Addressing Climate Change Using a Carbon Tax & Dividend Plan Within a Global Compact

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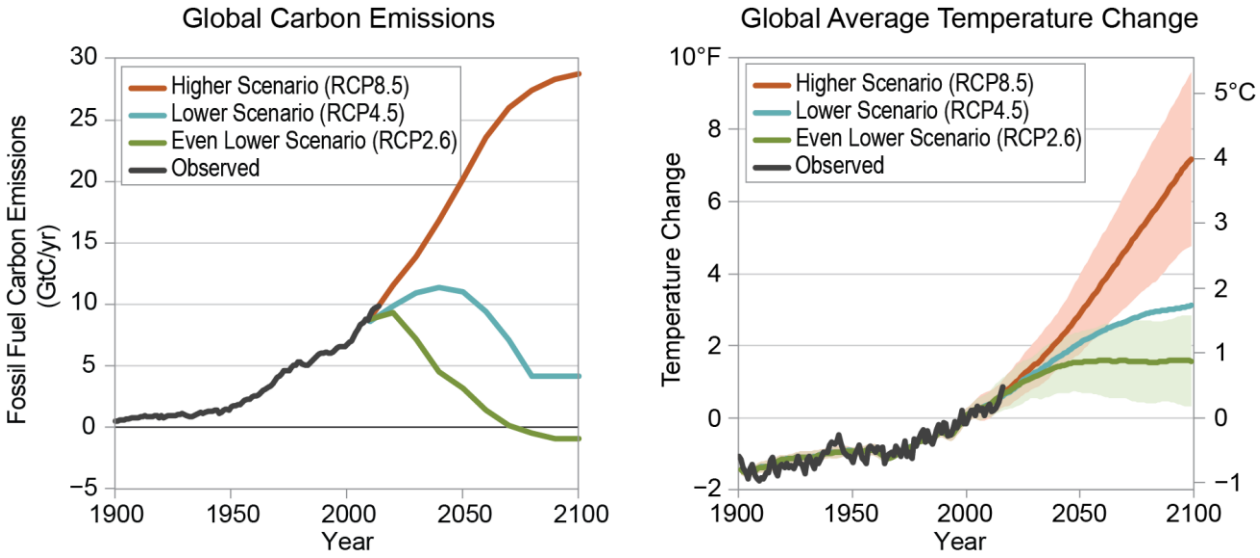
SUMMARY

The existential challenge of a rapidly changing climate requires America's leadership, vision and innovation to bring on decisive and unifying national and global climate policies. The adoption of a **Carbon Tax and Dividend** approach is a necessary component of U.S. policy to reduce carbon emissions in line with internationally accepted targets. It can be launched quickly with bipartisan support and ensure a fair transition towards a clean energy economy. Additionally, the U.S. could lead a **Global Climate Compact** to enlist major nations to join in carbon reduction.



Pathways for future emissions of carbon dioxide (left) are linked to scenarios for increases in global average temperatures (right).

Source: Hayhoe, Wuebbles et al. (2018) Our Changing Climate. *Fourth National Climate Assessment*

The Carbon Tax and Dividend Plan. To fend off the worst climate change impacts, global CO2 emissions must decline by 50% by 2030 and nearly 100% by 2050. The most expeditious way to meet emission targets is via a carbon tax and dividend plan as the central component of U.S. climate policy. The carbon tax revenue is collected at the source of energy production by the Treasury and all revenue is returned to citizens in equal portions as dividends. The tax discourages consumption of carbon-intensive products while encouraging production of clean energy substitutes. Regulations will also be needed but cannot do the job alone. The increasing price differential between a rising carbon tax and the decreasing cost of renewables is the profit lure that makes businesses the prime catalyzers of the energy transition. Dividends to citizens help the economy grow. Analysis shows the transition will create more jobs than it displaces, and with better pay, aiding economic recovery (see Addendum: Employment Effects of the Energy Transition).

Three design elements are important:

1) start quickly;

2) make money flows fully transparent; and

3) collect carbon taxes at the source of production.

There are no exceptions, all consumers and businesses pay the tax on fossil fuel-based goods and services. The plan is a bipartisan solution. Public trust is paramount.

Dividends Enable A Fair Transition. Major economic transitions inevitably lead to disruptions and often disproportionally hurt those most vulnerable. Quarterly dividends paid in equal amounts to all adult citizens will more than offset the cost of carbon taxes embedded in products for 60 to 70% of U.S. citizens, including all lower income levels.

US-led Global Climate Policy. Although the plan described above will drastically reduce U.S. carbon emissions to forestall the worst effects of climate change, other major economies must put an effective price on carbon as well. Such a global endeavor will not happen without U.S. leadership as argued by Professor William Nordhaus in "The Climate Club." Nordhaus describes the failure of international climate efforts: "At the end of this long string of conferences, the world in 2020 is no further along than it was […] in 1995: there is no binding international agreement on climate change" (Nordhaus 2020). Carbon emissions are still increasing. Nordhaus suggests a new approach through the "club model", which we call the global climate compact.

The Global Climate Compact. The Compact combines domestic climate policy through a carbon tax or Cap and Trade with international trade policy. This overcomes the lack of authority in prior international agreements by uniting countries striving to reduce emissions into a collaborative sovereignty that pressures all countries to reduce global emissions. Members joining the Compact must implement a similar domestic carbon tax and place tariffs on all imports from non-Compact countries. Incentives are designed to induce all countries to join the Compact. The more countries involved, the greater the chance of reducing emissions and lowering the burden on members. Modeling results show that most countries and regions would join the Climate Compact if the carbon price is not excessive and tariffs are sufficiently high. With a $25/ton of CO2 carbon price, a 3% tariff is needed to have at least 12 members. With a $50 carbon price, tariffs must be 5% to obtain similar results.

This Plan creates the centerpiece for a new foreign policy that positions the U.S. to lead a coalition of nations to protect all people by transitioning to a low-carbon and just future. We join Nordhaus and other economists and climate scientists in support of decisive global climate action. **The time for action is now.**

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PART ONE – A National Energy Transition Plan for America: Informing the Development of a Carbon Dividend Approach

The time is now. The climate of our future is at our doorsteps. UN studies show that the U.S. and other countries need to reduce carbon emissions by as much as one half by 2030 and to near zero by 2050 to avoid the worst dangers of climate change. This proposal describes a carbon dividend and tax plan as the key driver to transform our fossil-fuel based economy to renewable energy. Effective carbon pricing is an essential piece of any array of policy solutions. The proposed National Energy Transition Plan (NETP) is designed to be the most effective yet fair, inexpensive, and bipartisan way of meeting emission goals. It is our hope that this plan will inform the development and refinement of proposed climate change plans being considered in the national debate and by Congress. Appendix A compares the NETP proposal with carbon tax and dividend plans submitted to Congress, and with current research to highlight elements important to a successful carbon dividend approach.

This is an update to the NETP report and supplementary materials, which are available at www.greenleafcommunities.org/climate-policy/

In Summary: The National Energy Transition Plan (NETP) includes a national tax placed on all carbon-based fuels at or near their source, with all revenue collected being paid back quarterly to all adult citizens in equal amounts. The initial tax rate is set at $25/metric ton of carbon equivalent and increases by $10/year, reaching $125/metric ton by 2030. The increasing cost of carbon energy will drive people and industry towards purchasing products made from renewable, non-fossil fuel energy while the equal dividends to all adults will compensate citizens for the increased cost of fossil fuel energy and ensure an inclusive and just transition.

Why this approach? The market and industry will do the major transition work through the increasing price differential between fossil fuels and alternative energy, thereby encouraging consumers to move away from purchasing fossil fuel-based goods and services. All citizens would benefit equally from the carbon dividend, and there would be little opportunity for special interests or corporate manipulation to corrupt or derail the process. Minimal government expenditures and expansion would be required.

The Plan is Fair. The NETP provides all adult citizens with an equal cash dividend every quarter. Those who use a great deal of fossil fuel through their purchases are penalized the most by the tax, while those who pollute less have a net cash bonus via the dividend. As consumers reduce fossil fuel use, they pay lower carbon taxes and keep more of their dividend. Over 60% of the populace, including low-income households, will be net beneficiaries, gaining income through their carbon dividends. The plan favors fairness, energy efficiency, conservation, and the use of alternative energy. The U.S. Treasury Department would ensure there is no diversion

of the carbon tax funds. Note that this is an unusual tax since its purpose is not government expenditures, and all tax revenue are returned to citizens.

Purpose of this Proposal: The analysis, as described herein and in Appendix A, concludes that a) the bipartisan Energy Innovation and Carbon Dividend Act, HR 763 (referred to herein as the Deutch Plan[1]), and b) the plan of the Climate Leadership Council (CLC) (sometimes referred to as the Baker/Schultz plan) which is supported by many corporations, are both similar to the NETP proposal. All three will reduce U.S. carbon emissions by 50% by 2030 and represent a bipartisan way forward (see Appendix A). It is our hope that analysis of the NETP can inform coalescing of climate policy discussions and proposals toward the implementation of an effective national policy instrument by highlighting the criteria essential for a successful plan (described in Section III), and the need for including the following important elements: a) no economic sectors exempted, b) dividend payments only to adult citizens, c) no export subsidies, and d) mid-course rate adjustments made outside of the political process. The rationale for these enhancements is discussed in Section VII. It is important to note that this report does not address the vital issue of support and assistance to displaced workers caused by the energy transition. These are crucial issues that must be covered in complementary policy initiatives.

Impact on the US Economy: The energy transition of America to sustainable fuels is a necessity. Although it will cause temporary disruption to the US economy, the transition will increase economic development and jobs in the long run. The froth of change will cause unemployment and disarray in industrial and labor markets but rapid movement to sustainable fuels will power new industries and many good paying jobs. The energy transition will give the economy a jolt to regain global technological leadership. This question of economic impact is analyzed in our special study Addendum: Employment Effects of the Energy Transition.

Covid-19 and the Economic Recovery: As America moves to rebuild the economy after the Covid-19 recession, it will be faced with the choice of returning to the old "normal" or to build a greener and more equitable normal. Passage of a tax and dividend climate policy would be important to steer industry and investments toward a sustainable path to the future. The pandemic is a harbinger of what is to come if we fail to stand together in the fight against climate change. It has brought to light our shared interests, the need for a unified response to common threats and a readiness of communities to adapt to a new reality.

I. Climate Situation: Why an action plan is needed now

The *Fourth National Climate Assessment* (USGCRP 2017; 2018) is a major assessment of climate change and its current and potential effects on the American people, as required by Congress under the Global Change Act signed by President H. W. Bush. This assessment is

[1] The Citizens' Climate Lobby has endorsed the Deutch Plan.

divided into two volumes: Volume I on the science of climate change and Volume II on the impacts and economic implications of climate change.

The *Fourth National Climate Assessment* emphasizes that climate change is happening now, that it is happening very rapidly, and that it is greatly impacting the United States. Such assessments of the science and resulting impacts, and international assessments by the United Nations Intergovernmental Panel on Climate Change (IPCC), warn of deep and possibly irreversible damage to our planet, damage that we can minimize, **but only if we act now**. Excerpts below are from the *Executive Summary of Volume 1 of the Fourth National Climate Assessment,* which was co-led by Professor Donald J. Wuebbles of the University of Illinois, and offer a concise overview of our present situation and major findings:

- Global atmospheric concentrations of carbon dioxide (CO_2) have now surpassed 410 parts per million, a level that was last reached about 3 million years ago. Continued growth in CO_2 emissions would lead to CO_2 levels not experienced in tens to hundreds of millions of years. This increase from the 300 ppm in the pre-industrial atmosphere is due to human activities, namely the burning of fossil fuels and land use change. Similarly, the amount of atmospheric methane and other radiatively important gases are also increasing dramatically because of human activities.

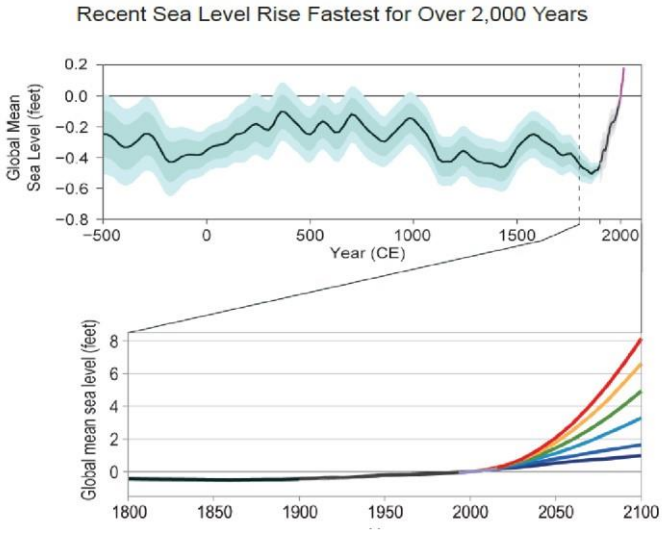
- Thousands of data-driven studies conducted by researchers around the world have documented observed changes in surface, atmospheric, and oceanic temperatures; melting glaciers; diminishing snow cover; shrinking sea ice; rising sea levels; ocean acidification; increasing atmospheric water vapor; and other important climate parameters.

- While it took 115 years (1901-2016) for U.S. temperatures to increase 1.8°F (1.0°C), the annually-averaged temperature is expected to rise by another 2.5°F (1.4°C) over the next few decades (2021-2050) when compared to the annually-averaged temperature for 1976-2005.

- It is extremely likely (95-100% likelihood) that human activities, especially emissions of greenhouse gases, are the dominant cause of observed warming since the mid-20th century. *There is no convincing alternative explanation (emphasis added).*

- The magnitude of climate change beyond the next few decades will depend primarily on global greenhouse gas emissions. *Without major reduction of emissions, the average global temperature increase could reach 9°F (5°C) or more by 2100 (emphasis added).*

- Global average sea levels have risen by 7-8 inches over the last century and will rise another 1 to 4 feet by 2100. A rise of as much as 8 feet by 2100 cannot be ruled out.



- The U.S. East and Gulf Coasts will see rises above the global average. Tidal flooding is accelerating significantly in over 25 Atlantic and Gulf Coast cities.

- The oceans are currently absorbing more than a quarter of atmospheric CO2 emissions, making these more acidic, with potential negative impacts on marine ecosystems. Acidification of U.S. coastal waters will be greater than the global average.

- Since the 1980s, Arctic sea ice coverage has decreased between 3.5% and 4.1% per decade, has become thinner by between 4.3 and 7.5 feet, and is melting at least 15 more days each year. Ice mass loss in Greenland is accelerating.

- Alaskan and Arctic near surface temperatures have, over the last 50 years, increased more than twice as fast as the global average temperature. Rising Alaskan temperatures are causing permafrost to thaw which can release more CO_2 and methane into the atmosphere thus setting into play a vicious feedback loop (human caused CO_2 emissions → temperature increase → permafrost thaw → CO_2 + methane emissions → temperature increase → more permafrost thaw). Permafrost emissions have the potential to compromise our ability to limit global temperature increases.

- Heavy rainfall is increasing in intensity and frequency across the United States, and the rest of the world, and is expected to continue to increase.

- Rising temperatures, earlier spring melt and reduced snowpack are already affecting western U.S. water resources. Under higher emissions scenarios, chronic, long-duration hydrological drought is increasingly possible before the end of the century.

- Large forest fires in the western United States and Alaska have increased since the 1980s and are projected to increase further.

- U.S. heatwaves have become more frequent since the 1960s, while extreme cold and cold waves are less frequent. Recent record setting hot years are projected to become commonplace in the near future.

- To reiterate, without major reductions in emissions, the average global temperature increase could reach 9°F (5°C) or more by 2100.

- Humanity's effect on the earth system is unprecedented and thus creates significant potential for unanticipated effects.

- There are at least two types of potential surprises: *compound events*, where multiple extreme events occur simultaneously or sequentially (with greater overall impact), and *critical threshold* or *tipping points* that lead to large and cascading impacts. The probability of a surprise—some of which may be abrupt and / or irreversible—increases as the impact of human activities on the climate system grows.

