secondary wave of renewable energy and rising environmental concerns (Kuykendall et al., 2020).

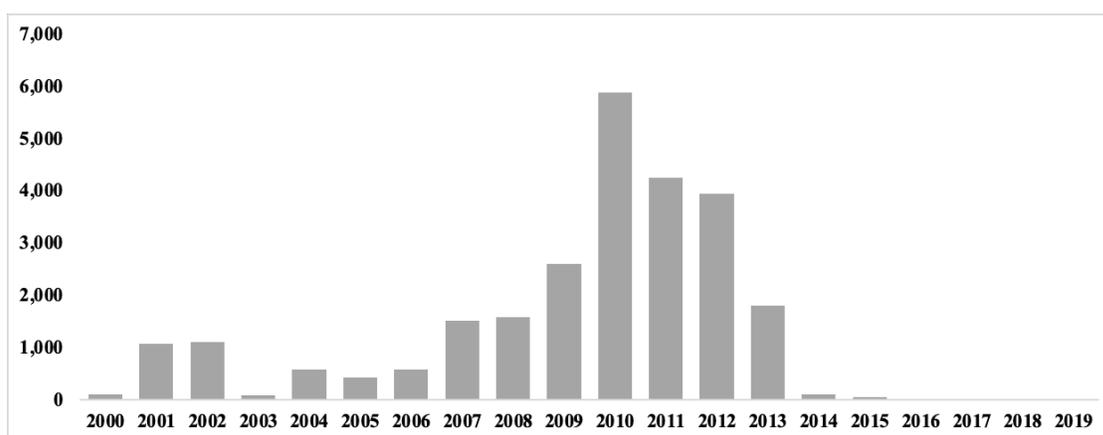
Figure 4.0 – U.S. Coal-fired Capacity Retired or Repurposed to Natural Gas (gigawatts)



Capacity factors reflect a power plant's electricity output as a percentage of generating capacity. As a result of the mass retirement of coal-fired units and falling natural gas prices, capacity factors have fallen from 75% in 2008 to 54% in 2017, illustrating the steep decline in demand (EIA). To avoid further losses against natural gas, many owners redevelop coal fired units into combined natural gas turbine plants, requiring less space and relying on the same already existing electric infrastructure. Figure 4.0 describes the total amount of retired or repurposed capacity from 2011 to 2019.

In 2015, coal made up 80% of total retired electricity capacity, and 30% of this lost capacity took place in April 2015, directly after the EPA's Mercury and Air Toxics Standards Act (MATS) went into effect under the Obama administration (EIA, 2016). While the exact percentage of retired capacity related to the CPP is unknown, it is reasonable to assume that the CPP impacted the number of plant closures and retrofits from 2015 to 2019, even if the rule was eventually stayed by the Supreme Court and later repealed by President Donald Trump.

Figure 5.0 – New Coal Plants in U.S. by Year (megawatts)



(Global Energy Monitor, 2020).

According to Figure 5.0, the U.S. continued to increase coal capacity from new plants since 2000. After reaching a peak in 2010, the amount of added capacity has fallen, and no new power plant construction has taken place since 2014. These trends highlight the strength of various Obama-era environmental policies regulating existing and new coal plants beginning in 2013. It also emphasizes the strong economic profile of other resources like natural gas and renewable energy over coal.

3.3 Natural Gas

Natural gas consumption has increased considerably by 190% from 2001 to 2019, while it has grown more steadily as a proportion of total generation from 20% in 2008 to 37% in 2019 (EIA, 2020). Since natural gas emits about half as much CO₂ as traditional coal-fired plants, the Obama administration advocated that natural gas represented a viable solution to curtail coal CO₂ emissions. Non-conventional production presented a cost-effective way to drill for gas trapped in shale rock. 2013 to 2015 experienced the most significant increase in the number of natural gas power plants constructed. Simultaneously, as non-conventional production has increased domestic supplies of natural gas, prices have decreased from \$7-9 highs in 2008 to \$2.5 per million btu in 2019 (EIA).

The favorable market trends for natural gas have contributed to its increasing use by the electric power sector to substitute coal capacity. More specifically, Figure 4.0 displays the amount of coal capacity repurposed as natural gas boilers or natural gas combined cycle plants ("NGCC"). Shifting from coal-fired electricity generating units (EGUs) to NGCC units is the primary re-dispatch method for EGU owners due to stricter emission standards, lower prices, and greater efficiency from gas turbine technology. Though recent research contests some of the EIA's projections at the time of the proposal, the EIA estimated that net methane emissions from natural gas are likely to be smaller than the CO₂ reduction impact from shifting from coal-fired steam EGUs to NGCC units (CPP, 2014).

3.4 Renewable Energy

Renewable energy continues to play a significant role in transforming the U.S. into a zero-emission energy economy and reducing the nation's reliance on fossil fuels. Solar and wind energy have more limited effects on the atmosphere, making them sound alternatives to replace coal-fired capacity. Despite the many environmental benefits, some types of RE are limited by their reliability due to unpredictable weather conditions. Regardless, RE, including biofuels and conventional hydroelectric, has almost doubled as a generation source from 9% in 2008 to 17% in 2019 (EIA, 2020). Solar has grown from 0% in 2008 to 9% in 2018, and wind has increased from 15% to 39% as a share of RE over the same period (EIA). While conventional hydroelectric produced 67% of RE generation in 2008, solar and wind's increasing spread and technological improvements have led hydroelectric to drop off to 41% of total RE capacity in 2018.

The improving performance of wind and solar, coupled with various federal and state Investment Tax Credits (ITCs) and Renewable Portfolio Standards (RPS), has led the cost of RE to become increasingly more competitive with other generation sources. Simultaneously, demand

side energy measures have improved the reliability of wind and solar through demand response management, responsive loads, and energy storage systems (ESS). Such smart grid technologies aim to increase use of intermittent sources by better detecting grid conditions, shifting load into peak solar hours, and storing excess generation in batteries. In 2019, over 56% of total U.S. RE generation was used by the electric power sector, demonstrating a massive shift in generation mixes (EIA). RE is the fastest-growing electricity source and is expected to make up 31% of total generation by 2050 (EIA). Understanding the potential for RE generation is key to evaluating the CPP and other Obama era environmental policies' aim to support this shift by regulating power plants and investing in new RE technologies.

The Clean Power Plan

As the first-ever policy to limit carbon emissions from power plants, the CPP set a foundation for a nation-wide transition to a greener energy economy and a legitimate scheme to tackle climate change. The CPP aimed to set carbon limits on "existing" fossil fuel plants, which accounted for 31% of CO₂ emissions in the U.S (NWF, 2018). Plants subjects to the regulation included "any fossil fuel-fired electric generating unit (EGU) that was in operation or had commenced construction as of January 8, 2014" (CPP, 2014). Under the Clean Air Act, the CPP had the authority to require states to submit state implementation plans (SIPs) to the EPA for approval, outlining how they would achieve their emission reduction targets. Should states refuse or fail to submit plans, the EPA would impose a federal plan on those states under the CAA section 111(d)(2)(A). The proposal lays out four building blocks to outline how states can reduce CO₂ emissions under the EPA's determination of the best system of emission reduction (BSER). By creating four significant pathways to achieve emission reductions, the EPA provided states considerable flexibility to choose their most appropriate method for meeting the required

emission performance levels. In fact, states that failed to achieve the estimated reduction under individual building blocks could "compensate through over-achievement in another one, or employ other compliance approaches not factored into the state-specific goal at all" (CPP, 2014). The CPP's four building blocks included conducting heat rate improvements, shifting generation, investing in renewable energy, and enhancing energy efficiency. Examining the four components is crucial to understanding the policy's key directives and how the release of this information may have influenced investor decision-making regarding future profits.

i. Building Block #1: Reducing the carbon intensity of generation at individual affected EGUs through heat rate improvements.

