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AN ANALYSIS OF POTENTIAL CLIMATE CHANGE POLICY SOLUTIONS AND
THEIR ECONOMIC AND POLITICAL IMPLICATIONS

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ABSTRACT

When looking at potential solutions to any issue in the United States, it is important to analyze any policy on economic, legal, and political levels to ensure the maximum positive benefit. This is no different for finding policy solutions to climate change. In this thesis, a literature review will focus on two major policies that have been enacted around the world or in certain areas of the United States: carbon pricing and emission trading. These two issues will be analyzed on a legal, political, and economic matrix, fleshing out potential advantages and issues between the two policy schemes. After analysis, a policy proposal will be put forth that will be both economical and politically palatable.

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Chapter 1: History

Climate change is a word that elicits strong responses from scientists, government officials, and the public alike. The history regarding a changing climate is complicated but long, as researchers have been concerned about the influx of carbon dioxide in the atmosphere since the 19th century.

In 1824, Joseph Fourier, who was a French physicist, first described the greenhouse effect. He was interested in how the Earth regulates temperature and what forces determine the average temperature of Earth. He first described the role of atmosphere in keeping temperatures within livable ranges, and began to hypothesize that a planet without an atmosphere would be uninhabitable.¹ As science began to develop throughout the 19th and 20th centuries, researchers began to recognize that water vapor and carbon contributed to what Fourier described as the greenhouse effect on Earth.²

The first researcher to begin to describe a warming trend throughout the planet was Guy Callendar, a well-educated British engineer. Callendar accurately described that fuel combustion—which rose considerably during the 19th and early 20th centuries—was increasing the greenhouse effect in the atmosphere. He also discussed the average warming trend to be approximately .003 degrees Celsius a year, which is widely regarded as one of the first times this warming trend was quantified into numbers.³

¹ The Discovery of Global Warming, Rutgers University

² A Brief History of Climate Change, 2013, BBC

³ G.S. Callendar (1938)

It was not until the 1950s that researchers began to recognize the uncertainty surrounding the effect of increased carbon concentration in the atmosphere. Computer programs in 1955 estimated that doubling carbon dioxide concentrations would increase temperatures by 3-4

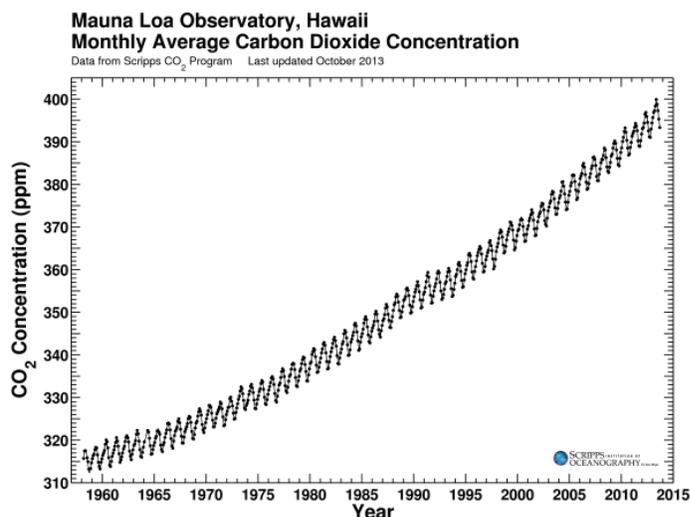


Figure 1: Carbon concentrations, Hawaii Mauna Loa Observation Station

degrees Celsius, and scientific equipment developed by Charles Keeling provided the first data stream that proved beyond a doubt that concentrations were rising year over year.⁴ The Keeling Curve—as referenced in this paper—is still used by academic researchers and

government officials today to illustrate the

growing amount of carbon dioxide in the atmosphere. The Mauna Loa station is considered the gold standard in carbon dioxide measurements throughout the globe due to its sophisticated environmental monitoring equipment and its remoteness to many mainland continents.

In the run up to the new millennia, international organizations like the United Nations began to take what would later be known as climate change seriously, which caused numerous independent governments and non-governmental organizations to begin to place emphasis on understanding the cause and effect of increased carbon on ecosystem health and human life. In the 1980s, one of the first multinational, binding treaties known as the Montreal Protocol began to regulate chlorofluorocarbons in response to concerns surrounding the ozone layer that was beginning to feature large holes. While the protocol itself wasn't created to combat climate

⁴ J. Gillis (2010)

change, scientists now recognize the Montreal Protocol as one of the greatest practices that mitigated climate change into the 21st century—even more so than the Kyoto Protocol, which was created with the in the interest of combating climate change.⁵ In the year following the adoption of the Kyoto Protocol, the Intergovernmental Panel on Climate Change (IPCC) formed to begin to assess the growing body of evidence surrounding a changing climate. IPCC released its first report in 1990. The report concluded that temperatures had risen by between .3 and .6 degrees Celsius over the last century and that the continued addition of carbon into the atmosphere would result in continued warming trends.⁶ The IPCC’s second report—in 1995—stated a “discernible human influence” was present on Earth’s climate—one of the first scientifically-supported statements that humans are responsible for climate change.⁷

The aforementioned Kyoto Protocol was the first multinational treaty with the specific goal of addressing climate change. While this protocol will be explained in greater detail later in this thesis, the basic premise involved holding parties to internationally binding emission reduction targets with the goal to reduce the concentration of carbon dioxide in the atmosphere and thus limiting the warming pattern of the globe. The United States—one of the largest contributors to climate change due to reliance on coal and natural gas for power production—is not a signatory and has no plans to join the agreement as of 2018.⁸

Climate change research accelerated substantially in the decades following the Kyoto Protocol and increasingly explored anthropogenic causes. As science began to coalesce around the fact that humans were “more than 95% likely”⁹ the dominant cause of global warming,

⁵ The Montreal Protocol, 2017

⁶ IPCC, 1990.

⁷ IPCC, 1995.

⁸ Kyoto Protocol to the United Nations Framework Convention On Climate Change, Technical Document

⁹ IPCC, 2013.

governments across the globe began to take the threat of climate change seriously. Over 150 countries have submitted national climate plans as of 2015—which includes the United States—and have begun to enact practices that will limit the amount of carbon being emitted from their countries. A summary of the most ambitious measures being taken is located in Table 1 below. All data is provided by the World Resources Institute.¹⁰

Table 1: Country and Emission Reduction Goals

Country	Action
China	Set targets to reduce emissions per unit of GDP by 40-45% from 2005 levels by 2020
Mexico	Set targets to reduce emissions by 50% from 2000 levels by 2050.
Indonesia	Set targets to reduce emissions by 30% by 2030, relative to business-as-usual levels

The United States, which is the second largest carbon contributor across the globe, had put a climate plan in place ahead of the 2015 conference, and had begun enacting it under President Obama between the years 2013-2016. The 2015 conference was the basis of the Paris Agreement, which was negotiated by 196 countries at the 21st Conference of the Parties of the UNFCCC in Paris. The Paris Treaty was an international plan that offered flexibility of individual governments to create plans to combat climate change and make regular reports available

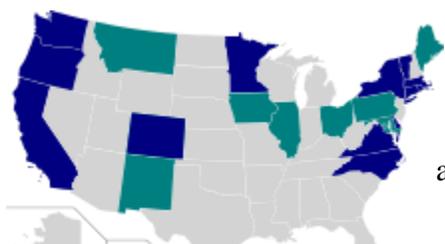


Figure 2: Map of States that have agreed to enter the US Climate Alliance

regarding progress associated with carbon emissions and anthropogenic climate change. Because of the change of administrative priorities under President Donald Trump, the climate plan has been put on hold. In addition, the fate of the