- Positive feedbacks (self-reinforcing cycles or deviation amplifying loops—see permafrost loop above) within the climate system can accelerate human-induced climate change and even shift the Earth's climate system into states that are very different from the recent past.

- The physical and socioeconomic impacts of compound extreme events (e.g., simultaneous heat and drought, hot and dry conditions coupled with wildfires) can be greater than the sum of the parts. *Few analyses consider the spatial or temporal correlation between extreme events (emphasis added)*.

Simulations with climate models have shown a systematic tendency to underestimate temperature change during past warm epochs. One reason for this is that climate models do not fully consider all of the contributions to self-reinforcing cycles that could lead to irreversible changes. *This suggests that climate models are more likely to underestimate than to overestimate the amount of change that lies ahead (emphasis added).*

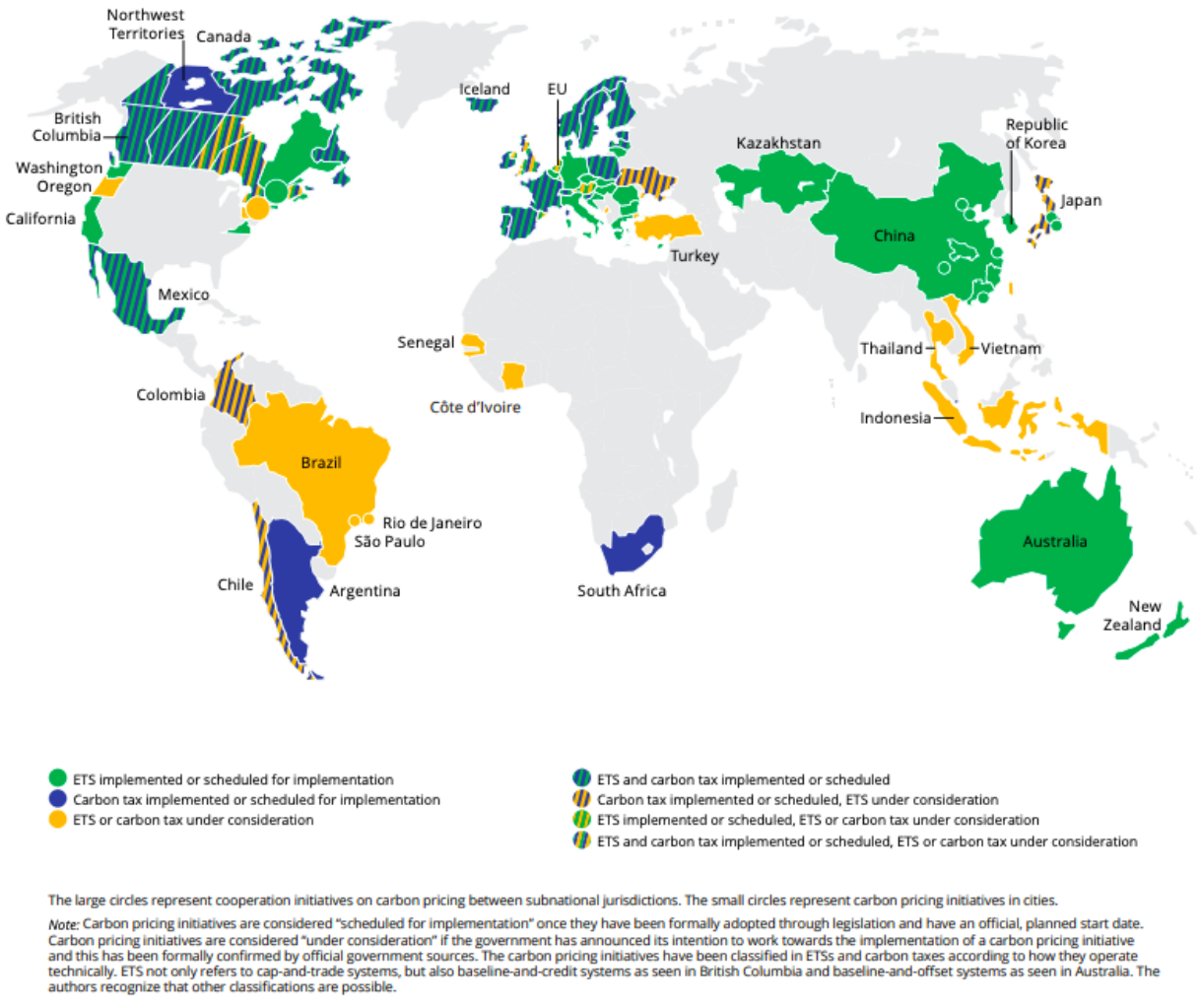
II. Historic Experience with Carbon Taxes and Cap and Trade Policies

This section looks at prior experience with similar carbon tax concepts. Analysis of these past efforts contributes useful lessons for choosing a successful energy transition plan for the United States, in particular the importance of pricing carbon high enough, redistributing the tax revenues, developing a convincing narrative and fostering public trust.

In January 2019, 3589 U.S. economists, including 27 Nobel Laureates, signed a statement in the Wall Street Journal in support of a carbon tax and dividend policy (Wall Street Journal 2019). Economists have long supported putting a tax on the source of carbon pollution, and this has been put to practice in a growing number of jurisdictions around the world for the purpose of reducing greenhouse gas (GHG) emissions. As of June 2020, there were 61 carbon pricing initiatives in place or scheduled around the world, covering 22% of GHG emissions (see Figure

1 below) (World Bank 2020).[2] In 2019, carbon pricing raised over $45 billion. However, less than 5% of carbon emissions covered by a carbon price were priced within the range necessary to meet the goals of the Paris agreement (i.e. at least US$40–80/tCO2 by 2020) (World Bank 2020).

Figure 1 - Carbon pricing initiatives implemented, scheduled for implementation and under consideration



The large circles represent cooperation initiatives on carbon pricing between subnational jurisdictions. The small circles represent carbon pricing initiatives in cities.

Note: Carbon pricing initiatives are considered "scheduled for implementation" once they have been formally adopted through legislation and have an official, planned start date. Carbon pricing initiatives are considered "under consideration" if the government has announced its intention to work towards the implementation of a carbon pricing initiative and this has been formally confirmed by official government sources. The carbon pricing initiatives have been classified in ETSs and carbon taxes according to how they operate technically. ETS not only refers to cap-and-trade systems, but also baseline-and-credit systems as seen in British Columbia and baseline-and-offset systems as seen in Australia. The authors recognize that other classifications are possible.

Source: (World Bank 2020)

Sweden passed a carbon tax in 1991 equivalent to $30/metric ton which has risen to $139/metric ton in 2018. The Oxford Martin School at Oxford University released an article on July 30, 2018 confirming the importance of carbon taxes, stating:

[2] 30 of these carbon pricing initiatives are carbon taxes.

> *"Putting a price on carbon emissions is an indispensable tool for meeting the goals of the Paris agreement to mitigate climate change, say the researchers. Success stories like that of Sweden, which has the highest carbon price in the world at US$139 per ton of CO2, demonstrate that it is possible to make carbon pricing work: while the Swedish economy has grown by 60% since the introduction of the Swedish carbon tax in 1991, carbon emissions have decreased by 25%.*
>
> *Other examples of carbon pricing initiatives include Switzerland which has a carbon tax which recycles part of the carbon tax revenue as checks to citizens.* (Plumer and Popovich 2019).
>
> *In Australia, however, the abandoned carbon pricing scheme provides a cautionary tale, says Professor Hepburn. 'It was nicely designed but in the adversarial and aggressive political climate the scheme failed because of lack of a convincing narrative, a focus on technical details in public debate, and problems of political credibility'.* (Oxford Martin School 2018)

In France, a carbon tax without a dividend was introduced in 2014 at €7 per ton of CO2, rising to €44.60 in 2018. Protests erupted when president Émmanuel Macron attempted to raise the tax to €86.20 by 2022, and the tax has remained frozen since then (Savolainen 2020). The tax hit the poor hardest since there were no dividend refunds of the tax. A recent OECD study estimated that carbon emissions were around 5% lower in 2018 than in a no-tax scenario, while the effect on jobs was slightly positive (+0.8%) (Horobin 2020). A dividend policy and more progressive increase in the tax might have protected those most vulnerable to higher energy costs while maintaining positive momentum in the transition towards a decarbonized economy. Another issue with the French carbon tax is that it exempts a number of sectors, such as domestic air and water transport, while agriculture and road transport receive partial reimbursements.

Canada implemented its Carbon Dividend and Tax plan in April 2019. It is similar to the NETP and the Deutch Plan with a 100% distribution of carbon tax revenue. It applies to all provinces that do not already have a carbon tax, namely British Columbia, Quebec and Alberta. The tax starts at $20 per ton and increases $10 per year (CAD) and is capped at $50. The Plan is designed to meet Canada's Paris pledge of a 30% decrease in emissions by 2030. In addition, Mexico introduced a pilot ETS (Emissions Trading System) in 2020, covering 37% of national emissions (World Bank 2020).

Historically, it is notable that the earlier Cap and Trade Plan (the EU ETS) missed the mark in Europe because the plan was not tamper-proof (see section IX). Major interests gained exceptions and the plan had little effect because the carbon price was too low. Other regulatory approaches have failed for this reason. Corporate and other interests used lobbying and litigation

to scuttle the regulations. In Washington state, two well organized efforts failed because the use of the tax revenue was not clear or not trusted.

The economic downturn caused by the COVID-19 pandemic has affected carbon pricing initiatives worldwide. ETS initiatives have experienced a decline in the price of allowances (i.e. tradable carbon credits) as these depend on supply and demand, while scheduled raises in carbon taxes have been postponed (World Bank 2020).

III. The NETP Carbon Tax and Dividend Proposal

The following are the key elements of the NETP Carbon Dividend and Tax Proposal based on the two fundamental drivers of this plan: consumer choice and industrial free market transformation of the economy.

1. A tax is placed on each metric ton of CO_2 produced at the point of production (i.e. mine head, well head, refinery or port of entry into the U.S). The Treasury/IRS collects the tax revenue and places it in the Treasury's new Climate Fund. The tax will start at $25/metric ton of carbon or carbon equivalent, increasing each year thereafter for ten years by $10/ metric ton to reach $125/ metric ton by 2030.[3] This represents a starting tax of 25 cents/gallon of gasoline reaching $1.25/gallon by 2030.

2. Each quarter, a dividend check of an equal amount will be paid to each U.S. adult citizen. The amount of the dividend would be equal to all the funds in the Climate Fund minus administrative costs divided by the total number of adult citizens in the U.S. or by the number of adult persons who have a Social Security number. To assuage the skepticism of the public about government promises and cushion the impact on household expenditures, the plan calls for a first estimated payment of dividends one quarter prior to commencing the carbon tax.

3. Congress must ensure to its best ability that the tax rates set forth in the bill cannot easily be changed. A Climate Council would be established as an independent entity, along the lines of the Federal Reserve Board, consisting primarily of climate scientists and economists. The Council would be responsible for any needed future adjustment of the tax rates to meet the 50% emission reduction goal by 2030.

4. The carbon tax paid at source and passed on is infused in all carbon-using products across the economy and finally embedded in the carbon-content products people buy. Rising prices in the free market direct consumers away from more costly carbon products while industry

[3] The price of the carbon tax, in this study, is determined by its effectiveness in reducing carbon emissions to meet internationally defined greenhouse gas reduction targets (pushing the price up) and its acceptability by the broader public worried about the financial and economic pain of the energy transition (pushing the price down). Our approach aims to balance both concerns. The concept of the marginal cost of carbon as used in economic analysis is discussed in Appendix B on page B-2.

invests in innovative and new technology products to make profits and transition to the new energy economy.

5. This proposal is an *all-America plan* with no exceptions for any economic sectors (Metcalf 2019, p.112). All participate in this national endeavor and all benefit. Given the global climate crisis described previously and the need for quick action, an effective energy transition plan must work the first time since there will be no second try. The analysis of prior carbon tax efforts has identified the following essential elements for a successful energy transition plan:

   Start Soon: An energy transition plan must commence within two years (no later than 2022) if we are to meet greenhouse gas reduction targets for 2030 and 2050. Meeting this timetable requires a bipartisan bill broadly acceptable to most political factions. Climate policy will not succeed as a partisan endeavor.

   Effective in Achieving Set Emissions Goals: It must have a high probability of reaching the emission reduction targets. We partly start low to make the carbon tax acceptable to the broader public, but also to avoid the economic impacts of a sudden cost shock. The set price path is essential to give business a signal about future prices and costs so they can plan accordingly.

   Escalating and Adjustable Rate: It must include an escalating rate, secured with a nonpolitical mechanism for mid-course adjustment to keep the plan on track to meet the emissions goal. Rapid escalation allows the price to attain a level fairly quickly to both encourage industry and consumers to switch to production and purchase of low carbon fuels and products. Although substitute products seem expensive now, they will be increasingly competitive as the price of carbon rises and technology improves. A mid-course adjustment allows for the assessment of the effectiveness of the tax as well as new information on the Social Cost of Carbon.

   Fair: It should deal with increased carbon tax costs by: a) placing the most tax on those who pollute the most; and b) ensuring that disproportionate costs of the transition do not fall on the poor and working classes.

   Tamper Proof: It must be designed to be as unchangeable as possible through the political process.

These are stringent criteria, but history and the existential challenge before us make each necessary.

IV. How the NETP works

The Main Motor. The main driver restructuring our economy is the price differential between the rising price of fossil fuel, such as gasoline, and the decreasing price for the replacement sustainable energy products coming to market, such as those made from wind and solar energy plus storage technology. The increasing cost advantage of renewable over fossil fuel is the prime mover of the plan and of the energy transition. (Sharma 2018) The major assurance of fairness is the equal dividend to each citizen.

Polluters Pay and the Disadvantaged Are Protected. All fossil fuels (oil, coal, natural gas) will be taxed so anyone using carbon energy pays extra for fossil-fuel based energy products. All the tax revenue is distributed back to citizens equally. Those who use more fossil energy will pay taxes that exceed their dividend. Those who use little or no fossil energy will receive dividends that exceed their carbon tax payments. (see Figure 5, p. A-14).

Tax Rate. The Appendix reviews the research literature on tax rates and concludes that a range from $15/metric ton to $73/metric ton will cause a major decrease in carbon energy consumption. The various studies indicate that a yearly rising rate commencing from $15/metric ton to $50/metric ton and reaching $100/metric ton to $125/metric ton by 2030 is most likely to reduce emissions 50% from the 2015 level by 2030. (Metcalf 2019, p.48)

Border Carbon Adjustment. At the border, a tariff equal to the U.S. carbon tax would be added on carbon imports from countries that do not have an equivalent tax on carbon. This would prevent countries without carbon taxes from undercutting U.S. efforts to reduce fossil fuel use and would push all trading partners to adopt the same carbon levy prevailing in the U.S. The suggested tariff on all imports within a Climate Compact would eliminate the need for the above Border Carbon Tax Adjustment as detailed in Part TWO Section XI.

The Cost of the NETP. The enormous costs of transforming our economy's energy base will not be borne by government or by the carbon taxes levied. The costs and profits will be internalized by businesses and passed on to consumers as well as funded by the financial institutions of our country and spread out over many years. Many firms will suffer losses, but many more will make large profits. Energy costs may stay stable or even decrease since in many cases the new renewable energy will be less costly than the old fossil fuel.

V. The Economic Mechanisms of the NETP

The Supply Side of the Market. The NETP calls for a beginning tax of $25/metric ton and rises to $125/metric ton over the decade. Producers of goods and services will increase their prices to consumers and manufacturers based on their added costs. The prices of products will rise depending on their fossil fuel energy content.

The NETP's success rests on the ability of the supply side of the economy to produce replacement products fast enough at attractive prices to supply the new tax-induced demand for renewables. As technology and manufacturing acumen continue to lower the cost of renewables (e.g. wind, solar and energy storage), these energy producers will gain an increasingly favorable price advantage over fossil fuel products, thus assisting the energy transition (Foehringer 2018; IRENA 2018).