Heat rate improvements can increase an EGUs' efficiency at converting fuel energy into electric energy. In theory, improvements would reduce the fuel needed to produce an equivalent amount of energy while simultaneously reducing CO₂ emissions. Through the adoption of best practices including turning off unneeded pumps at reduced load, installing digital control systems, tuning control systems more frequently, and replacing old system components, the EPA estimated that an optimal and achievable heat rate was between 1.3% and 6.7% (CPP, 2014). However, to determine state-specific goals, EGUs, on average, should achieve a minimum of a 4% improvement in heat rate. 4% was a reasonable estimate that required an average of \$50 per kW and an average cost of \$5.81 per metric ton of CO₂ reduced (CPP, 2014). Nonetheless, 6% was the maximum potential for heat rate improvement and would cost, on average, \$100 per kW and \$7.75 per metric ton of CO₂ (CPP, 2014). Heat rate improvements were expected to be implemented relatively quickly since they required retrofitting existing plants rather than investing in new infrastructure (Taube, 2015). While a heat rate improvement may reduce fuel costs, it simultaneously requires periods of plant downtime, burdening EGU operators. Although the proposal expected that plants could save 4% to 6% of the energy lost to inefficiencies, the

finalized CPP decreased the heat rate improvement to 2.1% to 4.3%, taking into consideration the various EGUs that already implemented upgrades.

- ii. *Building Block #2: Reducing emissions from the most carbon-intensive affected EGUs in the amount that results from substituting generation at those EGUs with generation from less-carbon intensive affected EGUs (including NGCC units that are under construction).*

Because EGUs are interconnected by transmission grids, owners and operators can manage reliability and operational constraints by maximizing the flexibility of the interconnectedness and deciding whether to increase or decrease generation at individual plants over others. The EPA determined that reliance on generation shifting – reducing pollution by transitioning from dirtier to cleaner generation sources – is compliant with the Clean Air Act's BSER. Plant owners can lower overall emissions by reducing operation hours at a plant and shifting to less carbon-intensive sources. Given that the natural gas pipeline systems support 60% NGCC utilization rates, increasing existing NGCC capacity in states towards a 70% utilization rate is technically feasible and would help states displace coal-fired steam generation. In response to comments on the proposal indicating that the EPA should measure "net summer capacity factors," which reflects maximum operating capacity at peak demand, instead of nameplate capacity," the designed capacity of a power plant, the final CPP revised the capacity factor to 75% for all existing NGCC units. Under the re-dispatching scenario, the EPA estimated that CO₂ reduction costs over the 2020-2029 period would be \$30 per metric ton (CPP, 2014).

- iii. *Building Block #3: Reducing emissions from affected EGUs in the amount that results from substituting generation at those EGUs with expanded low-or zero carbon generation.*

By using nuclear and renewable energy as forms of "replacement generation" for coal-fired plants, states could achieve substantial reductions in CO₂ emissions. Since more than half of all states at the time of the proposal had renewable portfolio standards (RPS) in place, which

required a minimum proportion of generation from renewable sources, some states could have found it easier to implement this building block. Additionally, since renewable resource generation and reliability vary by region, the EPA set regional standards and regional RE development rates instead of a single national standard. The CPP ensures that all types of communities could benefit from RE by creating the Clean Energy Incentive Program (CEIP) to reward early investors in wind and solar and low-income communities that proved substantial progress towards targets by 2020 (EPA, 2015). The CEIP included specific allowances or emission rate credits (ERCs) to continue to incentivize states to invest in RE.

While the proposed plan classified both "at-risk" and "under construction" nuclear power plants as subject to the ruling, the final rule removed these provisions in response to concerns that specific states had incentives to maintain "at-risk" plants in order to avoid increasing their emissions rates. In other words, "at-risk" plants already produce lower CO₂ emissions than coal fired EGUs but require replacement or rehabilitation, so the CPP would deter states with "at-risk" nuclear plants from redevelopment, as these plants would assist states in meeting their emission targets. The EPA stated in the final rule that, "It is inappropriate to base the BSER in part on the premise that the preservation of existing low-or zero-carbon generation, as opposed to the production of incremental, low-or zero-carbon generation, could reduce CO₂ emissions from current levels" (CPP, 2015: p.63). The EPA claimed that the anticipated generation from under construction plants would significantly lower emission rate targets of specific states, and if construction were to be delayed or halted, those states with under-construction plants would be at a disadvantage in achieving their targets. While nuclear plants were removed in the calculation of BSER, states with nuclear plants were still able to apply nuclear capacity for compliance. Given the removal of nuclear energy from the plan and the inclusion of updated RE cost and

performance data, the EPA also increased the RE generation level in 2030 to almost two-times the proposal levels. The CPP's mandate for national RE development increased the attractiveness of these investments and their earnings potential, thus, enlisting interested investors.

- iv. Building Block #4: Reducing emission from affected EGUs in the amount that results from the use of demand-side energy efficiency that reduces the amount of generation required.*

By increasing demand-side energy efforts to reach a 1.5% annual electricity savings, the CPP aimed to reduce overall consumption from fossil fuel EGUs. Since fossil fuel EGUs have higher variable costs, this generation source is typically reduced first when demand subsides. In 2011, state demand-side energy-efficiency programs reduced CO₂ emissions by an estimated 75 million metric tons (CPP, 2014). Given that 12 states had already achieved or were on track to achieve considerable energy savings by 2015, the accelerated use of such policies federally would significantly impact coal demand. While the cost of CO₂ reductions through energy efficiency would be incurred at the time of investment, the long-term cost savings from reduced usage would be realized in bill reductions during later years (e.g., 10-years). The EPA's cost analysis projected a levelized cost of saved energy from \$85/MWh to \$90/MWh over 2020 to 2030. Some of the most effective measures for states to adopt are implementing a general energy savings target, enacting new model building codes, constructing combine heat and power systems, and assigning efficiency standards for products/equipment (Hayes et al., 2014).

Despite the benefits of energy-efficiency, the EPA ultimately removed building block #4 from the final legislation since the CAA Section 111 stated that "regulated entities [can] produce as much of a particular good as they desire, provided that they do so through an appropriately clean process" (CPP 2015: p.533). Accordingly, enforcing demand-side consumption policies would force states to comply rather than freely choose how to reach their state reduction targets.

Timeline and Events of the Clean Power Plan

4.1 President Barack Obama's Year of Action

On June 25, 2013, former President Barack Obama spoke at Georgetown University in Washington, D.C. about climate change and his plan to secure the U.S.' energy future. Without formally calling his plan the Clean Power Plan, the President outlined the steps he would take to develop limits on CO₂ emissions from power plants. His remarks set forth the various former ways the EPA had regulated air pollutants under the CAA and the need for new investment in RE technologies. Fighting climate change was integral to the Obama administration, and the concerted effort made to pass the CPP is evident through the extensive rulemaking processes and legal battles it faced.

Then in January 2014, after the President's State of the Union Address, Obama conveyed to the public that 2014 would be a "year of action," and the EPA would release a proposal for emission standards on existing plants (Feldman, 2014). Before this, the EPA had only proposed CO₂ pollution standards on new plants in April 2012 and September 2013 (EPA, 2013).