¹⁰ C. Deconcini 2015

Paris climate accord—a plan aimed at strengthening international response to global climate change—has changed with the administration. While President Obama initially committed to the climate accords, the Trump administration decided to withdraw the United States from the agreement, as he expressed concerns about the economic impact such actions would have on industry in the United States. Trump explained this action by stating that the Paris Climate Accord will put the United States economy at a significant disadvantage to the rest of the world, and is not in accordance with the administrations “America First” policy, which promises to place American citizens and businessman at the forefront of any policy decision.¹¹ As of January 2018, the United States is the only country in the world that is not a part of the Paris Climate Accord.¹² It is important to note that the United States is still technically a signatory of the agreement, as the article concerning withdrawal from the plan requires the plan to be in force for 3 years before signatories can officially withdraw. The official date of withdrawal is November 4th, 2019. Fifteen States within the United States, including large carbon-producing states like California, Colorado, New York, North Carolina, and Virginia, have formed the United States Climate Alliance, which aims to keep the commitment to the Paris Accord on a state rather than a federal level.¹³ Several large cities, including Los Angeles, California; Philadelphia, Pennsylvania; and New York, New York have also formed a similar group, titled Mayors National Climate Action Agenda, that seeks to reduce greenhouse gas emissions in a manner consistent with the Paris Accord.¹⁴ These states and cities represent approximately 25% of the total carbon emissions of the United States.

¹¹ T. Cama and D. Henry, 2017

¹² M.D. Shear, 2017

¹³ US Climate Alliance, 2017

¹⁴ US Mayor Alliance, 2017

International organizations, government agencies, and NGOs have all begun to recognize the growing threat climate change poses to global ecosystem health and human safety. While there are pockets of doubt among some government officials—predominately in the United States—about the human impact on the climate, most agencies have moved forward with plans to mitigate the effect of climate change. There have been multiple policy solutions proposed to dealing with climate change, including a free market-inspired emission trading scheme and a carbon pricing scheme. Both of these will be analyzed on three dimensions as it applies to the United States: economically, politically, and legally.

Chapter 2: Effects of Climate Change

When looking at policy proposals that deal with climate change, it is crucial that policymakers understand the vast effects that climate change will have on ecosystems, human health, communities, and economies. This information will help guide government officials on which areas to focus, and what type of mitigation measures should be put into place to help offset potential economic damages associated with climate change.

One of the most well-researched consequences of climate change is the effect of a warming climate on natural disasters, especially in regards to hurricanes, flooding, and fire season.¹⁵ Because warmer temperatures often correspond with increased precipitation and more severe hurricanes, coastal zones—especially in the Gulf of Mexico and on the eastern coast of Asia—are expected to see a large increase in flooding and infrastructure damage related specifically to climate change. In the United States, extreme weather has cost the United States economy over \$200 billion over the past decade—a figure that is being made extensively worse by climate change. In 2017 alone, three major hurricanes and the 76 wildfires in the western United States cost upwards of \$300 billion dollars—a figure that underscores the acceleration of natural disasters as the climate continues to change across the globe. Projections from the Universal Ecological Fund estimate that the average losses will exceed \$350 billion dollars annually over the next ten years, mainly due to large natural disasters and health costs that are associated with air pollution.¹⁶

While the economic cost alone should prompt concern among policy makers and the general public, human health is expected to be affected as well due to increased temperatures, declining air quality, and the spread of tropical diseases. An extensive report compiled by the

¹⁵ M.K. Aalst, 2006

¹⁶ R. Watson, J.J. McCarthy, and L. Hisas 2017

National Institute of Health captures the potential effects of climate change on the health of the general populace. Allergic diseases, which include asthma, hay fever, and skin rashes, are expected to increase significantly as the climate continues to change and urbanized areas experience warmer summertime temperatures. Ground-level ozone, which is formed due to a reaction catalyzed by sunlight, is expected to increase as temperatures increase. This is a particular concern to public health officials, as ozone is considered one of the primary triggers of asthma in vulnerable populations.¹⁷ In addition, changing rainfall patterns in the desert region of Africa and Asia will cause an increase in dust suspension in the atmosphere, contributing to particulate matter loads and adding to emergency room visitations.¹⁸

Cancer, the second leading cause of death in the United States, is also expected to see an increase in incidence rate. A report in the *Human and Ecological Risk Assessment Journal* discusses how volatile organic compounds (VOCs) are expected to see an increase in volatilization as temperatures increase, especially compounds that were previously stored in waterways across the globe.¹⁹ VOCs, like formaldehyde and benzene, are thought to be proven/probable human carcinogens. Because of increased volatilization of these compounds, places that were previously largely free from these compounds will be exposed in both increased duration and concentration than previously seen.¹⁹ In addition, increased precipitation events will likely increase the amount of leaching of toxic chemicals and heavy metals from storage sites, while also setting conditions that will increase runoff from industrial sites that feature large concentrations of potential carcinogenic chemicals.²⁰ This runoff will lead to an increase in

¹⁷ Health Effects of Ozone in Patients with Asthma and Other Chronic Respiratory Disease, EPA, 2016

¹⁸ C.J. Portier and K.T. Tart (2015)

¹⁹ R. Macdonald, D. Mackay, Y. Li, and B. Hickie (2003)

²⁰ D. Mcaloose and A.L. Newtown (2009)

chemicals in marine ecosystems, triggering long-range bioaccumulation in food webs and thus exposing humans to a greater concentration to chemicals and heavy metals via dietary choices.

There are numerous other health effects that will be associated with climate change, including an increase in cardiovascular disease and stroke, an increase in both incidence and prevalence of neurological diseases and disorders, and an increase in vector-borne diseases. Vector-borne diseases have recently become a focal point of research among climate scientists and public health officials, as previously well-controlled diseases are beginning to emerge again, especially in developing nations where the government doesn't have strong anti-vector programs and has poor health infrastructure to give care to infected patients care.²¹ In the United States alone, a report by Climate Central estimates that mosquito season has grown by over 75% since the 1980s, mainly due to increases in warm and humid weather—two conditions that are conducive for vector-borne infectious diseases (VBID). The United States has already seen the effect of climate change and its influence on VBID, as mosquitos carrying the Zika virus are now viable in some portions of the southeastern United States.²² While the US has done an excellent job in removing vectors that cause diseases like dengue, yellow fever, and typhus, public health officials believe that increased temperatures across the United States will lead to a reintroduction of these diseases into the population and require local health organizations to develop strategies to help mitigate the effect of these diseases in the human population.²³

²¹ Climate Risk and Vector Borne Diseases, 2017

²² More Mosquito Days Increasing Zika Risk in US, 2017

²³C.B. Beard, et.al 2916

In addition to changing disease patterns and human health effects, many agricultural researchers have also begun explore climate change to help better understand how a changing climate will change the growth patterns of crops and livestock throughout the United States and the world. A report by the National Oceanic and Atmospheric Association (NOAA) highlights the changes in the growing seasons that will occur in 2070-2099, in comparison to the