The Demand Side of the Market. Markets work by product substitution. Products with greater renewable energy content will tend to remain stable or fall in price while, conversely, carbon intensive products will rise in price because of the rising carbon tax. Consumers will follow their price advantage by substituting sustainable products for fossil energy products. In fact, the greater the price differential, the faster consumers will switch from fossil fuel products to sustainable fuel and products (Kaufman et al. 2018, 5).

How the Market Works. The prices in a free market inform consumers of the cost of materials and labor used to produce goods and services they buy. If some production costs are left out of the sales price, such as collateral damage to the environment, then prices as signals do not work. For example, the environmental and health damage of mercury effluent from a battery factory are not counted in the price of batteries. Such byproducts as mercury causing social harm are called negative externalities. Such goods mispriced at a lower cost that excludes their true social cost can be regulated by taxes or regulations, but often are not. The greatest mispricing, or negative externality in history, was not counting the cost of emitting CO_2 into our atmosphere. When externalities exist, they should be taxed to warn people away from products that are not fully priced including the costs of their social harm.

How the Dividends Work. By paying a quarterly dividend to all adults, the NETP maximizes fairness and political viability (Wall Street Journal 2019). The economic and environmental rationale for the equal ownership by the people of environmental common resources, like the air and oceans, is presented in the Appendix on p. A-10.

First, those who pollute the atmosphere with more carbon than the average person will pay larger taxes for their excessive pollution. Yet, they will receive the same average dividend as everyone else. The dividend they receive will be less than the carbon taxes embedded in their consumption. Those who pollute the atmosphere less than the average person will pay less tax yet receive the same average dividend as everyone, thus gaining a cash benefit. In this way, the combination of tax on pollution with equal dividends increases the incentives for consumers to move away from fossil fuel or carbon taxed products. *Every dollar of carbon tax not paid on carbon products is a dollar of dividend gained.*

Second, although the poor spend less per person overall than higher income individuals, they spend a higher proportion of their smaller income on necessities such as fuel to heat their homes and for electricity and food. And because these products are carbon intensive, they are taxed more heavily than luxuries and services. Higher income individuals spend a smaller percentage of their income on necessities and a higher percentage on luxuries and services. Thus, the carbon tax alone turns out to be regressive, placing a relatively large percentage burden of financing the energy transition on the poor and working classes. This is shown in Figure 5 in the Appendix, page A-14. Therefore, dividends are essential to protect the poor and working-class consumers from paying for a problem caused more by others than themselves.

Technology is the Driver. Fortuitously, technology has brought the cost of producing solar and wind energy down by 80% over the last decades and made energy storage less expensive. (Jacobson et al. 2017, p.108-121; IRENA 2018) As a result, the tax plus declining renewable energy costs create profit opportunities for entrepreneurs and innovators. Innovation will become a driving force in transforming the energy foundation of our economy in ways we cannot visualize today.

Business investment will follow consumer demand. The increased demand for renewable energy and the products made from it will result in large investments by both existing and new entrepreneurs. This growth to meet the new demand will also create new jobs. Innovators will be the dynamic movers of the NETP. Business leaders, investors, engineers, accountants and research personnel have the knowledge and timely information as well as vision to develop the new sustainable energy products that consumers will demand.

The Free Market is Indispensable to the Energy Transition. A carbon tax is the most cost-effective way to attain necessary reductions in carbon emissions (Wall Street Journal 2019). This is why the carbon tax is the essential first step to jump start the energy transition. Regulations, such as those on methane and fuel economy standards are also essential and will build momentum as the transition develops. The key point is that the carbon tax impacts the entire industrial sector in one stroke.

VI. An Illustration of How the Tax and Dividend Work Together

Drawing from national income statistics and the research of Professors Anders Fremstad and Mark Paul, the following is an illustration of how the NETP would work, and especially how the tax and dividend offset each other.

Fremstad and Paul used a high tax rate of $230/metric ton to demonstrate how high the tax might have to go in several decades and to approximate a then current estimate of the social

cost of CO_2 emissions made by professor Nordhaus.[4] (Fremstad and Paul 2018) Tax revenues and dividends presented in the table below are about eight times higher than the NETP because the NETP's starting tax rate is $25/metric ton. Later, lower tax rate studies will be discussed. Nevertheless, the impacts of the tax on the income distribution will be accurate. This model is expanded on in Appendix A.

Assume there are three citizens:

a) Joan is poor, lives in urban Chicago, has no car, and income in the bottom 10% of adults.
b) Jose is middle class, lives in St. Louis, has income in the top 40%.
c) Emil is rich, lives in LA, has a yacht and three cars, and income in the top 10%.

Table 1 - Taxes and dividends at different income levels

Citizens	**Joan (poor)**	**Jose (middle)**	**Emil (rich)**
Tons of Carbon Emitted	4	10	21
Carbon Tax/year per adult	$866	$2,250	$4,738
Dividend/year to adults	$2,237	$2,237	$2,237
Net Benefit = Dividend - Tax = Cash Kept	$1,371	-$13	-$2,501
Net Benefit for Family of Three for a Year, 2 Adults	$2,742	-$26	-$5,002

Note: The above data are for the U.S. and are annual figures for an individual unless noted otherwise.

The NETP will have a much lower annual dividend than this illustration, as the carbon tax is much lower. Please see the Appendix, page A-16 for impacts of a $50/metric ton tax.

Emil spends 5.5 times as much on carbon taxes as does Joan, thus polluting the atmosphere 5.5 times as much as Joan. Emil, though receiving the same dividend, pays carbon taxes of $4,738, leaving him a net tax payment of $2,501. This shows the balancing of pollution and benefits: spend more on carbon energy and pay net taxes; pollute less and receive a cash bonus.

For Jose, the dividend offsets his carbon taxes so that he has neither a net benefit nor a tax cost. This would be true of the upper portions of the Middle Class. The dividend received would equal or exceed the carbon taxes paid for 70% of the population.

Joan, the lowest carbon emitter of the three, paying only $866 in carbon tax per year, keeps $1,371 of her dividend payment.

[4] See Appendix A page A-13 for definition and discussion.

VII. The Philosophy and Design of the Proposed Plan and Enhancements

The NETP is designed to gain public trust. There are two foundational themes that underlie and tie together both the plan itself and the four proposed enhancements, which are not included in other plans. First, keep the plan simple and universal with total transparency. The plan should be uncomplicated and without sector boundaries to diminish opportunities to cheat, challenge or skirt elements of the plan. Public trust depends on these building blocks, and public trust is essential. Second, nothing should distract from the primary objective of eliminating fossil fuel emissions soon and fast.

The Enhancements:

- **No Economic Sectors Exempted**. A national effort requires national participation. This requires trust that everyone else is also working and sacrificing for the same goal. People should know that everyone and every industry pays carbon taxes, every adult citizen receives equal dividends, and all sectors of the economy are included. Leaving any sector out of the plan, such as the military or agriculture, is a disservice to that sector.[5] Those businesses tied to existing technology will ultimately be left behind with old and high cost fossil fuel technology, no ability to sell their products in the new energy world and a missed opportunity for innovation. The carbon tax is needed to prod energy producers into the new energy economy and the new reality of climate change. Exempting the military and agriculture sectors means their carbon emissions will continue.

  Exemptions also result in a missed opportunity at improvement and innovation. As an example, DOD studies conclude that the Army's war-fighting ability is sorely jeopardized by a logistical tail of petrol supplies as described below. As General James Mattis declared during the drive to Baghdad in 2003, "Unleash us from the tether of fuel!"

[5] The United States Department of Defense (DOD) is one of the largest single consumers of energy in the world, using 4.6 billion gallons of fuel a year. (Lengyel 2007) The Citizens' Climate Lobby estimates that about one-half of the fuel purchases would be made outside of the US and hence would not be subject to the carbon tax. Agriculture contributes to 9.6% of U.S. emissions through agricultural soil management causing nitrous oxide emissions, methane emissions from livestock, manure decomposition, and carbon dioxide from combustion of gasoline and diesel fuel by farm equipment. (U.S. EPA 2019)

Petrol and water resupply convoy in Afghanistan. (Conca 2019)

"Multiple studies identify that air and ground delivery of liquid fuel comes at a significant cost in terms of lives and dollars. Approximately 18,700 casualties, or 52% of the approximately 36,000 total U.S. casualties over a nine-year period during Operation Iraqi Freedom and Operation Enduring Freedom occurred from hostile attacks during land transport missions, mainly associated with resupplying fuel and water. This alone is motivation enough to evaluate and deploy alternatives to petroleum-based fuel systems." (Conca 2019)

Agriculture as well can benefit from innovation and improvement driven by the transfer to a renewable energy economy and efforts to mitigate climate change. Agriculture stands to face devastating impacts from climate change. No doubt, agriculture will require special regulations and perhaps transitional financial assistance from the Farm Bill budget. However, exemption from the carbon tax, the authors contend, is not assistance that would benefit the sector in the long term. The carbon tax will ultimately benefit agriculture by creating the resilience to nimbly adapt, to innovate, and be better prepared for the future.

- **Adults Only**. The argument that dividends should only be paid to adults stems from the need to simplify the plan's administration. Payments to children can make a simple plan complex and contentious; experience with tax refunds and entitlements based on custody arrangements demonstrates this. Dividend recipients must be easily and correctly identified. Payments only to adults will mean larger individual dividend checks and simplified administration.

- **No Export Subsidies**. The argument against export subsidies is fourfold. First, the stagnant technology argument described above applied here also. Assured of an export subsidy equal to the carbon tax, exporters would be tempted to keep exporting and miss out on new technology. However, the new energy world will progress leaving the

exporters who continue old practices in a diminishing old technology market. Second and most important, by continuing to export as before, such firms would not reduce their emissions, and thus not contribute to the singular, national effort. Third, the complexities of ensuring that only bona fide exporters get the subsidy makes the plan complex and open to fraud. Finally, the US can hardly become a world climate leader if it encourages carbon emissions.

- **Midcourse Tax Adjustments**. As mentioned previously, the crucial management of the plan and its rates over time should be guided by a panel of climate scientists and economists. A Federal Reserve-like Climate Council should be created to make rate adjustments in terms of target fulfillment and not political tactics. Such an entity could be composed of scientists, economists and risk management experts. Midcourse rate adjustments will almost certainly be necessary to meet the emission reduction goal and could use the methodology presented by Kaufman et al. to make the rate adjustments.[6] (Kaufman et al. 2020) Given all the unknowns about climate change and its impacts, and the uncertainties about energy restructuring, the scheduled rates will likely have to be changed at some point to keep emission reductions on target. However, businesses and sectors need a degree of certainty that these adjustments, and the plan as a whole, will not be curtailed by political or special interests. Any such concern could lead to a sharp fall-off in investment in alternative energy.

VIII. Conclusion

The NETP provides a helpful benchmark by which to compare the current carbon tax and dividend plans under consideration by Congress. Description and analysis of the NETP has informed the development of a set of criteria to evaluate carbon dividend plans and has identified elements that are important to a successful approach and should be included in current plans. Carbon dividend plans should be evaluated against the following criteria to ensure success: 1. Start soon; 2. Effective in achieving emission goals; 3. Escalating and Adjustable Rate; 4. Fair through individual dividends; and 5. Tamper Proof. As well, it is the opinion of the authors that a carbon dividend plan should include the following elements to ensure a successful energy transition (as described in Section VII above): a) no economic sectors exempted, b) dividend payments only to adult citizens, c) no export subsidies, and d) mid-course rate adjustments made by an expert group outside of the political process. Based on analysis described herein and in the Appendix, the Deutch/Citizens' Climate Lobby Plan, the Baker-Schultz/Climate Leadership

[6] Kaufman et al. (2020) suggest a pragmatic approach to carbon pricing. First, it involves selecting a net zero carbon emissions target year, informed by the best available science and economics, and an emissions pathway adapted to a jurisdiction's circumstances. Carbon prices for the selected pathway can then be estimated using energy-economic models with a near-term focus to avoid uncertain long-term projections. These carbon prices can be combined with other policy measures (e.g. CAFE standards) and can be periodically updated based on new scientific knowledge and the evolving costs of mitigation technologies. The Climate Council could use such a near-term, iterative method in its adjustment responsibilities.

Council Plan and the NETP are bipartisan and well aligned to meet our country's climate exigency and reduce U.S. carbon emissions by 50% by 2030. It is recommended that these plans be further developed and combined with the proposal for a Global Climate Compact in PART TWO to accelerate policy action that transitions the economy and the world away from carbon-based energy to renewable alternatives.

The Appendix includes a comparison of the NETP with the other plans pending in Congress. The plans are also evaluated against the same five criteria and current research on carbon dividend and tax plans.

END NOTES – Part One

1. **A focus on Industrial Free markets** The proposal put forward is the indispensable mechanism to commence the transition of our economy from dependency on fossil fuels to a clean energy economy. As stated earlier, the dividend/tax approach cannot do the job by itself without assistance from rapid technological progress and other major policies and regulations. The carbon tax and dividend plan is a crucial component of a broader mosaic of responses to the climate crisis. This was emphasized in the 2018 IPCC report: "Policies reflecting a high price on emissions are necessary in models to achieve cost-effective 1.5°C pathways (high confidence)." (Rogelj et al. 2018) Energy Innovation estimates that carbon pricing will contribute at least a quarter of the needed solution to transition to a low-carbon future, more than any other single policy solution (Harvey, Orvis, and Rissman 2018).

   Finally, there are those who oppose using the free market as a major climate policy tool because they see capitalism as malicious and harmful to both the poor and the environment. This is especially the view of poor and vulnerable people who have had their air, water and crops contaminated by noxious wastes and chemicals. Understandably as victims, they conclude that all market capitalism is rapacious. However, government can take charge and oversee and regulate business to ensure that harm is not done to people or the environment. The free market is one of the great inventions of mankind. It has accomplished a great deal in bringing a good life to billions of people. Damaging externalities can be stopped. The compelling reason to use the free market is that there is no alternative.

2. The Resources for the Future Study by Goulder et al. is both comprehensive and measures progress over time. The study uses a general equilibrium analysis over time which calculates simultaneously price increases from the carbon tax and the demand response to these price changes, or, the extent of switching. The study supports the conclusions reached herein on both effectiveness and fairness.

   Resources for the Future's tax rate schedule is hard to compare with the NETP's as it goes from zero in 2017 to $40/metric ton in 2020 and then escalates slowly to $48/metric ton by

2035. This is an average tax of $40/metric ton for 2017 to 2035 compared to the three plans examined in Section II, Criterion 2, p. A-4 which average $55 and $65/metric ton for the decade of the 2020s. The Resources for the Future tax rate reduces emission by 30% by 2035 compared to the NETP which reduces emissions by 48%-52% by 2030. This lower reduction of emissions in the Resources for the Future study suggests that the considerably lower tax rate is not as effective as the higher NETP escalating rates. These studies have now been revised and made interactive.

On the Fairness Criterion, the Resources for the Future study confirms unequivocally that the carbon tax with 100% dividend creates tax progressivity and offsets the tax costs for the lower income deciles.

3. Carbon tax is regressive? The Office of Tax Analysis (OTA) in the Treasury in their report "Methodology for Analyzing a Carbon Tax" (Horowitz et al. 2017) concluded that the carbon tax incidence would be progressive, counter to what most studies had concluded. The Congressional Research Service in its report of March 26, 2019, "Attaching a Price to Greenhouse Gas Emissions with a Carbon Tax or Emissions Fee: Considerations and Potential Impacts" states that carbon tax studies come out with conflicting conclusions about the impact on the U.S. income distribution. Under the heading of "Household Impacts", page 16, the report states that if the wholesalers and intermediaries pass the tax "...forward to consumers (this) leads to a regressive outcome" because the consumers must pay the carbon tax. Alternatively, when the intermediaries absorb the tax and do not pass it forward but perhaps cut their labor costs or profits, then the tax is progressive because consumers do not pay the tax. Since it is generally accepted that tax costs are pushed forward to the consumer, one can assume that a carbon tax is regressive.