Obama's "year of action" included many regulations on power plants, otherwise known as set of regulations waging a 'War on Coal.' Leading up to the CPP, the D.C. Court of Appeals upheld the EPA's MATS on April 15, 2014, requiring power plants to cut 91% of mercury emissions (Harder, 2014). Challengers in the case included 20 states with utilities heavily dependent on coal, the National Mining Association, Peabody Energy Corp, FirstEnergy Corp, and other industry groups. Later, on April 29, 2014, the Supreme Court endorsed CSAPR to regulate power plant's sulfur dioxide (SO₂) and oxides of nitrogen (NO_x) to improve air quality and protect local resident health (Richey, 2014). The Court previously vacated the regulation under the opinion that CSAPR violated the EPA's authority by requiring upwind states to reduce

emissions by more than the CAA's established threshold (Pepper, 2016). On May 9, 2014 – almost a month before the CPP's announcement – the President's "Commitments and Executive Actions to Advance Solar Deployment and Energy Efficiency" committed 300 public and private sector companies to create jobs and cut carbon pollution by deploying solar energy (The White House, Office of Press Secretary, 2014). The executive action also led a \$2 billion investment to make federal buildings more energy efficient. While these regulatory actions and court proceedings were separate from the CPP, they set a precedent for contention between the Obama administration's power plant emission standards and the 'war on coal' backlash.

4.2 News Analysis

In order to appropriately conduct a market event study, it is crucial to understand what new information was released to investors and the general public at the policy announcement. For the purpose of this analysis, it is equally important to evaluate the state of the news leading up to the cutoff value or announcement date. News can be a strong indication of the current state of public discourse, revealing personal opinions, related current events, and public controversies. At the same time, news remains an important source of information for investors due to its effect on corporate decision-making and government regulation.

From the months leading up to the CPP Proposal on June 2, 2014, and even after the final version was announced on August 3, 2015, various challengers launched claims against the CPP for its detriment to the coal industry, destruction of the mining sector, costs to consumers' electricity bills and most importantly, its presumed unconstitutional federal overreach. In early February 2014, the EPA struggled with its rulemaking, a tight timeline due to the upcoming 2014 election, and an anticipated legal battle (Davenport, 2014). The EPA was well aware that an

aggressive regulation could result in legal pushback and states challenging the federal requirements by suing the EPA. The extent of stakeholder participation is clear from the 8 million comments gathered during the comment period that ended on December 15, 2014.

Stakeholders including public health officials, scientists, large-scale energy and utility corporations, environmental NGOs, senators, and representatives from coal-reliant states got involved through commenting on the CPP, spreading awareness, and educating the public. In February, Democrat Tom Steyer launched a \$100 million ad campaign tailored to California's Hispanic voters, stressing power plant emissions' negative health implications (Confessore, 2014). In the 2014 Virginia's governor race, NextGen Climate, a political advocacy and research organization, began signaling messages about the CPP's green job creation rather than its threats to coal (Confessore). Only a month later in March, Vice President and former Indiana Governor Mike Pence requested that Janet McCabe, head of the EPA's Office of Air and Radiation, visit Indiana to learn about the adverse effects that regulation can have on a state like Indiana, which derives two-times its power from coal than the national state average (Groppe, 2014).

As early as May 21, 2014, public news headlines indicated that the EPA would soon release the first-ever carbon emissions standards for power plants under the CPP (Eilperin & Mufson, 2014). The backlash from the coal sector increased as specific information regarding the policy's building blocks was leaked ahead of time. The coal industry and its allies in the Republican Party accused Obama and his administration of "waging a war on coal," claiming that utilities have already been forced to shut down one-third of the nation's power plants, which constitutes about one-fifth of the nation's coal generating capacity (Grunwald, 2014). While environmental advocates applauded Obama's efforts in the days leading up to the announcement, the coal industry readily attacked the administration for "executive overreach that would wreck

economic havoc” (Davenport, 2014). In the 10-days preceding the CPP announcement, opinion pieces, local papers, and newspapers with worldwide readership covered the CPP's agenda and highlighted its various implications and points of contention, enlisting the general public's attention and specifically both individual and institutional investors.

4.3 Murray Energy v. Environmental Protection Agency (June 2014 – June 2015)

Only two weeks after the June 2nd announcement, the largest privately-owned coal company in the U.S., Murray Energy, filed a petition for extraordinary writ in the D.C. Circuit Court of Appeals, attempting to prohibit the EPA from regulating greenhouse gas emissions from existing power plants. Despite nine states' attempts to support the petition and request a rehearing, the Court ruled in favor of the EPA on June 9, 2015, stating that it did not have the authority to challenge a proposed plan because it is "non-final agency action." (*Murray Energy v. EPA, 2015*).

Alongside Murray Energy, the rest of the coal industry began to publicly identify the CPP as "anti-coal." Murray Energy believed that the EPA was inflicting injury on their company by attacking their customer base and disrupting coal capacity in markets. The Petitioner stated that the CPP "would unlawfully subject power plants to double regulation and force many to commit to long-term construction projects or even shut down entirely before the EPA publishes its final rule" (*Murray Energy v. EPA, 2015*). The EPA responded that the CPP was still undergoing revision stages, and the Petitioners only suggested speculative evidence but did not prove any instances of immediate injury. Respondents also argued that these claims were unwarranted and disregarded competition from cheaper natural gas already driving down coal demand and causing the retirement of EGUs. While the Court's rejection of the 15 states and several coal companies

presented a victory for President Obama's climate agenda, there was little doubt that further legal battles would arise once the CPP was finalized only a few months later.

4.4 The Spread of Disinformation and Efforts to Save the Nation's Coal Industry

The CPP's regulatory environment further contributed to macro headwinds that the coal industry has experienced over the last decade. Aware of the market dynamics, coal companies engaged in blurring the connection between coal and climate change. Through false advertising campaigns and misleading financial disclosure over this period, the coal industry attempted to rebrand its industry and alter public perception of the state of coal. Starting in February 2014, Peabody Energy launched an advertising campaign, known as "Advanced Energy for Life," that promoted the end of global energy poverty through broader access to low cost, reliable coal-powered generation. Peabody's Energy Chairman and Chief Executive Officer Gregory H. Boyce stated, "the company believes that access to clean, modern energy from coal is as basic as food, water or shelter, enabling a high standard of living and helping people live longer and better" (Darby, 2014). Peabody's altruistic mission to alleviate poverty in developing nations was a disguised sales pitch to shift the conversation from climate change to poverty, where coal was the solution. In August 2014, the United Kingdom's Advertising Standards Authority banned Peabody from using the term "clean coal," as it was misleading and suggested that coal is a non-polluting energy source. The Company engaged in a similar advertising strategy amidst the 2015 Ebola crisis by suggesting that expanded access to energy from coal generation would have stopped the spread of Ebola and assisted with the roll-out of a vaccine (Goldenberg, 2015). At the time, public health experts dismissed Peabody for their opportunistic corporate efforts to

exploit the disease and argued that lack of electricity could not act as a hindrance when no approved vaccine existed at the time.

Despite Peabody's intervention in *Murray Energy v. EPA* arguing that the CPP would cause immediate harm to the coal industry, the Company wrote to investors in their 2014 Security and Exchange Commission (SEC) Financial Year Statements that they could not determine how regulation may affect their operations or financial condition due to too much uncertainty. However, they simultaneously noted that "we believe that any final rules issued by the EPA will be challenged," suggesting that there was sufficient certainty that legal recourse might be necessary (Peabody Energy, 2014). In a November 2014 news release to investors, Peabody Energy responded to the CPP's proposed power plant regulations, highlighting the impact on energy prices and electric reliability without any mention of the impact to coal-demand (Peabody Energy). In November 2015, the New York Attorney General Eric T. Schneiderman launched an investigation that found Peabody guilty of spreading false and misleading information regarding their financial risks associated with climate change (Office of Attorney General Archives, 2015). While the Company provided incomplete and biased discussion to investors, they failed to share essential information and financial predictions provided by an outsourced consultant. These instances of disinformation are not only vital contributions to the public's perception of coal but shape the very evidence and documentation that institutional investors use to make choices about redirecting their capital.

