FEDERAL MARKET-BASED DECARBONIZATION OF THE U.S. ELECTRIC POWER SECTOR

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APEX CLEAN ENERGY

Disclaimer

The author conducted this study as part of the program of professional education at the Frank Batten School of Leadership and Public Policy, University of Virginia. This paper is submitted in partial fulfillment of the course requirements for the Master of Public Policy degree. The judgments and conclusions are solely those of the author, and are not necessarily endorsed by the Batten School, by the University of Virginia, or by any other agency. This study was conducted for Apex Clean Energy but does not represent an official position of the organization or any member thereof.

Acknowledgements

And just like that… my two years at the University of Virginia's Frank Batten School of Leadership & Public Policy have concluded. This capstone project represents nearly a year's worth of work on a topic I have been interested in since 2014: climate change and America's energy future. The completion of this project would not have been possible without the endless encouragement and support I received from my family and friends, the faculty of UVA's Batten School, and the team at Apex Clean Energy. I want to extend a special thanks to my advisors in the Batten School, Professors Ray Scheppach and Kirsten Gelsdorf, who dedicated countless hours of their time to provide me with thoughtful feedback throughout the year. I am also grateful for my Cost Benefit Analysis Professor, Bill Shobe, who aided me in conducting my very first cost effectiveness analysis, as well as my classmates (and also best friends), Robert Haggart and Justin Cooksey, who share my passion for energy policy and served as a sounding board for ideas at all hours of the day and night. Second to last, but certainly not least, I want to thank my wonderful clients at Apex Clean Energy, Steve Bowers and Steve Caminati, who believed in me and went above and beyond to ensure I had all the resources I needed to be successful. Finally, I want to thank the handful of advocacy professionals who generously dedicated their time to a political feasibility interview. I hope that someday I can pay it forward.

Honor Pledge

On my honor as a student, I have neither given nor received aid on this assignment.

Preface

About Apex Clean Energy

Located in Charlottesville, Virginia, Apex Clean Energy ("Apex") develops, constructs, and operates utility-scale wind and solar power facilities across North America. Initially a small start-up in 2009, today Apex is one of the leading wind developers in the country and has the ability to influence public policy. Apex lobbies the state and federal governments directly and is also represented by federal lobbyists from Jochum, Shore & Trossevin PC, the American Wind Energy Association, the American Council on Renewable Energy, and Advanced Energy Economy where Apex is a member. Apex also retains state contract lobbyists on an as-needed basis. One of Apex's current efforts relating to policy advocacy—and the effort the company has hired me to focus on—is determining which federal decarbonization policy the company should support if a Democrat wins the presidential election in 2020 and the Republican majority in the U.S. Senate lessens. A decarbonization policy could speed the shift to clean electricity and drive down carbon dioxide emissions, two of Apex's core goals.

The COVID-19 Pandemic

On March 11, 2020, the World Health Organization declared COVID-19 a global pandemic, pointing to the over 118,000 cases of coronavirus in over 110 countries and territories around the world and the sustained risk of further global spread. Although the wind energy industry installed double the total capacity in the first quarter in 2020, as compared to the first quarter of 2019, the pandemic poses significant challenges to the U.S. wind industry. In the American Wind Energy Association's March 2020 report, the trade reported an estimated 25 gigawatts of planned projects—which represent $35 billion in investments—were at risk (Frangoul, 2020).

Though it is reasonable to expect the development of new wind capacity to fall, it is too early to know with certainty how extensive the impact of the COVID-19 pandemic may be, especially when accounting for a possible extension of the wind production tax credit in a fourth coronavirus stimulus package. In addition, the U.S. Energy Information Administration, the source that I use to project future energy outlook on an annual basis, has not yet conducted modeling to account for the possible impacts of the COVID-19 pandemic. For these reasons, the potential impact of the pandemic is not included in the assumptions for the status quo scenario.

Acronym Glossary

ACE Rule = Affordable Clean Energy Rule

AWEA = American Wind Energy Association

API = American Petroleum Institute

C2ES = Center for Climate and Energy Solutions

CAA = Clean Air Act

CaT = WCI = California Cap-and-Trade Program

CES = Clean Energy Standard

CLC = Climate Leadership Council

CO2 = Carbon Dioxide

CPP = Clean Power Plan

DOE = U.S. Department of Energy

USDT = US. Department of Treasury

EIA = U.S. Energy Information Administration

EPA = U.S. Environmental Protection Agency

GDP = Gross Domestic Product

IPCC = Intergovernmental Panel on Climate Change

ITC = Investment Tax Credit

NSPS = New Source Performance Standards

NRDC = Natural Resources Defense Council

PTC = Production Tax Credit

RFF = Resources For the Future

RGGI = Regional Greenhouse Gas Initiative

RPS = Renewable Portfolio Standard

SEIA = Solar Energy Industries Association

UCS = Union of Concerned Scientists

WCI = CaT = California Cap-and-Trade Program

WoodMac = Wood Mackenzie

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Executive Summary

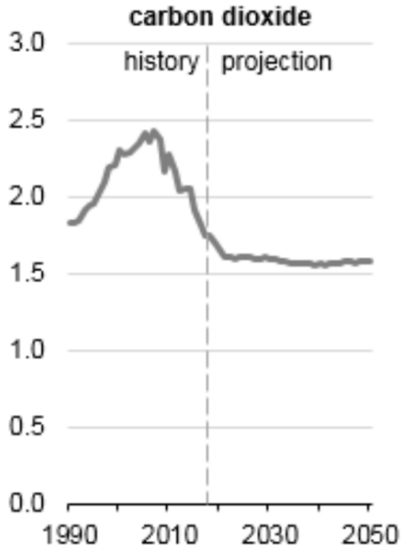
The federal government's efforts to drive down national carbon emissions have not been substantive enough to avoid the severe impacts of climate change. Lack of appropriate action poses serious risks to the health and well-being of future generations of Americans and is projected to cost the U.S. economy $4.57 trillion ($2018) by 2100 in a business-as-usual scenario. Though about half of states have implemented policies and joined regional programs to drive emissions reductions in the absence of strong federal action on climate change, ultimately an effective decarbonization policy from the federal government will be necessary to prompt action from the remaining (highest-polluting) states and drive a timely and meaningful reduction in national carbon emissions (AWEA, 2019). Although the literature presents several policy alternatives to the status quo, I narrow the analysis to the three most viable market-based alternatives. Each of the alternatives represents a different method of driving down emissions from the U.S. power sector through federal intervention. I evaluate each policy alternative using the criteria of political feasibility, cost effectiveness, and administrative feasibility. Based on this analysis, **I recommend that Apex enacts the Climate Leadership Council's (CLC's) Baker-Shultz Carbon Dividends plan, an economy-wide carbon tax that returns revenues in equal amounts to every U.S. resident with a valid Social Security number**. Though costly as with any decarbonization approach, this alternative represents the most cost-effective approach of all the alternatives and would drive substantial emissions reductions in the electric power sector. Since most of the major provisions impact spending and revenues, a carbon tax also has an ability to pass through reconciliation, a procedure requiring only 51 votes to pass the Senate. Finally, it can be easily implemented by the U.S. Department of Treasury (USDT).

I. U.S. Emissions, Electricity Production, & Carbon Policy Tools

The Problem

Since 2008, the U.S. has decarbonized its electric power sector by three percent per year on average, a rate that is too slow to mitigate the severe impacts of climate change (Schauer and Shreve, 2019; Lawson, 2018).[1] With total electricity demand on the rise,[2] a three percent average annual rate of decarbonization is projected to have a marginal impact on greenhouse gas emissions reductions; as shown in *Figure 1 (p. 9),* the already problematic emissions levels we observe today will remain relatively constant through 2050 in the absence of federal government intervention (U.S. EIA, 2018; Lawson, 2018).[3]

Figure 1 **Total U.S. electricity sector CO_2 emissions (billion metric tons).** Historic generation and emissions are shown from 1990-2015 and are drawn from the U.S. Environmental Protection Agency's Greenhouse Gas Inventory. Projection from 2050 is from the Energy Information Administration's "Annual Energy Outlook 2018" reference case.



— *Source: U.S. EIA, 2019*

Since 2005, electricity sector emissions have decreased even in the absence of a federal decarbonization policy and can be attributed to fuel-switching from coal to natural gas (61 percent) and from coal to renewable energy sources (39 percent).[4] Fuel-switching from coal to these sources led to emissions reductions, because natural gas emits less carbon dioxide (CO_2) for the same amount of electricity generated as compared to coal, while renewables do not emit CO_2 at all. Coal use will continue to ramp down, comprising only 5 percent of the market share by 2050 (EIA, 2019).

Despite projections for continued fuel-switching from coal to cleaner sources (Wood Mackenzie, 2020), increases in total U.S. electricity demand and production will soon offset the decarbonization that is occurring from existing policies and trends (U.S. EIA, 2018; Lawson,

[1] According to the Intergovernmental Panel on Climate Change's 2018 report, the world has 12 years to reduce greenhouse gas emissions or else face irreversible damage to future generations (Schauer and Shreve, 2019).
[2] As the U.S. population grows, total U.S. electricity demand is expected to grow 32 percent by 2050. In a business-as-usual scenario, per capita electricity consumption is expected to remain constant (U.S. EIA, 2018.)
[3] Given existing policies, the average annual rate of decarbonization will remain at three percent through 2050, maintaining already problematic emissions levels of about 1.6 billion metric tons. Levels are projected to decrease by only 0.1 billion through 2050 in the absence of a federal decarbonization policy[3] (U.S. EIA, 2019; U.S. EIA, 2018; Lawson, 2018).
[4] Between 2005 and 2018, EIA has calculated that cumulative U.S. CO_2 emissions reductions attributable specifically to shifts from coal to natural gas and to non-carbon generation totaled 4,621 MMmt. Of this total, 2,823 MMmt resulted from decreased use of coal and increased use of natural gas. 1,799 MMmt resulted from decreased use of coal and increased use of non-carbon generation sources (EIA, 2019).

2018). This means that in order to avoid severe impacts from climate change, according to the Intergovernmental Panel on Climate Change's (IPCC'S) 2018 report, the world has 12 years to reduce its greenhouse gas emissions. The IPCC is the United Nations body for assessing the science related to climate change and supports a 97 percent scientific consensus across 195 countries that business-as-usual behavior by humans will increase carbon emissions to concerning levels. The United States is currently the largest per capita producer of greenhouse gases in the world and is the second largest producer after China overall (Stevens, 2019). The U.S. electricity sector is responsible for 28 percent of the country's total emissions (U.S. EPA, 2017).

Lawmakers on both sides of the aisle in Congress agree that the federal government should take action to reduce the country's emissions. While there remains disagreement about the policy solutions to climate change and the level of ambition that is necessary, Republicans in positions of leadership and otherwise are no longer challenging the science of human contribution to climate change (Green, 2019). At this writing, Republican leadership does not support a market-based solution to climate change and is instead focused on innovation, investment, and carbon capture technology as a means of reducing emissions. The few Republican lawmakers that support a market-based approach call for an 80 percent reduction in emissions (from 2005 levels) by 2050 (Schrader and McKinley, 2020). Democratic lawmakers largely agree on a more ambitious approach: 100 percent emissions reductions (from 2005 levels) by 2050 (Coons, 2020).[5]

Climate Change

According to the United Nations, climate change means a change in average global temperature which is attributed to human activity that alters the composition of earth's atmosphere and which is in addition to natural variability in climate (United Nations, 1992). Because human-induced warming interacts with a naturally varying climate, the temperature rise has not been, and will not be, "uniform or smooth" across the United States or over time. U.S. average temperature has risen by 1.3°F to 1.9°F since 1895, with most of this increase occurring since about 1970 (Walsh and Wuebbles, 2014). Over the last 50 years and still today, the change in global climate was and is primarily due to human-induced emissions of heat-trapping gases. These emissions primarily come from the burning of fossil fuels—coal, oil, and gas—for electricity, with other activities such as the clearing of forests and agricultural practices contributing, as well (Karl, Melillo, and Peterson, 2009).

Climate change is not a market failure, rather it is a result of the market working properly. Unfortunately, the market is working by using the cheapest electricity to keep electricity rates affordable while still meeting demand (U.S. Department of Energy, 2015).[6] The

[5] In February 2020, Reps. David McKinley (R-WV) and Kurt Schrader (D-OR) proposed a framework that would establish a federal Clean Energy Standard for the power sector to achieve an 80-percent reduction in emissions by 2050. Modeling indicates that standard means the power sector will be 95-percent clean by 2050 (Schrader and McKinley, 2020). Also in February 2020, Sens. Coons (D-DE) and Carper (D-DE) introduced the Clean Economy Act, a bill to achieve net zero emissions in the U.S. (economy wide) by no later than 2050 (Coons, 2020).

[6] One day ahead of actual dispatch, participants submit supply offers and demand bids for energy. These bids are applied to each hour of the day and for each pricing location on the system. From the offers and bids, the RTO constructs aggregate supply and demand curves for each location. The intersection of these curves identifies the market-clearing price at each location for every hour. Supply offers below and demand bids above the identified price are...scheduled (U.S. Department of Energy, 2015).

problem is that society bears the cost of the CO_2 emissions that burning fossil fuels for electricity produces, while the fossil fuel industry accrues the benefits without consequence to the industry itself.

The impacts of climate change are apparent in the United States and are expected to grow. Such impacts touch nearly every sector of the global and national economy, from water to energy, transportation, agriculture, ecosystems, and health. The United States has already experienced changes in the form of extreme weather, rising sea level, rapidly retreating glaciers, thawing permafrost, lengthening growing seasons, earlier snowmelt, and alterations in river flows. Over the next several decades, the United States can expect climate change to (1) stress water resources in every region of the United States, especially in the West; (2) lower crop yields and livestock production; (3) inundate coastal areas as storms surge and sea levels rise, especially along the Atlantic and Gulf Coasts, Pacific Islands, and parts of Alaska; (4) increase human health risks associated with increasing heat stress, waterborne diseases, poor air quality, extreme weather events, and diseases transmitted by insects and rodents; and (5) dramatically alter ecosystems by creating new conditions for the survival of species (Karl, Melillo, and Peterson, 2009).

The risks and damages of climate change are already underway and will worsen unless the U.S. government takes substantial measures to drive deep carbon emissions reductions (Shreve and Schauer, 2019). The last decade marked the nation's warmest on record with continued changes projected through 2100 and beyond in a business-as-usual scenario (Walsh and Wuebbles, 2014). That is, choices made today to lower emissions would reduce the amount and rate of climate change, mitigating the anticipated negative impacts described above (Karl, Melillo, and Peterson, 2009).

The Social Cost of Emissions

While climate change is a global issue, it is important to identify the costs of climate change, or increased carbon emissions, as they pertain to the United States specifically. In a status quo scenario in which market forces continue to facilitate the use of fossil fuels for electricity, greenhouse gas emissions will have significant direct and indirect costs. The four major costs of business-as-usual emissions in the United States—detailed below—are health, energy, infrastructure, and labor.

The future health costs associated with climate-change related extreme weather events—including heat waves, hurricanes, ozone pollution, infectious disease outbreaks, river flooding, and wildfires—are projected to be substantial. A 2011 *Health Affairs* study on the health impacts of climate change estimates that health costs exceeded $14 billion between 2000 and 2009 ($2008), with 95 percent due to the value of lives lost prematurely. Actual healthcare costs were an estimated $740 million ($2008). Given that extreme weather events are projected to occur with increasing frequency in the coming decades, health costs are only expected to intensify (Knowlton et al., 2011). The U.S. EPA projects in a 2018 report that the health costs of climate change will be more than $166 billion ($2015) by 2090 in a business-as-usual scenario as a result of extreme temperature mortality and reduced air quality (Martinich, 2018).

In addition to an increase in health costs as national emissions levels rise, the United States government can expect an increase in expenditures on electricity. A 2008 study by the National Resources Defense Council finds that although hotter global temperatures will require less heating in the winter, they will also require more air-conditioning and impose a substantial,

costly strain on electric power plants during increasingly frequent high-demand periods in summers. Overall, the Natural Resources Defense Council (NRDC) finds **annual costs attributed to climate change in the U.S. energy sector (excluding transportation) in the business-as-usual case will be $141 billion ($2006) higher in 2100**, or 0.14 percent of projected U.S. gross domestic product (GDP) in 2100[7] (Ackerman and Stanton, 2008). NRDC's 2008 estimate compares with an estimate of $92 billion ($2015) by the U.S. EPA in 2018 (Martinich, 2018).[8]

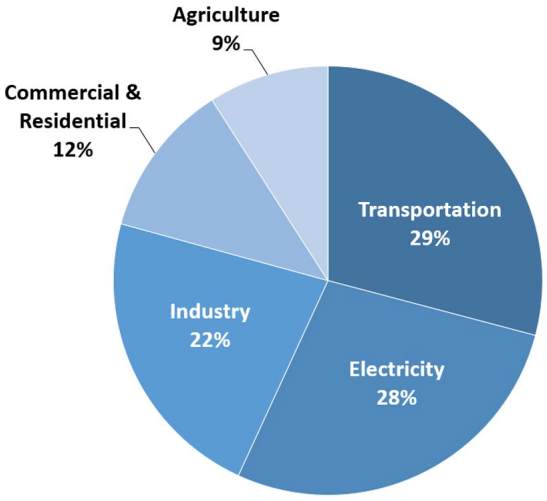
Along with health and energy sector costs, another major cost of business-as-usual emissions is infrastructure damage. The damage to roads as a result of changes in temperature and precipitation is estimated at $230 billion ($2015) through 2100 in a business-as-usual scenario. Coastal property damages due to sea level rise are projected to exceed $3.6 trillion ($2015) (Martinich, 2018).

The final, and largest, major cost of business-as-usual emissions is lost labor and thus reduced wages and GDP. An increase in extreme heat in the summer is expected to affect worker safety and productivity. With higher temperatures, workers may have to take more frequent breaks or stop work entirely, resulting in lower overall labor capacity. The U.S. EPA projects that 1.9 billion labor hours across the national workforce are projected to be lost in 2090, totaling over $160 billion ($2015) in lost wages per year. More than a third of this national loss is projected to occur in the Southeast ($47 billion lost annually by 2090) (Martinich, 2018).

Overall, the total sum of the costs associated with health, energy, infrastructure, and labor is approximately $4.57 trillion ($2018) through 2100. In theory, if a federal decarbonization policy were developed, these costs could be avoided. One of the broad approaches presented by economists, NGOs, and government officials to reduce the costs that greenhouse gas emissions have on society is to require polluters to pay the social cost of carbon either directly or indirectly through a "carbon price" (Carbonbrief.org).

Why Target the Electric Sector?

According to Wood Mackenzie, decarbonization of the electricity sector is a prerequisite to any meaningful progress towards deep decarbonization of the overall energy system (Wood Mackenzie, 2019). As shown in *Figure 2 (p.12)*, electricity production generates 27.5 percent of emissions, the second largest share among the sources of emissions in the United States after transportation. As compared



U.S. Environmental Protection Agency (2019). Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2017

Figure 2 Total U.S. Greenhouse Gas Emissions by Economic Sector in 2017

[7] Overall, climate change will increase the retail cost of electricity by $167 billion and will lead to $31 billion more in annual purchases of air-conditioning units. Simultaneously, warmer conditions will lead to a reduction of $57 billion in natural gas and heating oil expenditures (Ackerman and Stanton, 2008).

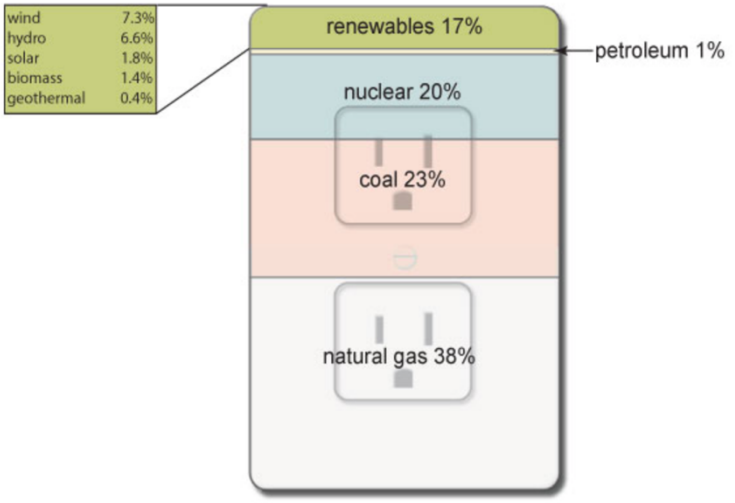
[8] Note that the EPA's estimate does not include the cost of annual increases in the purchase of air-conditioning units, explaining at least in part the discrepancy between the Natural Resources Defense Council (NRDC) estimate of $141 billion and the EPA estimate of $92 billion (Martinich, 2018).

to electricity production, transportation produces 28.9 percent, industry (22.2 percent), commercial and residential (11.6 percent), and agriculture (9 percent) (U.S. EPA, 2017). Though decarbonization of the electric power sector would be a necessary, and quite possibly even a sufficient, component of a first federal decarbonization plan in the United States, some proposals extend to the other sectors of the economy, as well.[9] While targeting all of the economic sectors of the economy would generate deeper emissions reductions and increase program efficiency, at least at the state and regional levels, an "economy-wide" plan represents a more ambitious approach.[10] The vast majority of state and regional-level programs in the United States are confined to the electricity sector with nine Northeastern and Mid-Atlantic states interested in designing a regional cap-and-trade program for transportation emissions[11] (Walton, 2018) and California participating in the only cap-and-trade program that extends to transportation. At the same time, electric utilities might perceive a federal approach that applies beyond the electricity sector as more equitable, perhaps boosting the political feasibility of an economy-wide approach at the national level.