4. **Environmental justice** The poor and minority communities often bear the brunt of pollution. Transforming our energy base from carbon to sustainable energy sources will also remove many of the preponderant and harmful pollutants they are exposed to. If the energy transition were not being carried out to slow climate change, it would still be worth doing to improve Americans' health.

PART TWO – Placing a Global Price on Carbon - Formation of a Global Climate Compact

While support for a US climate action is increasing, the Paris Accord is clearly missing the mark. Almost five years later, emissions are still increasing. According to Stéphane Dion, a Canadian politician who attempted to introduce a carbon tax in Canada in 2008:[7]

> "*Governments and businesses are unlikely to realize their climate change goals if they have no definite assurance that their competitors will play by the same rules. To address this stalemate, we need an international agreement that gives them that assurance […]. We need to create a system whereby every decision-maker, public or private, is responsible for taking into account the true cost of global warming, and is secure in the knowledge that the competitors are doing the same*" (Dion 2015, 51).

Assuming the US acts expeditiously to enact a carbon tax and dividend plan along the lines discussed in PART ONE, the US effort will still be largely in vain if other countries do not join in. To meet the UN goals, all major countries must be on board to counter climate change. In short, it is vital for the US to have a two-part plan: reduce domestic emissions by half by 2030 and to near net zero by 2050 and help organize and energize an international effort for all countries to join in emissions reduction. Before presenting a design for a global plan, it is essential to understand why prior efforts failed. Then follows an assessment of the 'Climate Club' plan of Professor William Nordhaus of Yale University.

IX. The Failure of International Climate Action

None of the international agreements developed so far have been effective in reducing carbon emissions. The basic reason for this is that voluntary agreements have led to "free-riding". When there are global public goods (e.g. our climate) with global negative externalities but no binding agreements, then naturally some countries will accept the benefits and eschew the work of reduction. The solution is to impose penalties for free-riding so that the world can move from non-cooperation to cooperation.

a. Three decades of international efforts

There have been few instances of effective international cooperation to protect Earth's atmosphere worth noting. The Montreal Protocol was successful but other agreements have failed for reasons discussed below.

[7] Although Dion's attempt failed at the time, Canada implemented a nation-wide carbon tax in 2019, starting at C$20/ (tCO2e).

Montreal Protocol as a success case

The Montreal Protocol is a binding international agreement that entered into force in 1989 with the aim to reduce the production as well as the consumption of ozone-depleting chlorofluorocarbons (CFCs). All parties were required to phase out the manufacturing and use of these substances (O'Brien and Gowan 2012). It addressed the issue of non-compliance (i.e. free-rider problem) by applying trade restrictions. The agreement, ratified by 197 parties, has been a success. As newer, more efficient chemicals had already been developed, the industrial sector was willing to support the phasing out of CFCs.[8]

Kyoto Protocol

The Kyoto Protocol was the first major global treaty to limit climate change and starkly illustrated the free-riding problem. It entered into force in 2005 setting binding national targets for the reduction of carbon emissions linked to penalties for non-compliance. The Kyoto Protocol was ineffective as it failed to include all major emitters, and many felt it was unfair and pulled out.

Paris Agreement

The 2015 Paris Agreement represents a commitment by 195 nations to keep the increase of global average temperatures below 1.5°C to 2°C (Pihl 2020). Country commitments were based on *Nationally Determined Contributions (NDCs)*, which turned out to be far too small and unenforceable. It was effectively the death knell of the agreement when the US dropped out and countries failed to meet their commitments.

EU efforts towards carbon adjustment borders

The European Commission created the EU Emissions Trading System (EU ETS) to reduce greenhouse gas emissions through a "cap and trade" principle. It covers around 45% of the EU's greenhouse gas emissions, forming the largest carbon-pricing system in the world. After the carbon price was stuck in the single digits since 2010, the EU ETS' carbon price finally rose to around $27 as the EU reduced the number of permits in circulation.[9] Nevertheless, although emissions have always been below the caps, these are not ambitious. The cap system also means that emission reductions in one country are compensated by more emissions in other countries. A carbon floor price or better management of surpluses of carbon allowances is needed (Vailles and Berghmans 2020). As there is no global price on carbon, European companies concerned about carbon leakage are pushing for a Carbon Border Adjustment mechanism that imposes import fees to level the playing field. (*The Economist* 2020). A carbon tax would be less vulnerable to economic shocks and more compatible with additional, national policies to reduce carbon emissions.

[8] The co-author of Part one, Dr. Wuebbles, was a key scientist involved with the Montreal Protocol.
[9] 30% fewer allowances were auctioned in 2019 compared to 2018 (EFET 2020).

b. The missing global governance

International political relations have been shaped by the Westphalian model and its principles of national sovereignty (i.e. 'my country is in charge of its destiny'), (legal) equality of states and non-intervention into the international affairs of another. The implications are discussed below.

National Sovereignty – No Higher Authority

Each nation is free to make its own decisions about its affairs, without interference or coercion from other nations. A country cannot be forced by foreign nations into actions they reject, including actions to protect the global commons. Thus, all international climate agreements are voluntary.

Democratic Equality – Rights without Responsibilities

Each state is considered equal in international law, regardless of size, economic power or government competence, and all should be invited to join appropriate international agreements. In this vein, the General Assembly of the UN states that all countries desiring membership must be admitted as equal members without requisite responsibilities except paying their dues. All countries were expected to join the Kyoto Protocol. Most did, had no serious obligations, and the effort failed.

An agreement that grants the benefits of carbon reductions to all members without stipulating responsibilities, effective enforcement mechanisms or incentives will necessarily fail. Free-riding saps the motivation of other participants. Despite all the good will and hard work that went into the innumerable international climate conferences since 1992 and culminating in the 2015 Paris Accord, we are back to square one in 2020. This is not the fault of the negotiators, but of the environmental and government leaders who sent their negotiators into a conceptual trap of International Democracy and National Sovereignty. A growing number of authors suggests that an effective solution within the limits of international law could come through plurilateral climate governance.[10] (Grasso and Roberts 2013; Nordhaus 2017; Keohane, Petsonk, and Hanafi 2017)

[10] Agreements between a relatively small number of countries.

X. Global carbon pricing as proposed by William Nordhaus and others

For thirty years, effective action on international climate policy was stymied by the prevalent paradigm of 'national sovereignty' and 'democratic equality'. Political scientists had proposed only voluntary, non-enforceable ways forward. Then, in the May/June 2020 issue of Foreign Affairs, Professor Nordhaus of Yale University presented "The Climate Club" (Nordhaus 2020). Though he introduced the concept in 2015, no nation has promoted it. His way forward overcomes the sanctity of national sovereignty to create a collaborative sovereignty, which he calls the Climate Club. Since the world lacks an international authority to force countries to protect global commons such as our climate and marine fisheries, it is necessary for some countries to combine their sovereignties to create a supra-sovereignty to compel global action through market incentives. This is "the Club Model" of Professor Nordhaus.

The key obstacle to eliminating free-riding, according to Nordhaus, is identifying effective and viable penalties placed on non-participants, namely, trade sanctions. He proposes the creation of a "climate club" that combines domestic climate policy – either through carbon tax or a Cap and Trade system – with international trade policy. This overcomes the lack of compliance in prior international agreements by instituting penalties for noncompliance. Here the club is called a Compact to emphasize commitment to address a major common concern – catastrophic impacts from a rapidly changing climate. Members of the Compact must implement specified emission reductions in their countries and apply tariffs on **all** imports from non-Compact countries. Incentives are designed to induce all but the least developed countries to eventually join the Compact. The more countries that join, the greater the chances of climate success and the lower the burden on the initiating countries. For example, the UK, France, Germany, Japan, U.S., Canada and possibly India and China might form a compact, committing to sharply reduce carbon emissions. They choose a target carbon price and place a tariff of 5% to 10% on **all** imports from non-member countries. As more countries join the Compact, incentives to participate increase as nonmembers lose more exports, income and employment.

Nordhaus' suggestion of creating a climate club is appealing as it addresses the core design failure of previous approaches to climate change – the free-rider dilemma – by creating strong incentives for Compact countries to reduce carbon emissions within an international order where national decisions must be voluntary. It also addressed carbon leakage concerns, as explained by Stéphane Dion:

> "*Carbon pricing will not reach the desired level as long as individual countries fear that carbon price-setting within their respective jurisdictions will scare away businesses and investments, sending them off to countries where CO_2 emissions are cheaper or free of charge*." (Dion 2015)

In addition to eliminating free-riding and creating an effective framework for mitigating climate change, the coalition can also make investments in non-fossil fuel technologies more attractive

and lead to greater international recognition for participating countries (Keohane, Petsonk, and Hanafi 2017).

The renewable energy sector is growing rapidly and already creating many more jobs than the fossil-fuel sector. A recent study demonstrates that the total decarbonization of America's energy systems would create millions of well-paying jobs that will be highly distributed geographically and difficult to offshore (Griffith and Calisch 2020).[11] US leadership in the Climate Compact along with much greater government research in carbon-replacing technology will ensure the US remains competitive and a leader in technological innovation. As Nordhaus emphasizes, US government regulations, research, investments, and innovation are vital to decarbonizing our economy. A regional or global carbon price will give polluters an economic incentive to reduce emissions and spur the needed behavioral change and technological innovations to further reduce emissions and even to lead to substantial negative emissions (Nordhaus 2017; Keohane, Petsonk, and Hanafi 2017). Pricing carbon correctly is the fundamental lynch pin without which other efforts will not succeed.

XI. Creating the Climate Compact

a. The Club as a Compact

Club theory is the name used in economic theory to understand key dynamics of a group where members can collectively produce and/or consume a club good. Nordhaus defines a club as "a voluntary group deriving mutual benefits from sharing the costs of producing an activity that has public-good characteristics" (Nordhaus 2015). A successful club is sufficiently beneficial to members that they are willing to pay dues and adhere to club rules to gain the benefits of membership. The term "compact" will be used to emphasize that this is not a club in the ordinary sense. The purpose of the Climate Compact is to bring about the global energy transition from fossil to non-fossil energy. The members of the compact use the price of carbon and a tariff penalty to accomplish this. As Nordhaus demonstrates in his research and modeling, without penalties countries free-ride and let other countries do the work for them. An international task is essential for the world and cannot be achieved without global cooperation.

b. Linking US Domestic Climate and Foreign Policy

Because US climate policy will be ineffective if other major economies do not also reduce their emissions, the US could use the potential adoption of a tax and dividend policy as leverage to encourage other countries to join the Compact (Colgan 2020). Indeed, the US could initially adopt a modest carbon tax and offer to increase it if other countries join the Compact. For example, the US could offer to double its tax rate from, say $25 to $50 if other countries would join the Compact at the higher rate. This would be advantageous to the US and other countries

[11] Decarbonization in the U.S by 2035 could produce around 25 million peak new jobs, with about 5 million sustained new jobs in addition to existing energy jobs (Griffith and Calisch 2020).

joining since the larger the Compact and the higher the tax rate, the less the climate disruption. If the US does not act fast it may be compelled to anyway, as jurisdictions around the world are approving and implementing various carbon pricing mechanisms. The European Union is in advanced stages of enacting a border carbon adjustment on imports from countries that do not have an equivalent carbon price. Such a measure would leave US companies at a costly disadvantage. The founding chairman of the Atlantic Council's Global Energy Center recently stated this "could become the mother of all trade issues if not handled right" (Worland 2020). Beyond economic reasons, there are also geopolitical and national security rationales for the US to lead efforts on climate change mitigation (Baker, Shultz, and Halstead 2020). China and India are investing heavily in renewable energy technology, and China also strives to dominate the coming energy storage and delivery transformation. According to Baker et al. (2020), "the winner of the emerging clean energy race will determine the economic and geopolitical balance of power for decades to come". The window of opportunity for the US to be the leader rather than left on the bench is narrowing.

c. Forming the Climate Compact

To form the Climate Compact, countries come together to build an international coalition around the shared objective of reducing carbon emissions to meet the UN reduction targets. The membership requirements are as follows:

- **Pricing carbon –** The first requirement for members, effectively their dues, is to set the same effective carbon tax on their country's consumption of carbon (CO2) as other Compact members. The tax rate would probably be between $25 and $50 per metric ton of CO2 (see Part One), increasing by $5 to $10/metric ton yearly. This would increase the price of carbon and lead to a decrease in emissions in Climate Compact countries. The tax on gasoline in the first year would be between 25 to 50 cents per gallon. It is generally agreed that carbon taxes in this range will meet the UN target if sufficient countries participate. The benefits to Compact countries of increased mitigation, as well as the follow-on investment and innovation, must be weighed against the abatement costs of shifting resources away from carbon intensive to noncarbon intensive products, and the costs of administering the tax. Higher carbon taxes create larger economic adjustments and abatement costs and fewer new members joining, but greater emissions reductions by participants, while lower carbon taxes bring less mitigation and more members.

- **Tariffs on Non-Members** – When the Compact is formed, a tariff penalty rate – probably between 3% to 5 % based on the model results – on all goods entering their countries from non-member countries will encourage countries to join. As recommended by Nordhaus, this tariff should be uniform across all imports from non-member countries. The tariff performs two functions: it dissuades member countries from leaving the coalition, which would result in tariffs on their exports, and it encourages new

countries to join to avoid having their exports penalized. Setting the tax rate is a critical question for the Climate Compact as discussed further in Section XII.

Extensive modeling (Sections XI and XII) shows that these two requirements of carbon pricing and penalty tariffs can bring participation by sufficient countries to achieve the emission goals of 1.5-2°C, but only if this is combined with regulations and government investment in Research and Development to support decarbonizing technological development at a rapid rate (Nordhaus 2019). Other factors that determine the success of the Climate Compact are:

- **Size of coalition –** To meet reduction targets, the coalition must grow and be seen as legitimate and trusted by other countries. The starting coalition must consist of a group of countries that are sufficient in size, economic strength, and global leadership to convince countries that the Compact will endure and countries rejecting it will regret their choice. The larger the coalition the more invincible it becomes and the greater the carbon reductions achieved in a positive feedback loop.

- **Stability:** The price of carbon must be set high enough to reduce the required emissions, but not so high that large abatement costs discourage membership.

d. Key elements for the Compact's success

The Compact's carbon tax will attract countries determined to reduce emissions. They will be motivated to increase the size of the coalition by setting a sufficiently high carbon tax and tariff rate to induce new countries to join and existing members not to leave. A number of countries around the world have already been making efforts to reduce emissions, with or without a carbon tax, and will see this as an opportunity to build on and magnify their efforts and become even more competitive.

Strong starting group Success of the coalition depends crucially on the strength of the originating members and their ability to attract new members. Gaining "critical mass" was key to the success of the GATT, the predecessor of the WTO, by exerting further market pull to broaden membership (Keohane, Petsonk, and Hanafi 2017). As climate change causes increased harm it may become easier to expand the Compact's membership, although joining later will mean transitioning from no carbon tax to an already increased tax rate and thus a more difficult transition.

Permanence Success depends upon peoples' and countries' perception of the Compact. If there is a perception that a country's efforts are not being matched by others and they are losing competitive advantage, motivation to accelerate decarbonization could rapidly diminish (Walker and Ostrom 2005). As the competitiveness of firms is preserved through the tariff penalty, they will not move production out of the country (*The Economist* 2020). Members must have confidence that the Compact will endure rather than be another vanishing bundle of words and promises.

Impact of the Covid-19 Recession Economic recovery policy could either help or hinder climate pricing policy. Hindering: Post-recovery, countries may shy away from deficit financing given their recent debt splurge to climb out of recession and may devote what investments they make to short term, shovel-ready projects to spur employment. Helping: Countries might realize the future will be controlled by the Compact and join it, and they may realize that they need new technology to face the future and pass the carbon tax to ensure this. In addition, the lessons learned during the pandemic from lack of cooperation among countries and mismanagement by incompetent governments might make the Compact a focus of international support and expertise.

The Climate Compact – By Whose Authority?

Global authority would be needed for countries to place tariff penalties on countries that do not join the Compact and to prevent tariff retaliation by nonmembers. There are several responses to this crucial question.