Peabody's dishonest reporting and false advertising is not the only case of disinformation. Across coal companies' Chapter 11 bankruptcy filings, there is consistent evidence of funding climate denial agencies and corporate lobby groups. Peabody's 2016 bankruptcy filings show support for the American Legislative Exchange Council, which works to fight clean energy

standards and impose penalties on homeowners using solar panels, and the State Policy Network, which tries to reject climate bills and repeal EPA rules regulating power plants. Exposing these disclosures is crucial to understand how coal companies try to intervene in the regulatory market and thwart legislation that supports competition. Arch Coal's filings showed \$10,000 of direct funding in 2014 to the Energy and Environment Legal Institute (E&E), a group recognized for gathering climate scientists' personal emails and unpublished research to file nuisance lawsuits against them to waste their time, delay crucial academic research, and impair their reputation (Goldenberg & Bengtsson, 2016). Alpha Resources also provided funding to one of E&E's lawyers and the Free Market Environmental Law Clinic's senior attorney, Chris Horner, to underwrite his work of filing Freedom of Information Act (FOIA) requests and harassing scientists. Ultimately, coal companies' false financial disclosure and funding for groups that actively try to change coal's public perception throughout 2014 to 2016 demonstrates the industry's aggressive efforts to misinform investors and compensate for their bleak financial outlooks.

4.5 Macro Headwinds in Coal Sector Markets

In the months leading up to the final regulation, coal stocks trended downwards and natural gas surpassed coal for the first time as the largest generation source in the U.S in April 2015, consuming capital markets. Markets signaled the significant losses in coal stocks as shares of the largest American coal companies experienced extreme stock losses in the first half of 2015. On May 12, 2015, Patriot Coal, a coal mining company in Appalachian states, filed for bankruptcy following James River Coal in April 2014. By June, Peabody Energy dropped as much as 30%, Arch Coal Inc had lost 14%, and Alpha Natural Resources' 30% drop led the New York Stock Exchange to suspend trading of Alpha's stock (Parker & Loh, 2015). Chief

executives at coal companies like Arch Coal and Patriot Coal recognized the deteriorating market conditions and began warning workers of mass layoffs at mines and processing plants (Rowland, 2015). Walter Energy Inc. filed for bankruptcy protection in July 2015 as drops in coal prices and high labor costs threatened their ability to pay back bond interest payments (Jarzemsky & Checkler, 2015).

On August 3, 2015, the EPA released the final version of the regulation and soon after published it in the Federal Register on October 23, 2015. Shares of several coal companies declined further at the CPP's announcement, with Peabody Energy, Cloud Peak Energy, and Westmoreland Resource Partners stocks dropping off more than 8% each (Egan, 2015). On the same day, Alpha Natural Resources, the third-largest coal company, filed for voluntary bankruptcy due to surmounting debt liabilities that they acquired at the peak of market prices and its struggles to profit off a 2011 acquisition of Massey Energy (Rowland, 2015). As a result of the extended downward spiral of coal companies and fears over losses to state economies, West Virginia, alongside 26 states and several coal companies, sued the EPA and filed an option for a stay within the D.C. Court of Appeals under the *State of West Virginia, et al. v. EPA*.

4.6 State of West Virginia, et al. v Environmental Protection Agency (Oct 2015 – Sept 2019)

While other states began drafting state implementation plans (SIPs) to follow the CPP's regulatory obligations, states like West Virginia, Texas, Indiana, Oklahoma, Colorado, and Arkansas sought to reverse the Obama administration's plans. The Petitioners and Intervenors aimed to question the EPA's authority to regulate greenhouse gas emissions, including CO₂, from existing fossil fuel-fired power plants under Section 111(d) of the CAA. They asserted that the EPA's CPP posed a threat to States' control over their energy economies if they did not submit

SIPs and violated their state rights under the Tenth Amendment and the Federal Power Act. For these reasons, the challengers requested that the Court stay the legislation while the Court was examining the legislation's legality.

The CPP's challengers included 27 states with heavy coal mining and production sectors and over 120 business organizations, electric utilities, cooperatives, and labor unions. The majority of the challengers' case predicated on the significant job loss and critical contribution that coal, as a generating source, provides to specific state economies. According to the Petitioners, states would have to spend time and resources reengineering their electric grids and divert productive resources away from the public interest.

The National Mining Association and United Mine Workers of America attested that the industry's transformation and the market's response would be irreversible once the CPP was in place even if the Court overturns the agency's actions. Their brief indicated that the markets had already adjusted to the policy leading to plummeting share prices, declared bankruptcies, and lack of access to capital. States that intervened insisted that the impact would be most significant for lower-income areas, where most coal mining provides blue-collar jobs to local communities. The American Coke and Coal Chemicals Institute, North American Coal Cooperation, and individual coal-producing companies like Peabody Energy and Murray Energy declared that if the Court granted the stay, no parties would undergo harm because those states that wished to proceed with emission reductions could and others could maintain the status quo.

The EPA's response to the Petitioners indicated that the EPA had authority under Section 111(d) to limit air pollution emitted by power plants and that the ruling created reasonable flexibility for states to comply with CO₂ performance levels. More specifically, the EPA believed that the Rule did not limit states to measures only included under BSER,

suggesting that there were ample ways for states to develop their own SIPs without negatively affecting some sectors. The EPA also highlighted that the benefits to public health, welfare, and the environment strongly outweighed the Petitioner's request, meaning that the public interest should prevail over any likelihood of irreparable injury to industry.

The EPA received crucial support from state boards and agencies, public health associations, environmental NGOs, utility companies, educational institutions, political non-profits, and many religious groups. States like Massachusetts, Connecticut, Maryland, Hawaii, New Hampshire, Delaware, and New York contended that it was a state's responsibility to protect the public interest from climate change in addition to publicly owned infrastructure, coastal property, and diverse ecosystems (*West Virginia v. EPA, 2015*). Similarly, a multitude of environmental NGOs intervened in support of the EPA, such as the Natural Resource Defense Council, the Clean Air Council, Environmental Defense Fund, and the Center for Biological Diversity, addressing their interest to protect the health, recreation, and welfare of its members from the threats of air pollution and climate change.

Even members of the power sector like Calpine Corporation, New York Power Authority, PG&E, Austin Energy, and National Grid Generation explained in an amicus motion that while the Movants claimed that without a stay of the regulation, they would suffer immediate harm and force early retirements of coal plants, this claim was unfounded since the Rule required nothing from affected resources until 2022. Like many others, they argued that the Movants' claims ignored on-going sectoral declines from cheaper natural gas and RE sources.

While coal companies argued that they would undergo harm from the implementation of the CPP, the American Wind Energy Association, Advanced Energy Economy association, and NextEra Energy, Inc, the largest provider of wind and solar generation in the U.S., all argued that

in the absence of the CPP, they too would be subject to harm. Not only would the CPP provide an opportunity for investment in RE and a chance for states to meet CO₂ emission through RE, but the mere flexibility of the CPP would allow each state to take the most appropriate and well-suited path forward (*West Virginia v. EPA, 2015*).

The Institute for Policy Integrity at New York University School of Law also filed an amicus curia brief in support of the respondents, arguing that the CPP is a "natural extension of decades" of CAA policies under different administrations to monitor greenhouse gases and limit negative externalities (*West Virginia v. EPA, 2015*).

The National Medical Association, the American Thoracic Society, and other public health organizations criticized state governors for jeopardizing Americans' health and ignoring the regulation's ability to provide cleaner air to Americans and reduced health care costs. The National Association for the Advancement of Colored People claimed that 40% of the six million Americans living nearby coal plants are people of color, establishing that minority communities are most vulnerable to the health impacts associated with air pollution (Hamlette, 2015).