The Nation's Electricity Generation Mix and Trends

U.S. power is provided by about 17,000 generators with the capacity to provide upwards of 1,000 gigawatts (NRDC, 2008). As shown in *Figure 3 (p.13)*, natural gas generates the most electricity in the United States, making up 38 percent of the market share. Natural gas is followed by coal (23 percent), nuclear (20 percent), wind (7.3 percent), hydro (6.6 percent), and solar (1.8 percent) (U.S. EIA, 2020). Notably, wind is the fastest growing renewable energy source in the United States; U.S. wind power capacity grew 8 percent in 2018, more than double the capacity the U.S. had in 2010.

Figure 3 Sources of U.S. Electricity Generation, 2019



Note: Electricity generation from utility-scale facilities. Sum of percentages may not equal 100% because of independent rounding.
Source: U.S. Energy Information Administration, *Electric Power Monthly*, February 2020, preliminary data

In shaping a federal decarbonization policy, the primary goal would be to reduce dependency on coal-fired power plants and increase dependency on renewables. If any, the coal plants scheduled for electricity production by a regional transmission organization would only be economical if retrofitted with the most up-to-date clean-coal technology. The extent to which the

[9] All of the carbon tax proposals at the federal level extend economy-wide.
[10] In the United States, there are only 17,000 electricity generating entities, which are far easier to regulate and enforce than 90 million cars, buses and trucks.
[11] In December 2018, a coalition of nine states (Connecticut, Delaware, Maryland, Massachusetts, New Jersey, Pennsylvania, Rhode Island, Vermont, Virginia) and the District of Columbia announced their intent to develop a regional initiative to cap transportation emissions and invest proceeds from the program into cleaner infrastructure that could help incentivize the adoption of electric vehicles (Walton, 2018).

country maintains or increases its dependency on natural gas and nuclear energy for electricity is dependent on the type of policy. For example, in the case of a carbon tax, power generation from natural gas would depend on the carbon price and rate of increase. In the case of a Clean Energy Standard, natural gas generation would depend on the carbon intensity set for a clean source.[12]

The Current Regulatory Landscape

As we consider ways to drive emissions reductions and the possibility that an alternative would replace existing regulations, it is important to understand the current regulatory landscape, particularly with respect to the U.S. EPA. EPA has an obligation under a federal law called the Clean Air Act of 1970 (CAA) (42 U.S.C. §7401 et seq.) to regulate certain sources of CO_2 emissions, including stationary sources and mobile sources.[13] Stationary sources, which are of most relevance to this report, emit a variety of pollutants into the air. Stationary sources of air pollution include factories, refineries, boilers, and power plants. The EPA controls emissions from these sources through development and implementation of standards and guidelines (U.S. EPA, 2020).

Stationary sources of air pollution can be grouped into fourteen broad sector oriented categories,[14] with the category most applicable to this report being "electric utilities." *Figure 4 (p. 15)* shows the stationary sources of air pollution for the electric utilities industries, and their corresponding air pollution regulations.

Current and previous administrations' tendencies to overturn and/or replace regulations promulgated by administrations before them demonstrates the need for congressional action on climate change. Because laws originating in Congress often have bipartisan support, they face a much lower risk of repeal when the next administration comes into office. Unlike executive orders and agency actions, statutory laws have a far greater lifetime, on average.

[12] The average fleet-wide carbon intensity levels of coal and natural gas combustion generators are, respectively, 0.96 and 0.6 metric tons of CO_2 per megawatt hour (AWEA, 2020).
[13] In 2007, the U.S. Supreme Court held that the EPA has the authority to regulate greenhouse gases, including CO_2 emissions, in what is known as the "endangerment finding." This decision was made on the basis that greenhouse gas emissions endanger the public health and welfare of current and future generations. Since 2009, the EPA has proposed or finalized over 100 global warming regulations detailed in more than 5,000 pages in the federal register (amsresearch.org).
[14] The fourteen industry sector groups include: (1) agriculture, food and forestry, (2) chemical production and distribution, (3) generic chemical rules (4) electric utilities, (5) energy, engines, and combustion, (6) foam, fiber, plastic, and rubber products (7) metals production, (8) mineral processing, (9) oil and natural gas, (10) petroleum refineries and distribution, (11) semiconductor manufacturing, (12) solvent use and surface coating, (13) sterilizers, and (14) waste management industry (U.S. EPA, 2020).

Air Pollution Regulation	Regulation/ Guideline Type	Description of Regulation/Guideline
Electric Utility Generating Units	Emissions Guidelines (Affordable Clean Energy rule)	• On June 19, 2019, EPA issued the final Affordable Clean Energy rule (ACE), repealing and replacing the Obama administration's Clean Power Plan (CPP). The CPP intended to reduce greenhouse gas emissions from the power sector by 32 percent (of 2005 levels) by 2030 through increasing the heat-rate efficiency of coal-fired power plants, generation shifting from coal to natural gas and renewables, as well as improving consumer energy efficiency to reduce energy demand (CPP, 2015). The generation shifting option raised serious controversy over the legality of the rule under Section 111 of the Clean Air Act (Glicksman et al., 2015), and the rule was almost immediately put on hold by the courts, as such. • By contrast, the ACE rule calls for voluntary efficiency improvements at generating stations and directs states to take the initiative on how they choose to regulate power plant emissions. AWEA contends the ACE rule does not satisfy the minimum requirements of the Clean Air Act.
Standards for GHG Emissions from New, Modified and Reconstructed Electric Utility Generating Units	New Source Performance Standards (NSPS)	• Under Section 111(b) of the Clean Air Act, EPA sets New Source Performance Standards (NSPS) for greenhouse gas emissions from new, modified, and reconstructed fossil fuel-fired power plants. • On December 6, 2018, EPA proposed to determine that the best system of emission reduction for newly constructed coal-fired units is the most efficient demonstrated steam cycle in combination with the best operating practices. EPA did not propose to amend the standards of performance for newly constructed or reconstructed stationary combustion turbines.

Figure 4 Stationary sources of air pollution for the electric utilities industries and their corresponding air pollution regulations.

Establishing the Need for a National Response and Discussing Policy Approaches

For years, U.S. states have implemented policies and joined regional programs to drive emissions reductions in the absence of strong federal action on climate change. Within individual states, one of the most common policies is a Renewable Portfolio Standard (RPS), a policy that requires electric utilities to incrementally increase the proportion of renewable energy that they provide to consumers, relative to non-renewable sources of energy. There are also ten states that have joined together to form a regional cap-and-trade program called the Regional Greenhouse Gas Initiative (RGGI) to reduce emissions from the states' power sectors over time. California represents the most ambitious state in the country by far, implementing its own cap-and-trade program to reduce emissions from nearly all sectors of its economy.

Though state and regional decarbonization initiatives exist—including state requirements for clean and renewable energy generation as well as regional caps on emissions—they are not sufficient to achieve an 80 to 100 percent reduction in national emissions by 2050 (WoodMac, 2020). This is because about half the states in the country are unlikely to adopt any carbon-related goals without federal intervention,[15] including the states with particularly high-carbon generation fleets that are collectively responsible for 67 percent of generation. While state-level initiatives should be encouraged, an effective federal decarbonization policy will ultimately be necessary to drive substantial decarbonization of the U.S. power sector (AWEA, 2019).

So far, Congress has addressed climate change through (1) offering tax incentives for renewable energy technologies, and (2) funding research and development in (a) end-use efficiency[16], (b) grid flexibility[17] and energy storage, (c) carbon capture, utilization and storage technology, and (d) clean energy technology. In fact, as recently as February 2020, Minority Leader McCarthy (R-CA) and the Ranking Member of the House Energy and Commerce, Greg Walden (R-OR), endorsed a set of bills with a particular focus on carbon capture and investment in clean energy technology.[18]

As compared to the approaches that Congress has employed, market-based solutions are capable of much deeper emissions reductions and should form a national decarbonization policy. The most widely discussed market-based solutions to decarbonization are a carbon tax (or carbon fee and dividend), a cap-and-trade program, a renewable portfolio standard, and a clean energy standard. These distinct approaches, detailed in *Figure 5 (p. 17)*, either (1) set a direct price on carbon, indirectly reducing emissions; (2) establish a trading market to reduce emissions, indirectly setting a price on carbon; or (3) establish a trading market to increase clean electricity generation by displacing emissions-producing electricity generation. Governments at the state, regional, and national levels—though not necessarily in the United States—have successfully implemented each of these market-based approaches in practice.

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[15] Non-RPS states generate 6 percent more electricity than RPS states and are on average 39 percent more carbon intensive (AWEA, 2019).

[16] End-use efficiency research would seek to reduce energy waste from lighting, ventilation, heating, and cooling in existing commercial structures and homes, as well as advancing efficiency in the design and construction of new buildings (Stanford University, 2019).

[17] Grid flexibility can be defined as the ability to shift electricity demand or supply quickly in reaction to system needs, allowing consumers to take advantage of the cost declines, policy appeal, and scalability of wind and solar resources (Climate Policy Initiative, 2017).

[18] On February 12, 2020, Leader McCarthy and Ranking Member Walden endorsed four bills: (1) a permanent extension of 45Q, (2) the Carbon Capture, Utilization, and Storage Innovation Act, (3) The New Energy Frontiers Through Carbon Innovation Act, and (4) The Trillion Trees Act.

Figure 5 Three categories of market-based decarbonization policy tools.

1. Sets a direct price on carbon	2. Establishes a trading market to reduce emissions	3. Establishes a trading market to increase clean electricity generation
• a) Carbon tax (carbon fee and dividend)	• a) Cap-and-trade program (Emissions Trading System)	• a) Renewable Portfolio Standard • b) Clean Energy Standard

1. Setting A Direct Price on Carbon: Carbon Tax (Carbon Fee and Dividend)

What is a carbon tax?

A carbon tax would directly place a price on carbon through the tax rate to be paid by "first sellers" of fossil fuels—coal, oil, and gas companies, or about 1,500 entities—and reflected in the costs of goods and services. The monetary cost to the producer (and consumer) would depend on how much carbon-equivalent emissions are emitted by the fuel in question. That is, since burning a ton of coal produces more carbon-equivalent emissions than natural gas, the price for burning coal would be relatively higher. The goal of a carbon tax is to reduce greenhouse gas emissions through cost-effective responses by energy users (Repetto, 2013; Stavins, 2011). Carbon taxes in general can be categorized according to their revenue use, some of which are more politically feasible than others. Among possible revenue uses are (1) returning revenues by household (a "dividend"), (2) funding other initiatives (often climate or transportation infrastructure-related), (3) reducing distortionary federal taxes, (4) rebating revenues to states, and (5) reducing the federal deficit (Hafstead, 2019).

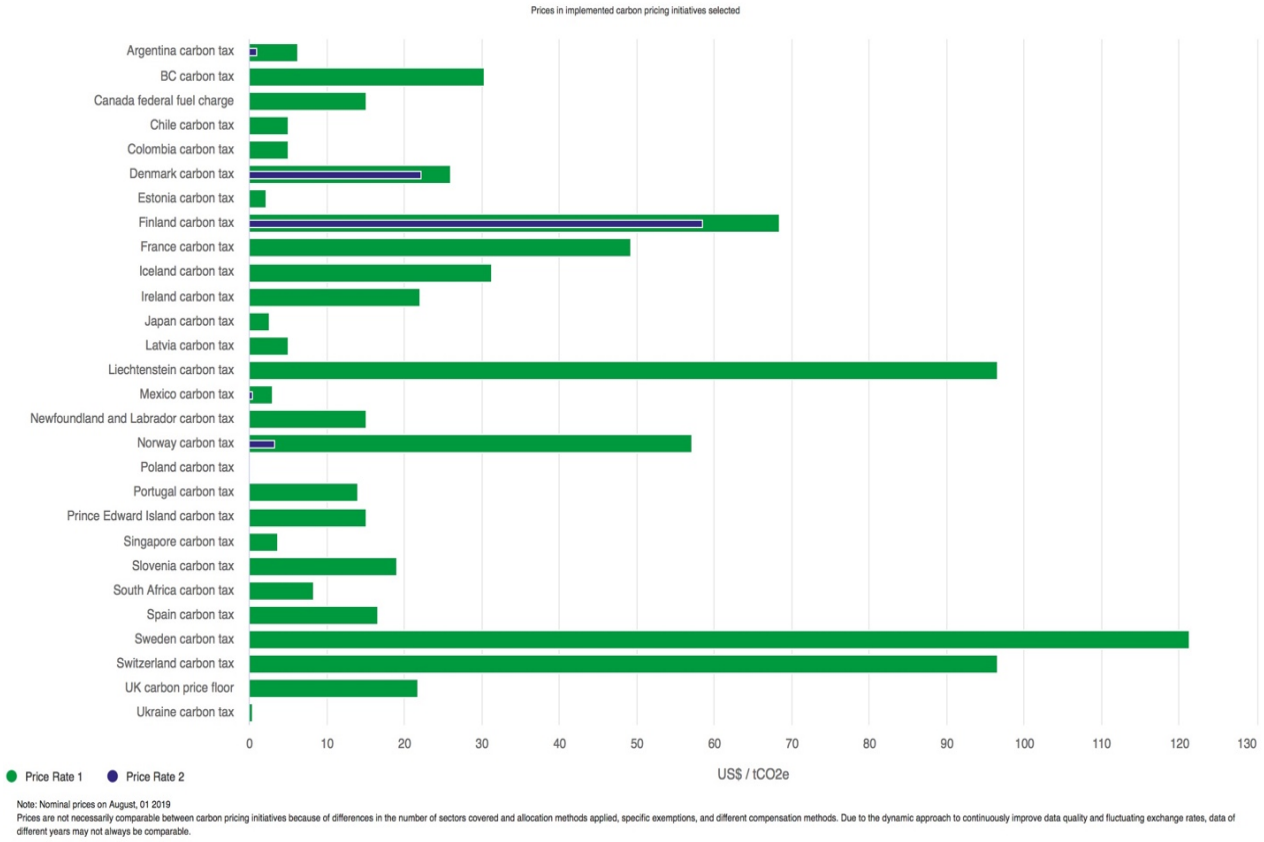
Has a carbon tax been used or attempted before?

A carbon tax has never been adopted at the state, regional, or national levels in the United States, but it has been implemented at the national level in 25 countries and in the City of Boulder, Colorado. As seen in *Figure 6 (p. 18)*, in countries with carbon taxes, carbon prices have been relatively modest—averaging $29.12 per metric ton of CO_2—due to political backlash about rising energy prices (Plumer and Popovich, 2019). The lowest carbon price is Estonia's at $2.21, while the highest carbon price is Sweden's at $121.29 (World Bank, 2019).

The city of Boulder, Colorado is home to the first and only carbon tax in the United States. The initial seller of the fossil fuel does not pay the tax; instead residential, commercial, and industrial consumers downstream pay a fee based on their consumption of fossil-fuel based electricity. Revenues from the tax fund energy efficiency and renewable energy programs (C2ES, 2016).

Washington is the only state to come close to passing a carbon tax. In both 2016 and 2018, Washington state voters rejected a carbon tax ballot initiative, which would have placed $15 per ton taxes on carbon emissions, increasing gradually to $100 per metric ton of CO_2. The two proposals differed in that the proceeds from the 2016 tax would have been used to fund a sales tax cut, while the proceeds from the 2018 tax would have funded climate resiliency investment (Shughart, 2018).

Figure 6 Carbon tax price by country ($2019) per metric ton of CO_2 equivalent-emissions.



Source: World Bank, 2019

The UK's carbon tax, known as the "UK carbon price floor" *(Figure 6, p. 18)* was introduced in 2013 and has demonstrated a high level of effectiveness, allowing Britain to achieve its lowest greenhouse gas emissions since 1890. The tax, which applies to certain sectors of the economy including electricity, has prompted utilities to switch away from coal to natural gas. According to *The New York Times*, the UK carbon price floor is "perhaps the clearest example in the world of a carbon tax leading to a significant cut in emissions" (Plumer and Popovich, 2019).

What are the considerations when contemplating a carbon tax approach? What is up for debate?

While carbon taxes are attractive in that they can be simplistic in design, there are concerns with the lack of U.S. experience at the state level with them and the program cost increases that would result from granting tax exemptions to vulnerable industries and economic sectors (Stavins, 2011). Even still, lawmakers have flooded Congress with carbon tax proposals this year and a carbon tax seems to be the preferred market-based mechanism among conservative groups. *See Appendix I (p. 47-52) for an overview of the carbon tax proposals we've seen introduced in the 116th Congress.*

Figure 7 Social Cost of Carbon ($2019 per metric ton of CO2)

Year of Emission	Average Estimate at 3% Discount Rate – EPA's Central Estimate	$ Increase	Rate of Increase
2020	$44	-	-
2025	$49	$5	11.4%
2030	$53	$4	8.2%
2035	$58	$5	9.4%
2040	$63	$5	8.6%
2045	$68	$5	7.9%
2050	$73	$5	7.4%

Source: U.S. EPA, 2017

As lawmakers design a carbon tax, they face four primary issues. First, while economic theory finds that the tax rate should equal the social cost of carbon, this cost changes frequently as more is learned about the economic impacts of climate change – unfortunately, an estimate for emissions costs with a high degree of certainty represents one of the most concerning gaps in the literature at this time. The best existing estimate comes from President Obama's EPA who calculates that the social cost of carbon is $44 in 2020 and will escalate about $4-5 every five years through 2050, as seen in *Figure 7 (p. 19)* (U.S. EPA, 2017). Second, there is disagreement over who should take ownership of the tax revenues: the federal government, state governments, or individual citizens. Third, it is unclear how broad the tax base should be. While state-level policies primarily apply to the electricity-sector only, all of the carbon tax policies in consideration at the federal level would apply economy-wide. Fourth and finally, there are concerns about the shifting of fueling activities to countries without a carbon price, also known as "leakage" (Metcalf and Weisbach, 2019).

2. Establishing a Trading Market to Reduce Emissions: Cap-and-Trade Program

What is a cap-and-trade program?

Just like a carbon tax, a cap-and-trade program is a price mechanism, but it differs in that a cap-and trade program is implemented through allowance trading. A cap-and-trade program sets an overall limit or "cap" on aggregate emissions for specified sectors of the economy and requires utilities and industrial sources to obtain an allowance for each ton of its emissions either for free or for a fee. The programs also give lower emitters the ability to "trade" any excess allowances to higher emitters in an auction, often for a profit. Generally speaking, the

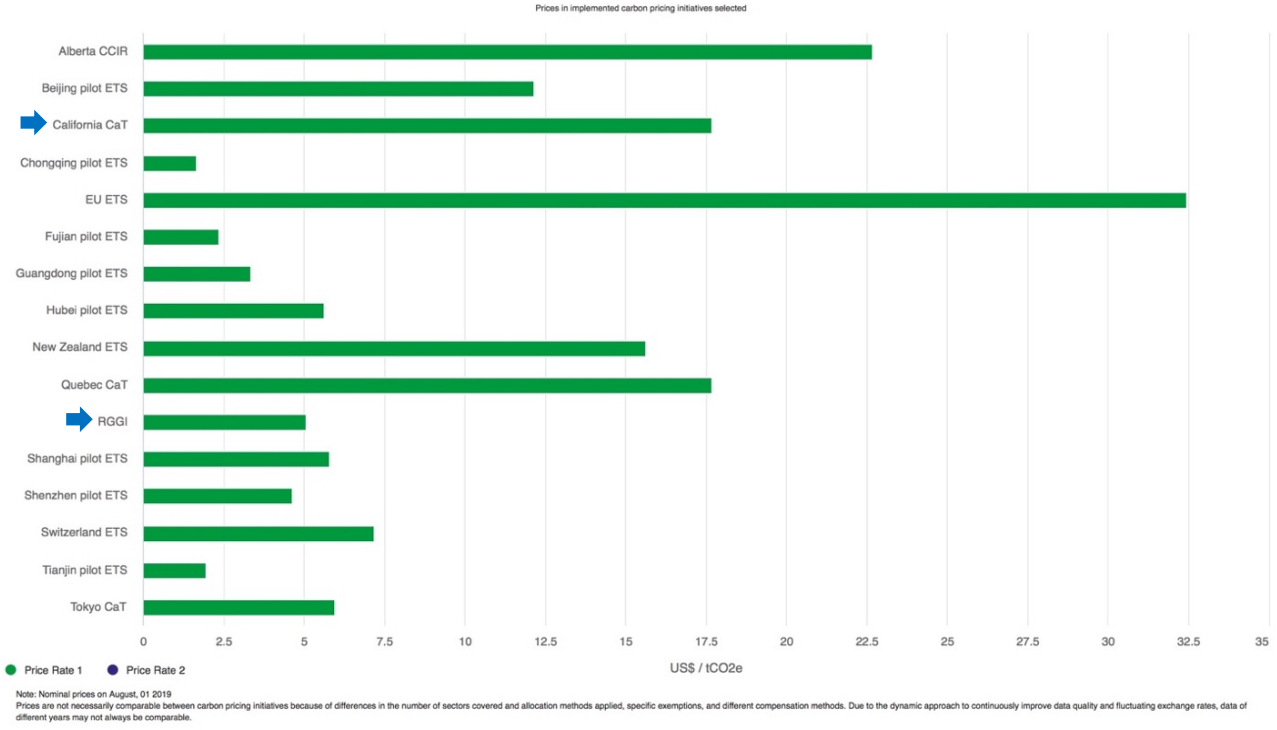
cap will fall over time, requiring larger reductions in total emissions from the specified sectors. By creating supply and demand for carbon, a cap-and-trade program indirectly sets a price on carbon emissions (Schmalensee and Stavins, 2017; Bang et al, 2017).