- There is no international authority in our world of national sovereignty. Yet the exceptional circumstances of the global climate threat justify exceptional measures of international action. With climatic disasters multiplying around the world, the best solution would be for the UN and WTO to authorize a Climate Compact with requisite authority and legitimacy. Leadership by the US would help in this quest. Both Stéphane Dion and Nordhaus argue that negotiations for a global price on carbon will not succeed without US leadership (Dion 2015).
- A number of WTO member countries have already expressed interest in action to reform fossil-fuel subsidies and other measures addressing climate change (Birkbeck and Denton 2020). If a large number of WTO members endorse climate action, then it makes sense for the WTO to authorize the Compact. The Climate Compact could also develop as a separate institution within the WTO, focused on global climate mitigation (Keohane, Petsonk, and Hanafi 2017). There is precedent for using trade sanctions within an international environmental agreement, as was the case in the 1988 Montreal Protocol.
- An entity with a strong global governance structure, similar in institutional design to the International Civil Aviation Organization (ICAO), could adjust the global carbon price over time, based on new information, to ensure emission reduction targets are met.
- Maybe most important, environmental justice requires that those who create negative externalities should be penalized for harming others, regardless of national borders. Professor Cecil Pigou argued one hundred years ago the necessity of what economists call ‘internalizing the externalities’ by taxing firms the dollar amount of the harm they inflict on nature and society through negative externalities. This principle of fairness also applies to nations (Pigou 1920). Further discussion is on page A-10.

If global authority from the UN and WTO cannot be obtained, then a less desirable solution would be for the Compact countries themselves to impose penalty tariffs on noncarbon reducing countries, at the risk of starting a trade war which could get out of hand.

XII. Promising results for international collaboration on carbon reductions

a. Overview of the Climate Club Model

The methods and results of Nordhaus (2015) are summarized below and presented in more detail in Appendix B.

Nordhaus used the C-DICE international economic model in which he inserted economic and climate data into his idealization of country benefits and costs. He tested using economic data from fifteen countries and regions of the world. He calculated the value of the benefits and the quantity of reduced emissions using his estimate of the world marginal social cost of carbon to estimation mitigation costs (abatement costs) as well as climate costs and tariff costs.

He ran the model hundreds of times with different starting prices for carbon, tariffs and country configurations. As shown in Appendix B, the modeling validated that with various incentives and penalties the countries would almost always come to a stable membership of Compact countries under various combinations of target carbon prices and tariffs. Most important, these stable equilibria would also achieve emissions reductions close to the UN targets.

b. Results of the model testing

The model simulations provided the following main results (Nordhaus 2015):

Stability of Membership: Nordhaus analyzed the effectiveness of Climate Clubs by examining 44 different *regimes* (combinations of 4 target carbon prices and 11 tariff rates). Somewhat surprisingly, the majority of computer runs – 36 of the 44 regimes tested – resulted in a stable membership. All countries found situations where they were comfortable, neither wanting to leave or join.

Sanctions: Tariffs proved to be invaluable in attracting members to the Compact and stabilizing membership.

Higher Global Carbon Prices: Tariffs also made higher global carbon prices possible by pushing countries into the Compact. Furthermore, by facilitating higher carbon prices, the tariffs caused significantly greater carbon reduction, helping keep climate change under the target of $2^{o}C$.

Fair International Trade: Tariffs rectified the competitive advantage given to free riding countries by offsetting their cheaper carbon energy prices with tariffs placed on their exports. Trade is made fair. Tariff retaliation by non-compact members would not be allowed by international trade law. This will require action by the UN or WTO.

Income Growth: The model showed that creation of the Compact invigorated economic growth, increasing GDP sharply compared to the scenario where there was no Compact or sanctions. This conclusion of enhanced economic growth is corroborated by our Employment Addendum.

Best Performance Regimes: The model demonstrated that stability of membership and the best performance were achieved with regimes of a $50 carbon price and 4% tariff and a $25 price and 3% tariff.

c. Will the Climate Compact do the Job?

Prior agreements have failed. Since the Rio Conference in 1992, public awareness about climate change has grown but not effective global action. Therefore 'bottom-up' international efforts have been weak. On the other hand, enormous efforts were expended to create 'top down' global climate policy and they have all failed. Certainly, something was amiss. There are several reasons to believe that this proposed Climate Compact could accomplish the task assigned so long as the essential technological research and innovation is financed, and the needed regulations and carbon sequestration are carried out:

- **There is no coercion in the Compact plan**. Countries join and act following only their own perceived self-interests given the tariff penalty rules.

- **Free riding is eliminated**. Previous agreements created an unfair contract. Those who strived for significant emission reductions were increasingly penalized through unfair trade practices by those who did not contribute, yet who benefited from the reductions made by those that did. The Kyoto and Paris Agreements created unfair situations. This underlines the reasons for prior instability of membership.

- There is a **wealth of experience and theory** addressing how and why organizations stick together and fall apart. This comes from two sources: economic and game theory that analyze analogous situations in cartels and monopolies, and club theory and computer modeling of idealized organizations with assumed costs and benefits to see how they behave following their self-interest. Professor Nordhaus used both sources to test and validate his Club proposal.

- **Stability and Effectiveness.** As the model test results show, the proposed plan should create a stable membership in the Compact and achieve a sufficiently high carbon tax rate to decrease emissions to meet the UN target dates.

XIII. Conclusion

The evidence is clear that climate objectives that could not be achieved under prior voluntary agreements have a reasonable chance to succeed under a Climate Compact. The Compact and tariff overcome free riding and membership instability. High global carbon prices accelerate the adoption of fossil fuel substitutes. Tariff penalties on countries who continue to use fossil fuels are penalized, thereby creating incentives for them to join the global climate endeavor.

The results of the model built by Professor Nordhaus are striking; actions are voluntary, but countries eliminate free riding, and their behavior validates both historical experience and the club theory of how to organize international cooperation to reduce emissions. This analysis confirms the findings of the NETP in Part ONE and demonstrates that even carbon prices of $25 and $50 with a modest tariff push are sufficient to create a stable and large coalition of countries to fight climate change.

Nevertheless, it is one thing to show that climate agreements with penalties will work, but another to attain global authority and legitimacy for a Climate Compact to set the world price for carbon and tariff penalty rates. The answer: Those who are willing to step forward and do the heavy lifting of reducing carbon emissions must set the rules to save our planetary homeland. The United States is best placed to initiate the Climate Compact and lead the technological advancements needed to fight climate change.

END NOTES – Part Two

1. Carbon Tax and Dividend or Cap and Trade?

Nordhaus leaves it up to countries to choose between cap and trade and a carbon tax. We believe a carbon tax is more effective to ensuring that carbon is priced adequately and predictably, thereby sending a clear message to all markets to decarbonize. It would also enable greater transparency and accountability between member countries. As explained in the NETP, a carbon tax is relatively easy to create and administer. This is generally not the case with a Cap and Trade Program. While a Cap could create the target price required by the Compact, Europe learned that negotiating caps for multiple industries low enough to achieve an effective carbon price is difficult for advanced countries and nigh impossible for weak political systems. A sophisticated and independent judicial system is also a requisite for Cap and Trade. Additionally, a carbon tax produces revenue that can support vulnerable populations efficiently through dividends, which is perhaps especially important in developing countries. Ultimately, each member country would be able to choose the carbon pricing mechanism that best addresses its needs as long as it

commits to an equivalent carbon price floor. Member countries may choose to distribute domestic tax revenue entirely through dividends or via support to other government programs or a mix of the two.

2. Across the Board Tariff or Border Carbon Adjustment

Most carbon tax plans call for a border carbon adjustment tax or tariff on all carbon-containing imports from countries that do not have a domestic carbon tax equal to the home country carbon tax. Supporters argue the fairness of this approach since the low carbon price of the exporting country is raised to that of the importing country. In the global plan proposed here, the objectives are not so much fairness as rightness and feasibility. It is simple to understand, leaving as little room as possible for 'under the table' operations. The border adjustment method requires all countries to both determine carbon content for a plethora of products and services and validate accuracy, and then pay the right tariff amount. This would be highly burdensome, complex and vulnerable to corrupt practices. Yet, as stated by Ernie Moritz, former US energy secretary and head of the Energy Futures Initiative, without global carbon pricing something like border adjustments will be inevitable (Worland 2020). An across the board set tariff on all imports from non-Compact members is shown by Nordhaus to do the job at low cost. Ironically, President Trump's widespread use of tariffs have upended trade norms and paved the way for either a border carbon tax or tariffs for countries that do not join the Climate Compact (Worland 2020; Harrell 2020).

3. Tariff Penalties on Developing Countries

Upholding the maxim of no exceptions will support blocking international corporations from moving to cheaper energy countries (called carbon leakage). We acknowledge that tariff penalties can represent an unfair burden on developing countries that have contributed much less to the current climate crisis and transition assistance could be integrated into the Climate Compact. However, it is beyond the scope of this analysis to examine and propose such measures.

4. International Abatement Fund

Many poorer countries would have difficulty funding and administering a carbon tax. Thus, it would be useful in the process of negotiating the Climate Compact to create an 'International Abatement Fund' that is financed by either Compact members or from country grants. It would be prudential to require the receiving countries to themselves apportion the funds among recipient countries and possibly to oversee use of the funds.

5. An inclusive global energy transition

The Compact is more likely to succeed if the starting group includes major economies. However, it should not lead to increased disparities between developed and developing nations. Stéphane Dion proposes that developed countries set aside part of their carbon pricing revenue to help developing countries develop climate mitigation and adaptation policies (Dion 2015). Joseph

Stiglitz and Nicholas Stern similarly argues for global coordination on climate change mitigation that includes a "burden-sharing mechanism involving rich and poor countries to enhance this reciprocity and enable countries to increase their domestic carbon prices" (Stiglitz and Stern 2017). Turning fossil fuel reserves and investments into stranded assets has implications for countries' development and concerted global action can help the transition – or even leapfrogging – to renewable technologies and investments (Bos and Gupta 2019).

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Appendix A - Analysis of the National Energy Transition Plan: Comparisons of National Carbon Dividend and Tax Plans

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The proposed National Energy Transition Plan (NETP) is comparable to both the Energy Innovation and Carbon Dividend Act, HR 763 (herein referred to as the Deutch Plan), which is supported by the Citizens' Climate Lobby (CCL), and the Climate Leadership Council Plan (Baker/Schultz Plan). Both have similar carbon tax rates and 100% dividend distributions as does the NETP. These three plans[12], because they are similar, will be compared to the other plans which are described later. The Appendix explores the following: a) comparison of these three plans with other contending plans as of early 2019 and with research studies, and b) examination of the proposed plans by the five criteria listed below to see which plans offer the best opportunity for the U.S. to make a rapid transition to renewable energy.

Five criteria for an Effective Energy Transition Plan:

- Start Soon
- Effective in Achieving Set Emissions Goals
- Escalating and Adjustable Rate
- Fair
- Tamper Proof

Overall Goal: To propose a plan that will fulfill the UN objective of reducing carbon emissions 50% below their 2005 level by 2030. The full energy transition requires reducing fossil fuel energy to near zero by 2050. Climate scientists are in accord that this goal cannot be met without such an energy transition, and that further steps are indispensable as well (though not covered by a tax and dividend plan): rapid technological development, sequestering massive amounts of CO_2 in land and forest through soil management, stopping deforestation and commencing major reforestation, and starting the difficult process of withdrawing CO_2 directly from the atmosphere.

I. Key Elements of Plans

The following is an overview of the key elements of the plans under consideration in this analysis.

[12] There were four plans when this analysis was carried out. The CCL had a separate plan which they now melded into the Deutch plan.

NETP –Tax rate starts at $25/metric ton of CO_2 equivalent and increases $10/metric ton per year reaching $125/metric ton by 2030. These rates are projected to decrease emissions 50% by 2030. No industry sectors are exempted. All carbon tax revenue is distributed by quarterly equal dividends to adult citizens. Rate adjustments in the future are determined by a quasi-governmental body like the Federal Reserve. While the rising tax rate gives a certain level of certainty to consumers, businesses and investors, periodic assessments are necessary to adjust the price based on a) how well the emissions decline in response to the escalating carbon tax, and b) new information on the Social Cost of Carbon. A quarterly dividend prepayment would be made to citizens before the tax commences. Plan is designed to be bipartisan.

Deutch Plan – Rate starts at $15/metric ton, increases $10/metric ton per year, reaching $115/metric ton by 2030, adjusted for inflation. Exempts agriculture and the military. 100% of dividends paid with children set at one-half share. Plan is bipartisan.
Full plan available at: https://www.govtrack.us/congress/bills/116/hr763

Citizens' Climate Lobby (CCL) – same as the Deutch Plan.

Climate Leadership Council (Baker/Schultz plan) –Rate starts at $40/metric ton, with small yearly increases to $50/metric ton. The plan is bipartisan.
Full plan available at: https://www.clcouncil.org/our-plan/

Whitehouse Bill (2018): Starts at $50/metric ton, increasing to $60/metric ton in 2030. 75% of tax revenues used to reduce federal payroll taxes and 25% goes to the poor to offset price increases caused by the carbon tax.
Full plan available at: https://www.govtrack.us/congress/bills/115/s2368/text

Curbelo Bill – Rate is $24/metric ton with no yearly increases. 75% of tax revenues replace the federal gasoline tax. 25% of revenue used to offset increased energy prices for the poor and working classes. Full plan available at: https://www.congress.gov/bill/115th-congress/house-bill/6463

Canadian Plan Started in April of 2019. Rate starts at $20/metric ton, rises rapidly, capped at $50/metric ton in 2022. 100% of tax revenue paid as rebates to citizens.
Full plan available at: https://citizensclimatelobby.org/canada-adopts-carbon-fee-and-dividend-to-rein-in-climatechange/

The following table compares the key elements and projections of the NETP Plan with the other plans outlined above, as of May 2019. Note that the rates of the Deutch Plan, CCL, and Baker/Schultz plans are similar to the rates of the NETP.

Table 2 - Summary Comparison of Carbon Dividend and Tax Plans – Rates, Yearly Increase in Rates, CO2 Reductions by 2030 and Uses of Tax Revenue

Plan	Starting Rate/metric ton in 2020	Yearly Rate increases/metric ton	Tax rate in 2030/metric ton	2030 CO_2 % decline below 2015 level	Dividend Used For:
NETP	$25	$10 or $15	$125	50%	100% to adult citizens
Deutch Plan	$15	$10	$115	50%	100% to citizens + child ½
CCL - similar to Deutch Plan	$15 in 2020	--	$115	50%	100% dividends to citizen
Baker /Schultz Plan (CLC)	$40 in 2021	$50 in 2030	$50	n/a	100% citizens & child ½
Whitehouse	$50	$60 in 2030	$60	35%	Decrease payroll taxes + 25% poor
Curbelo Bill	$24 approx.	--	$22	25%	Repeal of US gasoline excise tax & 25% to poor
Canada Plan starts in April 2019	$20	$10 until 2022	$50; capped in 2022	30%	90% back to citizens

The NETP, Deutch, CLC**,** and CCL plans have tax rates that are approximately the same both for starting rate and yearly rate increases. The NETP, Deutch and CCL plans increase rapidly. By 2023 the rates would be Deutch and CCL at $45/metric ton and NETP at $55/metric ton. Thus, in a very short time the rates of these four plans would be at the $50/metric ton rate used in Figure 3a and 3b on page A-6.

II. Analysis of the Six Plans by the Five Criteria

The following analysis compares the plans by the five criteria identified as important elements of a successful energy transition plan. If a plan is not referenced under a Criterion, it was deemed to have not met the criterion or to have met it negligibly.

a. Criterion One: Start Soon

Highlights - No plan abhorrent to a major political faction in the US will pass Congress. Thus, the NETP, Deutch, CCL and CLC Plans are most likely to "start soon" because they should find favor among climate activists across the political spectrum[13]**.**

Both the United Nations IPCC *Special Report: Global Warming to 1.5˚C* and the *Fourth National Climate Assessment* state that action to mitigate climate change must start within a few years. But there will be no "start soon" without broad political acceptability. The NETP, Citizens

[13] In the May 2019 version of the Appendix the CLC bill did not meet the criteria, but removal of the exemption for tort liability, brings the CLC bill in accord with these criteria.