Even the City of Los Angeles' Department of Water and Power ("LADWP"), the largest municipal utility in the U.S. with a diverse portfolio of generation including units directly subject to the CPP's regulation, supported the CPP and the flexibility provided to states with affected EGUs. The utility advocated for the opportunity for other electric utilities to commit themselves to meaningful CO₂ reductions and provided counterevidence of its individual success in adopting similar strategies to the CPP in the past (*West Virginia v. EPA, 2015*).

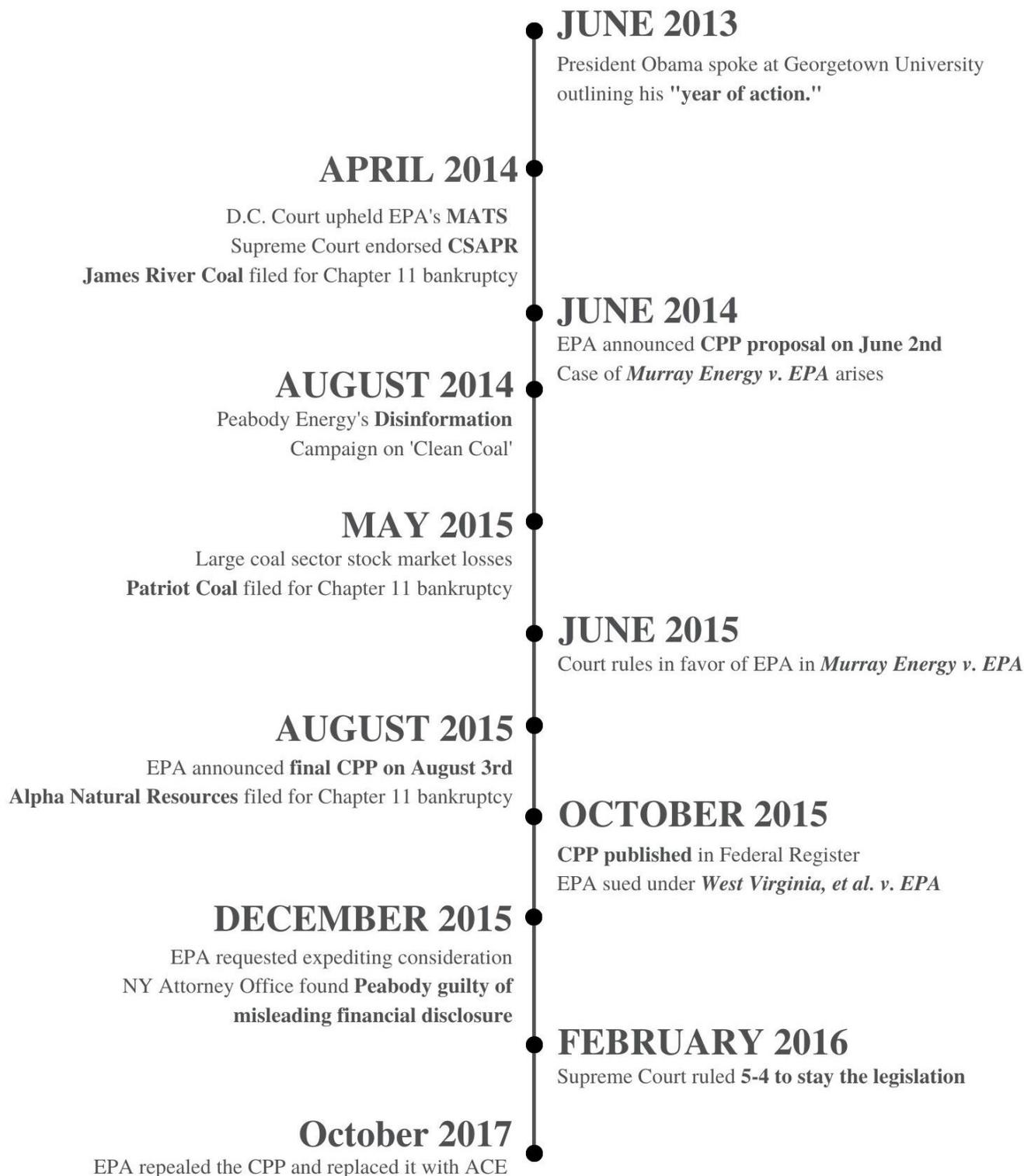
In December 2015, the EPA requested that the Court expedite the consideration of the EPA's authority, and on January 21, 2016, the D.C. Circuit Court rejected the motion for stay of the Rule and ordered to expedite considerations of appeals. Then on February 9, 2016, the Supreme

Court ruled 5-4 to stay the legislation until the D.C. court determined whether the ruling was constitutional. The Court's stay demonstrated sufficient reason to wait and not enforce the emission standards at the current moment, a clear victory for the coal industry and its intervenors.

Ultimately, with the inauguration of Republican President Donald Trump in 2017 came a new administration and an entirely different EPA. The final ruling was held in abeyance for several months until Scott Pruitt, the then administrator of the EPA, announced the CPP's repeal on October 10, 2017, causing the court case to be moot. While the court proceedings took place after the CPP was formally announced on August 3, 2015, the case of *West Virginia, et al., v EPA* remains vital to understanding the regulatory debate and public perception surrounding the CPP.

Overall, the timeline of the CPP is important to understanding what new information and perspectives were made public to institutional investors. In order to appropriately apply the RDD design used in determining whether the CPP created abnormal market returns on the day of the proposal and final announcement, the timeline is pertinent, so readers are aware of the changes to public sentiment and how news and regulatory pushback swayed market perceptions. While this analysis does not assess the quantitative impact of these individual court proceedings, cases of disinformation, and public news, these sources frame the broader narrative surrounding the CPP and the various stakeholders resting on all sides of the Rule.

Figure 6 – Timeline and Events of the Clean Power Plan



Empirical Results

To situate the general performance of green indices against brown indices, I created a composite green index, brown index, and energy index using PCA. Table 1.0 shows the proportion of the variance explained by the first principal component. Again, PCA measures the central tendency of the indexed stocks daily prices across the 100 trading days.