Projected Changes in Key Climate Variables Affecting Agricultural Productivity

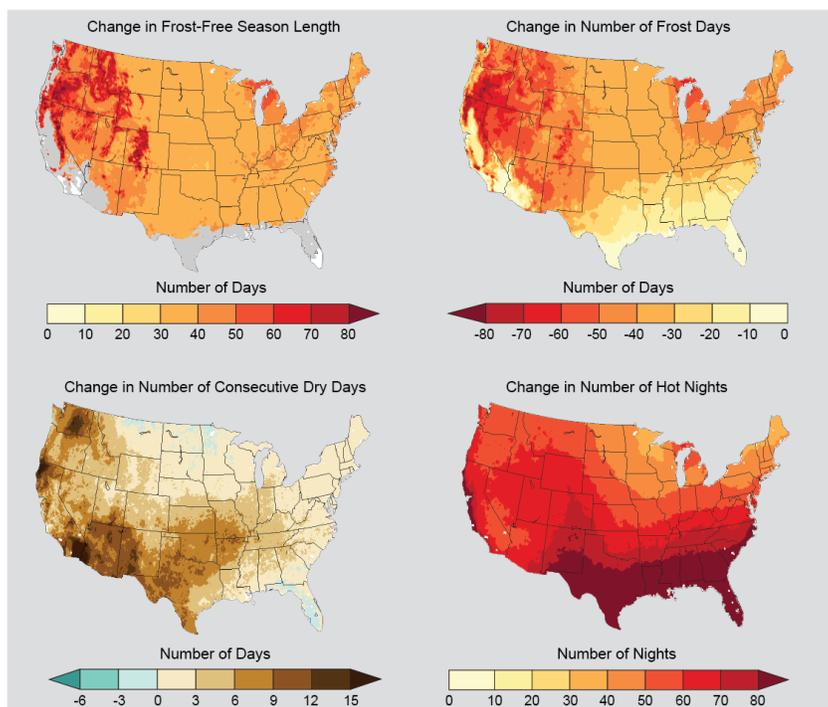


Figure 3: Changes in Key Climate Conditions, NOAA

years of 1971-2000. A summation of these findings can be seen in Figure 3. These changes will greatly influence the growing season in many parts of the country, thus allowing different areas to grow crops that are currently untenable for a particular area.

Being able to cultivate crops in different areas of the country is a topic that is fiercely debated among climate scientists and agricultural researchers in regards to whether this change is positive for humans overall. Individuals who believe that increased crop production is a positive point to the fact that an increased food supply due to increases in cultivation in the Upper Midwest and the Northeast will help address food insecurity in areas across the globe, along with an increase in economic activity that is associated with wide-spread cultivation of crops and the production of livestock. However, many individuals question whether fact soils in these potential locations are suitable for long-term wide-spread cultivation, and that some of these

locations will require substantial nutrient supplementation and irrigated water to support these crops.²⁴ Critics also point out that an increase in livestock production will further exacerbate the issue of carbon entering the atmosphere, as animals are one of the largest natural sources of methane across the globe. Regardless of viewpoints, it is widely recognized that the field of agriculture will be significantly altered because of changing climatic conditions, and policy makers must be ready to enact land-use regulations and water law to ensure optimal outcomes for economic and societal health.

One of the areas of research regarding the effects of climate change that is not well understood is how warming patterns in the Middle East and elsewhere will effect migration patterns throughout the globe. Many political scientists who specialize in conflict and war have begun to point to climate change as a “threat multiplier” for the Syrian civil war, as increased droughts pushed many individuals—most of them young men—to urban areas in search of economic opportunity and a better livelihood as the climate has become too warm and dry to reliably cultivate crops. Political science literature has long held that one of the primary indicators of unrest and civil war is an increase in youth with a subsequent decline in economic opportunity, which is the exact conditions that occurred in Syria in the late 2000’s that led to the current Syrian War crisis.²⁵ However, it is recognized that some scholars disagree with the idea that the Syrian Civil War has been partially caused by climate change, as an article in the *Political Geography* journal found that the associated climatic conditions did not influence the Syrian Civil War as many pundits originally thought.²⁶ Syrian Civil War aside, the case for climatic influence on the general Middle East refugee crisis is backed up by substantial research.

²⁴ Climate Impacts on Agriculture and Food Supply, 2016

²⁵ P.H. Gleick (2014)

²⁶ J. Selby, et.al. (2017)

An article published in *Science Magazine* found that as temperatures deviated from 20° C—an optimal temperature for agriculture—asylum applications increased. The paper goes even further, and implicates that continued increases of temperatures is likely to increase asylum applications by between 28% and 188% by year 2100, depending on what climate models are used in determining future increases in temperature.²⁷ This will have a profound impact on Europe, as countries are still crafting policies in regards to the refugee crisis that occurred during the mid 2010's. Literature suggests that increased movement from Southeast Asia, the Middle East, and several Central America regions will place a strain on Western economies, as many of these refugees will require substantial investment from the state to ensure that new immigrants meet the higher standard of living of developed countries.²⁸ As is seen in western elections in the 2010s, immigration and migration have continued to be flashpoints in modern-day democracies, and it is likely that this issue will continue to polarize and become more salient, as countries like the United States and Great Britain—two areas of the world expected to see the least deleterious effects of climate change—will need to develop policies with regard to increased migrant populations in their country.

Climate change is going to affect every facet of society in some ways. Between the changing disease patterns, differing agriculture production, and increased strain on refugee support systems, changing climatic conditions will effect wide swaths of the global populace. It is the job of researchers, policy makers, and the general public to analyze the data and determine best courses forward to properly mitigate the effects of a changing climate. In following sections, potential climate change policy solutions will be discussed and analyzed on three different dimensions: economic, political, and legal.

²⁷ A. Misirian and W. Schlenker (2017)

²⁸ C. Raleigh, L. Jordan, and I. Salehyan (N.D.)

Chapter 3: Policy Proposal: Carbon Tax

Basic Premise

A carbon tax is a policy that has been debated and proposed in numerous nations across the globe, as well as in individual states across the US. The basic premise behind this policy is to internalize the negative externality that is associated with carbon pollution. Many environmental economists do not believe the current price associated with processes that produce carbon fully capture the negative effects that this carbon output has on ecosystems and society as a whole. One proposal that prices in these negative externalities is to place a tax on processes that produce carbon at a level to be set by a regulating body. There are substantial differences in proposals to place carbon taxes on products, and even greater differences in how the redistribution structure should work in regards to revenue raised by the carbon tax.

Who has implemented a carbon tax?

Many nations across the globe, including Australia, New Zealand, parts of Canada, Spain, and Portugal, all have enacted some form of a carbon pricing scheme that attempts to internalize the negative externality associated with carbon emissions. Each country has their own nuances in how they enact this policy. The United Kingdom sets a carbon price floor, requiring fossil fuel producers to pay £18 pound per metric ton of carbon dioxide, which corresponds to \$24-\$25 per short ton. Ireland places a tax of approximately \$23 per short ton on fossil fuels and solid fuels like coal and peat, while Sweden has a legislative tax of \$150 per ton of carbon dioxide. Australia had a carbon tax from 2012-2014, but repealed it due to political pressure. A full map of carbon taxation can be found in Figure 4, while a summary of different countries policies can be found in Table 2.