Has a cap-and-trade program been used or attempted before?

Although national and sub-national programs exist across the world, lawmakers have yet to adopt a similar program in the United States. In 2009, Rep. Henry Waxman (D-CA-30) introduced the American Clean Energy and Security Act of 2009 to create a federal cap-and-trade program, but the bill was unable to garner adequate support from the Senate and never became law (Bang et al., 2017).

Despite failure to develop a national cap-and-trade program to date, policy advocates have succeeded in developing cap-and-trade programs at the regional level in the United States (Bang et al., 2017). The two existing regional programs in the country are known as the Western Climate Initiative (WCI or "California CaT") and the Regional Greenhouse Gas Initiative, shown alongside programs across the world in *Figure 8 (p. 20)*. Though the WCI is the more ambitious of the two programs in that it is economy-wide, RGGI has been effective in reducing reductions from the electricity sector and more closely resembles the level of ambition that the federal government would support for a potential national program. *See Appendix V (p. 68) for more information on RGGI and the WCI.*

Figure 8 Market-price by cap-and-trade program for purchase of an allowance to emit one metric ton of carbon dioxide-equivalent emissions. National and regional programs are included globally, including "California CaT" (West Coast Initiative) and "RGGI" in the United States.



Source: World Bank, 2019

What are the considerations when contemplating a cap-and-trade approach? What is up for debate?

While there has been extensive experience with cap-and-trade at the regional level in the United States, as well as overwhelming support from economists, the failed attempt to design a straightforward cap-and-trade program in 2009 has discouraged members from supporting a cap-and-trade approach today (Stavins, 2011). In 2009, there were three major problems with the political climate. First, carbon pricing was a low priority of the Obama administration, which diverted its political capital to healthcare reform (Segal Interview, 2020). Second, Republican members, who had moved increasingly right from 2007-2009, were not willing to collaborate on climate legislation as climate change denial penetrated grassroots conservative opinion. Finally, environmental groups were extremely fragmented and unwilling to cooperate with business (Skocpol, 2013).[19]Aside from these issues, members were at odds over the "trade" aspect of the program; there was a question of what to do with the excess funds generated by the tradeable credit, as well as offsets.

As in 2009, lawmakers that support carbon pricing today contend that the approach is too prone to market manipulation since (a) firms have to manage and exchange allowances and (b) the government would need to track allowance transactions and ownership. Sen. Chris Van Hollen's (D-MD) Healthy Climate and Family Security Act is the only cap-and-trade program that a member has introduced in the 116th Congress and the bill has no co-sponsors, showing there is limited interest in a federal cap-and-trade program at this time. *See Appendix I (p. 55-56) for more information on the Healthy Climate and Family Security Act.*

In the highly unlikely event economists can convince lawmakers to consider a cap-and-trade program again, there still remains design issues with the tool such as (a) determining the cap on emissions; (b) minimizing emission leakage, or a shift of electricity generation and its corresponding CO_2 emissions to another country; (c) determining the proper use of auction revenues; and (d) managing allowance price volatility, among others (Stavins, 2013; U.S. DOE, 2015).

3. Establishing a Trading Market to Increase Clean Electricity Generation: Renewable Portfolio Standard and Clean Energy Standard

What is a Renewable Portfolio Standard and a Clean Energy Standard?

A renewable portfolio standard (RPS) constitutes a binding policy that requires electric utilities to incrementally increase the proportion of renewable energy that they provide to consumers, relative to non-renewable sources of energy. Specifically, the state awards utilities credits per MWh of renewable energy generation that can be traded, incentivizing cost reductions and efficiency gains across the renewable energy sources (PJM, 2019; Cleary, Palmer, and Rennert, 2019). A clean energy standard (CES) is the same as an RPS but extends to "clean" energy sources beyond renewables like coal (retrofitted with carbon capture technology), nuclear, and natural gas (Cleary, Palmer, and Rennert, 2019).

[19] To learn more about why cap-and-trade failed in 2009, see 2013 research paper (140 pages) by Harvard Political Scientist, Theda Skocpol.[19] The paper is summarized in a Washington Post article by Brad Plumer.

Has an RPS or CES been used or attempted before?

RPS and CES policies exist exclusively at the state level—in 29 states, two territories, and the District of Columbia[20] (NCSL, 2019)—as the U.S. Congress has never successfully established a national standard (Cleary, Palmer, and Rennert, 2019). While most jurisdictional targets are between 10 percent and 45 percent, 15 jurisdictions—California, Hawaii, Maine, Maryland, Nevada, New Jersey, New Mexico, New York, Oregon, Vermont, Virginia, Washington, as well as Washington, D.C., Puerto Rico, and the Virgin Islands—have requirements of 50 percent or greater. California, the District of Columbia, Hawaii, Maine, New Mexico, New York, Nevada, Virginia, and Washington have the most ambitious targets, mandating 100 percent of their electricity to come from renewable energy sources by 2050 *(See Appendix III, p.53-55 for details on RPS/CES policies by jurisdiction).* (AWEA, 2019). Following Governor Ralph Northam's April 2020 signing of the Virginia Clean Economy Act (HB 1526 and SB 85) into law, Virginia became the latest state to enact an RPS. Virginia is also the first southern state to make a 100% renewable energy commitment (NBC12 Newsroom, 2020).

Texas, which has a 10,000 MW goal for 2025, represents a state with a properly designed and implemented RPS program. The policy in Texas provided effective support for renewable energy development and has seen significant success. In contrast, states such as Connecticut, Maine, and Pennsylvania have seen little success as a result of poorly designed policies. Generally, a successful RPS policy is one that ensures policy goals are met. Possible policy goals are fuel diversity, economic development, electricity price stability, and environmental benefits (Fowler and Breen, 2013).

The federal government has made two attempts to establish a CES for the country, with both bills dying upon referral to the Senate Energy and Natural Resources Committee. In 2010, Senator Lindsey Graham (R-SC) introduced the Clean Energy Standard Act of 2010, which would have set aside 50 percent of electricity sales for clean energy by 2050. Two years later, Senator Jeff Bingaman (D-NM) sponsored the Clean Energy Standard Act of 2012, which would have set a standard of 84 percent by 2035 (Cleary, Palmer, and Rennert, 2019). *See Appendix I (p. 53-55) for an overview of the CES and RPS proposals we've seen introduced in the 116th Congress.*

What are the considerations when contemplating an RPS or CES? What is up for debate?

When designing a national RPS or CES, lawmakers must take several design considerations. These include determining which renewable or clean technologies to consider eligible for credits, the percentage of renewables mandated for the energy mix, the year by which utilities must meet this mandate, whether a technology or emissions-based standard is more appropriate, as well as how to address regional fairness, small utilities, and, compliance penalties (Cleary, Palmer, and Rennert, 2019). Since a CES is typically implemented at the utility level like an RPS, a federal policy will likely either override an existing state policy (if it is weaker) or allow the state policy to dominate (if it is stricter). This is the standard way of

[20] Six additional states have voluntary RPS programs, including: Indiana, Kansas, North Dakota, South Dakota, Utah, and Guam. Alaska, Montana, Oklahoma, West Virginia, Wisconsin, and Northern Mariana Islands do not have any form of standard or goal in place at this time (NCSL, 2019).

doing federal policy; states can do more, but they can't do less (Cleary, Palmer, and Rennert, 2019).

Drafting and Marking Up Legislation: Congressional Committee Jurisdiction Over Decarbonization Proposals

Carbon Tax Committee Jurisdiction

In Congress, carbon tax legislation falls under the jurisdiction of the House Ways and Means Committee and the Senate Finance Committee, who is authorized to amend the Internal Revenue Code of 1986 (Sobczyk, 2018). The House Ways and Means Committee is led by Chairman Richard Neal (D-MA) and Ranking Member Kevin Brady (R-TX). In the Senate, the Finance Committee is led by Chairman Chuck Grassley (R-IA) and Ranking Member Ron Wyden (D-OR) *(Figure 9, p. 23)*.

In the event Apex pursued the option of enacting carbon tax legislation through reconciliation, a procedure limited to revenue-raising or revenue-changing bills that requires only 51 votes to pass the Senate, the House and Senate Budget Committees would be key bodies, as well. The House Budget Committee is led by Chairman John Yarmuth (D-KY-03) and Ranking Member Steve Womack (R-AK-03). In the Senate, the Budget Committee is led by Chairman Mike Enzi (R-WY) and Ranking Member Bernie Sanders (D-VT) *(Figure 9, p. 23)*.

Figure 9 Names of committees with jurisdiction over carbon tax legislation coupled with the names of committee leaders. House Ways and Means, Senate Finance, House Budget, and Senate Budget are of particular importance.

Committee	Chairman	Ranking Member
House Ways and Means	Richard Neal (D-MA-01)	Kevin Brady (R-TX-08)
Senate Finance	Chuck Grassley (R-IA)	Ron Wyden (D-OR)
House Budget	John Yarmuth (D-KY-03)	Steve Womack (R-AR-03)
Senate Budget	Mike Enzi (R-WY)	Bernie Sanders (D-VT)
House Energy and Commerce	Frank Pallone (D-NJ-06)	Maybe Rep. Cathy McMorris Rodgers (R-WA-05) in 2021, currently Greg Walden (R-OR-02) *open seat
House Natural Resources	Raul Grijalva (D-AZ-03)	Rob Bishop (R-UT-01)
Senate Energy and Natural Resources	John Barrasso (R-WY) in 2021, currently Lisa Murkowski (R-AK)	Joe Manchin (D-WV)

Many of the carbon tax bills under consideration now also include amendments to the CAA and the Coastal Zone Management Act of 1972, which fall under the jurisdiction of the House Energy and Commerce, the House Natural Resources, and the Senate Energy and Natural

Resources committees. In January 2021, Rep. Greg Walden (R-OR), the ranking member of the House Energy and Commerce Committee, will retire from his post and a new ranking member, likely Rep. Cathy McMorris Rodgers (R-WA), will take his place. In addition, Senator Murkowski's (R-AK) term as Chairman of the Senate Energy and Natural Resources Committee will expire at the end of 2020 and Senator John Barrasso (R-WY) will replace her as chairman at the start of the 117th Congress *(Figure 9, p. 23)*. The lead agency in implementing a carbon tax would be the USDT.

Cap-and-Trade Committee Jurisdiction

As with a carbon tax, cap-and-trade legislation falls under the jurisdiction of the House Ways and Means Committee and the Senate Finance Committee who are responsible for amending the tax code. Chairman Neal (D-MA), Ranking Member Brady (R-TX), Chairman Grassley (R-IA), and Ranking Member Wyden (D-OR) would be the key players in driving committee consideration of a cap-and-trade bill. The U.S. Department of Energy (DOE) and the U.S. Environmental Protection Agency (EPA) would coordinate in developing the program with the lead agency being DOE.

Renewable Portfolio Standard/ Clean Energy Standard Committee Jurisdiction

RPS and CES legislation would fall under the jurisdiction of the House Energy and Commerce Committee and the Senate Energy and Natural Resources Committee who are authorized to amend the Public Utility Regulatory Policies Act of 1978. Incoming-Chairman Barrasso (R-WY), Ranking Member Manchin (D-WV), Chairman Pallone (D-NJ-06), and the incoming-ranking member for House Energy and Commerce—likely Rep. Rodgers (R-WA-05)—would be the members to target for developing an RPS or CES policy. In February 2020, Chairman Pallone introduced the CLEAN Future Act, which contained provisions for the development of a national CES. The lead agency in implementing a CES or an RPS would be DOE.

II. Evaluative Criteria

Evaluative criteria are the chosen standards for evaluating the results of a policy alternative. The three criteria that will be used to evaluate the policy alternatives I choose for rigorous analysis are political feasibility, cost effectiveness, and administrative feasibility. While cost-effectiveness will be reported as a numeric value, qualitative criteria—including political and administrative feasibility— will be assessed by category: "high," "medium-high," "medium," "low-medium," "low," or "very low." Each criterion is assigned a relative weight according to its importance.

Criterion 1: Political Feasibility (weight: 0.45)

Description: The first criterion I will use to evaluate the alternatives is political feasibility. Political feasibility is the ability to get a given policy alternative enacted into law. This criterion assumes that presumptive Democratic presidential nominee Joe Biden is elected president in 2020, since climate legislation is not a priority of the current administration and thus has an inability to gain sufficient momentum.

Measurement: Political feasibility evaluates the extent to which an alternative already has momentum at the federal level and is capable of building a coalition in support. Momentum of a given alternative will be measured by the number of major policy proposals at the federal level that are similar to the alternative in question. "Major" policy proposals are those that are introduced by corporations, associations, or members of Congress, though I will also consider the policy preferences of the presumptive Democratic presidential nominee, Joe Biden, and a bill's number of co-sponsors. Coalition capability will be assessed by projecting buy-in from the decisionmakers in Congress, as well as key stakeholders.[21] (*See Appendix IV, p. 67 for a comprehensive decisionmakers and key stakeholders diagram*.) Projected buy-in will be determined largely by the judgment of political experts, in addition to press releases and voting records. As projected buy-in is assessed, it is also important to account for the number of votes that the policy alternative would require to pass the Senate. Certain types of policies can be passed through reconciliation, a process requiring only 51 votes to pass (as opposed to 60), meaning that the policy requires fewer Republican votes to become law. Alternatives with high momentum and coalition capabilities will receive a high political feasibility score.

Criterion 2: Cost-Effectiveness (weight: 0.35)

Description: The second criterion that I will use to evaluate the projected outcomes of the alternatives is cost-effectiveness. The cost-effectiveness score represents the additional reduction in emissions, as compared to a status quo scenario, per dollar spent on the alternative.

[21] We did not include a separate criterion for equity to avoid overlap between criteria. That is, since an alternative that is politically feasible must also be equitable, we did not include a separate measure for equity.

Measurement: A cost-effectiveness score entails determining the effectiveness and costs of each alternative—for example, the total costs of additional renewable energy deployment, operation and maintenance of new renewable energy facilities, and direct labor costs of federal agency personnel (employee salaries and overhead). Once determined, costs are discounted at a rate of 3 percent[22] over the length of fifteen years (2021-2035). The costs of each alternative represent the total net present value of additional costs to the United States in $2018 over the fifteen year period. After determining costs, I will determine the outcome for each alternative, or the additional reduction in emissions (in millions of metric tons) from the U.S. electric power sector. Once I have a measure for both cost and effectiveness, I can generate a cost-effectiveness measure. A cost-effectiveness measure is generated by dividing the total additional cost projection of each alternative by its projection for electric power sector emissions reductions. I will compare these estimates across alternatives relative to the status quo. The alternative that projects the most emissions reductions at the lowest possible cost will receive the highest cost-effectiveness score.

Criterion 3: Administrative Feasibility (weight: 0.20)

Description: The third criterion I will use to evaluate the policy alternatives is administrative feasibility. Administrative feasibility measures the ability of the executive agencies with jurisdiction to implement each alternative. This criterion assumes Congress appropriates the lead agency resources consistent with past Democratic administrations. Depending on the alternative, the executive agencies and departments with jurisdiction may include EPA, DOE, and/or USDT.

Measurement: Administrative feasibility is measured by (1) the extent to which the United States has past experience with the alternative (i.e. whether there is an existing regulatory framework for the alternative or not); (2) the complexity of the program in terms of the number of rules and regulations the executive agency needs to promulgate; (3) the ability of an agency (or agencies) to conduct effective oversight and enforcement of the program; and (4) the number of agencies that need to be involved in developing and conducting the program. Alternatives that offer past experience in the United States, low complexity, manageable oversight and enforceability, and single-agency involvement will receive the highest administrative feasibility scores.

[22] Though OMB recommends an interest rate of 7%, an interest rate of 7% would be quite high for these policy alternatives. In fact, nowadays, 7% is higher than most people would apply for a real interest rate for any type of project. With respect to this analysis specifically, economists would certainly use a discount rate lower than 7% because it is for long-term environmental planning. 3% is a reasonable central estimate for bond finance of a project like this.

III. The Status Quo and Policy Alternatives

In this section, I outline three market-based policy alternatives to the status quo including a national carbon tax (the CLC Baker-Shultz Carbon Dividends Plan), a national renewable portfolio standard (the Renewable Electricity Standard Act), and a national Clean Energy Standard (CLEAN Future Act). Though there are many market-based alternatives to the status quo, these policies represent the most viable options for speeding decarbonization of the electric power sector. *See Appendix I (p. 52-53, 55, 56) for justification for excluding other alternatives.* After outlining these alternatives, I present an analysis of these alternatives using the chosen set of criteria described in the previous section.

Status Quo

Before analyzing the alternatives, it is first important to outline the status quo, or the legislative efforts driving decarbonization to date. Though the status quo assumes continued expansion of renewables within the US power grid due to corporate and utility demand, regardless of which way political winds are blowing, projected renewable development does not lead to substantial emissions reductions in 2035 (WoodMac, 2019). Even when including continued fuel-switching from coal to cleaner sources (Wood Mackenzie, 2020), increases in total U.S. electricity demand and production will soon offset the decarbonization that is occurring from existing policies and trends (U.S. EIA, 2018; Lawson, 2018). Regulation has little to no impact on emissions or renewable development. *Figure 10 (p. 27)* identifies the key assumptions for the status quo scenario.

Status Quo – No Federal Decarbonization Policy

Includes emissions reductions driven by:

- The December 2019 one-year extension of the federal **wind production tax credit** (PTC). Projects that begin construction in year 2019 are eligible for a 40% credit and projects that begin construction in 2020 are eligible for a 60% credit. The PTC is set to expire at the end of 2020 (National Law Review, 2019).
- The **permanent federal solar investment tax credit** (ITC) of 10% for commercial and utility-scale projects. The residential ITC sunsets by 2022.
- The **West Coast Initiative** (WCI) cap-and-trade program in California.[1]
- The nine states that make up the **Regional Greenhouse Gas Initiative** (RGGI).[2]
- **RPS and CES policies** in 32 jurisdictions in the United States.

Figure 10 Key assumptions for status quo scenario. *Note that The WCI cap-and-trade program kicks in with the auction reserve price at $15.62/ton in 2019. The price then escalates by 5% annually going forward until 2040 (WoodMac, 2019).*

Given these existing policies, the average annual rate of decarbonization of the electric power sector will remain at three percent through 2050, maintaining already problematic emissions levels of about 1.6 billion metric tons. Levels are projected to decrease by only 38

million through 2035 and 100 million through 2050 in this scenario[23] (U.S. EIA, 2019; U.S. EIA, 2018; Lawson, 2018).

Policy Alternative #1

Carbon Tax – The Climate Leadership Council Baker-Shultz Carbon Dividends Plan*

Summary – Puts an economy-wide fee on CO2 emissions starting at $43 a ton ($2018) in 2022[a] and increasing every year at 5% above inflation through 2035. Energy-related CO2 emissions are 51% below 2005 levels by 2035[b] (CLC, 2020; RFF, 2019).

Revenue Use – Distributes all revenue as an equal dividend to U.S. residents with a valid Social Security number after accounting for administrative costs and direct costs to the federal government. The dividend will be paid on a quarterly basis.