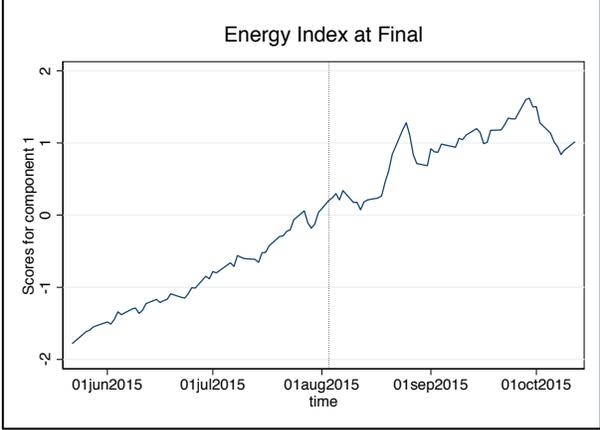
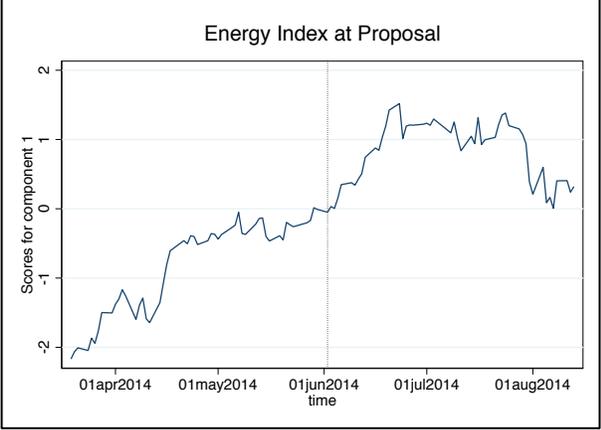
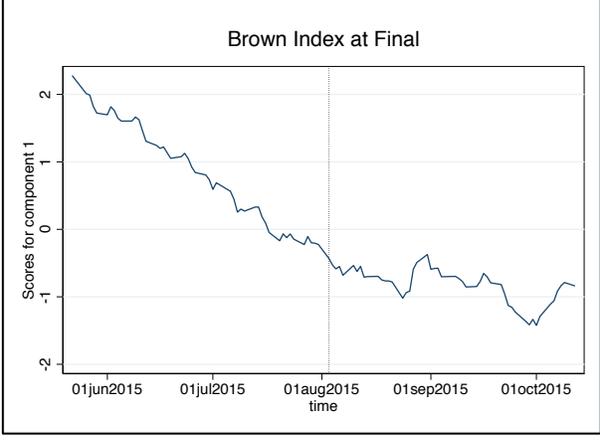
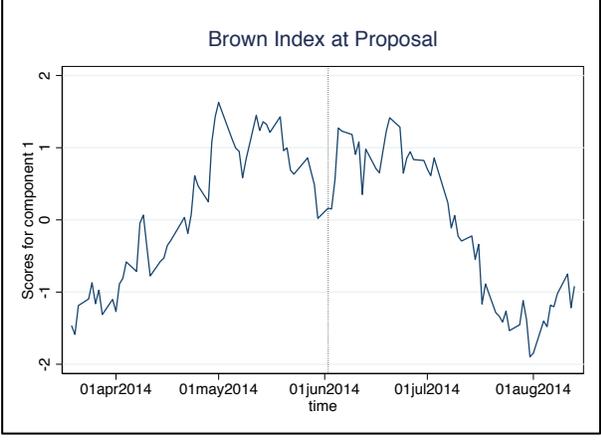
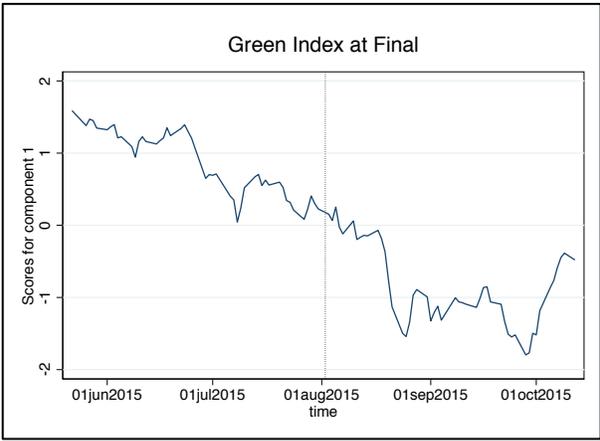
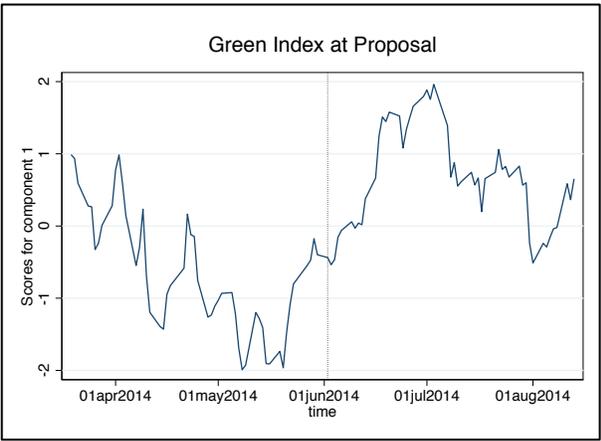
Table 1.0
Principal Component Analysis Results

Variables	(1)	(2)	(3)
	index_green	index_brown	index_energy
Proposal Announcement	78.49%	66.84%	99.98%
Final Announcement	96.95%	99.11%	95.00%

Table 1.0 demonstrates that the first principal component effectively explains a majority of the variation across the variables due to the fact that the variables are correlated to some degree. This analysis displays strong patterns across similar sub-indices in the dataset. For instance, the first principal component can explain 78% of the variation in green indices around the 100-day trading window surrounding the CPP's proposal. This indicates that the 8 individual indices that make up index_green vary together, so should one increase then the remaining ones tend to increase as well. The results indicate that at the final announcement, index_green and index_brown explain a greater proportion of the variability in the data set than at the proposal.

The following illustrations show the stock prices for the composite indices over the 100 trading days surrounding the proposal and final announcement.

Figures 1.1 – 2.3
Composite Indices at Proposal and Final Announcement



Even before conducting RDD, Figures 1.1 – 2.3 show a broader illustration of the noise and variability in the data surrounding the proposal compared to the final announcement. Early on, this suggests that market participants were exposed to more new information before the proposal than the final announcement, likely due to the minor changes in the building blocks that occurred between the two. This analysis will be further discussed within the context of the RDD.

The above illustrations also indicate that both the green and brown indices show jumps or drops ahead of the actual cutoff date, suggesting that the market reacted to information released in advance of the CPP proposal. To remove the effects of information leakage evident in the graphs and news analysis leading up to the policy's first announcement, I create a 10-day window before the policy that excludes these datapoints. This will allow RDD to predict the value of the flexible function at the cutoff value had there been no information released to the market in the 10 calendar days prior to June 2, 2014.

Employing visual inspection on a first and second order polynomial, both polynomial models illustrate the same qualitative results. In order to determine the goodness of fit for each composite index between a first and second order, I use the Bayesian Information Criterion (BIC). BIC is commonly utilized for model selection in time series data and will fit a model based on the likelihood of the function. Table 2.1 and 2.2 indicate the BIC for each composite index across a first and second order polynomial fit, negative values are displayed in parenthesis. The lower the BIC, the more likely that the model is considered the true model. Therefore, for each index I select the polynomial order with the lower BIC to use as the model in my RDD analysis. I also calculated the percentage change in the daily prices for the sub-indices that make up the green, brown, and energy indices based on the lowest BIC model selected.

Table 2.1
Bayesian Information Criterion Analysis - Proposal

Variables	(1)	(2)	(3)
	index_green	index_brown	index_energy
<i>First Order</i>	195.21***	141.48***	103.4**
<i>Second Order</i>	162.37***	145.65	1.45**

Note: *** p-value <0.01; **p-value<0.05; *p-value <0.1.

Table 2.2
Bayesian Information Criterion Analysis - Final

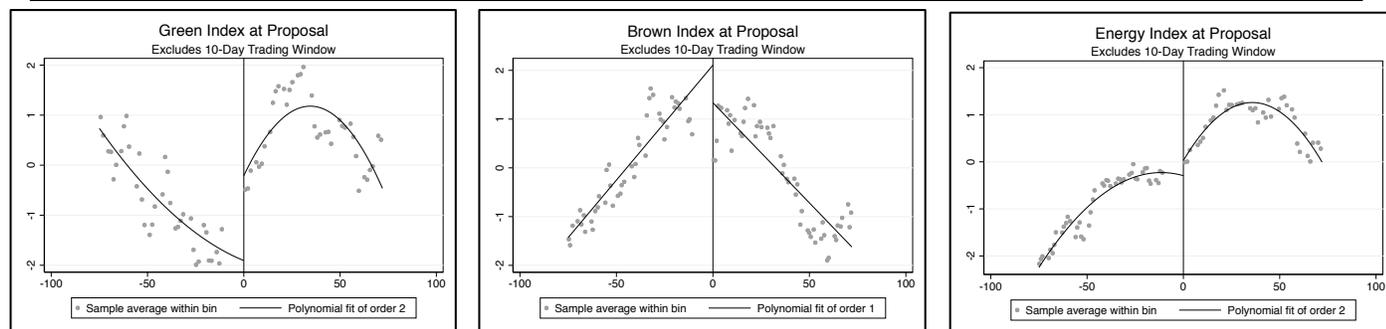
Variables	(1)	(2)	(3)
	index_green	index_brown	index_energy
<i>First Order</i>	92.8***	(74.5)	(27.4)***
<i>Second Order</i>	39.38**	(66.6)**	(62.0)

Note: *** p-value <0.01; **p-value<0.05; *p-value <0.1.