Locations of Existing, Emerging & Considered Carbon Pricing Instruments

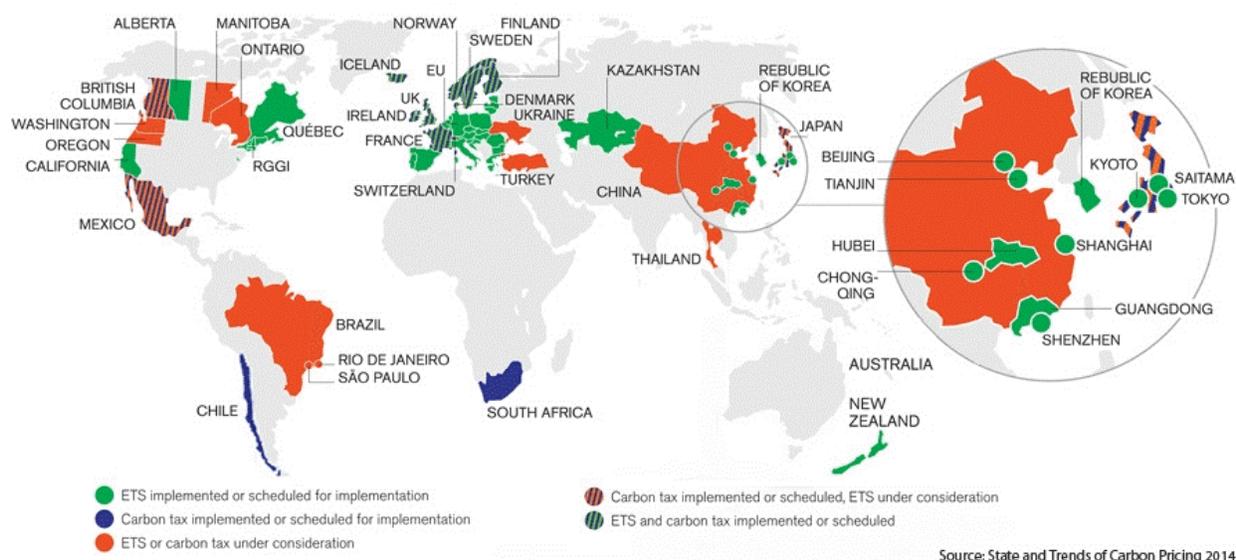


Figure 4: Map of Carbon Pricing Schemes Worldwide

Table 2: Summary of Carbon Taxes by Selected County

Country	Policy
United Kingdom	Carbon tax price floor, \$24 per ton CO ₂
Ireland	Carbon Tax at \$24.50 per ton CO ₂ , includes fossil fuels used in homes, offices, vehicles, and farms, including coal and peat
Australia	Carbon tax, \$19.60 per ton CO ₂ , repealed in 2014 due to political pressures
Chile	Carbon tax, \$5 per metric ton, will only cover 55% of emissions, enacted in 2018
Sweden	\$150/T CO ₂ , but not applied to fuels used for electricity generation and industries only pay 50% of the tax
Japan	\$3 per metric ton
Finland	\$24 per tonne CO ₂
Denmark	\$18 per metric ton CO ₂
Switzerland	\$38.43 per metric ton CO ₂
Costa Rica	3.5% of market value of fossil fuels

(Source: Carbon Tax Center)²⁹

²⁹ Where Carbon is Taxed, 2017

As is expected due to the varied nature of different nations, many different levels and programs surrounding carbon taxation have been enacted. Each of these nations also has different reinvestment schemes, with some opting to put the money taken from the tax and place it into the general reserve, while others use incentive programs and redistribute the tax based on usage and socioeconomic status statistics.

Models of Carbon Taxation: What choices are there?

When looking at establishing a carbon tax here in the United States, it is important to recognize the differing investment schemes that could be enacted when placing a carbon tax on United States emissions. The most basic scheme is to collect taxes just like any other federal income tax, in that the money raised from the carbon taxation would go into the general fund and be used to finance infrastructure, entitlement programs, or to pay down debt. This scheme, however, is often rejected by policy makers, as it would increase the tax burden on Americans and is regressive, in that lower income individuals, who tend to drive older cars and lack the financial resources to retrofit their houses/apartments with practices that will lower their carbon footprint. Several policy makers have suggested exempting the poorest of Americans from the carbon tax to mitigate the deleterious effects of this regressive tax, while another structure encourages placing stronger fines on the wealthy and large corporations to permit a more even structure of carbon taxation. Another strategy in regards to a carbon tax is a blend of cap-and-trade—which will be discussed later in this document—and the traditional carbon tax. The idea is that each individual would be taxed at a flat rate each year, and then based on usage patterns of comparable individuals, could receive a rebate in that tax if they fell below the target emission, or receive a higher tax bill if they created more emissions than their comparable cohort. This would help limit the effect of the regressive tax, and could encourage individuals to reduce emissions as much as possible in hopes of getting a tax rebate at the end of the reporting period.

This, too, has some drawbacks, as it is unclear of how emission data would be compiled, and it still would be easiest for the wealthiest to retrofit their homes in ways that would limit emissions and maximize rebates. One of the more popular structures among environmental economists is known as the double-dividend hypothesis.³⁰ In America's current tax system, there is a large deadweight loss in the way that the government collects taxes, meaning that the free market system is at a disequilibrium and thus loses efficiency. The double-dividend theory works under the assumption that a carbon tax can both decrease the inefficiency created by typical tax structures and internalize the externality associated with carbon emissions. Economists hypothesize that this double-dividend hypothesis could be realized by instituting a carbon tax and then subsequently decreasing the corporate income tax, in order to keep the tax burden relatively the same for businesses in operation.³¹ There are some political drawbacks associated with this double-dividend hypothesis, which will be discussed in subsequent pages of this document.

Economic Analysis: Carbon Tax

Adding taxes to an already-convoluted tax system requires significant analysis to determine what the effect will be on GDP growth and on citizen's spending habits and their subsequent tax burden. Many economists have looked to other countries that have implemented some form of carbon tax and analyzed the effect these policies had on economic growth and citizen spending habits.

Revenue-neutral carbon taxes are the easiest to analyze for economic activity. A paper published in the *Review of Environmental Economics and Policy* analyzed a revenue-neutral carbon tax based on several principles, which included:

³⁰ A. Bento and I. Parry (1999)

- A tax on GHG emissions at an initial rate of \$15 per metric ton of CO₂ (and equivalent) that gradually increases over time
- A refundable tax credit for sequestered emissions
- A refundable credit for embedded CO₂ in exported fuels and taxation imposed on the embedded CO₂ in imported fossil fuels
- An environmental EITC (earned income tax credit) on personal income taxes equal to the employer and employee payroll taxes on initial earnings, up to a limit.³¹

Calculations conducted by the author of this paper estimated that this taxation scheme would raise upwards of \$90 billion in tax revenues a year if behavior did not respond accordingly. However, the research team did expect that greenhouse gases would be reduced by fourteen percent in the short run, with greater reductions occurring in the future as the tax continued to rise. This carbon tax structure would be estimated to raise gasoline prices by 7%, natural gas by 9%, and coal-fired electricity by 24%. This would have the effect of increasing costs on consumers generally, and would lead to decreased amounts of spending money that could have been used in other sectors. Gilbert Metcalf, the author of the paper, calculated how the proposed policy structure would change household income based on various baseline income levels. He also illustrated how the payroll tax, which is the tax that places funds into the Social Security Trust Fund, would change under this carbon tax structure. The results can be seen in figure 5 and figure 6.

³¹ G. Metcalf (2008)

Relation of the environmental tax credit to payroll taxes

Wages (\$)	Payroll tax		
	Before credit (\$)	After credit (\$)	Reduction (%)
5,000	765	205	73
10,000	1,530	970	37
15,000	2,295	1,735	24
20,000	3,060	2,500	18
30,000	4,590	4,030	12
50,000	7,650	7,090	7
90,000	13,770	13,210	4

Source: Author's calculation.

Figure 6: Change in Payroll Taxes Under Carbon Taxation Plan

As can be seen in both charts, there is no large income changes associated with the two-pronged approach of reducing the payroll tax in accordance with instituting an initial \$15-per-ton CO₂ equivalent carbon tax. However, it is important to recognize that while there is no *significant* difference in change as percentage of income, there is at most a decrease of between half a percent and a percent of income at the lowest income levels, which could have a significant effect on the optics and feasibility of this type of proposal. Economically, this could have an effect on spending habits of Americans, and will likely hit those hardest who can least afford income decreases.