Sponsors – Introduced by former Secretaries of State James Baker and George Shultz in February 2017 and updated in February 2020 (CLC, 2020).

Co-Sponsors – Support from BP, ConocoPhillips, ExxonMobil, Shell, Total, Ford, General Motors, Goldman Sachs, JPMorgan Chase, AT&T, Procter & Gamble, Unilever, Johnson & Johnson, Allianz, MetLife, IBM, Microsoft, PepsiCo, First Solar, Exelon, Calpine, Vistra Energy, BHP, AECOM, Conservation International, World Resources Institute, and World Wildlife Foundation (CLC, 2020).

[a] The CLC indicates that the carbon tax is implemented in 2021, but we assume the tax is enacted in 2021 and implemented in 2022, a more realistic timeline politically. The starting price is adjusted for inflation and reported in $2018.
[b] According to my communication with Marc Hafstead, the power sector is responsible for about 60-65% of most emissions reductions in his (economy-wide) CLC tax model. He indicated that in the next round of updates to the model, he could imagine that this number would be even higher.

Figure 11 Key details about the CLC Baker-Shultz Carbon Dividends Plan.

Summarized in *Figure 11 (p. 28)*, this option would involve Apex enacting amendments to the Internal Revenue Code of 1996 and the CAA to create a carbon tax, or fee on carbon emissions, that distributes revenues to the American people as a direct deposit[24]. Administering this program would require the creation of a trust fund that would function similarly to the Highway Trust Fund.

The carbon fee will cover energy and non-energy CO_2 emissions and implemented at the refinery exit or at the first point that fuels enter the economy, meaning the mine, well, port, or local gas distribution company. The plan includes an emissions assurance mechanism to ensure that emissions reductions targets are met. Beginning 5 years after the introduction of the fee, if cumulative emissions exceed the target path, the carbon fee escalation rate will automatically

[23] It is important to note that total demand and production is expected to increase due to population growth, as per capita electricity consumption is projected to remain constant (U.S. EIA, 2018).
[24] In Appendix I, I include an evaluation of the previously considered carbon taxes that differ by revenue usage, concluding that enacting a carbon tax that returns revenues by household is the most viable version of a carbon tax. Other revenue distributions that were considered include (1) funding other initiatives, (2) reducing distortionary federal taxes and (3) rebating revenues to states.

increase. After 2035, the default escalation rate of 5% above inflation could be reassessed to modify the emissions trajectory through 2050.

The plan will also suspend, repeal, or preempt all current and future stationary source CO_2 emissions regulations, future federal low-carbon fuel standards, and mobile source emissions standards for certain non-road vehicles (e.g. farm equipment). Finally, the plan will include a border carbon adjustment that applies the U.S. carbon price to carbon intensive imports and rebates fees paid on carbon-intensive exports (CLC, 2020).

The congressional committees of substantive jurisdiction are the House Ways and Means Committee, the Senate Finance Committee, the House Budget Committee, and the Senate Budget Committee. Leadership in the House Energy and Commerce Committee as well as the Senate Energy and Natural Resources Committee is likely to be involved, as well. The lead agency in implementing the program would be the USDT.

Policy Alternative #2

Renewable Portfolio Standard – The Renewable Electricity Standard Act (S.1974)

Summary – The Renewable Electricity Standard Act requires 50% renewable energy by 2035 and 80% renewable energy by 2050. It starts at 18.2% in 2022*, escalating 2.2 percentage points per year to 2035. Relative to business-as-usual, the RPS would result in a 46% reduction in power sector carbon dioxide emissions in 2035.[c]

Sponsors – Introduced by Sen. Tom Udall (D-NM) in March 2019.

Co-Sponsors – 6 co-sponsors: Sens. Martin Heinrich (D-NM), Angus King (I-ME), Tina Smith (D-MN), Sheldon Whitehouse (D-RI), Chris Van Hollen (D-MD), Jacky Rosen (D-NV).

[c] The Renewable Electricity Standard Act bill text indicates an implementation year of 2020. For this analysis, we assume the bill is enacted in 2021 and implemented in 2022, a more realistic timeline politically. Accordingly, we adjust the percentage of renewables required from 16% to 18.2%, accounting for the 2.2% increase that would have occurred if the act had been enacted on schedule (Udall, 2019).

Figure 12 Key details about the Renewable Electricity Standard Act (S.1974).

Summarized in *Figure 12 (p. 29)*, this option would involve Apex enacting an amendment to the Public Utility Regulatory Policies Act of 1978, the Renewable Electricity Standard Act, to create a national RPS. The act creates a binding federal floor-setting standard that increases annual sales from renewable electricity generation from utilities in all states. Starting in 2022, the RPS requires that each retail electricity provider increase its supply of renewable energy by a percentage of total retail sales each year.

Renewable electricity is defined as solar, wind, ocean, tidal, geothermal, biomass, landfill gas, incremental hydropower, and hydrokinetic energy. Each kWh of electric energy generated by a new renewable resource is entitled to a renewable energy credit (REC), which will be turned in for compliance. While some small exceptions apply, most existing renewable electricity is not eligible for federal RECs.

The federal floor-setting standard (ramp-up rate) starts at 1.5% in 2022 for utilities over 1 million megawatt hours, increasing to 2% per year through 2029, and maxing out at 2.5% per

year through 2035. The federal ramp-up rate for utilities under 1 million megawatt hours is half the rate of large utilities. States with RPS or CES standards at or above the federal floor, as well as states with generation mixes of at least 60% renewable electricity, can opt out. The act allows the banking and borrowing of credits for three years (Udall, 2019).

The congressional committees of substantive jurisdiction are the Senate Energy and Natural Resources Committee, the House Energy and Commerce Committee (Subcommittee on Energy), and the House Science, Space, and Technology Committee. The lead agency in implementing the RPS would be DOE.

Policy Alternative #3

Clean Energy Standard – The CLEAN Future Act (Discussion Draft)
Summary – The CLEAN Future Act requires electricity providers to provide an increasing percentage of clean electricity each year starting in 2022, rising linearly from its baseline level to 100% in 2050. It has a national average clean energy requirement of 78% in 2035. It achieves emissions reductions of 45% by 2035 (Picciano, Rennert, and Shawhan, 2020).
Sponsors – Introduced by House Energy and Commerce Committee Chairman Frank Pallone, Jr. (D-NJ), Environment and Climate Change Subcommittee Chairman Paul Tonko (D-NY), and Energy Subcommittee Chairman Bobby Rush (D-IL) in January 2020.
Co-Sponsors – TBD, but the CLEAN Future Act incorporates elements of Rep. Ben Lujan's (D-NM) Clean Energy Standard Act, as well as Rep. DeGette's (D-CO) forthcoming Clean Energy Innovation and Deployment Act.

Figure 13 Key details about the CLEAN Future Act (Discussion Draft).

Summarized in *Figure 13 (p. 30)*, this option would involve Apex enacting an amendment to the Public Utility Regulatory Policies Act of 1978 through the CLEAN Future Act to create a national CES. The discussion draft proposes defining "clean energy" as electricity generated at a facility with an annual carbon intensity lower than 0.82 metric tons of CO_2 equivalent per megawatt-hour. Non-emitting generators receive full credit for the electricity they produce, whereas coal- and gas-fired generators with carbon intensities lower than 0.82 metric tons of CO_2 receive partial credit after accounting for upstream fossil emissions.[25]

The annual percentage increase for a retail electricity supplier is the product obtained by multiplying the difference between 100 percent and the baseline qualified energy percentage by 1/28. The baseline qualified energy percentage is the average percentage of the electric energy consumed by all electric consumers of the retail electricity supplier that is qualified energy during calendar years 2017-2019.

[25] The Draft Bill proposes that a clean source is one that emits less than 0.82 metric tons of CO_2 equivalent per megawatt hour. Under this standard, zero-emission sources, such as renewables or nuclear, would receive a full credit, while coal or natural gas-powered generators with carbon intensities lower than the 0.82 threshold would receive a partial credit. The average fleet-wide emissions rates of coal and natural gas combustion generators are, respectively, 0.96 and 0.6 metric tons of CO_2 per megawatt hour. This means that almost all natural gas, at least initially, gets partial credit.

Regulated suppliers must possess a sufficient quantity of "clean energy credits" at the end of each year, or they may otherwise make an "alternative compliance payment." Suppliers may buy and trade clean energy credits from one another or purchase them via auction. Alternative compliance payments start at $22 in 2022 and rise to $64 in 2050 (and each calendar year thereafter). The act allows states to adopt or enforce their own clean or renewable energy standards if the state program is more stringent than the federal program.

The congressional committees of substantive jurisdiction are the Senate Energy and Natural Resources Committee, the House Energy and Commerce Committee (Subcommittee on Energy), and the House Science, Space, and Technology Committee. The lead agency in implementing the CES would be DOE.

IV. Findings

Outcomes Matrix

Figure 14 (p. 31) represents an outcomes matrix to demonstrate how each alternative performs across criteria for political feasibility, cost effectiveness, and administrative feasibility relative to the status quo, or no federal decarbonization policy. Political feasibility was weighted as the most important category (0.45) with cost effectiveness rated as the next most important category (0.35), followed by administrative feasibility (0.20). The recommended policy will score highest across the three criteria.

		Policy Alternatives			
Evaluative Criteria	**Weight**	Status Quo – No Federal Decarbonization Policy	*Option #1: Enacting a Carbon Tax and Dividend	Option #2: Enacting an RPS	Option #3: Enacting a CES
Political Feasibility	0.45	High	Low-Medium	Very Low	Low
Cost Effectiveness	0.35	**$37.5 billion** per million metric tons of emissions prevented	**$24.6 million** per million metric tons of emissions prevented	**$114.7 million** per million metric tons of emissions prevented	**$38.7 million** per million metric tons of emissions prevented
Administrative Feasibility	0.20	High	Medium	Low	Low

Figure 14 Outcomes matrix showing a comparison of the three policy alternatives, relative to the status quo scenario.

Status Quo

Political Feasibility

The status quo, or no federal decarbonization policy, receives a score of "High" for political feasibility, because it requires no additional action at the federal level. The policies currently determining emissions levels occur at the state and regional levels, with the exception of tax credits for wind and residential solar set to expire in 2020 and 2022, respectively.

Cost Effectiveness

The status quo has an overall cost to society of approximately $37.5 billion ($2018) per million metric tons of emissions prevented, earning a qualitative rating of "Very Low" for cost effectiveness. This score is the result of negligible emissions reductions—only 38 million metric tons by 2035—in the absence of a federal decarbonization policy, as well as a high social cost of carbon (ranging from $52.41 to $67.35 in $2018) between 2021 and 2035 (U.S. EPA, 2017)[26]. Costs were discounted at a rate of 3 percent over the 15-year period. This projected outcome served as the baseline for all policy options.

Administrative Feasibility

The status quo receives a score of "High" for administrative feasibility as demonstrated by DOE's ability to administer wind and solar tax credits since 1992 and 2006, respectively. The federal government does not administer regional and state level programs, meaning that these programs will continue irrespective of federal capabilities.

Policy Alternative #1: Enacting a Carbon Tax and Dividend – The Climate Leadership Council Baker-Shultz Carbon Dividends Plan*

Political Feasibility

Relative to the status quo, the carbon tax and dividend option has low to moderate momentum at the federal level. At this writing, there are at least nine major carbon tax policy proposals in consideration at the federal level, more than any other decarbonization policy approach. As described above, major policy proposals are those that are introduced by corporations, associations, or members of Congress. Of these nine proposals, three indicate that revenues will be distributed as a dividend to households[27] making it the second most popular use of revenues among all the revenue use options. Presumptive Democratic presidential nominee Joe Biden supports a price on carbon such as a carbon tax or a cap-and-trade program but has not endorsed a specific policy or use of revenues (Washington Post, 2020).

The carbon tax and dividend option, specifically the CLC's Baker-Shultz Carbon Dividends plan, has moderate coalition capabilities in comparison to the status quo. While the Energy Innovation and Carbon Dividend Act has an emissions reductions schedule that is far too ambitious to be politically viable[28], like the CLC's approach it distributes revenues as a dividend and has 79 Democratic co-sponsors, demonstrating that the concept of distributing revenues by household is already supported by the Democratic party. The bill also has the support of one Republican, Rep. Francis Rooney (R-FL-19), who will retire in December 2020. At this time, the CLC's plan has the support of major oil and gas companies like Exxon, Shell, and BP,

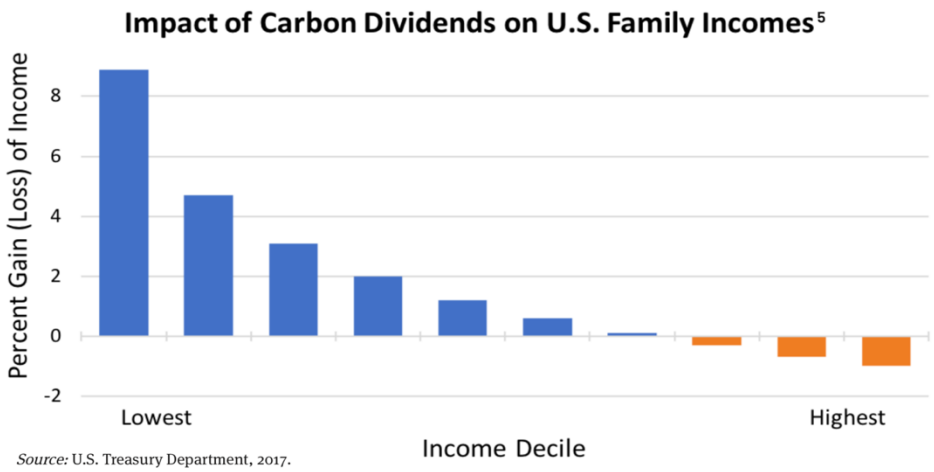
[26] I use the U.S. EPA's 3% average discounted estimates for the social cost of carbon between 2015 and 2050. I convert the EPA estimates to $2018 since they are provided in $2007.
[27] The CLC Carbon Dividends Plan, the Energy Innovation and Carbon Dividend Act, and the Climate Action Rebate Act all propose to distribute revenues as a dividend to households.
[28] In determining a reasonable level of ambition, it is important to choose a price that is high enough to drive innovation but low enough to prevent leakage and detrimental impacts to industry. Too low of a carbon price won't drive innovation and too high of a carbon price will either crush industry or cause leakage (Bataille, 2020).

though the American Petroleum Institute (API) and the American Gas Institute remain opposed to any form of carbon pricing.

Although this is a conservative approach to decarbonization, gaining the support of conservatives will remain challenging. There are rumblings that conservatives dislike dividends, because they fear U.S. residents will develop a dependency on the government funds as in entitlement programs (Shore Interview, 2019). In addition, while campaigning, many Republican candidates vow not to increase taxes (Americans for Tax Reform, 2018). American mistrust of the federal government is also high; constituents must be convinced that the government can not only be an honest broker of the revenues, but that the dividend they gain is more than the increased energy costs they face as a result of the carbon tax[29] (Mets Interview, 2020).

At the very least, in recruiting Republican members of Congress and generating grassroots support, it will be important to prove that the use of revenues for dividends to the American people will offset any electricity and gasoline price increase associated with the tax. The carbon tax alternative is an especially progressive,[30] or equitable, approach, as the dollar amount of a carbon dividend is expected to exceed the increased costs incurred by the average low-and middle-income household. As seen in *Figure 15 (p. 33)*, a distributional table from a 2017 U.S. Treasury research paper shows that distribution of the carbon revenue through an equal per capita cash grant as proposed for the CLC's tax would be sharply progressive, making approximately 70 percent of American households better off (Hafstead, 2019). Specifically, households up through the seventeenth percentile would be better off in the sense of receiving more from the cash grant than the impacts on disposable income through source and use side effects. Even without the cash grant, the carbon tax would be highly progressive, making households better off up through the 7th and 8th decile (Horowitz et al., 2017; Metcalf, 2019).

Figure 15 Impact of dividends on U.S. family incomes.



The addition of a workforce development provision for workers in the fossil fuel industry may also help build support, or at least lessen opposition, for the carbon tax alternative among moderate and centrist members representing fossil fuel states. Moreover, it would be useful to show Republicans representing states with vast renewable energy potential in their state the economic benefits of a carbon tax.

[29] A key reason why the 2016 carbon tax ballot initiative in Washington state failed is because Republicans didn't believe the assertion that a tax cut is actually revenue neutral, although in theory revenue neutrality would bring them on board (Mets Interview, 2020).

[30] A policy is progressive if the costs constitute a larger proportion of income for high-income households than for low-income households (Hafstead, 2019).

Most importantly, in assessing coalition capability, it is important to recognize that a carbon tax is unique in that it can be passed through reconciliation—a process requiring only 51 votes to pass the Senate—and therefore it does not need overwhelming Republican support. A carbon tax qualifies for reconciliation because, by changing a law that would result in revenue, it does not violate the Byrd Rule[31] and therefore cannot be subject to a filibuster (requiring 60 votes to overcome) (Flint Interview, 2020). Assuming every Democrat and Independent in the Senate supports the CLC's proposal, the bill's passage would require a "yes" vote from only four Republicans as opposed to thirteen, at least in the 116th Congress. The Republican majority is expected to stay the same or slim even further after November 2020 elections. Overall, the carbon tax and dividend alternative receives a political feasibility score of "Low-Medium."

Cost Effectiveness

The carbon tax policy alternative has an overall cost of approximately $24.6 million ($2018) per million metric tons of emissions prevented, earning a qualitative rating of "High" for cost effectiveness relative to the status quo. This score is the result of $336.3 billion in total net present value of additional costs achieving $13.7 billion metric tons in total additional emissions reductions from the electric power sector (including electrification of transportation) by 2035. Capital costs were determined by projecting the cost of the additional build of renewable energy facilities that would be required to meet the emissions reductions schedule outlined in the tax for 2021 and 2035. These costs were then discounted at a rate of 3 percent over the 15-year period.

Administrative Feasibility

Relative to the status quo, the carbon tax alternative receives an administrative feasibility score of "Medium." Though a carbon tax has never been implemented at the state or national level in the United States, 25 countries have successfully implemented a carbon tax at the national level. In addition, the USDT's Internal Revenue Service already has experience managing the Highway Trust Fund, a fund that operates similarly to how the trust fund for carbon tax revenues would run. The IRS also has experience distributing government funds to individuals in a timely manner. Following enactment of the third coronavirus stimulus package, the Coronavirus Aid, Relief, and Economic Security Act (CARES Act), the IRS developed a process for distributing stimulus money to Americans.[32] The IRS could easily apply this preexisting process, utilized to implement the CARES Act, to distribute carbon tax revenues as a direct deposit. For these reasons, the carbon tax policy alternative receives a score of "Medium" for administrative feasibility.

[31] The Byrd Rule says that measures cannot be included in the Senate reconciliation package if they are viewed as "extraneous" provisions that are not primarily budget related. When the parliamentarian rules that a provision violates the Byrd rule, it is dropped from the bill unless sixty senators vote to waive the Byrd rule. The Byrd Rule is usually waived.

[32] The IRS distributed direct deposits to taxpayers that filed in 2018 or 2019. Since not all recipients pay taxes, the IRS merged the taxpayer dataset with the 1099-G dataset to account for those on social security or disability.

Policy Alternative #2: Enacting an RPS – The Renewable Electricity Standard Act (S.1974)

Political Feasibility

Relative to the status quo, the RPS policy alternative has poor momentum and coalition capabilities, giving it a political feasibility score of "Very Low.". At this writing, despite an RPS being the policy of choice in states, there is only one major proposal for an RPS that has been offered at the federal level: the Renewable Electricity Standard Act. The existence of only one proposal suggests that there is little appetite for an RPS becoming the nation's decarbonization policy.

Aside from the low number of RPS policies in consideration, the Renewable Electricity Standard Act also lacks bipartisanship and has few cosponsors, with support from only five Democrats and one Independent in the Senate. This is significant, because an RPS requires support from every Democrat and Independent, as well as 13 Republicans, to pass the Senate; unlike a carbon tax, an RPS requires 60 "yes" votes in the Senate to become law. As a result, the principles of the legislation are at risk of being corrupted in making compromises to overcome this 60-member threshold, losing broad support for the policy altogether (Flint Interview, 2020). The bill also lacks support from prospective Democratic decisionmakers; an RPS is neither the policy of choice of presumptive Democratic presidential nominee Joe Biden, nor the preferred policy of the Chairman of the House Energy and Commerce Committee, Frank Pallone (D-NJ-06). The House Energy and Commerce Committee has jurisdiction over RPS legislation.