Climate Lobby (CCL)/Deutch Plan and Climate Leadership Council (CLC) plan gain very high marks for being politically acceptable. Conservatives should be attracted to the free market approach that does not require an expansion of government. Independents will be attracted by the serious, pragmatic and transparent qualities of these three plans. Liberals and progressives will appreciate the assistance to the poor and working classes and the aggressive approach to acting on climate change.

Summary: NETP, Deutch and CLC are the plans that are most likely to start soon.

b. Criterion Two: Effective in Achieving Set Emissions Goals

Highlights - Studies show that moderate tax rates with yearly rate increases are the driving force that will work to reduce carbon emissions. Using current research, this section demonstrates that the NETP, Deutch and CLC have the required tax rates that are the most likely to meet the 50% reduction goal.

Summary of research and analysis Tables and Figures:

Table 3: Both the $50 and $73 per metric ton rates come close to the goal at 39% and 41%; p.A-5
Figure 2: Shows sharply rising rates for Deutch Plan, which are similar for the NETP. The CCL plans, whose rate trajectories track the Deutch, increases more slowly; p. A-6
Figure 3a and 3b: $14 rate reduces emissions by 27% by 2030; $50 rate reduces these 39 to 44% by 2030; p. A-6
Figure 4: Depicts emissions reductions for four plans; p. A-7
Table 4: Describes regulations maintained and removed by the various plans; p. A-9

Rates and Increase per year: The combined effect of a rising tax placed on carbon-based fuels coupled with declining costs of renewable fuels will make the latter increasingly attractive to consumers. (Turner and Mathur 2018)

Methodology Used: Two different tools of analysis are used to a) estimate the extent of CO_2 contained in products (requires input-output analysis of the industrial economy which maps inputs such as carbon to consumer products), and b) estimate the price effect, that is, how much consumers will switch to sustainable fuels as the price of fossil fuels rises.
Economists use 'elasticity' to measure the quantity percentage response of supply or demand to a given percentage change in price. Here the price change is the increase in the tax rates. The four steps of analysis will demonstrate that the similar-rate Deutch/NETP/CLC plans are the most likely to meet the UN target of 50% reduction by 2030. (IPCC 2018b)

STEP ONE: The Treasury and the Congressional Budget Office: These studies in 2016 and 2017 tested two tax rates starting at $25/metric ton and $49/metric ton increasing 2% per year in real terms. (Horowitz et al. 2017; Congressional Budget Office 2016) They demonstrated that

relatively low starting rates rising over future years are effective in raising tax revenue and reducing emissions.

STEP TWO: A July 2018 study by Colombia University/SIPA tested three tax rates for ten years which are summarized in Table 2 below. This study demonstrates that tax rates within a range of $50/metric ton to $73/metric ton can reduce emissions significantly by 2030 if started in 2020. (Bordoff and Larsen 2018, p.14)

Table 3 - Comparison of Three Tax Rate Scenarios over Twenty Years

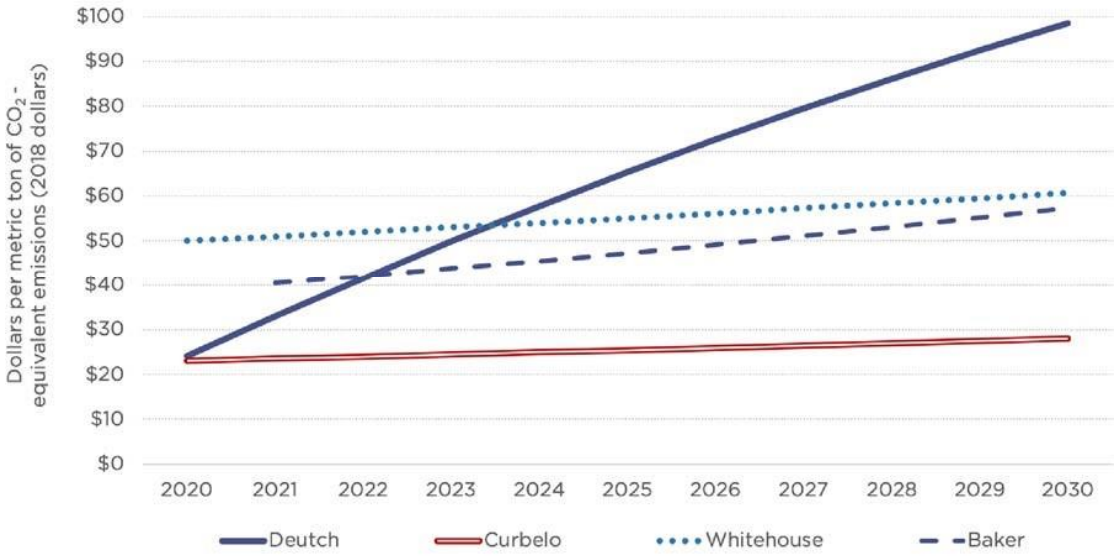
Three tax rates starting in 2020	Rate in 2030; yearly rate increase	Tax Revenue Raised Per Year	% Decrease from 2005 to 2030 of Emissions
$14/metric ton	$19, small yearly increases	$60 billion	27%
$50/metric ton	$61, small yearly increases	$180 billion	39%
$73/metric ton	$85, small yearly increases	$250 billion	41%
Current policy scenario			19%

Source: (Kaufman and Gordon 2018)

Figure 2 below shows that only the Deutch Plan, of those included, has rapidly rising rates over the years. The NETP, not shown in Figure 2, also has rising rates like those of the Deutch Plan. The NETP rates begin in 2020 at $25 and rise $10 each year to reach $125 in year 2030. Since the rates of these three plans are similar, they will be treated as one plan here for analysis.

Figure 3a indicates that a $50/metric ton rate is estimated to reduce emissions from 39% to 46%. This makes it clear that the Deutch/NETP/CLC(Baker) plans with an average rate over the ten years from $50/metric ton to $60/metric ton and yearly rising rates will likely meet the 50% reduction goal.

Figure 2 - Starting Rates for Four Plans and Schedule of Annual Rate Increases



Source: (Kaufman, Nov 2018, p.5) (The Baker Plan is the CLC plan)

STEP THREE The following studies indicate that the Deutch/NETP//CLC plans do a better job meeting the 50% reduction goal of this criterion than the other plans being considered. Figures 3a and 3b below show the results from the University of Colombia/SIPA study, *The Energy, Economics, and Emission Impacts of a Federal US Carbon Tax,* of the emissions impact of three starting rates: $14, $50, and $73 with no yearly rate increases.

Figure 3a - Emission Reductions from 2005 to 2030 for 3 Starting Rates w/ Innovation Estimate

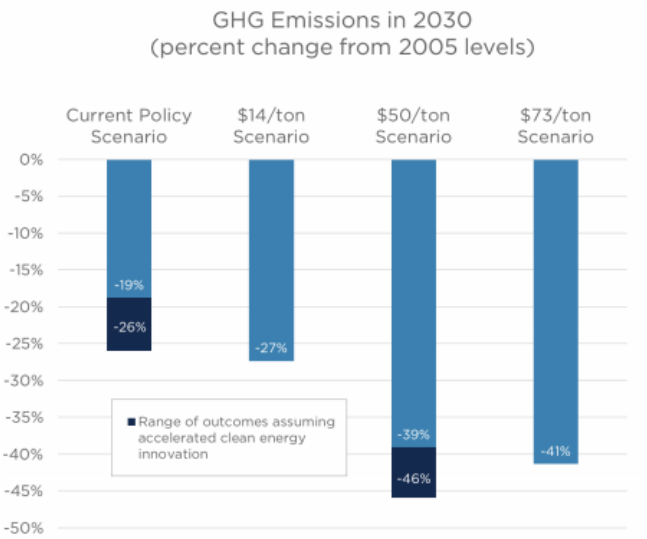
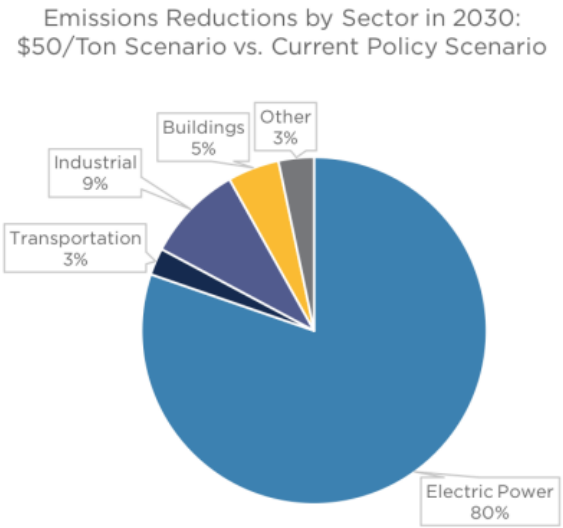


Figure 3b – Reduction by Sector

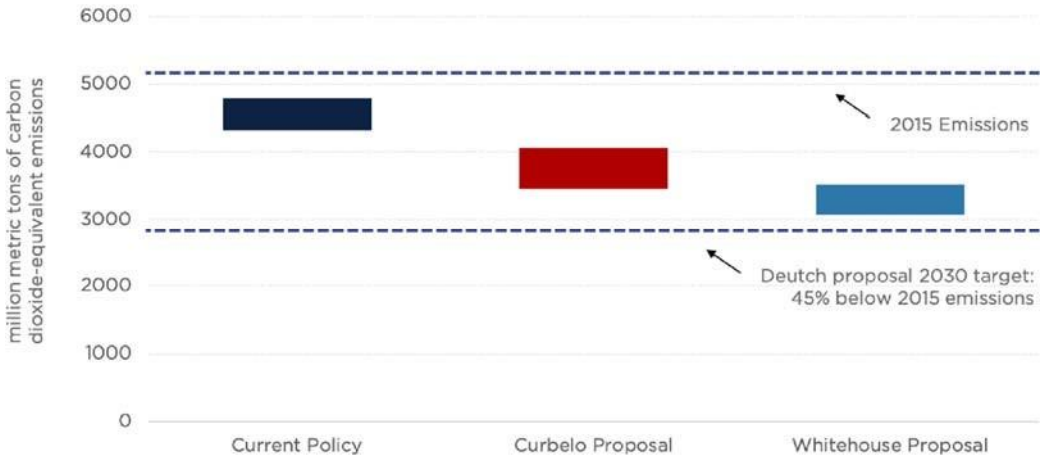


Source: (Kaufman and Gordon 2018, p.5)

The schedule of rates shown in Figure 2 indicates that the starting rates of the Whitehouse plan is $50/metric ton while the Curbelo and Deutch plans start at about $25. However, the Deutch/NETP/CCL plan increases considerably each year. Even by 2023 the three are already at $45 and $55/metric ton and continue to increase to $115 and $125 by the end of the decade. The other three plans, Curbelo, Whitehouse and Baker/Schultz increase very little.

The emission reductions by 2030 are impressive: the $50 tax reduces emissions by 39% - 46% by 2030. The next study in Figure 4 shows a reduction of around 52%. These reduction percentages bracket the goal of 50%. Even the lower $14/metric ton rate brings a reduction of 27%. While this is not enough for effective climate change mitigation, it shows that sufficient replacement renewable energy is expected to be available to meet the increased demand. This demonstrates once again that rates in the range of $15/metric ton to $50/metric ton can bring major emissions reductions, especially with guaranteed yearly increases in rates. Figure 3b displays the conclusion that 80% of the emissions reductions in the 2020s will come from conversion of fossil fuel sources in the power sector.

Figure 4 - Emissions Reduction by 2030 for Current Obama Policy, Deutch, Curbelo and Whitehouse Plans



Source: (Kaufman, November 2018, p. 9)

The results of the most recent Columbia University study in November 2018 are presented in Figure 4. Noah Kaufman states in reference to Figure 4, "For each scenario, the higher ends of the emissions ranges reflect assumptions of relatively rapid progress in clean energy technologies, while the lower ends of the ranges reflect slower progress." (Kaufman, November 2018, p.12)

The target of a 50% reduction from 5,200 million metric tons (mmt) would be about 2,600 mmt. The prior Administration's climate policy, after recent changes by the current Administration, reduces emissions minimally to 4,800 mmt by 2030, a decrease of 8%. Compared to the target of a 50% reduction to 2,600 mmt, Curbelo reduces to 4,000 mmt or a decrease of 23%, Whitehouse to 3,600 mmt, down by 31%, while NETP, and Deutch to 2,500 mmt, a 52% reduction. (NETP is

not shown on Figure 4). No estimate is given for the CLC here, but since its rate does not rise above $50 per metric ton the reduction could be estimated at less than that of the Deutch plan.

See Endnote 2 for further corroboration for the tax rates proposed by the NETP.

STEP FOUR - Thus far, emphasis has been placed on the extent of switching on the demand side. Next, it is important to examine the supply side. Will new supplies of renewable energy products be produced or imported fast enough to keep up with the switching of demand? If supplies of renewable energy products are inadequate, there will be inflation in this sector which will decrease switching.

The studies above show that even low tax rates cause considerable demand switching. This fact that a small tax rise causes an exodus of demand from fossil fuels makes clear that substantial alternative energy is expected to become available. If not, the flow of demand so far would have caused a hearty price increases of alternative energy products in the studies. The substitutes for fossil fuel are already here in solar and wind energy coupled with advancing storage technology, and all with falling prices. This power sector energy conversion will constitute about 80% of the replacement sustainable energy and hence emissions reductions during the 2020s. (Jacobson et al. 2017, p.108-121)

In conclusion, it appears that from both the demand and supply perspectives, one half of the energy transition can be carried out by 2030 so long as key methane and CAFE (Corporate Average Fuel Economy) regulations are enforced along with substantial government-financed and assisted research and development of carbon-replacing technology.

The final half of the reduction from 2030 to 2050 will deal with transportation, steel, cement, agriculture, glass, and aviation industries. This last half will be more difficult to achieve than the first half, but according to Lord Turner and other scientists it is possible if a carbon tax plan and research is commenced now. (Turner and Mathur 2018)

Underestimation of Emission Reductions. For three reasons, the analysis used in the studies to measure emission declines is likely to under-estimate reduction. First, current projections call for continuing declines in the cost of renewable energy for the next decade. (Foehringer Merchant 2018) Declining costs will speed emissions reductions. Second, Noah Kaufman has questioned the assumption underlying price studies that all price changes are equal. (Kaufman 2018a, p.2). For example, he found in his study that when gasoline price increases are viewed as permanent, such as those imposed by state and federal taxes, the increases caused a 3% greater reduction in quantity demanded than a similar increase seen as part of the everyday volatility of gas prices. It seems that consumers think seriously about what appear to be permanent price changes while disregarding weekly ups and downs.

Third, if as during the Second World War, people felt patriotic to cooperate with the government, they might cut energy use and seek out fossil fuel substitutes apart from the tax inducements. This could make a major difference as people increasingly realize the peril climate change is bringing.

The vision and camaraderie of a common undertaking is vital for any project of this magnitude.

Scientists Agree – Not Carbon Tax Alone, Also Regulations. We reiterate here that a carbon tax and dividend will reduce the thickness of the warming blanket that has been wrapped around the earth. Even sharp emissions reductions will not make the blanket go away, but they will keep it from getting thicker and even thin it somewhat. Climate scientists agree that a carbon tax by itself cannot meet the UN Emission Reduction Goal. (IPCC 2018a) In addition to employing a tax and dividend policy, it is also indispensable to sharply expand government research to ensure rapid technological innovation and progress in non-fossil energy, manufacture and transportation. Retaining certain regulations, such as building codes and fuel economy standards, will further strengthen the energy transition. Table 4 provides an overview of which regulations would be removed or retained by specific bills.