According to this analysis the best fit for index_green and index_energy at the proposal and announcement is a second order polynomial. While index_brown is best fitted by a first order polynomial at the proposal and final announcement. Using these fits, I apply RDD to quantify the policy's treatment on these composite indices. Figures 3.1 – 3.6 explain the jump or drop at the cutoff value.

5.1 Proposal Announcement

Figures 3.1 – 3.3
Regression Discontinuity Design at Proposal



Figures 3.1 - 3.3 show the sharp RDD in action. The plots show the jump in composite indices in the 100-day trading window surrounding the proposal of the CPP. The function exceeds 50-days on both sides of the cutoff value due to the fact that markets are only open on trading days which do not necessarily take place consecutively. The dots in the figure are the scores for the first principal component and the lines are the fitted values from a parametric model with discontinuity at zero. The most important feature of the plot is the jump or drop at the cutoff value that can be measured by the number of standard deviations. The standard deviation of the principal components is normalized to 1.0, so the observed RDD effect at the cutoff can be interpreted as a percentage of one standard deviation.

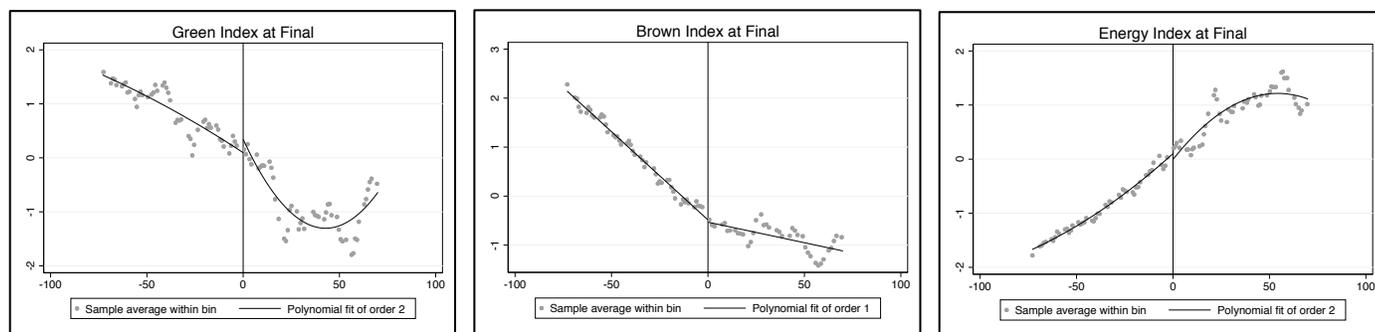
Green indices are falling in the 50-days prior to the CPP, however, at the cutoff there is a jump in the value of green indices likely as a result of investors viewing renewable energy sectors favorably at the proposal. The effect size of this jump is 1.7 standard deviations and is statistically significant. Across the individual indices making up the green composite index, each experienced a significant jump in their prices ranging from 3.5% to 9.3%.

Unlike the green composite index, the brown index is rising in the 50-days prior to the policy and reaches a peak at the cutoff. At the cutoff value, the effect size is 0.77 standard deviations and is statistically significant. All of the individual indices making up the composite show statistically significant daily decreases ranging from -1.5% to -3.8%. This entails that institutional investors in the market reacted to information regarding the CPP's negative implications for the coal industry. Given that the index is at a peak at the cutoff value, the change in sign of the slope indicates a switch from buying to selling off in the market. Coupled with the effects of `index_green`, there is strong evidence to suggest that an environmental regulation like the CPP can be effective at altering investor mindsets and redirecting capital away from coal.

The general energy index, which is composed of publicly-traded oil and gas companies, demonstrates a less dramatic jump in the returns in comparison to green and brown indices. This is a result of the fact that the CPP did not directly support or disregard the oil and gas sector. One could argue that Building Block #2, which reduces emissions from carbon-intensive EGUs through substituting generation with less carbon-intensive sources, like natural gas, led to the effect size of 0.32 standard deviations and a 1-1.5% daily percentage increase in the sub-indices' prices. One way to implement this CPP building block is through repurposing coal fired steam EGUs to natural gas combined cycle (NGCC) units. This, in theory, would increase natural gas demand and the equities of the associated public companies. Since the two sub-indices, IXE and SPN, are made up of ~75% natural gas and ~25% oil companies, there is evidence to suggest a causal relationship between the CPP and the movement in the energy index.¹

5.2 Final Announcement

Figures 3.4 – 3.6 Regression Discontinuity Design at Final



In comparison to the effect sizes at the proposal, the final announcement does not show substantial abnormal returns at the cutoff value on August 3, 2015. While the green composite

¹ Oil & gas production estimates are calculated from 2014 10-K filings and are based on a 2020 SPN and IXE list of constituents due to lack of data on historical components.

index is trending downward in the 50 trading days prior, at the cutoff it jumps 0.25 standard deviations and shows a statistically significant jump. When analyzing the individual indices that make up the general green composite, only `index_icln`, `index_grnfocusx`, and `index_grnregx` show significant jumps with a percent daily increase of 1.72% to 4.11%.

The brown composite index is also declining in the days prior to the final announcement and at the cutoff there is a statistically insignificant effect size of 0.05 standard deviations. However, across the individual indices, `index_cnx` is the only sub-index demonstrating a statistically significant daily price drop of -9.3%. `index_djuscl` and `index_kol` show statistically insignificant drops of -4.5% and -1.7%, respectively. There is sufficient evidence to suggest that the CPP's final announcement did not alter institutional investors' outlooks on coal and greater losses took place prior to the announcement as discussed in Section 4.5.

While `index_cnx` and `index_djuscl` have 100% of their holdings exposed to the United States, `index_kol` provides global equity exposure to coal companies with only 7.0% geographic exposure to the U.S. The fact that `index_kol`'s holdings are less exposed to U.S. regulation might result in the minor daily percentage drop at the final announcement. For this analysis to hold true, `index_kol` would likely see less impact than other indices at the proposal, however, this is not the case. `index_kol` shows the largest daily percentage change across the three coal sub-indices at the proposal.

Finally, the general energy sector index shows no statistically significant abnormal returns at the final announcement. According to Figure 3.6, the composite index is continuous at the cutoff. The individual sub-indices also show no statistically significant daily price drops, demonstrating that the CPP's final announcement had no impact on investor's perceptions toward oil and gas companies.

Conclusion

Principal Findings

As former President Barack Obama and his administration's EPA drafted the CPP in 2014, a primary focus was shifting generation away from coal and investing in widescale RE. Throughout this event study, I have analyzed the question of whether the CPP in its initial or final form incentivized institutional investors to divest from coal and deploy capital towards RE. I compared brown, green, and general energy indices across the 100 trading days surrounding the proposal and final announcement to determine whether the market considered the policy and responded accordingly. I also examined the news released before the proposal and final legislation to outline the information available to the investors ahead of the announcement date. Results indicated that the CPP's proposal did provide a shock to the market and produced positive abnormal returns for RE indices and negative abnormal returns for coal, while the finalized legislation did not as effectively direct capital away from coal equities.