Beyond the Hill, the Renewable Electricity Standard Act has the support of the American Council on Renewable Energy, the American Wind Energy Association (AWEA), the Solar Energy Industries Association (SEIA), the Union of Concerned Scientists, and the Sierra Club. As far as the renewable energy trade associations are concerned, the endorsement is unsurprising given that an RPS would drive substantial renewable energy development, even more so than a carbon tax (AWEA, 2019). An RPS, however, is less effective in driving emissions reductions, the outcome of interest in this report. I do not anticipate that organizations other than environmental NGOs and renewable energy interest groups will support this policy alternative.

Cost Effectiveness

The RPS policy alternative has an overall cost of approximately $114.6 million ($2018) per million metric tons of emissions prevented, earning a qualitative rating of "Medium-High" for cost effectiveness relative to the status quo. This score is the result of $620.5 billion in total net present value of additional costs achieving 5.4 billion metric tons in total additional emissions reductions from the electric power sector by 2035. Capital costs were determined by projecting the cost of the additional build of renewable energy facilities that would be required for utilities to meet their renewable energy sales requirements between 2021 and 2035. These costs were then discounted at a rate of 3 percent over the 15-year period.

Administrative Feasibility

Though an RPS has never been implemented at the federal level, it has been implemented in 32 jurisdictions in the United States. At the federal level, however, overseeing and enforcing RPS standards would likely be more difficult as a far greater number of entities are involved and

trading would be allowed across states. The RPS is similar to a cap-and-trade system on the electricity sector in that suppliers may buy and trade RECs from one another or purchase them via auction and will thus be subject to similar criticism. One of the key concerns about the cap-and-trade proposal in 2009 was an inability to track allowance transactions and ownership. Although more than a decade has passed, tracking allowance transactions and ownership may exceed DOE's capabilities. For this reason, the RPS alternative receives a score of "Low" for administrative feasibility.

Policy Alternative #3: Enacting a CES – The CLEAN Future Act (Discussion Draft)

Political Feasibility

The CES policy alternative has moderate momentum and low coalition capabilities, giving it a "Low" political feasibility score overall. At this writing, there are two CES policy proposals in Congress, the CLEAN Future Act and the Clean Energy Standard Act. Though there are few proposals, the CLEAN Future Act was introduced by House Energy and Commerce Chairman Frank Pallone, suggesting that it is the preferred policy approach of Democratic leadership in the House. Since the House Energy and Commerce Committee has only released a discussion draft text of the CLEAN Future Act, there are not yet co-sponsors listed. The CLEAN Future Act, however, incorporates elements of the Clean Energy Standard Act which has five co-sponsors (all Democrats).

As with the RPS policy alternative, a CES policy alternative would require 60 "yes" votes in the Senate to become law; it is not eligible for the reconciliation process. This means that after negotiations to get members on board, it is unlikely that the CES will remain an effective decarbonization policy (Flint Interview, 2020). As a result, early supporters of the bill—including certain environmental groups, renewable energy trade associations, and liberal Democrats—may withdraw their support. As of now, AWEA and the NRDC support the CLEAN Future Act framework (NRDC, 2020) and are providing recommendations at the Committee's request.

Cost Effectiveness

The CES policy alternative has an overall cost of approximately $38.6 million ($2018) per million metric tons of emissions prevented, earning a qualitative rating of "High" for cost effectiveness as compared to the status quo. This score is the result of $204.8 billion in total net present value of additional costs achieving 5.3 billion metric tons in total additional emissions reductions from the electric power sector. Capital costs were determined by projecting the cost of the additional build of renewable energy facilities that would be required for utilities to meet their clean energy sales requirements between 2021-2035. These costs were then discounted at a rate of 3 percent over a 15-year period. *(See Appendix II, p. 57-64 for the methodology for the cost-effectiveness analysis).*

Administrative Feasibility

Though a CES has never been implemented at the federal level, it has been implemented in 32 jurisdictions in the United States. At the federal level, however, overseeing and enforcing

CES standards would likely be more difficult as a far greater number of entities are involved and trading would be allowed across states. The CES is similar to a cap-and-trade system on the electricity sector in that suppliers may buy and trade clean energy credits from one another or purchase them via auction and will thus be subject to similar criticism. One of the key concerns about the cap-and-trade proposal in 2009 was an inability to track allowance transactions and ownership. Although more than a decade has passed, tracking allowance transactions and ownership may exceed DOE's capabilities. For this reason, the CES alternative receives a score of "Low" for administrative feasibility.

V. Recommendation

In order to speed emissions reductions from the electric power sector, **I recommend that Apex enacts the Climate Leadership Council's Baker-Shultz Carbon Dividends plan, an economy-wide carbon tax that returns revenues by household** *(Figure 16, p. 37).*

Figure 16 CLC Carbon Dividends Plan key features.

The CLC Carbon Dividends Plan has several key features:

- Puts an economy-wide fee on CO_2 emissions starting at $41 a ton ($2018) in 2021 and increasing every year at 5% above inflation.
- Distributes nearly 100% of the revenues in equal shares to Americans to protect households from energy price increases they cannot afford.
    - An exception is made to allow revenues to cover administrative expenses, which would account for approximately 1 percent of carbon tax revenue each year.
- Includes a border carbon adjustment intended to protect the competitiveness of US firms, prevent emissions leakage, and encourage other countries to implement their own prices on carbon emissions.
- Temporarily suspends EPA authority to regulate emissions from stationary sources of CO_2 that are also covered by the carbon fee.

There are three main reasons for this recommendation. First, because the carbon tax alternative has the most momentum at the federal level, some industry support, and would only require 51 votes to pass the Senate, it is the most politically feasible option. Second, though costly in achieving emissions reductions—as is the case for any decarbonization policy—the carbon tax policy alternative is the most cost effective option. Relative to an RPS or a CES, a carbon tax offers much more flexibility in compliance for achieving emissions reductions. Namely, a carbon tax offers additional ways of reducing CO_2 emissions other than just building renewables[33]; and these options often occur at a low cost. Finally, the option has high administrative feasibility because the USDT already has experience managing the type of trust fund a carbon tax would require and distributing government revenues. *See Appendix VI (p. 69-70) for an expanded recommendation and Appendix VII (p. 71-80) for enactment recommendations.*

[33] Some examples of ways that an economy-wide carbon tax would drive emissions reductions in ways other than building renewables are (1) electrifying part of the transportation sector, (2) electrifying some industrial processes, and (3) using electricity instead of natural gas or oil for heating homes.

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Appendix I: Market-Based Decarbonization Policy Proposals at the Federal Level

Figure 17 (p. 46) is an outline containing every market-based decarbonization policy proposal in consideration at the federal level. In general, a carbon tax proposal falls into one of four categories, but proposals sometimes fall into more than one category. For this reason, the carbon tax proposals are categorized according to their primary revenue use. The starred acts represent the most viable proposals and were subject to rigorous analysis. Following the chart is a detailed overview of each proposal and, when applicable, a justification for the proposals' exclusion from rigorous analysis.

Figure 17 Federal decarbonization policy proposals organized by category.

Carbon Taxes (by category)	RPS/CES	Cap-and-Trade Program
1a) Carbon tax returns revenues by household (dividend) • CLC Baker-Shultz Carbon Dividends Plan* • Energy Innovation and Carbon Dividend Act • Climate Action Rebate Act 1b) Carbon tax uses revenues to fund other initiatives • Market Choice Act • American Opportunity Carbon Fee Act • America Wins Act • Modernizing America with Rebuilding to Kickstart the Economy of the Twenty-first Century with a Historic Infrastructure-Centered Expansion 1c) Carbon tax uses revenues to fund a reduction of a distortionary federal tax • Stemming Warming and Augmenting Pay Act • Raise Wages, Cut Carbon Act 1d) Carbon tax rebates revenues to states	2) RPS • Renewable Electricity Standard Act* 3) CES • CLEAN Future Act* • Clean Energy Standard Act • Clean Energy Innovation and Deployment Act	4) Program returns revenues by household (cap-and-dividend) • Healthy Climate and Family Security Act

1A) An Overview of Carbon Tax Revenue Use Options and Major Proposals

Option 1: Returning Revenues by Household – Carbon Dividend Approach

This option would involve Apex enacting amendments to the Internal Revenue Code of 1996 and the CAA to create a carbon tax that distributes the entirety of revenues to the American people in the form of a dividend. In practice, the government would distribute the dividend to U.S. citizens as a check, a tax credit, an add-on to entitlement program payments, or a payment through the electronic benefit transfer system. The government may choose to provide an adult with a larger payment as compared to a child or distribute the revenue equally to all U.S. citizens (Coons, 2019). Administering this program would require the creation of a trust fund that would function similarly to the Highway Trust Fund.

Several federal policy proposals take a carbon dividend policy approach, including the CLC's Baker-Shultz Carbon Dividends Plan, the Energy Innovation and Carbon Dividend Act, and the Climate Action Rebate Act *(summaries below)*. The congressional committees of substantive jurisdiction are the House Ways and Means Committee, the House Energy and Commerce Committee (Subcommittee on Energy), the House Foreign Affairs Committee, and the Senate Finance Committee. The lead agency in implementing the program would be the USDT.

1. The Climate Leadership Council Baker-Shultz Carbon Dividends Plan*

Summary – Puts an economy-wide fee on CO_2 emissions starting at $43 a ton ($2018) in 2022[34] and increasing every year at 5% above inflation through 2035. Energy-related CO_2 emissions are 51% below 2005 levels by 2035[35] (CLC, 2020; RFF, 2019).

Revenue Use – Distributes all revenue as an equal dividend to U.S. residents with a valid Social Security number after accounting for administrative costs and direct costs to the federal government. The dividend will be paid on a quarterly basis.

Sponsors – Introduced by former Secretaries of State James Baker and George Shultz in February 2017 and updated in February 2020 (CLC, 2020).

Co-Sponsors – Support from BP, ConocoPhillips, ExxonMobil, Shell, Total, Ford, General Motors, Goldman Sachs, JPMorgan Chase, AT&T, Procter & Gamble, Unilever, Johnson & Johnson, Allianz, MetLife, IBM, Microsoft, PepsiCo, First Solar, Exelon, Calpine, Vistra Energy, BHP, AECOM, Conservation International, World Resources Institute, and World Wildlife Foundation (CLC, 2020).

[34] The CLC indicates that the carbon tax is implemented in 2021, but I assume the tax is enacted in 2021 and implemented in 2022, a more realistic timeline politically. The starting price is adjusted for inflation and reported in $2018 (Hafstead, 2019).

[35] According to my communication with Marc Hafstead, the power sector is responsible for about 60-65% of most emissions reductions in his (economy-wide) CLC tax model. He indicated that in the next round of updates to the model, he could imagine that this number would be even higher.

2. The Energy Innovation and Carbon Dividend Act (H.R. 763)

Initial Carbon Price and Rate of Increase – Puts an economy-wide fee on CO_2 emissions starting at $15 per metric ton in 2019, increasing by $10 each year.

Revenue Use – Distributes 100% of revenue as a dividend back to households. Dividends are paid in a pro-rata share to each adult with a Social Security Number or Taxpayer Identification Number, with a half-share paid to each child.

Sponsors – Introduced by Reps. Ted Deutch (D-FL) and Francis Rooney (R-FL) in January 2019.

Co-Sponsors – 79 Democratic co-sponsors.

3. The Climate Action Rebate Act (S.2284 and H.R. 4051)

Initial Carbon Price and Rate of Increase – Puts an economy-wide fee on CO_2 emissions starting at $15 per metric ton in 2020, increasing by $15 each year. If the emissions targets are not met in a given year, the fee is raised by $30. Once emissions reach 10% of 2017 levels, the fee no longer rises.

Revenue Use – The legislation directs:

- 70% of revenues to low- and middle-income Americans with a Social Security Number or Taxpayer Identification Number as a dividend. An equal share is provided to adults and a half share is provided for children under 19 years old.
- 20% of the revenue funds infrastructure (transportation, coastal resiliency, abandoned mine reclamation, hospital and health center resiliency, etc.)
- 5% of the revenue goes towards energy innovation and R&D
- 5% funds transition assistance for those affected by disproportionately high energy costs, as well as workers and communities dependent on the fossil fuel industry.

Sponsors – Introduced by Sen. Chris Coons (D-DE), Sen. Dianne Feinstein (D-CA), and Rep. Jimmy Panetta (D-CA) in July 2019.

Co-Sponsors – No co-sponsors in the Senate, 5 Democratic co-sponsors in the House

Option 2: Using Revenues to Fund Other Initiatives

This option would direct Apex to advocate for amendments the Internal Revenue Code of 1986, the CAA, and the Coastal Zone Management Act of 1972 to create a carbon tax that directs the revenues toward other initiatives. While proposals can call for all funds to be set aside for environmental programs, which largely serve to drive even further emissions reductions, each of the proposals in consideration today encourages or mandates states to split the revenues across a variety of uses, identified in *Figure 18 (p. 49)* (Hafstead, 2019). Administering this program would involve the creation of a trust fund with funds distributed via a permanent appropriation.

Figure 18 Possible Environmental Uses of Revenues

Possible Environmental Uses of Revenues
• Subsidizing electric vehicles • Subsidizing clean energy generation • Funding weatherization programs • Investing in coastal flooding mitigation and adaptation infrastructure • Investing in carbon capture research and development • Investing in electricity transmission • Investing in energy efficiency and storage

Notably, each of the proposals—the Market Choice Act, the American Opportunity Carbon Fee Act, the America Wins Act, and the Modernizing America with Rebuilding to Kickstart the Economy of the Twenty-first Century with a Historic Infrastructure-Centered Expansion Act *(summaries below)*—also directs revenues to initiatives unrelated to the environment, such as workforce development and transportation infrastructure investment. The congressional committees of substantive jurisdiction are the House Committees on (1) Energy and Commerce, (2) Natural Resources, (3) Transportation and Infrastructure, (4) Agriculture, as well as (5) the Senate Committee on Finance. The lead agency in implementing the program would be the USDT.

1. The Market Choice Act (formerly H.R.6463)

Initial Carbon Price and Rate of Increase – Puts an economy wide-fee on CO_2 emissions starting at $35 per metric ton in 2021, increasing at a real rate of 5 percent per year.

Revenue Use – Abolishes the federal excise tax on gasoline and diesel fuel with 70% of revenue directed to transportation infrastructure investment and the remainder going toward spending on climate adaptation, energy research and development, and measures to mitigate the impacts of the tax on low-income households and coal communities (Sobhani, Majkut, and Bookbinder, 2019).

Sponsors – Reintroduced by Rep. Brian Fitzpatrick (R-PA) in September 2019.

Co-Sponsors – Not yet listed on Congress.gov, but the 2018 version (H.R. 6463) was introduced by Rep. Carlos Curbelo (R-FL-26) and had two Republican co-sponsors: Reps. Brian Fitzpatrick (R-PA) and Francis Rooney (R-FL).

2. The American Opportunity Carbon Fee Act (S.1128)

Initial Carbon Price and Rate of Increase – Puts an economy wide-fee on CO_2 emissions starting at $52 per metric ton in 2020, increasing at a real rate of 2 percent per year.

Revenue Use – Offers workers a refundable tax credit to offset payroll taxes paid and provides states with funding to deal with the costs of climate change and transition to a low carbon economy (Whitehouse, 2019).

Sponsors – Reintroduced by Sen. Sheldon Whitehouse (D-RI) in April 2019.

Co-Sponsors – Sens. Brian Schatz (D-HI), Martin Heinrich (D-NM), and Kirsten Gillibrand (D-NY).

3. The America Wins Act (H.R.4142)

Initial Carbon Price and Rate of Increase – Puts an economy wide-fee on CO_2 emissions starting at $52 per metric ton in 2021, increasing 6% each year (plus inflation).

Revenue Use – Most revenues would go toward transportation infrastructure investment. A fraction of the revenues would go toward workforce development programs and rebates to low-income Americans to help with increased energy costs.

Sponsors – Introduced by Rep. John Larson (D-CT) in August 2019.

Co-Sponsors – 9 Democratic co-sponsors.

4. The Modernizing America with Rebuilding to Kickstart the Economy of the Twenty-first Century with a Historic Infrastructure-Centered Expansion (H.R.4520)

Initial Carbon Price and Rate of Increase – Puts an economy-wide fee on CO_2 emissions starting at $35 per metric ton in 2021, increasing 5% per year (plus inflation).

Revenue Use – Revenues would be directed to transportation infrastructure investment and rebates to low-income Americans to help with increased energy costs.

Sponsors – Introduced by Reps. Ryan Fitzpatrick (R-PA) and Salud Carbajal (D-CA) in September 2019.

Co-Sponsors – Reps. Francis Rooney (R-FL) and Scott Peters (D-CA).

Option 3: Using Revenues to Reduce Distortionary Federal Taxes – Tax Swap Approach

This option would involve Apex lobbying the federal government to amend the Internal Revenue Code of 1986, the CAA, and the Coastal Zone Management Act of 1972 to establish a carbon tax that uses the revenue to reduce "distortionary" taxes, or taxes that cause a decrease in economic output by taxing labor or capital. The federal tax on gasoline, for example, encourages individuals to work fewer hours, because it reduces their after-tax wages (Taylor and Doren, 2007). Other taxes that are considered distortionary are payroll, individual income, and corporate income taxes. The idea is, if the government "swaps" the revenue generated from a carbon tax for a distortionary tax, the economic costs associated with a distortionary tax can be at least partially eliminated (Green, 2019).

Two federal policy proposals take a tax swap approach including the Stemming Warming and Augmenting Pay Act and the Raise Wages, Cut Carbon Act *(summaries below)*. The congressional committees of substantive jurisdiction are the House Committees on (1) Energy and Commerce, (2) Natural Resources, (3) Transportation and Infrastructure, (4) Agriculture, as well as (5) the Senate Committee on Energy and Natural Resources. The lead agency in implementing the program would be the USDT.

1. The Stemming Warming and Augmenting Pay Act (H.R.4058)

Initial Carbon Price and Rate of Increase – Puts an economy-wide fee on CO_2 emissions starting at $30 per metric ton in 2021, increasing 5% per year (plus inflation) and automatically increasing by $3/ton every two years if the previous year's emissions goals are not reached.

Revenue Use – 70% of revenues are used to reduce payroll taxes; 10% are distributed to social security beneficiaries; and the remaining 20% funds state block grants to offset higher energy costs for low-income households.

Sponsors – Introduced by Reps. Francis Rooney (R-FL) and Dan Lipinski (D-IL) in July 2019.

Co-Sponsors – No co-sponsors.

2. The Raise Wages, Cut Carbon Act (H.R.3966)

Initial Carbon Price and Rate of Increase – Puts an economy-wide fee on CO_2 emissions starting at $40 per metric ton in 2020, increasing 2.5% per year (plus inflation).

Revenue Use – 84% of the revenues are used to offset payroll taxes; 10% are distributed to social security beneficiaries; 5% goes towards the Low-Income Home Energy Assistance Program; and 1% goes towards the Weatherization Assistance Program.

Sponsors – Introduced by Reps. Dan Lipinski (D-IL) and Francis Rooney (R-FL) in July 2019.

Co-Sponsors – No co-sponsors.

Option 4: Rebating Revenues to States

This policy option would recommend that Apex advocates for amendments to the Internal Revenue Code of 1996 and the CAA to create a carbon tax that directs Congress rebate the revenues to states in block grants and allows states to choose among several options for how to distribute or use them. At the state level, states regulate their own air and receive the value of the resource, so there is at least some precedent to justify a policy in which the states retain the value of a federal carbon tax, as well. States may adopt either of the revenue uses described above, namely returning revenues by household or using revenues to fund initiatives to reduce carbon. In theory, more progressive states might choose to use their revenues for spending on environmental programs such as subsidizing clean energy generation or electric vehicles, while more conservative states might choose to return their revenues by household. A key political question in crafting this policy would be determining whether revenues should be distributed as a block grant based on state size, population, energy production, or some other characteristic (Shore Interview, 2019).

There are no proposals for a federal carbon tax that rebate revenues to states and allow their governments to decide revenue usage at this time. However, should legislation be proposed, the congressional committees of substantive jurisdiction would likely be the House Ways and Means Committee, the House Energy and Commerce Committee, the House Foreign Affairs Committee, and/or the Senate Finance Committee. The lead agency in implementing the program would be USDT.

1B) Justifying the Exclusion of Revenue Use Options 2-4 from Rigorous Analysis

Figure 19 Outcomes matrix for the four carbon tax revenue options.

		Carbon Tax Revenue Use Alternatives			
Evaluative Criteria	**Weight**	Option 1: Returning Revenues by Household	Option 2: Using Revenues to Fund Other Initiatives	Option 3: Using Revenues to Reduce Distortionary Federal Taxes	Option 4: Rebating Revenues to States
Political Feasibility	0.45	Low-Medium	Low	Very Low	Very Low
Cost Effectiveness	0.35	**$24.6 million** per million metric tons of emissions prevented			
Administrative Feasibility	0.20	Medium	Medium	Medium	Medium

In *Figure 19 (p. 52)*, I compare the different carbon tax revenue use options to the status quo. The options differ by their measure of political feasibility. Returning revenues by household represents the most politically feasible revenue use relative to the status quo and is analyzed in the body of the report along with CES and RPS alternatives.