When looking at other types of carbon taxation structures, there are mixed results regarding the effect on economic activity and growth. A paper published in the *International Tax and Public Finance Journal* found that in small economies with decentralized wage bargaining and equilibrium unemployment, a carbon tax can reduce employment in lower-skilled positions

Distributional impacts of the carbon tax swap

Income group (decile)	Change in disposable			Change as a percentage		
	income (\$)			of income		
	Carbon tax	Tax credit	Net	Carbon tax	Tax credit	Net
1 (lowest)	-276	208	-68	-3.4	2.7	-0.7
2	-404	284	-120	-3.1	2.1	-1.0
3	-485	428	-57	-2.4	2.2	-0.2
4	-551	557	6	-2.0	2.1	0.1
5	-642	668	26	-1.8	1.9	0.1
6	-691	805	115	-1.5	1.8	0.3
7	-781	915	135	-1.4	1.6	0.2
8	-883	982	99	-1.2	1.4	0.2
9	-965	1,035	70	-1.1	1.1	0.0
10 (highest)	-1,224	1,093	-130	-0.8	0.8	-0.0

Figure 5: Change in Disposable Income By Income Group

while increasing employment in higher-skilled positions.³² However, another paper illustrated that if involuntary unemployment exists in the same small, open economy analyzed in the prior paper that the double-dividend could be realized by increasing inputs towards labor and capital intensive processes rather than energy intensive processes.³³ This same paper also states that recycling revenue produced by a carbon tax in lump-sum transfers, as was proposed by the Metcalf paper, will slow growth, while also illustrating that recycling that same revenue through a reduction in value-added taxes and/or social insurance will increase growth, thus realizing the double-dividend hypothesis.³¹

Based on various research and case studies using other countries as case studies, it is evident that a double-dividend of increasing economic growth while limiting distortions and dead-weight loss in open markets can be realized *if the proper revenue recycling model is adopted*. It is important to underscore how some structures of carbon taxation are incredibly regressive, namely policies that either 1) don't recycle revenue at all and use this taxation policy as an additional revenue source or 2) recycle revenue in a way that rewards higher-income earners for retrofitting their lifestyles with environmentally friendly practices. While it isn't necessary for the policy to be progressive, it is likely that a regressive carbon taxation policy will have long-term negative effects on low-income families and will likely hamper economic growth, especially in states that are more reliant on fossil fuels for energy generation rather than renewable energy resources.

³² B. Holmlund and A.S. Kolm (2000)

³³ T. Conefrey, et.al. (2013)

Legal Justification

When analyzing a carbon tax program based on the legality and previous case law, it is fairly evident that this type of taxation is legal and within constitutional powers of the legislating body. Article I, Section 8, Clause 1 of the constitution states that that “the congress shall have Power to lay and collect Taxes, Duties, Imposts, and Excises, to pay the Debts and provide for the common Defense and general Welfare of the United States”. While case law in the 19th century would lead to some question regarding the legality of this tax, the passing of the 16th amendment has largely eliminated many challenges to taxation in the United States. However, state-by-state carbon taxation could prove to be more interesting to legal scholars. A report curated by the Carbon Tax Center illustrates that many states have constitutional clauses that require gasoline and diesel taxes to be spent directly on highway and infrastructure spending.³⁴ Because of revenue recycling that is often proposed with the legislation of a carbon tax, it is likely that the carbon taxes that are placed on gasoline on a state-by-state basis would thus need to be spent on infrastructure, thus limiting the amount of recycling that could realistically be expected by states. This is why a national carbon taxation scheme would be necessary to ensure the legality and effectiveness, as state-by-state solutions would seem to open up policy makers to large roadblocks that would be tough to overcome without a state constitutional amendment and/or referendums that will be voted on by the general populace. It is generally understood among most environmental policy makers that a carbon pricing scheme would need to be instituted on a federal level, as localized policies could have large deleterious effects on carbon emission reduction.

³⁴ Y. Bauman and C. Komanoff (2017)

Political Analysis

Taxation is always a controversial subject in regards to political realities, and a carbon tax is not immune to this phenomenon. During the late 2000's and early 2010's, many political parties across the globe have begun to recognize the political upside of instituting a carbon tax, especially the plans that are revenue-neutral and promise to increase economic growth. Recent polling done on this issue has suggested that the public has become more receptive to the idea of a carbon tax, with the National Society of Energy and the Environment finding upwards of 50% support versus 41% opposition as of Fall 2016.³⁵ This compares to a carbon tax polling with 36% support in Fall of 2009, when President Barack Obama and the Democrat-controlled House of Representatives and Senate were debating climate change legislation. United States public officials, on the other hand, have not shown similar trends of increasing support for carbon pricing schemes. In the United States Senate, fewer than ten senators have been on record supporting a carbon pricing scheme, with only one of them, Senator Lindsey Graham from South Carolina, currently caucusing with the majority party. In 2015, Barack Obama became the first sitting United States President to endorse the concept of carbon pricing, speaking to public officials and diplomats at the United Nations Climate Change Conference in Paris, France.³⁶ In the 2016 Presidential Election, Senator Bernie Sanders became the first major party candidate to endorse the idea of a carbon pricing scheme while running for office. Senator Sanders ended up losing to Secretary Hillary Clinton in the primary.

Within the two major parties in the American political system, there is little debate that the idea of a carbon taxation scheme is generally more popular among the Democratic Party than the Republican Party. However, it is important to note that this type of division is not uniform.

³⁵ D. Puskin and S. Mills (2017)

³⁶ E. Lehmann (2015)

RepublicEn is a nonprofit group that was founded by a conservative ex-congressmen from South Carolina who has encouraged conservatives to lead on climate and endorse revenue-neutral carbon pricing that does not add to the tax burden of businesses or the general populace. In addition, Democratic public officials throughout Pennsylvania, Ohio, West Virginia, Kentucky, and other coal-producing states have expressed pessimism when it comes to carbon pricing, citing the effect that it could have on employment in communities that heavily rely on carbon-rich energy production for employment and business.

The 2016 elections in the United States brought forth the first unified Republican-controlled government since 2006, with the election of President Donald J. Trump and the subsequent reelection of Republican majorities in both the House of Representatives and the Senate. Because of this, it is unlikely that a carbon tax would be enacted under this partisan breakdown of federal government control. President Trump has expressed skepticism to the existence of climate change, and has shifted government focus from developing green energy technologies to ensuring the profitability and growth of resource-intensive jobs like coal and natural gas development. In addition, the Environmental Protection Agency, the agency that would likely be key in developing this legislation, along with the Department of Energy, is currently run by Scott Pruitt, who has expressed deep skepticism regarding climate research and the effect of climate change on the United States. The United States has also recently withdrawn from the Paris Agreement, which encouraged policy and infrastructure development to help offset the effect of climate change worldwide. Climate change is not currently a priority of the federal government currently, and any push for legislation is unlikely under the current (as of March 2018) breakdown of partisan power in Washington, D.C.

Politically, one of the more realistic short-term solutions is to petition states that have public officials that are much more open to legislating and acting on issues regarding climate change. The United States Climate Alliance, as referenced earlier in this paper, has been identified as a key group for carbon taxation proponents to focus on. This group includes large states like California and New York, which houses large percentages of United States population and are thought to be able to make a dent in carbon emissions from the United States. Interest groups like the Sierra Club and the Natural Resources Defense Council have given tepid support to carbon taxation, although there is deep divide among members and localized groups that have advocated for different forms of carbon taxation, which makes it difficult to have a united policy force when advocating in the United States.

Final Thoughts

Carbon taxation is a complex policy proposal, with many different structures and revenue recycling models that need to be considered when advocating this legislation as a solution for dealing with carbon emissions in the United States. While the legal footing is sound, there is some question marks surrounding the economic implications of such an abrupt shift in tax policy in the United States. While the double-dividend hypothesis has been illustrated to work in differing economies around the globe, it is difficult to definitively determine what would happen in the United States under similar proposals, as the economy is much larger than countries like Ireland and Israel. In addition, political realities as of March 2018 make it unlikely that any type of carbon taxation legislation will be passed and enforced at a federal level. Until the partisan makeup of the federal legislature changes, it is likely that the best approach of advocates of this policy is to work with state governments that have been on record as being open to regulating greenhouse gases and being concerned about climate change.