The conclusion that the proposal provided more of a shock to the market than the finalized legislation is particularly true for coal. Market data not only showed a significant drop at the cutoff but signaled a peak, where the trendline shifted from buying to selling off in the market. However, the proposal also produced a jump in RE indices of almost seven times the effect size of the final announcement. The following trends conclude that Hypothesis #1 is true, RE indices undergo positive abnormal returns, while coal indices experience negative returns at the proposal. Hypothesis #3 is also true given that RE saw a significant jump at the final announcement. The discrepancy between the proposal and the finalized legislation's impact is likely a result of the proposal being made publicly available, generating increasing amounts of public backlash, greater certainty surrounding a potential legal battle, and significant coal sector

losses in between the two announcements. Not only did the media and various stakeholders begin to take positions publicly, but the CPP enlisted over 8 million comments, demonstrating its highly debated and recognized status. In addition, the Court's ultimate rejection of the coal industry in *Murray Energy v. EPA*, also within this timeframe, insinuated that coal companies and coal-reliant states would pursue further legal recourse following the final legislation. Whether or not coal companies, like Peabody Energy, acknowledged the CPP's distress to their industry in their financial disclosure, markets were fully aware of these trends and demonstrated some of the largest losses for coal companies. More specifically, between the two announcements, at least four major coal companies went bankrupt, the DOW Jones Coal Index (DJUSCL) dropped 76%, the S&P 500 Coal Sector Index (CNX) lost 66% of its value, and VanEck Vectors Coal ETF (KOL) lost 47%. Given these major drops in value and the sectoral declines and bankruptcies outlined in Section 4.5, the results at the final announcement present a lower bound of the policy's overall effect since markets already anticipated losses for the beleaguered coal companies. This analysis proves hypothesis #2 false, indicating that investors were not responsive to particular changes in the building blocks but followed general declining market trends for coal.

Due to Alpha Natural Resource's bankruptcy on August 3, 2015, an event study at the final announcement will always be tainted by the shock of the bankruptcy, making it impossible to disentangle the Company's Chapter 11 filing from the CPP. While this analysis finds no abnormal returns for coal at the announcement, so too should Coglianesse & Walters (2019). The fact that Coglianesse & Walters (2019) measure a negative effect can be attributed to the surprise brought about by one of the nine companies in their analysis. However, the brown index incorporates a larger and more representative index of the coal sector including all firms

classified under the Coal and Consumable Fuels Global Industry Classification Standard (GICS 10102050). Therefore, the index will not be biased to the performance or bankruptcy of one firm.

The use of disinformation campaigns by falsely advertising coal as “clean” and funding of climate denial agencies occurs throughout the Obama administration’s concerted effort to shift the energy economy toward renewables. To compensate for a bleak cash flow outlook, coal companies engaged in swaying public opinion regarding coal and, more specifically, misleading investors in press release statements and financial disclosure. As institutional investors must mediate between these two sides and look to deploy their capital, the market data suggests that they are ultimately unresponsive to coal companies’ tactics. Had some of these instances of disinformation regarding the CPP affected the market, it would entail that the effect at both the proposal and final announcement is understated. While the event study measures the shock of the policy announcement to the market rather than the cases of disinformation, these consistent efforts to thwart the CPP would ultimately lead to a smaller effect size at the cutoff. Since macroeconomic events and energy market trends are held constant throughout this analysis, the results provided estimate the policy’s shock to the market in addition to what was already known. The mere effect of disinformation at the cutoff remains out of the scope of my inquiry.

Limitations

Despite the valuable takeaways demonstrated, there remain some limitation to this analysis. First, while market indices provide good estimates of the general market sentiment across a specific group or sector, the sub-indices may not incorporate all of the affected publicly traded companies or may include less relevant companies, causing over or understatement of results. Second, while the first principal component explains a large portion of the variation in the data, the remaining variation across sub-indices is excluded from this analysis and therefore

not interpreted. Third, the extent of the variation explained by PCA differs across the various indices and dates. PCA explains ~65-80% of the variability in index_green and index_brown at the proposal but over 95% at the announcement. This analysis may be limited by the unexplained variability not accounted for under the first principal component. Lastly, the 10-day trading window utilized to remove the effects of information leakage forces the regression to rely more heavily on fewer observations, potentially overfitting the data.

Policy Implications

As climate change poses an increasing threat to society, it is the responsibility of governments to intervene and regulate the energy sector and its greenhouse gas emissions. The CPP is just one environmental policy put forth to effectuate a transition from carbon-intensive fossil fuels to cleaner renewable energy sources through regulating existing power plants. Since the CPP was revoked by the Trump Administration and replaced with the Affordable Clean Energy Rule (ACE), which requires a much weaker mandate across the power sector, new legislation aiming to reduce US power sector emissions and curtail the effects of climate change must be introduced and sustained over the long term. This analysis makes clear that policies, like the CPP, at their announcement can create significant changes to investor mindsets that result in redirecting investment from coal into RE. Ultimately, environmental public policies that provide sentiments of favoritism for one energy source over another can assist in transforming our economy to one that is greener and cleaner.

While this analysis does not compare the CPP's success at redirecting investment over other environmental policies, there are several reasons the CPP may have resulted in such dramatic losses for the coal sector. While past legislation promulgated under the Clean Air Act (CAA) continued to address newly constructed power plants, the CPP prohibited the

“grandfathering” of old plants due to its ineffectiveness at targeting emissions from the oldest and highest polluting plants and its failure to necessitate plant retirements. If only new plants are subject to strict and costly pollution controls and old plants can continue to operate under the status-quo, plant owners are incentivized to keep old plants running for longer (Revezs & Lienke, 2016: p.3). Unlike the CPP, which prompted investment in renewable energy technologies and took substantial actions to reduce pollution from grandfathered plants, loopholes in previous regulations ended up favoring existing sources. Any future policymaking in this realm must consider Congress’ grandfathering as a clear error and the CPP’s dedicated effort to broaden the scope of the CAA.

Obama’s Transport Rule, MATS, and CPP would be unwarranted in the absence of grandfathering and earlier retirements would have resulted in much lower total emissions today. While the EPA estimated that the Transport Rule and MATS would retire about 4.8 and 4.7 gigawatts of coal-fired capacity, respectively, the CPP had almost 5 times the amount of estimated retired capacity between 27 to 38 gigawatts (Revezs & Lienke, 2016: p.153). By increasing the number of power plants regulated under the legislation and doing away with grandfathering, the CPP makes coal relatively more expensive and thus expedites its retirement. The results make evident that assigning a price to carbon is directly linked with increasing costs of compliance for polluting industries. When investors anticipate the increased costs from regulation, they will redirect their capital accordingly. If the CPP can induce investors to buy or sell in the market, then other policy tools like carbon taxes, which increase the cost of carbon, may similarly incentivize divestment from coal in capital markets.

Future policies should also mirror the CPP’s strategy to give states enhanced flexibility to achieve emission reductions through generation substitution, renewable energy investment, and

demand side energy efficiency while taking into account regional capacity limits. Given the regulatory pushback against the CPP in support of state rights, any future policy should similarly consider flexible measures and guidelines in order to ease the transition and implementation process for individual states, while still targeting a greater total reduction in emissions.

Further Research

Future work can expand on the results of this study in several ways, beginning with an analysis similar to Coglianesse & Walters (2019), comparing the relative abnormal returns produced from different policies regulating power plants. It may be helpful to determine whether policies that solely promote renewable energy technologies like the Renewable Portfolio Standards (RPS) could potentially produce the same impact, absent of any ties to the coal industry and/or emission standards. Though both *Murray Energy v. EPA* and *West Virginia et al., v EPA* are mentioned as instances that potentially swayed market perceptions, investigating the potential impact on returns after the final rulings of these court cases may provide alternative insight into the impact of court rulings on environmental policy in the market. Future research may also broaden the inquiry to evaluate whether the introduction of publicly traded firm's Environmental, Social, and Corporate Governance (ESG) measures can impact their market valuation and performance.

My research on the impact of environmental policy, specifically the CPP, on institutional investors' perceptions of coal and RE is only the first step to exploring how policy can be used as a tool to direct investment in capital markets. As climate change evolves and new legislation is formulated, it is important that research continues to focus on how the financial sector can support the transition to a greener economy.

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