Using revenues to fund other initiatives is the second most politically feasible use of revenues, because handouts of funds for specified uses can be used to build coalition support among certain stakeholders, and there are four existing proposals. It is ruled out as an option for rigorous analysis because conservatives would never be on board, as demonstrated by the failed carbon tax ballot initiative in Washington state in 2018 which would have directed revenues toward climate resiliency investment.

The final two options, using revenues to reduce distortionary federal taxes and rebating revenues to states, both have low political feasibility but for different reasons. While there are two existing proposals in Congress for a tax that would reduce distortionary federal taxes, neither is likely to gain buy-in from conservatives. The carbon tax ballot initiative in Washington state in 2016, which would have funded a sales tax cut, failed largely due to lack of conservative support. Conservatives did not trust that the tax cut would make up for the increased energy costs ratepayers would face as a result of the carbon tax[1] (Mets Interview, 2020). In addition, this approach is very complicated, all taxes distort the price of real goods, and there is significant disagreement among economists on which taxes to distort.

The option of rebating revenues to states is not politically feasible because it is a new idea (developed by me and Professor Bill Shobe in the Batten School), and there are currently no proposals in Congress taking this form. For these reasons, both the option of using revenues to reduce distortionary federal taxes and the option of rebating revenues to states not rigorously analyzed in the body of the report.

2) An Overview of RPS Legislation

1. The Renewable Electricity Standard Act (S.1974)*

Summary – The Renewable Electricity Standard Act requires 50% renewable energy by 2035 and 80% renewable energy by 2050. It starts at 18.2% in 2022[36], escalating 2.2 percentage points per year to 2035. Relative to business-as-usual, the RPS would result in a 46% reduction in power sector CO_2 emissions in 2035 (Udall, 2019; UCS, 2019).

Sponsors – Introduced by Sen. Tom Udall (D-NM) in March 2019.

Co-Sponsors – 6 co-sponsors: Sens. Martin Heinrich (D-NM), Angus King (I-ME), Tina Smith (D-MN), Sheldon Whitehouse (D-RI), Chris Van Hollen (D-MD), Jacky Rosen (D-NV)

[36] The Renewable Electricity Standard Act bill text indicates an implementation year of 2020. For this analysis, I assume the bill is enacted in 2021 and implemented in 2022, a more realistic timeline politically. Accordingly, I adjust the percentage of renewables required from 16% to 18.2%, accounting for the 2.2% increase that would have occurred if the act had been enacted on schedule (Udall, 2019; UCS, 2019).

3A) An Overview of CES Legislation

1. The CLEAN Future Act (Discussion Draft)*

Summary – The CLEAN Future Act requires electricity providers to provide an increasing percentage of clean electricity[37] each year starting in 2022, rising linearly from its baseline level to 100% in 2050. It has a national average clean energy requirement of 78% in 2035. It achieves emissions reductions of 45% by 2035 (Picciano, Rennert, and Shawhan, 2020; Pallone, 2020).

Sponsors – Introduced by House Energy and Commerce Committee Chairman Frank Pallone, Jr. (D-NJ), Environment and Climate Change Subcommittee Chairman Paul Tonko (D-NY), and Energy Subcommittee Chairman Bobby Rush (D-IL) in January 2020.

Co-Sponsors – TBD, but the CLEAN Future Act incorporates elements of Rep. Ben Lujan's (D-NM) Clean Energy Standard Act, as well as Rep. DeGette's (D-CO) forthcoming Clean Energy Innovation and Deployment Act. The Clean Energy Standard Act has five co-sponsors (all Democrats).

2. The Clean Energy Standard Act (S.1359 and H.R. 2597)

Summary – The Clean Energy Standard Act would require electricity providers to provide an increasing percentage of clean electricity over time until that percentage is 100% by 2050. The bill is technology-inclusive, meaning all low- and zero-carbon technologies such as solar, wind, geothermal, hydro, nuclear, biomass with verifiably low net carbon emissions, and fossil with carbon capture and sequestration are all allowed to compete. The proposal enables states and utilities to choose their own best approach to decarbonization with the recognition that different regions will be starting the clean energy transition at different benchmarks (EDF, 2019).

Sponsors – Introduced by Sen. Tina Smith (D-MN) and Rep. Ben Lujan in May 2019.

Co-Sponsors – 5 Democratic co-sponsors in the Senate, 8 Democratic co-sponsors in the House

3. The Clean Energy Innovation and Deployment Act (Pending Legislation)

Summary – The Clean Energy Innovation and Deployment Act will be the power-sector section of a bill that will lead to a 100 percent clean energy economy by 2050. The clean energy fraction will grow by 2030 to the percentage projected to result in a 50% reduction of CO_2 emissions below 2005 levels from the power sector. The CES will be completely neutral in its treatment of non- and low-carbon electricity-generation

[37] The Draft Bill proposes that a clean source is one that emits less than 0.82 metric tons of CO_2 equivalent per megawatt hour. Under this standard, zero-emission sources, such as renewables or nuclear, would receive a full credit, while coal or natural gas-powered generators with carbon intensities lower than the 0.82 threshold would receive a partial credit. The average fleet-wide emissions rates of coal and natural gas combustion generators are, respectively, 0.96 and 0.6 metric tons of CO_2 per megawatt hour. This means that almost all natural gas, at least initially, gets partial credit.

technologies – providing credit to renewable energy, nuclear power, natural gas, fossil/CCS sources, and any power- generating source to the extent that it emits less CO_2 than an efficient coal-burning power plant (DeGette, 2020).

Sponsors – To be introduced by Rep. Diana DeGette (D-CO) at an unspecified date.

Co-Sponsors – TBD

3B) Justifying the Exclusion of the Clean Energy Standard Act and the Clean Energy Innovation and Deployment Act from Rigorous Analysis

The CLEAN Future Act was chosen over the Clean Energy Standard Act and the forthcoming Clean Energy Innovation and Deployment Act for two reasons. First, unlike the other two bills, the CLEAN Future Act was introduced by House Energy and Commerce Committee leadership. In January 2020, Chairman Frank Pallone, Jr. (D-NJ), Environment and Climate Change Subcommittee Chairman Paul Tonko (D-NY), and Energy Subcommittee Chairman Bobby Rush (D-IL) released a discussion draft (E&C, 2020). In the House, the Energy and Commerce Committee is the committee with primary jurisdiction over CES legislation, and the committee's leaders would be responsible for marking up the legislation and sending it to the full House for consideration.

Second, the CLEAN Future Act's inclusion of the other CES bills makes it the most representative legislation available and, as such, the act is likely capable of gaining broader support from members. The legislative framework for the CLEAN Future Act notes that the discussion draft incorporates elements of Rep. Ben Lujan's (D-NM) Clean Energy Standard Act, as well as Rep. DeGette's (D-CO) forthcoming Clean Energy Innovation and Deployment Act (E&C, 2020).

4A) An Overview of Cap-and-Trade Legislation

1. The Healthy Climate and Family Security Act (S.940)

Initial Emissions Cap and Rate of Decrease – The Healthy Climate and Family Security Act creates a cap-and-trade program requiring carbon emissions reductions of 12.5 percent by 2020, 35 percent by 2025, 50 percent by 2030, 60 percent by 2035, and 80 percent by 2040 below 2005 levels.

Revenue Use – The cap-and-trade program provides a dividend, returning all the auction revenue in equal amounts to every U.S. resident with a valid Social Security number (Chesapeake Climate Action Network, 2020).

Sponsors – Introduced by Sen. Chris Van Hollen (D-MD) and Rep. Don Beyer (D-VA) in March 2019.

Co-Sponsors – No co-sponsors. The 2018 version (H.R. 4889) had 36 Democratic co-sponsors in the House.

4B) Justifying the Exclusion of the Healthy Climate and Family Security Act From Rigorous Analysis

The Healthy Climate and Family Security Act was excluded, because there is explicit and implicit agreement among Democratic members of Congress and federal advocacy professionals that a cap-and-trade program is not a politically feasible policy option (Segal Interview, 2020; Flint Interview, 2020; Mets Interview, 2020). In addition, a carbon tax (included in the analysis) is a close substitute for a cap-and-trade program: both options put a price on carbon, though a carbon tax does it directly.

Appendix II: Cost Effectiveness Analysis

Summary of Cost Effectiveness Analysis Results

Figure 20 Bottom Line Up Front: Cost Effectiveness Analysis Results Summary

Status Quo	
Total Net Present Value of Costs to the United States (billions $2018)	**$1,424.0**
Total Emissions Reductions (millions of metric tons)	**38**
Cost (millions $2018) per million metric tons of emissions avoided	**$37,462.0**
Total Net Present Value of Additional Costs (billions $2018)	
Option #1: Enacting a Carbon Tax and Dividend*	$336.3
Option #2: Enacting an RPS	$620.5
Option #3: Enacting a CES	$204.8
Total Additional Emissions Reductions (millions of metric tons)	
Option #1: Enacting a Carbon Tax and Dividend*	13650
Option #2: Enacting an RPS	5427
Option #3: Enacting a CES	5299
Cost (millions $2018) per million metric tons of emissions prevented	
Option #1: Enacting a Carbon Tax and Dividend*	$24.6
Option #2: Enacting an RPS	$114.6
Option #3: Enacting a CES	$38.6

Identifying the Cost Effectiveness Ratio

A cost-effectiveness analysis is a technique that relates the cost of a policy to a key outcome or benefit. The analysis seeks to identify and place dollars on the costs of each of the policy alternatives we consider. It then relates these costs to a specific measure of policy effectiveness, or the total additional CO_2 emissions reductions (millions of metric tons) (Cellini and Kee, 2015).

Here, the cost effectiveness ratio is defined as the following:

$$\frac{\text{Total Net Present Value of Additional Costs (billions \$2018)}}{\text{Total Additional Emissions Reductions (millions of metric tons)}}$$

$$= \text{Cost (millions \$2018) per million metric tons of emissions prevented}$$

Determining Cost-Effectiveness for the Status Quo: Electric Power Sector Emissions Reductions and Social Costs of Carbon

The only costs that are considered are those that would occur over and above those that would occur without any action. As described in the text, the status quo scenario assumes that the United States[38] federal government does not enact a national decarbonization policy between 2021 and 2035. The status quo accounts for emissions reductions driven by the following:

- The December 2019 one-year extension of the federal **wind production tax credit** (PTC). Projects that begin construction in year 2019 are eligible for a 40% credit and projects that begin construction in 2020 are eligible for a 60% credit. The PTC is set to expire at the end of 2020 (National Law Review, 2019).
- The **permanent federal solar investment tax credit** (ITC) of 10% for commercial and utility-scale projects. The residential ITC sunsets by 2022.
- The **West Coast Initiative** (WCI) cap-and-trade program in California.
- The nine states that make up the **Regional Greenhouse Gas Initiative**.
- **RPS and CES policies** in 32 jurisdictions in the United States.
- **Federal policies funding research and development** in end-use efficiency, grid flexibility and carbon capture, utilization, and storage technology.
- **Fuel switching from coal to natural gas** due to increasing natural gas development in the Permian Basin (WoodMac, 2019).

For the status quo scenario, we used the electric power sector emissions reductions and social costs of carbon reported in *Figure 21 (p. 59)* for the years 2021 and 2035, the start and end year for the analysis. The emissions projections were provided by the U.S. EIA Annual Energy Outlook Report for 2019 and social cost of carbon estimates were provided by the U.S. EPA. While Year 0 is usually today in cost-effectiveness analyses, because none of the policy alternatives would be enacted unless and until the presumptive nominee for the Democratic party Joe Biden takes office in January 2021, this cost-effectiveness analysis assumes Year 0 is 2021. That is, Year 0 (2021) is the year we assume the policy alternative is enacted by Congress and Year 1 (2022) is the year we assume the policy alternative is implemented by a federal agency.

[38] The scope of the analysis is limited to the United States.

Figure 21 Business as usual emissions (millions of metric tons) and social cost of carbon ($2018) annually from 2021-2035.

	Year	ELECTRIC POWER SECTOR ONLY Business-as-usual emissions (millions of metric tons)	Social Cost of Carbon ($2018)- 3% discount rate
0	2021	1608	$52.41
1	2022	1604	$53.39
2	2023	1601	$54.37
3	2024	1602	$55.35
4	2025	1607	**$56.33**
5	2026	1602	$57.31
6	2027	1594	$58.54
7	2028	1592	$59.76
8	2029	1602	$60.99
9	2030	1601	**$61.23**
10	2031	1592	$62.45
11	2032	1579	$63.68
12	2033	1570	$64.90
13	2034	1570	$66.13
14	2035	1570	**$67.35**

For the status quo scenario, the total net present value of costs to the United States was calculated by multiplying the projected emissions from the electric power sector between 2021 and 2035 by the social cost of carbon for each individual year. Costs were then aggregated to provide a total net present value of costs of $1.4 trillion ($2018). Then, total emissions reductions of 38 million metric tons were calculated by subtracting the emissions projection for 2021 from the emissions projection for 2035. With a measure for total cost and effectiveness, I was then able to calculate a cost-effectiveness ratio by dividing $1.4 trillion by 38 million metric tons to get an overall cost-effectiveness score of $37.5 billion ($2018) per million metric tons of emissions prevented, as reported in *Figure 20 (p. 57)*.

$$\frac{\$1{,}423{,}560{,}540{,}000}{38}$$

= **$37,462,119,474** per million metric tons of emissions avoided ($2018)

Determining the Cost Effectiveness Score for Policy Alternatives

For the three policy alternatives, the costs that would have the most significant implications on each policy's cost effectiveness score were identified and categorized, while small or negligible costs were ignored. Most importantly, for each alternative, the capital costs resulting from new renewable energy deployment were determined. The **cost of new renewable energy deployment (wind and solar) was far and away the most significant additional cost associated with each alternative**. Aside from capital costs associated with new renewable deployment, other costs were determined including:

1. Operations and maintenance costs (variable and fixed)
2. Direct labor costs
    a. Employee salaries (number employed x average salary)
    b. Overhead (including real estate, telecommunications, and mobility devices)
3. Other expenses (office and travel expenses)

The assumptions used to calculate each additional cost are reported in *Figure 22 (p. 61)* and the method of valuation for the parameters are described in *Figure 23-26 (p. 62-64)*. All costs were discounted at a rate of 3 percent. *Figure 20 (p. 57)* includes a summary of the cost effectiveness analysis results.

Determining Cost-Effectiveness Score for Alternative #1: Carbon Tax and Dividend

The cost-effectiveness score for the CLC Baker-Shultz Carbon Dividends Plan was determined by dividing the total net present value of additional costs ($2018) by the total additional emissions reductions (millions of metric tons) from the electric-power sector only, including electrification of transportation:

$$\frac{\$336,262,698,947}{13,650}$$

= **$24,634,630** per million metric tons of emissions avoided ($2018)

Determining Cost-Effectiveness Score for Alternative #2: RPS

The cost-effectiveness score for the Renewable Electricity Standard Act (S.1974) was determined by dividing the total net present value of additional costs ($2018) by the total additional emissions reductions (millions of metric tons):

$$\frac{\$620,467,971,170}{5,417}$$

= **$114,551,458** per million metric tons of emissions avoided ($2018)

Determining Cost-Effectiveness Score for Alternative #3: CES

The cost-effectiveness score for the CLEAN Future Act (Discussion Draft) was determined by dividing the total net present value of additional costs ($2018) by the total additional emissions reductions (millions of metric tons):

$$\frac{\$204,799,751,732}{5,299}$$

= **$38,648,755** per million metric tons of emissions avoided ($2018)

Figure 22 General Assumptions used for CEA.

General Assumptions	
Number of Employees needed (25 on site, 5 teleworkers)	30
Average Salary Dept. of Treasury/ Dept. of Energy (base salary + bonus)	$108,825.05
Real estate costs (annualized)	$1,500,000.00
Telecommunications costs (annualized)	$12,425.00
Individual IT and Mobility Devices costs (annualized)	$150,500.00
Discount Rate	3%
Other expenses (office expenses, travel) over 14 years	$6,200,000.00
Horizon for Agency Work (years)	15
BAU Renewable Projections for 2035 (GW)	444.18
Overnight Capital Cost For Electric Generation Technologies in 2020 ($2018/kW)	$1,748.07
Average Renewables Operations and Maintenance Variable Cost ($2018/kW-yr)	$0.00
Average Renewables Operations and Maintenance Fixed Cost ($2018/kW-yr)	$44.21
Horizon for Policy Alternatives (years)	14
Carbon Tax – The Climate Leadership Council Baker-Shultz Carbon Dividends Plan*	
Proportion of total emissions reductions attributed to the electric power sector under a carbon tax (including electrification of transportation)	0.65
BAU Electric Power Sector Energy Consumption as a proportion of Total U.S. Energy Consumption (2021-2035)	0.37
Annual renewable generation increase relative to BAU (GW)	16.50
Renewable Portfolio Standard – The Renewable Electricity Standard Act (S.1974)	
RPS Scenario Renewable Projection for 2035 (GW)	888.36
Difference in amount of renewables gen. b/w RPS scenario and BAU (GW)	444.18
Total Electric Generation Technologies Capital Costs 2021-2035 (not discounted)	$776,457,732,600.00
Clean Energy Standard – The CLEAN Future Act (Discussion Draft)	
CES Scenario Renewable Projection for 2035 (GW)	590.76
Difference in amount of renewables gen. b/w CES scenario and BAU (GW)	146.58
Projected renewable energy generation increase relative to BAU for the CLEAN Future Act in 2035	33%
Total Electric Generation Technologies Capital Costs 2021-2035 (not discounted)	$256,231,051,758.00

Figure 23 General assumptions for CEA and method of valuation

General Assumptions	
Parameters	**Method of Valuation**
Number of Employees needed (25 on site, 5 teleworkers)	Informed estimate of the additional agency workers needed to implement any of the alternatives.
Average Salary Dept. of Treasury/ Dept. of Energy (base salary + bonus)	Department of Energy salary statistics for 2018.
Real estate costs (annualized)	U.S. General Services Administration Cost Per Person Model and input a lease Rate/ Sq. ft of $60,000 which is the average market rate for Washington, D.C. office space. I also input a total square footage of office space (rentable) of 25,000, an informed estimate.
Telecommunications costs (annualized)	U.S. General Services Administration Cost Per Person Model. Includes 25 laptops, 15 desktops, and 30 smartphones at market price.
Individual IT and Mobility Devices costs (annualized)	U.S. General Services Administration Cost Per Person Model.
Discount Rate	Though OMB recommends an interest rate of 7%, an interest rate of 7% would be quite high for these policy alternatives. In fact, nowadays, 7% is higher than most people would apply for a real interest rate for any type of project. With respect to this analysis specifically, economists would certainly use a discount rate lower than 7% because it is for long-term environmental planning. 3% is a reasonable central estimate for bond finance of a project like this. Cellini and Kee (2015) also suggest using a base real discount rate of 2 to 3 percent.
Other expenses (office expenses, travel) over 14 years	8% of total costs.
Horizon for Agency Work (years)	Informed estimate based on window for enactment and available data. Presumptive Democratic presidential nominee Joe Biden, if elected, would enter office in January 2021. 2035 was chosen as the end of the horizon because each of the policies includes a projection for this year.
BAU Renewable Projections for 2035 (GW)	Obtained from the U.S. EIA's Annual Energy Outlook for 2020 *Table: Table 54. Electric Power Projections by Electricity Market Module Region* *Region: United States*
Overnight Capital Cost For Electric Generation Technologies in 2020 ($2018/kW)	Obtained from a Union of Concerned Scientists Technical Appendix. A projected renewables average capital cost was then calculated by projecting the renewable energy mix for solar and wind resources in each year.
Average Renewables Operations and Maintenance Variable Cost ($2018/kW-yr)	Obtained from a Union of Concerned Scientists Technical Appendix. A projected renewables average operations and maintenance cost was then calculated by projecting the renewable energy mix for solar and wind resources in each year.
Average Renewables Operations and Maintenance Fixed Cost ($2018/kW-yr)	Obtained from a Union of Concerned Scientists Technical Appendix. A projected renewables average operations and maintenance cost was then calculated by projecting the renewable energy mix for solar and wind resources in each year.
Horizon for Policy Alternatives (years)	Assumed one year less than agency work period to account for the approximately 9 month agency rulemaking/ implementation process.