Chapter 4: Policy Proposal: Cap and Trade

Basic Premise

Cap and trade is another policy proposal that has been popular among environmental economists and policymakers since at least the late 1990s. The United States Environmental Protection Agency describes cap and trade as a market-based solution that “specifies the maximum quantity of emissions authorized from sources included in the program”.³⁷ While this seems like a simple policy proposal, it is quite difficult when looking at the market forces that need to be set up in order for this exchange program to work as intended. The main premise behind cap and trade is that it takes advantage of differential cost of abatement among different producers in the same industrial group. A central body—most likely the Environmental Protection Agency, in the case of the United States—gives an industry a certain amount of tons that they are allowed to produce, with caps on individual producers that encourages innovation and trading.

For example, say that the EPA has decided to regulate the natural gas producers in Pennsylvania, and that three producers will fall under the purview of this regulation. Currently, Producer A, Producer B, and Producer C all produce 10 tons of pollution before regulation. The EPA decides to limit carbon equivalent emissions to 15 tons for the sector, giving each producer 5 tons of emission credits. Producer A is able to abate its pollution at a cost of \$100 a ton, and are successfully able to get to the 5 ton reduction necessary. Producer B has a lower cost to abate their pollution, with a cost of \$80 a ton, and was able to successfully reduce its pollution to only 3 tons—2 more than required. With these additional 2 tons, it is able to sell those credits to producer C, who has an abatement cost of \$120 per ton of pollution. Because of the differential costs associated with pollution abatement, Producer B has both 1) gained profit because of it

³⁷ Tools of the Trade: A Guide to Designing and Operating a Cap and Trade Program for Pollution Control, 2003

selling credits and 2) has made its company more environmentally friendly. A summation of this process can be seen in figure 7

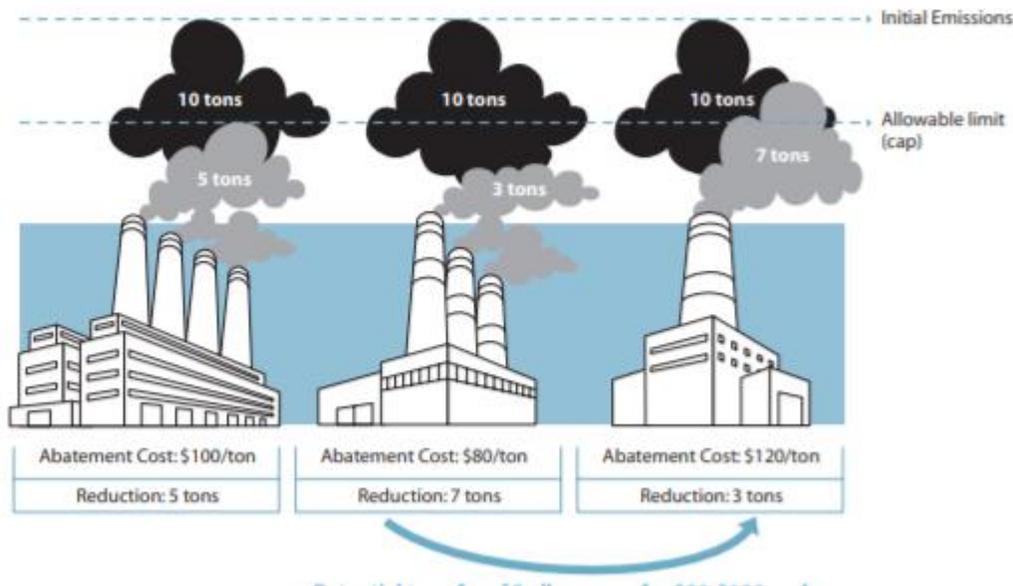


Figure 7: Summation of Credit Trading Scenario (Source: EPA)

Based on the above scenario, it makes sense that these cap and trade programs only will work when there are cost differences for pollution abatement. In addition, there needs to be enough producers in an industry to encourage trading—far more than the three producers above in the overly simplistic model showcased above. Without a sufficient market with a sufficient number of transactions, producers would be both hesitant to invest in greener retrofit programs and would be less likely to want to sell their permits, as there would be worries about business conditions changing and thus being able to buy back their permits at a price that was equivalent to what they sold them for.³⁵ There also has to be a central government authority to administer these programs, along with adequate political and market institutions (like property rights and contract law) that will help guide transactions. In the United States case, this type of policy could be enacted, as there is sufficient authority from a central government and there are multiple market institutions that will encourage accountability.

Another issue that policy makers must consider is how to measure emissions, as this is key to enforcing emission reduction quotas and encouraging transactions in a market. Any type of policy proposal will need to consider both how to measure carbon equivalent emissions and how often these measurements will take place, as changing market conditions will likely result in fluctuations of emission allowances given to each industry. In order to be an actual solution to emission reduction, there also needs to be a plan to gradually lower the amount of emission credits given to industry over time, which could pose some political and economic uncertainties that many policy makers try to avoid.

Many proponents of cap and trade point to the fact that this takes into account differential abatement costs, which promotes innovation in industry that helps limit emissions that have spillover effects into other parts of the economy, including education and consumer behavior. Because companies will try to lower their pollution as much as possible in order to sell lucrative credits to other companies within the same industry, it allows factories to be upgraded, technology to be developed, and individuals to develop innovative processes that help limit carbon emissions into the atmosphere. Cap and trade is a market based approach, whereas a carbon tax is considered command-and-control regulation. Potential drawbacks, however, point to the inherent uncertainty that is associated with market-based solutions versus a traditional carbon tax. There is no way to definitively forecast what the price of credits will be into the future, and there is a possibility of market collapse if either the industry sector grows too small or if the cap is set too high. This also leads into a criticism of intense administrative costs to oversee this program, which is an area where critics are quick to pivot to a carbon pricing scheme rather than emission trading.

Who has done this before?

Unlike carbon taxation, there has been precedent in the United States to set up market-based solutions to climate change. The Acid Rain Program, which was established under Title IV of the 1990 Clean Air Act Amendments, sets markets for sulfur dioxide, which is one of the major contributors to acid rain throughout the United States. The program established a cap of 8.95 million tons of SO₂ from electric generating units from the United States, and has been successful in significantly reducing sulfur dioxide emissions.³⁸ In addition, the Regional Greenhouse Gas Initiative (RGGI) is considered one of the first mandatory programs that utilizes market based solutions to reduce greenhouse gas emissions. Currently, the program operates in the Northeastern and Mid-Atlantic states, which includes Connecticut, Delaware, Maine, Massachusetts, New Hampshire, Rhode Island, and Vermont. RGGI sets a cap at which the entire region has to be under for carbon dioxide emissions from the power sector, which is currently set just over 60 million tons for the year 2018. The cap currently goes down about 2 million tons each year, with the goal of getting to about 56 million tons by 2020, which will then trigger an adjustment and will continue on through the next ten year reporting period. RGGI utilizes an auctioning system between power companies and states that allow for innovations to occur and for states to take advantage of the differential abatement costs effectively.³⁹ California, the largest state by population in the United States, has also established a cap and trade program that is expected to cut emissions by 40% below 1990 levels by 2030.⁴⁰ Markets across the globe have also established different cap and trade policies, including New Zealand, China, India, and the European Union.

³⁸Acid Rain Program, 2017

³⁹ Elements of RGGI, n.d.