Table 4 - Regulations Kept and Removed for Various Plans

	Deutch	**Whitehouse**	**Curbelo**	**Baker** *(indications)*
Modifications to existing policies:				
EPA regulations of GHGs from stationary sources covered by the carbon tax	Moratorium[1]	Retained	Moratorium[1]	Eliminated
EPA regulation of motor vehicle GHGs	Retained	Retained	Retained	Retained
EPA regulations of emissions not covered by the tax	Retained	Retained	Retained	Retained
Fuel excise taxes	Retained	Retained	Eliminated	Retained
Payment of state-level carbon prices	Retained	Retained	Temp. credit[2]	Retained
Tort liability for emitters	Retained	Retained	Retained	Eliminated
Policies in addition to the carbon tax:				
FCs/other fluorinated gases	Fee on HFCs	Separate Fee	Contingent[3]	May be added[4]
Methane and other GHGs from fossil fuel production	Uncertain	Separate Fee	No	May be added[4]

Source: (Kaufman, November 2018, p.7)

Table 4 gives a description of plans and what they do with existing regulations.

Summary: Examination of the six plans and their effectiveness shows that only the NETP, Deutch, and CLC, plans have the starting tax rates which indicate that they could l meet the goal of a 50% emissions reduction by 2030.

c. Criterion Three – Escalating and Adjustable Rate

Highlights –An escalating tax rate is necessary to help induce switching from fossil to renewable energy. As well, enabling legislation must specify the schedule of future tax rates during the 2020s. Business leaders and investors must believe future rates will not be changed through a political process. To the contrary, they must also know that rate adjustments will be needed but will not be made for political reasons. Substantial business investments will only be made if business leaders are convinced that they can count on specified future rates and that if changes are made by the Climate Council, they will be made to protect business and national interests by keeping the energy transition process on a path forward with speed and minimal unemployment and inflation.

As mentioned previously, the combined effect of a rising tax placed on carbon-based fuels, coupled with declining costs of renewable fuel, will make the latter increasingly attractive to consumers. (Turner and Mathur 2018). Any plan must include rate escalations to be successful. Furthermore, business leaders and investors will not build the transition infrastructure needed if the transition plan does not contain a schedule of set carbon tax rates for the 2020s that allows them to plan. This transformation of our economy will hold out great risks and associated rewards.

To ensure that the plan is protected from political intervention, the NETP specifies that rate adjustments be made only by a quasi-government panel of nine experts. This Climate Council, akin to the Federal Reserve Board, should consist of climate scientists and economists appointed for ten-year terms by the National Academy of Science and the Council of Economic Advisors to the President.

Summary: While all the plans have escalating rate schedules, the rate escalation for the CLC plan is minimal rising from $40/metric ton to $50/metric ton. The CLC plan conforms to all the necessary criteria except the escalating tax rate to keep up pressure for demand switching. This could easily be remedied. Only the NETP protects the efficacy of those rate schedules to address climate goals by placing their establishment within an independent expert advisory panel with a clear mission and authority.

d. Criterion Four – Fairness

Highlights – Today when large segments of the populace distrust the government and feel left behind economically, no transition plan will pass Congress that is seen as unfair to working-class citizens. In short, without fairness there is no "start soon" for any carbon plan. Only NETP, Deutch and CLC plans meet the Fairness criterion.

What is fair? This section explains how dividends and taxes balance each other to create fairness and then evaluates the regressivity or progressivity of the tax plans for fairness. The only plans that meet the fairness test are the NETP, Deutch and CLC plans.

The NETP distributes dividends only to adult citizens. This makes administration more foolproof, transparent and reduces litigation concerning who gets the check. See Part ONE, Section V for discussion.

Summary of research and analysis Tables and Figures:

Why Dividends? Three justifications support distributing the entire Carbon Climate Fund equally to all adult citizens through a dividend payment. First, economic and environmental theory based on property rights states that the atmosphere is a public, open-access, common resource that belongs to everyone. Those who harm public resources should pay a penalty to those who "own" the resources, the citizens. Therefore, it is reasonable to tax those who pollute the atmosphere and use the revenue to reward to all those who 'own' the atmosphere.

Second, the economic theory of negative externalities comes to a similar conclusion. It states that industrial harm to the public or the environment as a byproduct of production should be taxed to raise the price and dissuade people from purchasing these. The revenue from taxation theoretically raises the income of all the people by lowering their taxes. The NETP does just this except the tax revenue is returned directly to the people. Dividends offset the tax.

Third, the term fair means that all citizens should be treated equally, that is, all receive an equal share of the energy transition revenue created by taxing all adult citizens. The combination of "polluters pay" and equal dividends create the fairness of "proportionate to income," sharing of both the carbon tax costs and tax revenue. The poor and working class also receive an additional cash bonus because their carbon pollution and hence tax is lower than the population average.

Defining the Component Parts of an Energy Transition Plan

Monthly Tax Revenue = (tax rate per equivalent metric ton of CO_2) * (equivalent metric tons of CO_2 produced and taxed per month)

Climate Carbon Fund = Fund Available to pay Dividends consisting of the carbon tax collections

Dividends Paid Quarterly to Each Adult = Sum of Tax Revenue for three months minus administration costs divided by All Eligible Adults

For individuals:

Net Cash Balance: equals zero when Dividends received equal Taxes Paid – Deciles 6 & 7 on Figure 7. Blue color is the dividend plus or minus carbon tax.

Net Tax Paid: if Tax Paid is greater than Dividend received – orange shading for deciles 8, 9, and 10 on Figure 7. Orange bars on right show tax paid greater than dividend received.

Net Cash Benefit Received: if Dividend of $2,237 is greater than Carbon Tax Paid – green shading for deciles 1 through 5, on Figure 7. Blue portion of bars to left shows dividend remaining after carbon tax (green bars) is paid.

Switching and emissions reduction: the decline in the tons taxed. Plan success depends on large switching or emissions reductions (they are the same thing here).

Change in dividends one month to another: Whether dividends decrease or increase depends on whether the **quantity effect** [decrease in tons taxed times the tax rate (loss of revenue)] does or does not overwhelm the **price effect** [increase in the tax rate times the tons of emissions taxed (increase in revenue)].

A. Quantity Effect: (decline/change in tons taxed) * (tax rate)
is this negative $ amount smaller or greater than

B. Price/Tax Rate Effect: (Increase in Tax Rate) * (tons taxed) if A is greater than B then a decrease in revenue and dividend, if A is less than B then an increase in revenue and dividend

Example:
Month one – 1000 tons taxed * tax of $40 = $40,000 Revenue
Month two – 900 tons taxed * tax of $50 = $45,000 (i.e. increase of $5,000)
So, the change month to month is:

A = -100 * $40 = -$4,000 (Negative Quantity Effect)

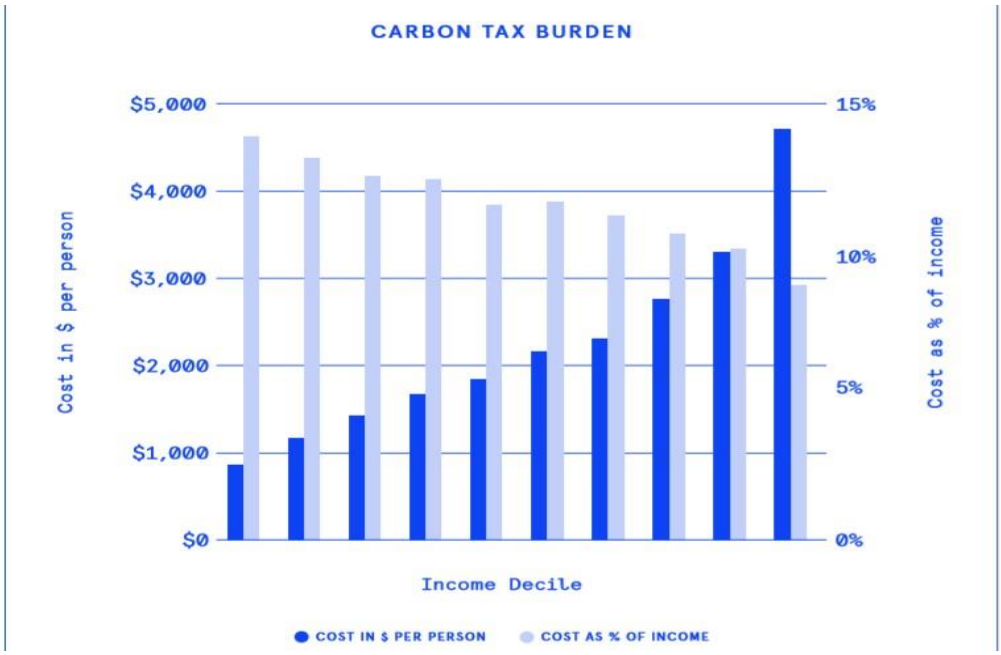
B = +$10 * 900 = $9,000 (Positive Price Effect),
$9,000 minus $4,000 = + $5,000 increase

A small amount of switching coupled with a tax increase leads generally to a large increase in tax revenue and dividends (B > A), while large switching in response to a tax increase leads to a decline in revenue and dividends (A > B). Hefty switching means the transition plan is working well but dividends are decreasing unless offset by a large tax increase. Conversely, when there is little switching the emissions reduction plan is failing though dividends are increasing.

Thus, the lifecycle of dividends, based on the above factors, will cause dividends to rise rapidly as the tax goes into effect pushing up revenue. Later, as switching starts to increase the dividends would continue to rise at a decreasing rate. Then gain and loss would reach a balance when the two mathematical products are equal and the rise in revenue is equal to the loss of revenue caused by the decline in tons taxed (the aim of the tax). At this point dividends would remain the same. Finally, as substitute renewable energy products become plentiful and attractively priced, switching will take off and dividends decline. The carbon tax and dividend plan is not a long run subsidy to the poor, but rather a tailored program to share the cost of the national energy transition.

The tax and dividend impact on the U.S. income distribution. Not surprisingly, the poorest 10% of Americans spend in dollar terms much less per person than do those in the top 10% of the income distribution. However, the poor spend a higher proportion of their consumption dollars on carbon intensive necessities that would rise in price because of the carbon tax. The tax causes their income to decrease more (before receiving the dividends) percentagewise, than for the rich. In contrast, the rich may hardly notice the increased spending caused by the carbon tax. This is shown dramatically in Figure 5 (p. A-14) where the solid blue bars give the dollar cost of the tax by deciles showing rising bars moving to the right, and light blue bars which show the tax cost as a percentage of the individual's income at a tax rate of $230/metric ton. This shows the tax cost as a percentage of income rising moving to the left. This is a picture of regressivity. (Fremstad and Paul 2018, p.10)

Figure 5 - Carbon Tax Burden



Source: (Fremstad & Paul, 2018, p.10)

Figure 6 (p. A-15) shows that the first five deciles (the persons in the bottom 50% of the income distribution) will receive a Net Cash Benefit (green) after the dividend payments, the next two deciles will roughly break even, and the persons in the top 30% of incomes will pay a Net Tax (orange). Though the tax rate used here is $230/metric ton, the distribution of benefits and tax costs will be the same no matter the tax rate even though the dollar amounts will be different.

Therefore, a carbon tax alone will always be regressive, causing the poor to lose a larger percentage of their income than the rich. However, with the add-on of an equal dividend to all, the situation is reversed. The combined tax and dividend policy create a fair outcome where the poor are not taxed disproportionately compared to their income to cover the energy transition costs of our society. They even gain a cash benefit.

These conclusions are illustrated in Figure 6 (Fremstad & Paul, 2018). Dividends are $2,237 per adult per year. The orange bars are the net tax paid while green bars are net cash benefit. The tax and dividend amounts are high because the authors used the high tax rate of $230/metric ton used by William Nordhaus as necessary to keep the temperature rise to under 2.5˚C. Nevertheless, the chart accurately describes how the dividend offsets the increased energy costs placed on the poor and working class. (Nordhaus 2017, p.1518 - 1523)

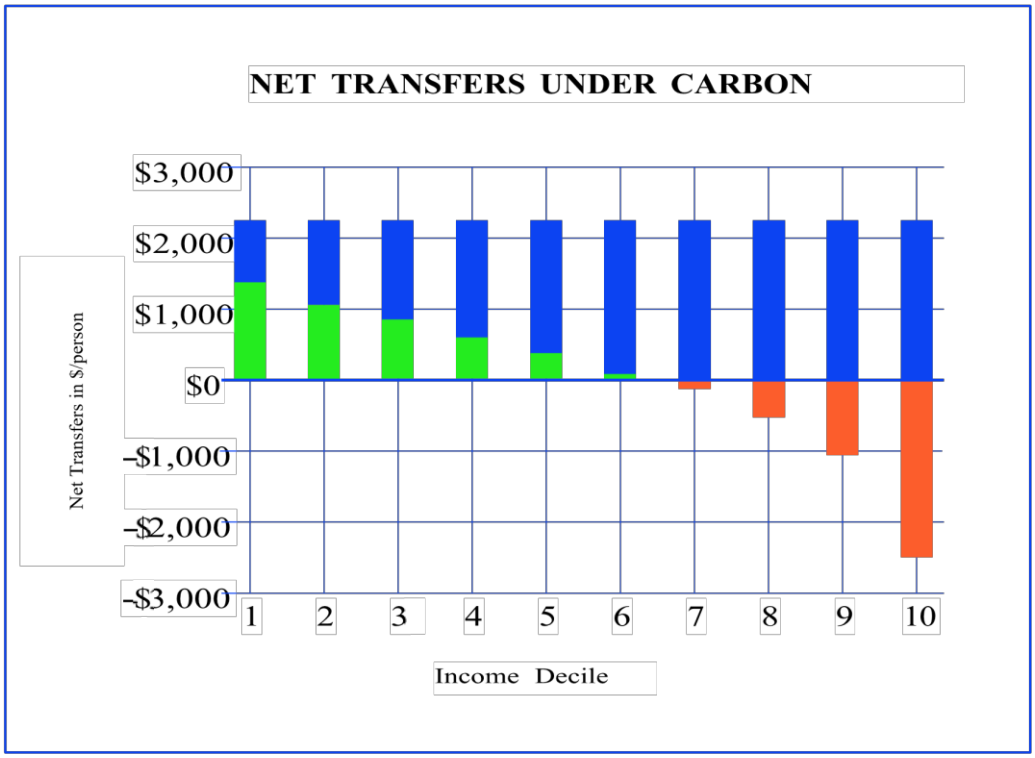
The sum of tax revenue equals the sum of dividends, that is, the sum of the orange bars (net taxes paid) equals the sum of green bars (net benefits received). For the lowest income decile: Net Cash

Benefits equal the dividends of $2,237 per person minus taxes paid (blue portion) equals Net Cash Benefits of $1,371 (shown as the green portion of the bars in deciles 1 through 5). Persons emitting more carbon than the average person pay taxes (orange) while those who emit less carbon than the average receive a cash benefit (green).

The second lowest 10% of the income distribution also receive the same dividend of $2,237, but their carbon footprint in terms of taxes paid comes to around $1,100 per person. This leaves them a Net Benefit of $1,137 per person. There is also a Net Benefit in the next 30% of the income distribution (deciles 3, 4, and 5). Persons in the 6th and 7th deciles break even with carbon taxes about equal to the dividends received.

The important conclusion is that the poor and working class and lower middle-class families, 60% of the adults, will receive a dividend that will offset their carbon taxes, no matter how high or low the tax rate is set. A higher tax rate creates a faster energy transition, up to the point of inflation. But it does not change the payment of Net Cash Benefits to the six deciles of income. The tax rate is primarily a throttle determining the speed of switching. Tax rates have no effect on fairness, which is the impact on the income distribution. Eventually, as the economy transitions away from fossil fuels, both the orange and green bars shrink. As this happens, the economy is coming closer and closer to a sustainable energy economy.

Figure 6 - Net Benefits and Net Taxes with a Carbon Tax of $230/metric ton



Source: (Fremstad & Paul, 2018, p.14)

A $50/metric ton Tax demonstrates the Importance of Dividends - The focus shifts now from a $230/metric ton to a $50/metric ton tax without yearly increases. This is roughly equivalent to the Deutch Plan. In the section on effectiveness (p. A-5) it was shown that a $50/metric ton tax was fairly effective in reducing demand for fossil fuels. Two studies show the importance of dividends with a $50/metric ton tax in eliminating regressivity.