Figure 24 Carbon Tax assumptions for CEA

Carbon Tax – The Climate Leadership Council Baker-Shultz Carbon Dividends Plan*	
Costs to the United States	**Method of Valuation**
Proportion of total emissions reductions attributed to the electric power sector under a carbon tax (including electrification of transportation)	Obtained by consulting Marc Hafstead, fellow and director of the Resources for the Future (RFF) Carbon Pricing Initiative.
BAU Electric Power Sector Energy Consumption as a proportion of Total U.S. Energy Consumption (2021-2035)	Obtained from the EIA Annual Energy Outlook 2020 *Table: Table 2. Energy Consumption by Sector and Source* *Region: United States*
Annual renewable generation increase relative to BAU (GW)	Data is not available for the annual renewable generation increase relative to BAU for the CLC's tax; 16.5 additional GW/yr is an informed guess. I use AWEA's modeling as an anchor. AWEA modeled a $60 tax on the electric-sector only. It begins at $20/ ton in 2022 and increases by $5/ton per year until it hits $60/ton in 2030. The CLC's tax, which applies economy-wide, has a roughly similar price in 2030 of $63.50 (not yet adjusted for inflation). In AWEA's model, relative to BAU, 16.5 GW/ yr (range 15-18 GW/ yr) of new renewables (wind and solar) are deployed. As compared to AWEA's electricity-sector only tax, the CLC's economy-wide tax would likely deploy even less new renewable generation. This is because an economy-wide carbon tax offers even more ways of reducing CO_2 emissions than an electricity-sector only tax. Even still, I report an estimate of 16.5 GW annually. *AWEA's Electricity Policy and Demand Committee Meeting, "Preliminary Carbon Modeling Results Presentation." Clean Energy Executive Summit. November 21, 2019*

Figure 25 RPS assumptions for CEA

Renewable Portfolio Standard – The Renewable Electricity Standard Act (S.1974)	
Costs to the United States	**Method of Valuation**
RPS Scenario Renewable Projection for 2035 (GW)	Obtained from a memo detailing the act released by Senator Tom Udall's (D-NM) office.
Difference in amount of renewables gen. b/w RPS scenario and BAU (GW)	Found by subtracting the BAU renewable projection for 2035 (GW) from the RPS scenario projection for 2035 (GW)
Total Electric Generation Technologies Capital Costs 2021-2035 (not discounted)	Found by multiplying the overnight capital cost for electric generation technologies in 2020 ($/kW) by the difference in the amount of renewables generated between the RPS scenario and BAU (GW). I then multiplied by 1 million to convert units.

Figure 26 CES assumptions for CEA

Clean Energy Standard – The CLEAN Future Act (Discussion Draft)	
Costs to the United States	**Method of Valuation**
CES Scenario Renewable Projection for 2035 (GW)	Found by adding the product of [the projected renewable energy generation increase relative to BAU for the CLEAN Future Act and BAU renewable projection for 2035 (GW)] to the BAU renewable projection for 2035 (GW).
Difference in amount of renewables gen. b/w CES scenario and BAU (GW)	Found by subtracting the BAU renewable projection for 2035 (GW) from the CES scenario renewable projection for 2035.
Projected renewable energy generation increase relative to BAU for the CLEAN Future Act in 2035	I make an informed estimate that the projected renewable energy generation increase relative to business as usual for the CLEAN Future Act will be 33% in 2035. AWEA notes that the Clean Energy Standard Act has a higher carbon intensity of 0.4 metric tons of CO_2 per mWh, as compared to a 0.82 intensity for the Clean Future Act. This means that almost all natural gas plants and some coal plants get partial credit under the Clean Future Act (but not under the Clean Energy Standard Act). That is, the Clean Future Act does not lead to as much renewable deployment as the Clean Energy Standard Act. *(DRAFT AWEA Comments on CLEAN Future Act Discussion.v.2).* In 2035, the Clean Energy Standard act will increase renewable energy generation by 43% (range of 30-56%) relative to BAU levels for 2035. While we don't have data on the Clean Future Act for projected renewable energy generation increases relative to business as usual, the integration of more natural gas (relative to the Clean Energy Standard Act) demonstrates that the Clean Future Act figure for renewable energy generation will be lower than 43% (Picciano, Rennert & Shawhan, 2019).
Total Electric Generation Technologies Capital Costs 2021-2035 (not discounted)	Found by multiplying the overnight capital cost for electric generation technologies in 2020 ($2018/kW) by the difference in amount of renewables generated between the CES scenario and BAU. I then multiplied by 1 million to convert units.

Appendix III: Summary of RPS and CES Policies By Jurisdiction

Figure 27 Jurisdictions with renewable energy standards or clean energy standards at or above 50%.

State	Title	Requirement/ Goal
1. California	RPS	44% by 2024; 52% by 2027; 60% by 2030. Also requires 100% clean energy by 2045
2. Hawaii	RPS	30% by 2020; 40% by 2030; 70% by 2040; 100% by 2045
3. Maine	RPS	80% by 2030; statewide target of 100% renewables by 2050
4. Maryland	Renewable Energy Portfolio Standard	30.5% in 2020; 50% in 2030
5. Nevada	Energy Portfolio Standard	50% by 2030; non-binding 100% carbon-free by 2050
6. New Jersey	RPS	50% by 2030
7. New Mexico	RPS	40% by 2025; 80% renewables by 2040; 100% of electricity supplied by zero-carbon resources by 2045
8. New York	RPS	70% renewables by 2030; 100% zero-emissions electricity requirement by 2040
9. Oregon	RPS	25% by 2025 (utilities with 3% or more of the state's load); 50% by 2040 (utilities with 3% or more of the state's load); 10% by 2025 (utilities with 1.5–3% of the state's load); 5% by 2025 (utilities with less than 1.5% of the state's load)
10. Vermont	Renewable Energy Standard	75% by 2032
11. Virginia	RPS	100% renewable by 2045
12. Washington	Renewable Energy Standard	15% renewable by 2020; 100% greenhouse gas neutral by 2030; 100% renewable or zero-emitting by 2045
13. Washington, D.C.	Renewable Portfolio Standard	20% by 2020, 100% by 2032
14. Puerto Rico	Renewable Energy Portfolio Standard	40% by 2025; 60% by 2040; 100% by 2050
15. U.S. Virgin Islands	Renewables Portfolio Targets	25% by 2020; 30% by 2025; up to 51% after 2025

Figure 28 Jurisdictions with renewable portfolio standards/clean energy standards below 50%.

State	Title	Requirement/ Goal
1. Arizona	Renewable Energy Standard	15% by 2025
2. Connecticut	RPS	44% by 2030
3. Colorado	Renewable Energy Standard	30% by 2020 (IOUs); 10% or 20% for municipalities and electric cooperatives depending on size; 100% clean energy by 2050 for utilities serving 500,000 or more customers.
4. Delaware	Renewable Energy Portfolio Standard	25% by 2025-2026
5. Illinois	RPS	25% by 2025-2026
6. Iowa	Alternative Energy Law	105 MW of generating capacity for IOUs
7. Massachusetts	RPS	New sources: 35% by 2030 and an additional 1% each year after. Resources in operation by 1997: 6.7% by 2020
8. Michigan	Renewable Energy Standard	15% by 2021 (standard), 35% by 2025 (goal, including energy efficiency and demand reduction)
9. Minnesota	Renewable Energy Standard	26.5% by 2025 (IOUs), 25% by 2025 (other utilities)
10. Missouri	Renewable Electricity Standard	15% by 2021 (IOUs)
11. New Hampshire	Electric Renewable Portfolio Standard	25.2% by 2025
12. North Carolina	Renewable Energy and Energy Efficiency Portfolio Standard	12.5% by 2021 (IOUs)
13. Ohio	Alternative Energy Resource Standard	8.5% by 2026
14. Pennsylvania	Alternative Energy Portfolio Standard	18% by 2020-2021
15. Rhode Island	Renewable Energy Standard	14.5% by 2019, with increases of 1.5% each year until 38.5% by 2035
16. South Carolina	Renewables Portfolio Standard	2% by 2021
17. Texas	Renewable Generation Requirement	10,000 MW by 2025 (goal; achieved)

Appendix IV: Decisionmakers and Key Stakeholders Diagram

Decisionmakers	Key Stakeholders

Leadership
- Speaker Nancy Pelosi (D-CA-12)
- Minority Leader Kevin McCarthy (R-CA-23)
- Majority Leader Mitch McConnell (R-KY)

Committee Leaders

House Budget
- Chairman: John Yarmuth (D-KY-03)
- Ranking Member: Steve Womack (R-AR-03)

Senate Budget
- Chairman: Mike Enzi (R-WY)
- Ranking Member: Bernie Sanders (D-VT)

House Ways and Means
- Chairman: Richard Neal (D-MA-01)
- Ranking Member: Kevin Brady (R-TX-08)

Senate Finance
- Chairman: Chuck Grassley (R-IA)
- Ranking Member: Ron Wyden (D-OR)

House Energy and Commerce
- Chairman: Frank Pallone (D-NJ-06)
- Subcommittee on Energy Chairman: Bobby Rush (D-IL-01)
- Ranking Member: Maybe Rep. Cathy McMorris Rodgers (R-WA-05) in 2021, currently Greg Walden (R-OR-02) *open seat

Senate Energy and Natural Resources
- Chairman: John Barrasso (R-WY) in 2021, currently Lisa Murkowski (R-AK)
- Ranking Member: Joe Manchin (D-WV)

House Natural Resources
- Chairman: Raul Grijalva (D-AZ-03)
- Ranking Member: Rob Bishop (R-UT-01)

Influencers/ Swing Voters
- Rep. Adam Kinzinger (R-IL-11)
- Rep. Ray LaHood (R-IL-18)
- Rep. Rodney Davis (R-IL-13)
- Rep. John Shimkus (R-IL-15) *open seat
- Sen. John Cornyn (R-TX)
- Sen. Mike Braun (R-IN)
- Sen. John Thune (R-SD)
- Sen. Joe Manchin (D-WV)
- Sen. Susan Collins (R-ME)
- Sen. Mitt Romney (R-UT)

Environmental Groups
- Union of Concerned Scientists
- Environmental Defense Fund
- Natural Resources Defense Council
- National Sierra Club

Industry Groups
- American Wind Energy Association
- Solar Energy Industries Association
- American Council on Renewable Energy
- Advanced Energy Economy
- Climate Leadership Council
- Alliance for Market Solutions
- U.S. Chamber of Commerce
- American Petroleum Institute
- American Gas Association

Figure 29

Appendix V: Overview of the West Coast Initiative and the Regional Greenhouse Gas Initiative

West Coast Initiative

The WCI administers a shared trading market between California and the Canadian provinces of Quebec and Nova Scotia (WCI, 2019). It has stringent requirements for emissions reductions economy-wide and constitutes over 85 percent of total state emissions, covering the electricity sector, the industrial sector, and—as of 2015—the entire transportation sector. All of the proceeds generated at auction are ser aside to fund adaptation and mitigation efforts on climate change (Bang et al, 2017).

Regional Greenhouse Gas Initiative

RGGI, which emerged in 2009 just before the WCI, (Bang et al., 2017) is a multi-state cap-and-trade program only applicable to the electricity sector. Currently, nine make up the RGGI coalition—Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New York, New Jersey, Rhode Island and Vermont (RGGI, 2019)—with Virginia expected to join later this year and state governments in Pennsylvania and North Carolina considering linkage. In one respect, RGGI was a "policy revolution" because the member states decided to auction nearly all allowances (90 percent) to electric utilities, rather than follow the past practice of free distribution (often referred to as 'grandfathering') (Hibbard and Berk, 2017; Huber, 2013; Raymond, 2016). So far, RGGI has accomplished substantial electricity sector emissions reductions and generated over $1 billion in funds for state energy efficiency programs through allowance auctions, demonstrating it is a valuable mechanism for mitigating climate change (Schmalensee and Stavins, 2017).

Appendix VI: Expanded Recommendation

In order to speed emissions reductions from the electric power sector, **I recommend that Apex enacts the Climate Leadership Council's Baker-Shultz Carbon Dividends plan, an economy-wide carbon tax that returns revenues by household**. There are three main reasons for this recommendation. First, because the carbon tax alternative has the most momentum at the federal level, some industry support, and would only require 51 votes to pass the Senate, it is the most politically feasible option. Second, though costly in achieving emissions reductions—as is the case for any decarbonization policy—the carbon tax policy alternative is the most cost effective option. Relative to an RPS or a CES, a carbon tax offers much more flexibility in compliance for achieving emissions reductions. Namely, a carbon tax offers additional ways of reducing CO_2 emissions other than just building renewables[39]; and these options often occur at a low cost. Finally, the option has high administrative feasibility because the USDT already has experience managing the type of trust fund a carbon tax would require and distributing government revenues.

Figure 30 CLC Carbon Dividends Plan key features.

The CLC Carbon Dividends Plan has several key features:

- Puts an economy-wide fee on CO_2 emissions starting at $41 a ton ($2018) in 2021 and increasing every year at 5% above inflation.[40]
- Distributes nearly 100% of the revenues in equal shares to Americans to protect households from energy price increases they cannot afford.
    - An exception is made to allow revenues to cover administrative expenses, which would account for approximately 1 percent of carbon tax revenue each year.
- Includes a border carbon adjustment intended to protect the competitiveness of US firms, prevent emissions leakage, and encourage other countries to implement their own prices on carbon emissions.
- Temporarily suspends EPA authority to regulate emissions from stationary sources of CO_2 that are also covered by the carbon fee.[41]

To boost political feasibility, **Apex should consider supporting the use of a small portion of revenues to invest in workers and communities dependent on the fossil fuel industry**. The Market Choice Act of 2018 provides a strong template for a workforce development provision, appropriating 3 percent of carbon tax revenues annually for ten years to a Department of Labor program to assist workers in the energy sector that may be displaced as a result of the enactment of the Act. The assistance may take the form of the following: (1) worker retraining, (2) relocation expenses for those who move to find new employment, (3) early retirement, (4) health benefits, or (5) other assistance that the Secretary determines appropriate. A workforce

[39] Some examples of ways that an economy-wide carbon tax would drive emissions reductions in ways other than building renewables are (1) electrifying part of the transportation sector, (2) electrifying some industrial processes, and (3) using electricity instead of natural gas or oil for heating homes.
[40] In 2021, with the initial carbon price of $41, economy-wide emissions are projected to drop by about one billion metric tons, a 19% reduction relative to BAU. Energy-related CO2 emissions are 51% below 2005 levels in 2035.
[41] If emissions reductions targets are not met or if the carbon tax is suspended or weakened, regulatory authority would be restored (CLC Roadmap, 2020).

development provision such as the one included in the Market Choice Act would help gain the support of—or at least lessen the opposition from—labor groups, as well as members from states that are highly dependent on the coal industry for economic stability including West Virginia, Kentucky, and Wyoming. House Budget Committee Chairman John Yarmuth (D-KY-03), Senate Budget Committee Chairman Mike Enzi (R-WY), Senate Energy and Natural Resources Ranking Member Joe Manchin (D-WV), as well as incoming Senate Energy and Natural Resources Chairman John Barrasso (R-WY) are key decisionmakers that also represent coal states. Ranking Member Manchin (D-WV) has made it clear that coal states cannot be left behind in the country's transition to a clean energy future.

Though supporting revenue use to fund additional initiatives—such as investment in electricity transmission or energy storage—may seem beneficial, resource use for this purpose is not supported by economic theory, and I would therefore urge Apex to **exercise extreme caution in promoting the use of tax revenues for purposes other than covering administrative expenses and supporting workforce development**. By drawing funds away from a dividend, alternate uses of revenue would lessen the positive impact associated with a dividend approach, risking withdrawal of support from CLC members and/or opposition from potential conservative allies.

Finally, in order to demonstrate administrative feasibility, **Apex should highlight the IRS's preexisting process available for distribution of revenues as a direct deposit to U.S. residents with a valid Social Security number**. The IRS developed this method for distribution of stimulus money following passage of the third coronavirus stimulus package, the Coronavirus Aid, Relief, and Economic Security Act (CARES Act), in March 2020. [42] While there are other options for distributing dividends—such as a check, a tax credit, an add-on to entitlement program payments, or a payment through the electronic benefit transfer system—Congress has identified a direct deposit as the best system available to the United States for distribution of funds to individuals.

Because the CLC's carbon tax is potentially more ambitious than state-level approaches in that it is economy-wide, it is possible that the approach could evolve into an electricity-sector only tax. **If Apex is presented with a situation in which the CLC's tax is narrowed to the electricity sector, while fewer emissions reductions would result, this option is still recommended.**[43] *See Appendix VIII (p. 81-82) for the impact of narrowing the CLC plan to an electric sector-only tax.*

Lastly, if it becomes clear that either the CES or the RPS policy options have greater political viability than the carbon tax alternative (e.g. if either of these options receives overwhelming bipartisan support or is endorsed by presumptive Democratic presidential nominee Joe Biden), I would recommend enacting these policies as they would still speed emissions reductions relative to a business-as-usual scenario. **Following the carbon tax alternative, my secondary recommendation is the CES policy option and my tertiary recommendation is the RPS policy option.**

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[42] The IRS distributed direct deposits to taxpayers that filed in 2018 or 2019. Since not all recipients pay taxes, the IRS merged the taxpayer dataset with the 1099-G dataset to account for those on social security or disability.

[43] AWEA's modeling finds that, by 2030, a $20 carbon tax on the electric sector would result in a 25 percent reduction in annual emissions—a 326 million metric ton difference—as compared to a "no policy" scenario[43], while a tax rising to $40 in 2026 would result in a 33 percent reduction, or a 431 million metric ton difference[43] (AWEA, 2019).

Appendix VII: Enacting the CLC's Baker-Shultz Carbon Dividends Plan

Executive Summary

We construct an aggressive advocacy campaign for the enactment of the CLC's Baker-Shultz Carbon Dividends plan. The four primary components of the advocacy campaign are (1) make-up of the coalition, (2) campaign structure, (3) campaign strategy, and (4) campaign financing. The recommended coalition make-up is broad but targeted, spanning from traditional allies to environmental NGOs, the business community, and non-traditional allies. For campaign structure, we recommend that the coalition designates half of the campaign's resources toward influencing key decisionmakers in the Washington, D.C. area and half toward influencing constituents represented by members that are possible swing votes. Passed through reconciliation, the CLC proposal would be under the jurisdiction of the House and Senate Budget Committees, so the leaders of those committees should be targeted most aggressively. For campaign strategy, we recommend that the campaign employs a three-pronged strategy: direct lobbying, grasstops lobbying, and grassroots lobbying. Finally, we include high financing ($30-50 million) and low financing ($18-25 million) options, indicating that the high financing option is the preferred approach.

Advocacy Campaign Design

Enactment of the CLC's Baker-Shultz Carbon Dividends plan requires an aggressive and expensive advocacy campaign. Below, I detail the four primary components of an advocacy campaign, including (1) make-up of the coalition, (2) campaign structure, (3) campaign strategy, and (4) campaign financing.

1. Makeup of the Coalition- Which stakeholders are included?

In order to launch an advocacy campaign, Apex must first decide the make-up of the coalition. As a first step, this process would require buy-in from Apex's most powerful ally, AWEA. After AWEA is on board, Apex can offer recommendations for the composition of the governing body for the campaign.

a. Obtaining buy-in from strongest ally

The first step toward enactment of the CLC's plan is generating buy-in from its strongest ally, the American Wind Energy Association (AWEA)[44] where Apex is a member. Given that AWEA is the most powerful trade association representing the renewable energy industry, AWEA is likely to take the organizational lead on the campaign and must be brought on board. This recruitment process should begin as far in advance of the November 2020 general election as possible with an assumption that

[44] The American Wind Energy Association (AWEA) is a national trade association representing wind power project developers, equipment suppliers, service providers, parts manufacturers, utilities, researchers, and others involved in the wind industry. AWEA represents 1,000 member companies and over 114,000 jobs in the U.S. economy.

presumptive nominee Joe Biden will win the election. The campaign requires AWEA's support in order to be successful.

In order to get AWEA's support, Steve Caminati, the Apex staff member who manages the company's work in all of its trade associations, should voice Apex's strong support of the CLC plan within AWEA's Federal Affairs Committee and work behind the scenes with other member companies to see if they might support the CLC plan, too. Though Pattern Energy Group, Inc., Avangrid Renewables, Xcel Energy and the other companies that typically partner with Apex should be approached first, Apex should confer with as many AWEA companies as possible to generate support. If several of AWEA's large member companies, or an overwhelming number of its smaller member companies, come out in support of the CLC's plan, AWEA will follow with an endorsement of the CLC's plan. That is, AWEA will support a consensus position of its members even if the position is not necessarily shared by all of its members. At this point, AWEA and the other member companies sitting on AWEA's Federal Affairs Committee could begin to construct a federal advocacy campaign for the CLC proposal.

b. Composition of the governing body for the campaign

With AWEA on board, AWEA staff, Apex, and other member companies sitting on the Federal Affairs Committee could discuss which non-governmental entities outside of AWEA's member companies should be included in the federal advocacy campaign. In advance of this conversation, Apex should have a readily available list of the non-governmental external entities it believes should be included in the advocacy campaign, representing between five and ten different interests collectively. These entities would form a steering committee with a purpose of minimizing the chance that entities with high-influence capabilities would not launch opposing campaigns. The environmental community, for example, is of particular concern, because its leaders often demand more ambition than is politically feasible, as was the case for the failed carbon tax ballot initiative in 2016 (Wortland, 2018).[45] Moreover, it is important to note that in the last national decarbonization advocacy campaign in 2009, environmental groups were extremely fragmented and unwilling to cooperate with business, to the detriment of the effort (Skocpol, 2013).