⁴⁰ California Cap and Trade, 2015

Economic Effects of Cap and Trade

When looking at previous academic work regarding cap and trade, it becomes quickly apparent that emission trading policies like cap and trade elicit mixed opinions among economists and environmental advocates. The United States considered enacting an emission trading scheme back in the late 2000s, which prompted numerous economists to begin researching what this type of policy would do to American economic growth. A study published by the Massachusetts Institute of Technology illustrated the mixed bag associated with cap and trade legislation. Households that make under \$10,000 a year would see a net benefit of approximately 1.5% of their annual income, mainly due to COLA that are associated with government benefit programs and the fact that the emission trading plan proposed during this time period had special rebates for those who were low-income and/or for regions that would have been particularly hard-hit due to carbon emission trading. On the other hand, individuals making over \$50,000 a year—which represents approximately half of Americans—would see a net negative change, with those at the highest income levels seeing a decrease of spendable income of about 0.5%—a small amount that nevertheless may be politically challenging. This decrease in income is mostly attributed to increased cost associated with energy, including gasoline costs, higher airline ticket prices due to jet fuel cost, and higher prices on products that involve carbon-intensive production techniques. This report also suggested, without specific numbers, that including the health benefits of reduced carbon emissions would likely be a net positive on every American, although future research would need to be done on the association between less carbon pollution and health care costs.⁴¹

⁴¹ S. Rausch, G. Metcalf, J. Reilly, and S. Paltsey (2010).

A separate report published in the journal *Climate Policy* suggest some different findings. The journal article, written by several prominent climate economists, illustrates that a cap and trade program in the United States would not “significantly slow economic growth” *if large-scale evolutions of American energy system occur as expected*. The authors placed this large caveat on economic effect, as the researchers explained that having such a large percentage of American energy production be reliant on natural gas and coal will increase the deleterious economic effects associated with a cap-and-trade system.⁴² Regardless of what study is utilized to determine policy effectiveness as it relates to the American economic system, it is apparent that different segments of the population will come out ahead in an emission trading model, especially those who reside in states where green energy is already abundant and in families who have low-incomes and utilize government assistant programs.

Political Analysis: Emission Trading

Measuring public reaction, and therefore political effects, associated with emission trading policies is difficult, as not many public opinion polls have been conducted on a specific climate change solution like emission trading. While a majority of Americans often believe in climate change and believe humans are the main cause of it, political action has been tepid in the past.⁴³ There has been a dearth of recent public opinion polling on this issue, with the most recent survey to poll specifically on emission trading conducted in 2008 showing 50% support-39% opposition.⁴⁴ Political realities and opinions have shifted since then, so it is difficult to ascertain that this level of support or opposition still exists today without the proper polling data.

⁴² S. Paltsey, et. Al. (2008)

⁴³ A. Leiserowitz, et. Al (2017)

⁴⁴ T. Rosentiel (2009)

When comparing the likelihood of passing an emissions trading bill in relation to a carbon tax, it is recognized that both of these policies are unlikely to pass under the current partisan breakdown of the federal government as of 2018. While recent surveys have suggested an increase in engagement and worry about the effects of climate change, there is still a large partisan gap, with a Gallup poll commissioned in June 2017 showing 66% of Democrats versus 18% of Republicans worrying a “great deal” about climate change.⁴⁵ While those worrying about climate change has increased among Democrats and Independents since 2001, it has actually *decreased* among Republicans in the same time frame.⁴⁴ Because of partisan feelings about the threat of climate change, it is unlikely that the Republican controlled federal government will enact any legislation in this sphere in the immediate future.

Despite political realities, it is possible that cap and trade and emission trading schemes could be more politically feasible if it is structured and marketed as a free-market solution. Political science and opinion research has indicated that the term “free market” elicits the most positive impression on a majority of Americans, whereas terms like “capitalism”, “socialism”, and “government-managed economy” poll far worse.⁴⁶ This suggests that correctly marketing cap-and-trade as a “free market solution” to climate change could elicit more positive responses and thus have more public support than a carbon pricing scheme. While public support doesn’t always correlate with political action, it is at least likely that government officials would be more receptive to policy change if the public is 1) squarely behind it and 2) actively pushing the issue through contacting representatives and voting in local, state, and federal elections.

⁴⁵ Public Opinion Research, Gallup Organization, 2017

⁴⁶ E. Ekins (2015)

Legal Justification

Finding case studies of legal justification of emission trading schemes in the United States proves difficult. Various states, including Delaware⁴⁷ and New York⁴⁸, have survived legal challenges surrounding the RGGI law, a type of emission trading scheme that could be similar to a scheme enacted nationwide. While plaintiffs have argued that the RGGI laws are “capricious” and “not backed by evidence”, courts have found that plaintiffs lack standing and fail to provide concrete illustrations of an undue burden imposed because of the implementation of this policy.⁴⁶

On the federal level, it is clear that the federal government has the authority to regulate carbon emissions—which includes programs like emission trading. In a landmark case in 2007, *Massachusetts vs. EPA* held that the EPA had the “statutory authority” to regulate greenhouse gas emissions, including carbon dioxide, under the Clean Air Act Section 202(a)(1), which stipulates that the EPA administrator should set emission standards for air pollutants that are likely to endanger public health and welfare.⁴⁹ While it is understood that the state can set emission limits, it is unclear on what the mechanism should be or what the limits are. In 2015, President Obama and Environmental Protection Agency Administrator Gina McCarthy announced their Clean Power Plan, which was a rule that aimed to reduce the amount of carbon pollution from Electric Utility Generation Units.⁵⁰ The EPA and President Obama, at the time, indicated that the Clean Power Plan was legal under section 111(d) of the Clean Air Act, which allowed the EPA to set overall standards for emissions of a pollutant on a state-by-state basis. However, the Supreme Court of the United States decided to issue a stay on the matter in February of 2016 until legal

⁴⁷ David T. Stevenson v. DDNRE court case

⁴⁸ AG Schneiderman Wins Court Victory Defending Critical State Effort to Combat Climate Change, n.d.

⁴⁹ Massachusetts v. EPA court Case

⁵⁰ Federal Register, EPA

challenges could be heard through the courts. The Clean Power Plan required individual states to submit plans to reduce carbon emissions, and it is likely that at least some of the states would have explored the possibility of implementing an emission trading scheme to limit these emissions. Because of the uncertainty surrounding the legality of regulating carbon emissions in this manner, it is likely that the most cautious approach when it comes to legal authority is to pass it through the legislative chambers and have it be signed by the president.

Chapter 5: Policy Proposal

When looking at the two policy options that have been examined in this paper, it is clear that there are advantages and drawbacks that need to be taken into account when proposing a policy that is economical, legal, and politically feasible.

Carbon taxes have some advantages over emission trading schemes. Carbon taxes often are favored by environmental professionals, mainly because there is little uncertainty regarding future carbon pricing, as the tax is definitive and isn't susceptible to typical economic drift that is associated with emission trading schemes. Conversely, emission trading schemes do offer certainty regarding total emission output, whereas carbon taxes do not. The issue with emission trading schemes includes increased administrative costs and the possibility of setting emission standards too high or too low, while the issues with carbon taxes is that the policy offers no guarantees with emission reduction, as companies and consumers could choose to ignore the price and still consume carbon-intensive products and services at the same rate as before the tax.

Based on research, economic feasibility, and political realities, it is likely that the policy that will offer the best path forward is an emission trading scheme rather than a carbon pricing scheme in the United States. While it is recognized that there are drawbacks to emission trading, the policy would be effective and economically feasible if it is structured in a way that limits the undue burden on states that rely on carbon-intensive energy production and limits the administrative burden that would be placed on a governing agency, which would most likely fall under the purview of the Environmental Protection Agency.

The emission trading scheme would need to be structured in a way that sets a rigorous cap on emissions while also allowing flexibility for industry to adapt to changes with market forces and technological advantages. This policy proposal will be based on the goal of having carbon emission levels 28% below 2005 levels by 2025, with an eventual goal of 83% reduction

in emissions by 2050, in accordance with recommendations from the Environmental Protection Agency and the Union for Concerned Scientists.