The included entities should be required to make a minimum financial contribution of $500,000 to $1 million to sit on the steering committee. Each entity included would be asked to fill their seats on the committee with staff and consultants that would be capable of dedicating a significant amount of time and energy to the effort in the form of discussions with members of the steering committee and direct lobbying of government officials.

[45] In Washington state, the Sierra Club and The Nature Conservancy refused to support a viable carbon fee and dividend policy, a policy to make polluters pay a fee for emissions, because they deemed the policy too conservative: the proceeds would have been used to fund a tax cut and not used to support climate resiliency programs. Two years later, in 2018, the same groups pushed for a carbon fee and dividend bill that would in fact support climate resiliency investment in the state. Viewed by many as too progressive of an approach, the measure did not have the support of the business community and failed (Wortland, 2018).

Figure 31 A list of possible non-governmental entities to include in steering committee. See p. 22-23 for stakeholder descriptions.

Traditional Allies	Environmental NGOs	Business Community	Non-Traditional Allies
• Solar Energy Industries Association • American Council on Renewable Energy • Advanced Energy Economy	• Union of Concerned Scientists • Environmental Defense Fund • Natural Resources Defense Council • National Sierra Club	• Climate Leadership Council • Alliance for Market Solutions • U.S. Chamber of Commerce • Microsoft • Shell, BP, ExxonMobil	• Labor Groups[46]

As seen in *Figure 31 (p. 73)*, Apex's list of non-governmental entities should include all key interests, spanning from traditional allies to environmental NGOs, the business community, and non-traditional allies. The listed entities represent possible options and do not cover all interests. No more than ten interests should be included as too many interests could make reaching a consensus unlikely.

2. Campaign Structure

Once the coalition make-up is set, one of the things the members of the steering committee will need to agree on is the geography of the campaign structure. Apex should come prepared with recommendations for the steering committee to this discussion. Specifically, Apex should offer recommendations for a campaign that focuses both within the beltway and on key states.

a. Inside the Beltway

Apex should recommend that the steering committee designates 50 percent of campaign resources toward influencing key decisionmakers in Washington, D.C. Key decisionmakers are generally leaders of the committees with substantive jurisdiction that have an ability to shape the legislation, with some having a greater ability than others based on their majority vs. minority status and the extent of their jurisdiction. Passed through reconciliation, the CLC proposal would be under the jurisdiction of the House and Senate Budget Committees. The House Budget Committee is led by Chairman John

[46] To boost political feasibility, Apex should consider supporting the use of a small portion of revenues to invest in workers and communities dependent on the fossil fuel industry. A workforce development provision would help gain the support of—or at least lessen the opposition from—labor groups, as well as members from states that are highly dependent on the coal industry. The Market Choice Act of 2018, provides a strong template for a workforce development provision, appropriating 3 percent of carbon tax revenues annually for ten years to a Department of Labor program to assist workers in the energy sector that may be displaced as a result of the enactment of the Act. The assistance may take the form of the following: (1) worker retraining, (2) relocation expenses for those who move to find new employment, (3) early retirement, (4) health benefits, or (5) other assistance that the Secretary determines appropriate.

Yarmuth (D-KY-03) and Ranking Member Steve Womack (R-AK-03). In the Senate, the Budget Committee is led by Chairman Mike Enzi (R-WY) and Ranking Member Bernie Sanders (D-VT).

Since carbon tax legislation in regular order falls under the jurisdiction of the House Ways and Means Committee and the Senate Finance Committee, who is authorized to amend the Internal Revenue Code of 1986 (Sobczyk, 2018), leaders on these committees are also likely to exert at least some influence on the legislation. The House Ways and Means Committee is led by Chairman Richard Neal (D-MA) and Ranking Member Kevin Brady (R-TX). In the Senate, the Finance Committee is led by Chairman Chuck Grassley (R-IA) and Ranking Member Ron Wyden (D-OR).

Less important, but still relevant, are leaders of the House Energy and Commerce Committee, the House Natural Resources Committee, and the Senate Energy and Natural Resources Committee. In January 2021, Rep. Greg Walden (R-OR), the ranking member of the House Energy and Commerce Committee, will retire from his post and a new ranking member, likely Rep. Cathy McMorris Rodgers (R-WA), will take his place. In addition, Senator Murkowski's (R-AK) term as Chairman of the Senate Energy and Natural Resources Committee will expire at the end of 2020 and Senator John Barrasso (R-WY) will replace her as chairman at the start of the 117th Congress. In *Figure 32 (p. 74)*, I include a comprehensive list of all the relevant decisionmakers in Congress with the most important decisionmakers bolded as they relate to the campaign.

Figure 32 Names of committees with jurisdiction over carbon tax legislation coupled with the names of committee leaders. House Budget, Senate Budget, House Ways and Means, and Senate Finance leaders are of particular importance.

Committee	Chairman	Ranking Member
House Budget	**John Yarmuth (D-KY-03)**	**Steve Womack (R-AR-03)**
Senate Budget	**Mike Enzi (R-WY)**	**Bernie Sanders (D-VT)**
House Ways and Means	**Richard Neal (D-MA-01)**	**Kevin Brady (R-TX-08)**
Senate Finance	**Chuck Grassley (R-IA)**	**Ron Wyden (D-OR)**
House Energy and Commerce	Frank Pallone (D-NJ-06)	Maybe Cathy McMorris Rodgers (R-WA-05) in 2021, currently Greg Walden (R-OR-02) *open seat
House Natural Resources	Raul Grijalva (D-AZ-03)	Rob Bishop (R-UT-01)
Senate Energy and Natural Resources	John Barrasso (R-WY) in 2021, currently Lisa Murkowski (R-AK)	Joe Manchin (D-WV)

b. Key States

Apex should recommend that the steering committee designates the remaining 50 percent of campaign resources toward influencing constituents represented by members that are possible swing votes. Swing vote members are Republicans representing states that have a strong potential for—or pre-existing presence of—renewable energy development.

One of the key reasons the decarbonization advocacy campaign in 2009 failed is because not enough resources were focused on the voters themselves and influencing voter opinion is an indirect way of influencing politicians. Unlike pro-decarbonization groups, opposition groups—largely comprised of oil and gas companies—put overwhelming financial resources into the manufacture of doubt at the grassroots level between 2007 and 2009, demonstrating to voters that there was still large scientific uncertainty surrounding the claim that climate change is the result of human activity (Conway and Oreskes, 2014). As climate change denial penetrated grassroots conservative opinion, Republican members of Congress moved further right and became unwilling to collaborate on climate legislation (Skocpol, 2013). This outcome demonstrates the importance of designating appropriate resources to swaying public opinion in key states.

The members of Congress identified in *Figure 33 (p. 75)* were identified by AWEA's advocacy team as members that have the highest likelihood of being influenced by their constituents on decarbonization policy. Senators John Cornyn (R-TX), Mike Braun (R-IN), and John Thune (R-SD) should be top targets as the states have relatively more wind presence/potential, and AWEA has stronger relationships with their offices at the federal and state levels (AWEA, 2019). Despite less wind presence/potential in their states, the steering committee should also target Sens. Rob Portman (R-OH) and Mitt Romney (R-UT), since passage of a decarbonization policy by reconciliation requires four Republican "yes" votes in the Senate. This list of members intentionally excludes those members that will be in cycle and can expect contentious Senate races, as the topic of decarbonization policy is generally avoided by such members.

Figure 33 The members of Congress proposed for strong influence tactics, along with their state and wind presence/potential. The starred members are top targets. Source: AWEA, 2019

Senator	State	Existing Wind (MWs)	Wind Under Development (MWs)	Wind Set For Development (MWs)
Cornyn*	TX	25,629	6,261	2,496
Braun*	IN	2,317	130	1,000
Thune*	SD	1,019	505	1,678
Portman	OH	729	388	21
Romney	UT	391	0	0

3. Campaign Strategy

After determining which members and constituencies should be targeted, the steering committee will need to decide exactly how those members and constituencies will be targeted. It is my recommendation that Apex presents to the committee a three-pronged strategy: direct lobbying, grasstops lobbying, and grassroots lobbying.

a. Direct Lobbying

Direct lobbying would include any communication the steering committee has to influence Congress through communication with a member or his/her staffers. This would include, for example, steering committee members calling or meeting with a member, or one of his/her staffers (Worth, 2019). Steering committee members would conduct the direct lobbying activities, including those on the committee from Apex.

For this campaign, I would recommend that the steering committee employs "persuasion" as a theory of lobbying and attempts to change lawmakers' minds (Hall and Deardorff, 2006).

In meetings, steering committee members should:

- Educate lawmakers on the specific benefits of the carbon tax in their state, including renewable energy development.
- Emphasize the fact that the CLC plan is revenue neutral and does not raise prices for consumers. A 2017 U.S. Treasury research paper shows that distribution of the carbon revenue through an equal per capita cash grant as proposed for the CLC's tax would be sharply progressive, making approximately 70 percent of American households better off (Hafstead, 2019). *See p. 33 for more details.*
- Demonstrate a willingness to support the use of a small portion of the carbon tax revenues to invest in workers and communities dependent on the fossil fuel industry, when meeting with members representing states that are highly dependent on the coal industry for economic stability (West Virginia, Kentucky, and Wyoming)[47]. House Budget Committee Chairman John Yarmuth (D-KY-03), Senate Budget Committee Chairman Mike Enzi (R-WY), Senate Energy and Natural Resources Ranking Member Joe Manchin (D-WV), as well as incoming Senate Energy and Natural Resources Chairman John Barrasso (R-WY) are key decisionmakers that also represent coal states. Ranking Member Manchin (D-WV) has made it clear that coal states cannot be left behind in the country's transition to a clean energy future.
- Highlight the IRS's preexisting process available for distribution of revenues as a direct deposit to U.S. residents with a valid Social Security number, demonstrating high administrative feasibility. The IRS developed this method for distribution of stimulus money following passage of the third coronavirus stimulus package, the

[47] Steering committee members should exercise extreme caution in agreeing to the use of tax revenues for purposes other than covering administrative expenses and supporting workforce development.

Coronavirus Aid, Relief, and Economic Security Act (CARES Act), in March 2020.[48]

- **SPECIFICALLY FOR BUDGET COMMITTEE LEADERS IN THE HOUSE AND SENATE:** Ask for two reconciliation packages, one of which dedicated to climate. The first reconciliation package will be healthcare focused, and the second reconciliation package will be climate focused. Note that it is impossible for one package containing both healthcare and climate to succeed (Flint Interview, 2020).[49]

In order to secure a meeting with the target lawmakers, Apex and other steering committee members should consider making campaign (PAC) contributions, if they do not already, to the target members in coordination with the other committee members. As an example, Apex, which has a PAC called the "Apex Clean Energy PAC,"[50] currently coordinates its campaign contributions with AWEA's PAC. This level of coordination should generally be consistent across all committee members. PAC contributions come from personal accounts and must be $5,000 or less annually (CRS, 2018).

If the steering committee members give money to the members' campaigns, there is some perception on the member's part to give the committee members access. When a political organization randomly assigned some congressional offices (of 191 total offices) to be informed that prospective attendees were political donors, the group had between three and four times greater success in securing meetings with senior policymakers (Kalla and Broockman, 2015). That is, there is strong evidence to show that PAC contributions facilitate access to influential policymakers. *Figure 34 (p. 78)* shows the members that should receive a PAC contribution along with the recommended amount.

[48] The IRS distributed direct deposits to taxpayers that filed in 2018 or 2019. Since not all recipients pay taxes, the IRS merged the taxpayer dataset with the 1099-G dataset to account for those on social security or disability.
[49] A president typically does only one package through reconciliation while in office (Segal Interview, 2020), but doing more than one package is achievable (Flint Interview, 2020). Also note that in reconciliation, as compared to regular order, lobbyists have a reduced ability to specify where the revenue goes (Flint Interview, 2020).
[50] The Apex Clean Energy PAC is run by Steve Caminati, the Director of Strategic Communications. The PAC currently gives funding to state and federal campaigns, with a heavier portion dedicated to Republican campaigns. On federal side, PAC contributions in two buckets: (1) members who are willing to help because of the economic development that is happening within their state/district (members that would otherwise not support clean energy development/policies), and (2) members that are potential champions or leaders for Apex interests (members that advance long-term policy objectives). Steve Caminati discusses possible PAC contributions with VP of Marketing and Commutations, Steve Bowers, and also seeks board approval before moving forward with any PAC contributions.

Figure 34 Title, member name, state/district, and recommended PAC contribution amount for 2020 and 2021.

Title	Member Name	State/ District	PAC Contribution 2020	2021
Rep.	John Yarmuth	D-KY-03	$5,000	$5,000
Sen.	Mike Enzi	R-WY	$5,000	$5,000
Rep.	Richard Neal	D-MA-01	$5,000	$5,000
Sen.	Chuck Grassley	R-IA	$5,000	$5,000
Rep.	Frank Pallone	D-NJ-06	$5,000	$5,000
Rep.	Raul Grijalva	D-AZ-03	$5,000	$5,000
Sen.	John Barrasso	R-WY	$5,000	$5,000
Sen.	Lisa Murkowski	R-AK	$5,000	$5,000
Rep.	Steve Womack	R-AR-03	$5,000	$5,000
Sen.	Bernie Sanders	D-VT	$5,000	$5,000
Rep.	Kevin Brady	R-TX-08	$5,000	$5,000
Sen.	Ron Wyden	D-OR	$5,000	$5,000
Rep.	Cathy McMorris Rodgers	R-WA-05	$5,000	$5,000
Rep.	Greg Walden* open seat	R-OR-02	$5,000	$0
Rep.	Rob Bishop	R-UT-01	$5,000	$5,000
Sen.	Joe Manchin	D-WV	$5,000	$5,000
Sen.	John Cornyn	R-TX	$5,000	$5,000
Sen.	Mike Braun	R-IN	$5,000	$5,000
Sen.	John Thune	R-SD	$5,000	$5,000
Sen.	Rob Portman	R-OH	$5,000	$5,000
Sen.	Mitt Romney	R-UT	$5,000	$5,000
TOTAL			$105,000	$100,000

b. Grasstops Lobbying

In addition to direct lobbying, the steering committee should employ grasstops lobbying. Grasstops lobbying would refer to recruiting key influencers at the federal and state level to publicly endorse the CLC plan. This could include opinion leaders, people with a large followership, people who have personal connections to elected officials, former elected officials, or the leaders of large state organizations. The CLC is already underway in launching a grasstops lobbying effort. It has recruited former elected officials, as well as CEOs of large companies including five oil and gas supermajors, the #1 and #2 largest automobile manufacturers in the U.S., two of the largest global financial institutions, the largest telecommunications company in the world, among

others[51] (CLC, 2020). The steering committee should assist the CLC with efforts to recruit additional individuals and companies.

c. Grassroots Lobbying

Grassroots lobbying would refer to attempts by the steering committee to influence legislation by attempting to affect public opinion with respect to the CLC proposal and encouraging the public to take action with respect to the CLC proposal. This would include sending out mailers and emails urging individuals to "call your senator" (Worth, 2019). I would also recommend that the grassroots lobbying effort includes press coverage, digital ads, and cable (earned media and paid media) within the beltway and in the key states.

Grassroots messaging should:

- Frame the carbon tax as one that will be levied on large polluters, as both a penalty on pollution and an incentive to cleaner alternatives. One effective strain of messaging highlights all the actions consumers take to reduce their own emissions (have car emissions checked, not burning firewood, etc.) and stresses the importance of holding major corporations to the same standard (Metz and Weigel, 2018).
- Focus on the outcomes carbon pricing will deliver, and not the mechanics of the system that will deliver them. Voters are easily confused about the details of how carbon pricing works (Metz and Weigel, 2018).
- Provide specifics about the funding allocations to which the carbon tax dollars will be dedicated. Vague references tend to heighten voters' suspicions that the money is going into a piggy bank for politicians' pet projects[52] (Metz and Weigel, 2018).

As described in *Figure 33 (p. 75)*, the key states are Texas (Cornyn), Indiana (Braun), South Dakota (Thune), Ohio (Portman), and Utah (Romney) (AWEA, 2019). Note that the committee would only be able to devote one-fourth of its total lobbying expenditures to grassroots lobbying (Worth, 2019).

[51] Grasstops supporters of the CLC plan include: BP, ConocoPhillips, ExxonMobil, Shell, Total, Ford, General Motors, Goldman Sachs, JPMorgan Chase, AT&T, Procter & Gamble, Unilever, Johnson & Johnson, Allianz, MetLife, IBM, Microsoft, PepsiCo, First Solar, Exelon, Calpine, Vistra Energy, BHP, AECOM, Conservation International, World Resources Institute, and World Wildlife Foundation (CLC, 2020).

[52] Note that there is little evidence that highlighting the "dividend" aspect of the tax will convert people who already oppose a carbon tax into supporters, but a dividend could be key to winning over swing legislators (Metz and Weigel, 2018).

4. Campaign Financing

Last but not least would be a discussion on the financing of the campaign. It is my recommendation that Apex presents a high financing option and a low financing option to the steering committee, while indicating that the high financing option is the preferred approach.

a. High Financing Option

The advocacy measures described in the previous section would be most conducive to a high financing option, or a budget of $30-50 million. This level of financing could be raised collectively by the companies on the steering committee, as well as external trade associations, businesses, non-profit organizations, philanthropies, and high net worth individuals.

b. Low Financing Option

The steering committee could still implement an advocacy campaign under a low financing option, or a budget of $18-25 million. This option would necessitate severe cuts to the amount of funding that could be spent on grassroots lobbying efforts.

Appendix VIII: The Emissions Reductions Impact of Narrowing the CLC Plan to an Electricity Sector-Only Tax

As described in the expanded recommendation *(p. 71)*, there is a possibility that the CLC's plan could evolve into an electricity-sector only tax. This outcome may occur if key decisionmakers and stakeholders perceive an economy-wide tax, which the CLC plan is, as too ambitious. After all, all of the carbon pricing approaches at the state and regional levels, with the exception of California, are confined to the electricity sector *(For more info, see top of p. 13)*.

In *Figure 35 (p. 81)*, I outline projections for exactly how much emissions reductions would increase on an annual basis (2021-2035), relative to business as usual emissions, for two versions of the CLC tax: (1) electric power sector including electrification of transportation ("electric + transportation"), and (2) electric sector-only. Note that the electric + transportation scenario is the version assessed in the cost-effectiveness analysis section of this report.

Figure 35 Annual emissions reductions projections (millions of metric tons) for two CLC tax scenarios between 2021 and 2035. The two versions of the CLC plan investigated here are a tax on the electric power sector including electrification of transportation ("electric + transportation") and a tax on the electric sector-only.

Year		Tax on Electric + Transportation (millions of metric tons)*	Tax on Electric Sector-Only (millions of metric tons)
0	2021	0	0
1	2022	650	370
2	2023	715	407
3	2024	780	444
4	2025	845	481
5	2026	910	518
6	2027	910	518
7	2028	975	555
8	2029	1040	592
9	2030	1040	592
10	2031	1105	629
11	2032	1170	666
12	2033	1170	666
13	2034	1170	666
14	2035	1170	666
Total Additional Emissions Reductions (millions of metric tons)		**13,650**[53]	**7,770**

[53] Note that to facilitate a comparison of the CLC plan with the RPS and CES alternatives, which apply exclusively to the electricity sector, we narrowed our focus for the CLC plan to projected emissions reductions for electric power sector, including reductions that would result from the electrification of transportation. The CLC plan in its current form would apply beyond the electric and transportation sectors and lead to approximately 54 percent more emissions reductions (21 billion metric tons) between 2021 and 2035 (CLC, 2020; RFF, 2019).

As shown in *Figure 35 (p. 81)*, narrowing the CLC tax to the electricity sector would lessen the projection for emissions reductions by 43 percent, a 5.8 billion metric ton difference. Even still, the electric-sector only version of the CLC tax would lead to greater emissions reductions at a lower cost, as compared to the CLEAN Future Act and the Renewable Electricity Standard Act alternatives. For this reason, I recommend that Apex enacts the CLC plan even if it is narrowed to an electricity-sector only tax.