The proposal is as follows:

- Currently, the United States emits roughly 6500 Million Metric Tons of carbon dioxide-equivalent emissions. This is already 10% below 2005 carbon emission levels. To get to the 25% reduction by 2025, emission caps should decrease by 261 MMT each year for FY2018-FY2025, which will allow the United States to meet the emission reduction goals. From there, emission caps should decrease by 161 MMT each year between FY2025-FY2050. This emission cap will enable the United States to reach its goal of 83% emission reduction by 2050. A graph of this metric can be seen in Figure 8.

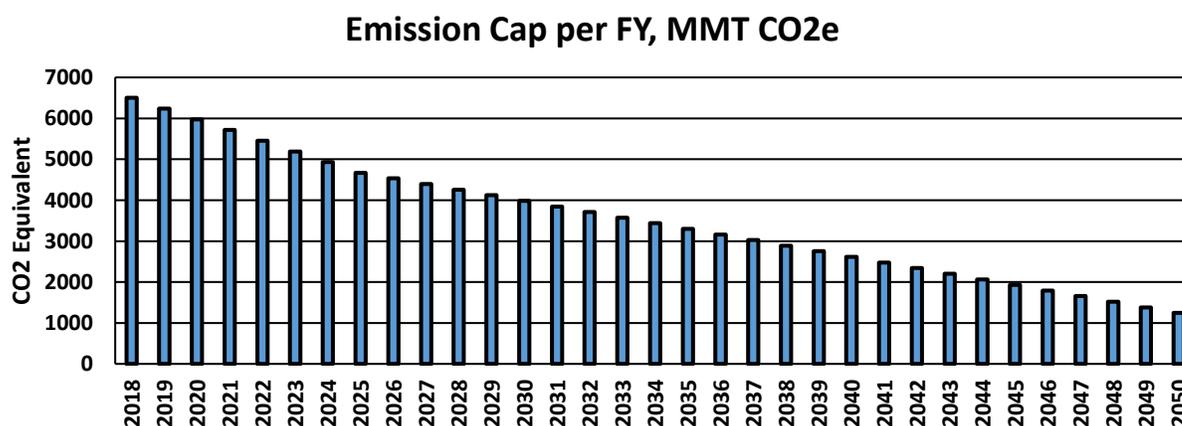


Figure 8: Proposed Carbon Cap System Graph

- Administration of the emission trading markets should be established by the Environmental Protection Agency. For the first three years, the Environmental Protection Agency should give out permits for free, until market mechanisms can be properly tested and maintained. One of the main reasons for failures in this market relates to setting the bid too high or too low, which then either requires companies to pay significant sums to pollute if the credits are set too high or would create less incentive to reduce pollution if the amount of credits is sufficient and low-priced. The Environmental

Protection Agency should utilize this three year grace period to analyze the proper price for emissions and encourage research and development in the areas of fuel efficiency.

The administration of the program will be paid for by the revenues received due to auctioning of permits, after the three year evaluation period is over. Start-up costs for this program will be appropriated by Congress through the Environmental Protection Agency as a line-item in the annual budget. This line item will be minimized after the 3-year probationary period is complete.

- Require 50% of the funds received from auctioning permits to be utilized to fund a research and development grant program for institutions of higher education and research specifically for developing technologies related to energy efficiency and renewable energy, with a specific focus on alternative fuels for vehicles and air craft.
- Require 20% of the funds received from auctioning permits to be utilized to help subsidize the burden of increased energy costs to predetermined “high-impact” states. These high impact states would be determined by analyzing sources of electric generating units and other factors, including already existing gasoline taxes and high cost-of-living areas.
- Require 30% of the funds received from auctioning permits to pay for EPA staff to ensure compliance and pay for the administrative costs associated with the program.
- Require the Environmental Protection Agency to do a mandatory review period every five years regarding economic costs associated with emission trading, with a specific focus on the cost to American consumers as it relates to higher energy and gasoline prices, along with general increase in costs of goods and services.

- Offer tax credits to electric generating units and private research firms who invest in retrofitting existing plants with energy efficient best practices and/or are developing innovative technologies that help limit the amount of carbon in the atmosphere
- Offer tax credits to low-income individuals who are likely to be burdened by the increased costs associated with energy. These tax credits can be used to pay other taxes or to receive a refund each year.
- Require metrics associated with carbon dioxide-equivalent emissions each year, with the results being publically available and open to public comment each FY. This will include developing strategies to better capture emission amounts and ensure compliance.
- Require the Environmental Protection Agency to release a biannual report on the effect on jobs, energy prices, and electric source breakdown, with a specified focus on baseline GHG emissions and costs saved/incurred due to the policy change.

This policy above is fair, legally sound, and will be politically feasible in the near future.

Because of the uncertainty surrounding how much these emission credits will sell for, percentages—rather than dollar amounts—are used to help breakdown where the revenue collected from the program should be allocated. There is an expressed goal to keep administrative costs below 30% of total revenue collected, as it is crucial for political feasibility that the program invests in research to help make this massive program more affordable for those who will be especially hit hard in states that feature carbon-intensive electric generating portfolios. In addition, the idea of requiring different reporting mechanism allows transparency into the effectiveness of the policy, and will allow private citizens to see the effect of this policy on their wallets and their health

Chapter 6: Conclusion

Climate change has been described as the issue that will define the 21st century. While some skeptics debate the merits of climate science, it has been a top priority of the United Nations and many developed and developing countries to come up with concrete solutions to the issue of climate change. While this thesis explored the history of climate change and the background, along with two popular, competing policies that many policy professionals have proposed in the past, there are many policies that could be enacted to help combat a changing climate.

Carbon taxation and emission trading schemes are both legally sound in the United States, as the constitution and previous case law explicitly states that the US government has the right to collect taxes and has the power to regulate GHG emissions. However, due to challenges to the Clean Power Plan, it is clear that the only way to ensure carbon emission regulation is through the legislative process—not any type of executive order or increased rule making powers from the agencies in the federal government. While the legal justification seems to be sound, the political feasibility is one factor that is questionable. Due to differing ideologies, it is apparent that any type of long-term solution to climate change must feature mechanisms that will be tolerable to both the center-right and center-left parties here in the United States. That is why the policy proposed in this paper has features that may be attractive to both ideologies. For example, the center-left party would like the aggressive push to limit greenhouse gas emissions and reduce these levels to 83% below 2005 while subsequently encouraging investment into energy efficient technologies. On the other hand, the center-right party will like the limit on administrative costs, the reinvestment of funds raised into the economy, the requirement to give metrics on economic and health care data in regards to carbon emission trading, and the tax incentives for businesses and electric generating units to innovate and reduce costs and emissions on their own volition.

No matter what policy change is pursued, it is likely that there would be unexpected hurdles and legal challenges due to the polarized and federalistic, decentralized nature of the United States political system. It is crucial that any solution puts an increased emphasis on ensuring any type of climate change policy limits the effect on the lowest-income of Americans, and encourages private innovation, development, and investment for long-term, sustained reductions in carbon emissions. This isn't an issue that can be tackled overnight. It is going to take a sustained effort both domestically and internationally to develop policies that encourage GHG reduction and help mitigate the effect of climate change on the most vulnerable of communities.

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HONORS AND AWARDS

Academic Excellence Scholarship	Fall 2014-Present
Galen Dreibelbis Scholarship for Excellence in Ag	Fall 2014, Fall 2016
Leoda Gummo Excellence Award	Fall 2015
United Food and Commercial Workers Union Award	Fall 2014-Fall 2017
Arthur Mitchell Honors Award	Fall 2016, Fall 2017
Ag Internship Alumni Award	Fall 2017
Agricultural Future of America Conference Scholarship	Fall 2015
Dean's List	Fall 2014-Present

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