In the Deutch plan using calculations by Fremstad and Paul, with a starting rate of $50/metric ton, the dividend in 2020 would commence at $413 annually per person or $1,239 annually for a family of four (2 children at ½ dividend each). For the NETP starting at $25/metric ton and increasing rapidly to $55 by 2023, averaging over the decade $75, it is easy to use the flat $50 rate as a stand-in for the $75/metric ton average rate for the NETP. Thus, the NETP would start with the same dividend of $413 in 2020 but be recalculated to $826 per person because dividends in the NETP are only paid to adults. The tax rate and dividends per person for the NETP can be approximated as: 2020/$25/$826, 2023/$55/$1,010; 2027/$95/$1,744; and 2030/$125/$2,294[14]. For a family of two adults and two children the dividends per year would be triple. (Fremstad & Paul, 2017, p. 22)

In the same working paper, Fremstad and Paul have analyzed a $50/metric ton tax in terms of who bears the tax costs when there is tax and no dividend compared to when there is a tax and a dividend. (Fremstad & Paul, 2017, p. 22 & 28) These findings are presented in Figure 7 for income deciles and in Figure 8 (p. A-17) for demographic categories. In each, the red bars show the negative income effect of a $50/metric ton tax on the category while the green bars show the positive income effect with a dividend. The sum of the red and green bars indicates the income difference for that group between *tax and no dividend* and *tax and dividend*. For the bottom income decile in Figure 7, a dividend brings their individual income up 10% compared to a no dividend policy and tax. The regressivity is shown by the increasing red bars as income decreases.

Virtually all studies agree that a carbon tax alone is regressive. However, a Treasury study concludes that such a tax is progressive. See Endnote 3 for an explanation of this difference.

In Figure 8, the red bars show the tax impact on incomes averages about minus 2%. Hispanics, Blacks and young persons are hit hardest by a tax-only policy, but clearly also helped the most by dividends giving them a 1.5% and 1% gain in income even with a tax of $50/metric ton. The Figure also shows little differential impact between urban and rural sectors. Not shown here, the study also concludes that using tax revenue for cutting labor taxes instead of paying cash dividends does not reduce the regressivity of the carbon tax, but rather increases it (as will be shown again in Figure 9, p. A-18). These two charts demonstrate the effectiveness of the NETP in creating fairness in the impact of the carbon tax on the income distribution.

[14] These dividends do not take into account switching as described on pages A-12 and A-13.

Figure 7 - Tax of $50/metric ton: Comparison Before and After Dividends by Deciles

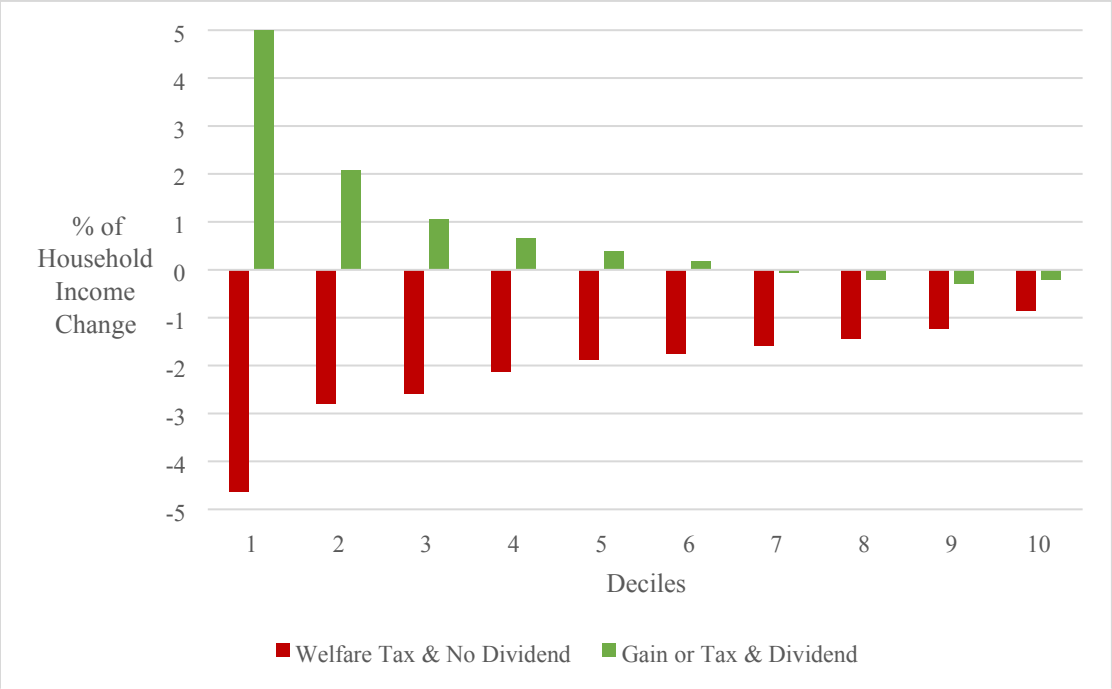


Figure 8 - Tax of $50/metric ton: Comparison Before and After Dividends by Demographics

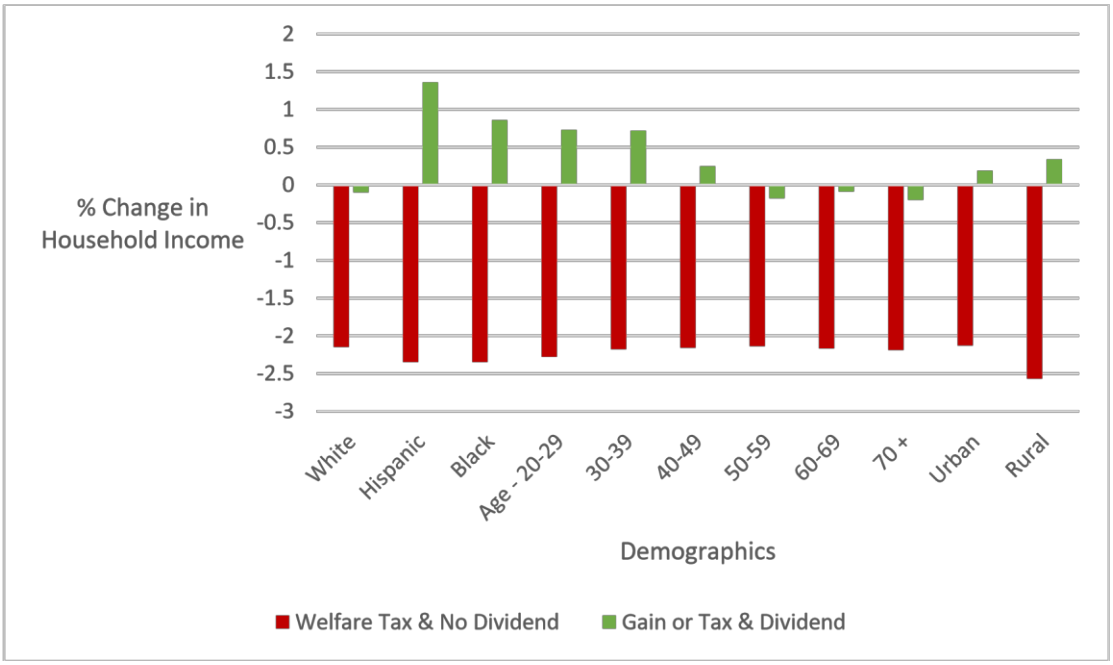
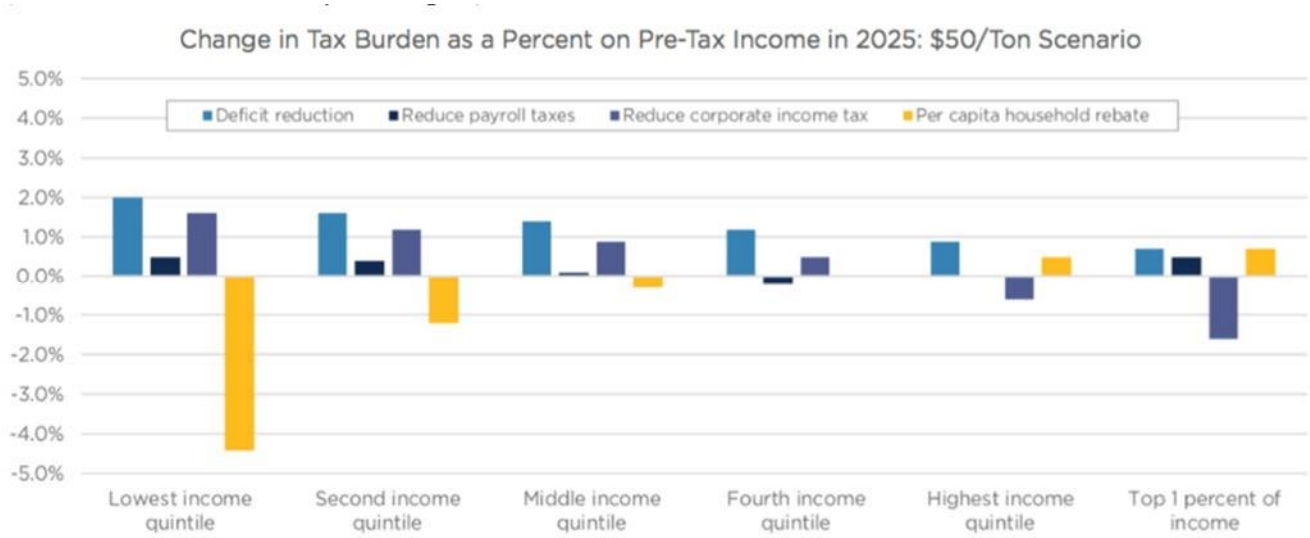


Figure 9 substantiates, as do Figures 6, 7, and 8, that adding the 100% dividend distribution to the Deutch/NETP/CCL plan changes its impact on the income distribution from regressive to progressive. Furthermore, as Figure 9 demonstrates, none of the other uses shown for the tax revenue turn the regressivity into progressivity (See Endnote 2 for further support in the Resources

for the Future study of the 100% dividend). Figure 9 displays the impact of the various tax plans by the change they would cause on persons' income in the quintiles (20% portions of all incomes) by a $50/metric ton carbon tax that does not increase.

All four plans and the two proposals depicted in Figure 9 are tax and dividend plans, but with different uses of the tax revenue. Whitehouse uses the revenue collected to reduce payroll taxes, while Curbelo cancels the federal gasoline excise tax and uses most of the revenue to fund the Federal Highway Administration. The other two proposals reduce the federal deficit and lower the corporate income tax. (Kaufman, Noah and Kate Gordon, July 2018, p.3 & 4). The Deutch/NETP/CLC plan calls for 100% of tax revenue to be distributed as dividends (except for administration costs) to the citizenry. Overall, the 100% cash dividends are striking in their ability to decrease the tax burden on the lowest 20% of incomes by 4% while increasing the taxes on the richest 20% by ½ of one percent. The yellow color pattern tells the story.

Figure 9 - Changes in Individual Income Tax Caused by Different Uses of Dividends



Source: (Kaufman and Gordon 2018, p.3)

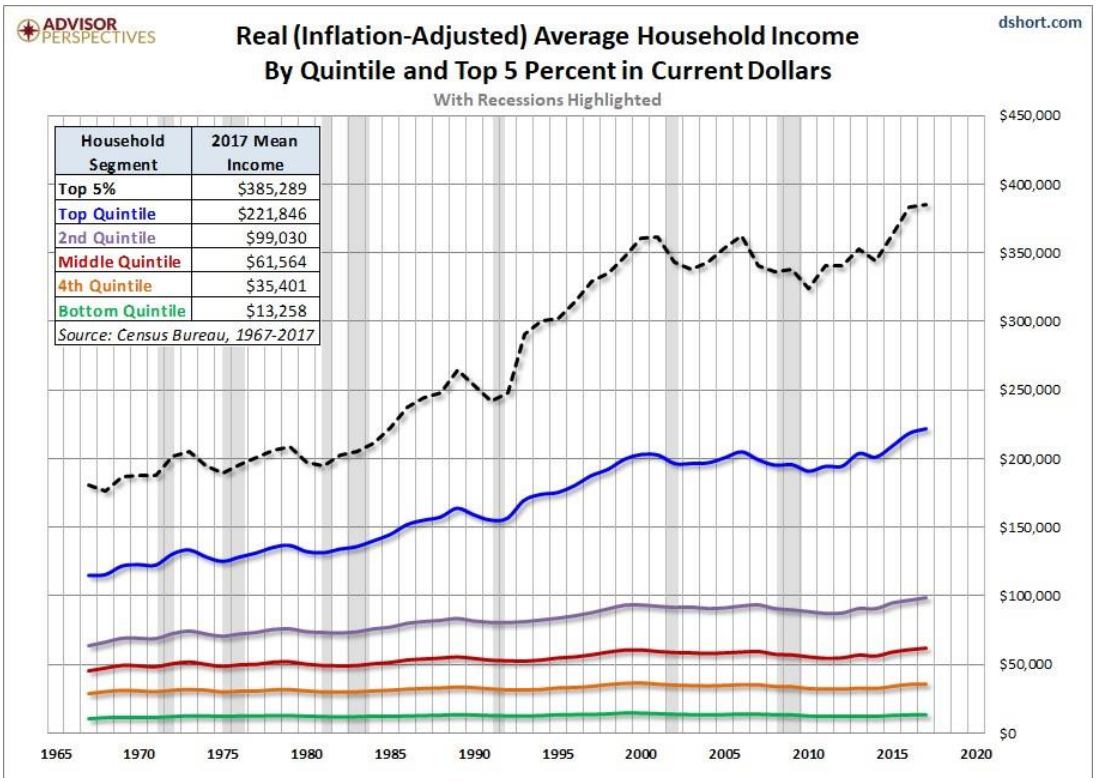
As illustrated by the yellow bar in Figure 9, only the three plans, the NETP, Deutch, and CLC return all tax revenue to the people. These plans meet the fairness criterion, while the others do not. The dividends ensure that the costs of the energy transition plan are not placed unduly on the poor and working classes. In this study persons in the bottom three quintiles, 60% of the population, all would have their taxes decreased, the middle classes just a bit and the poorest 20% of our population by a little over 4%. Note that the measurement of change in federal taxes is just a way to compare income distribution impact across plans.

The 100% dividend plans will more than cover their new tax costs through the lowest six deciles as shown in Figure 7 (p. A-17), where red is converted to green. For the poorest decile the carbon

tax costs the individuals a loss of 4.64% of their income, yet as the green column shows, the dividend covers the red cost and adds on a Net Cash Benefit in green of 5% of their income for a total gain over no dividend of 9.6% of their income. In the top four deciles the consumers spend more on carbon taxes than they get back in dividends. This is the aim of the plan. Using dividends to reduce corporate taxes, or reduce the federal deficit, or reduce payroll taxes increase taxes on the poorest citizens to finance our country's climate policy, moving the income distribution in a regressive direction. The Curbelo and Whitehouse plans and the federal deficit reduction and corporate tax reduction proposals do not meet the fairness criterion.

Fairness in our Populist Era The rise of populism in recent years in the US, Europe, and Brazil is the critical context within which a dividend/tax climate policy must be designed today. Recent elections have demonstrated that many people in the electorate feel put upon, angry and left out of the prosperity of their fellow citizens. They do not trust the government to have their best interests in mind. Figure 10 below shows the U.S. income distribution in 20% population slices, quintiles, from the 1960s to the present. The chart confirms why the poor and working-class in the US feel left out. The graph tells a dramatic truth: for over fifty years 60% of Americans have not shared in the income growth of their fellow citizens.

Figure 10 - U.S. Income Distribution 1965 to 2018



S*ource*: (Census Bureau n.d.)

Paying for our vital energy transition by placing the heaviest relative taxes on the poor and working/middle classes is not the way to go forward on climate policy.

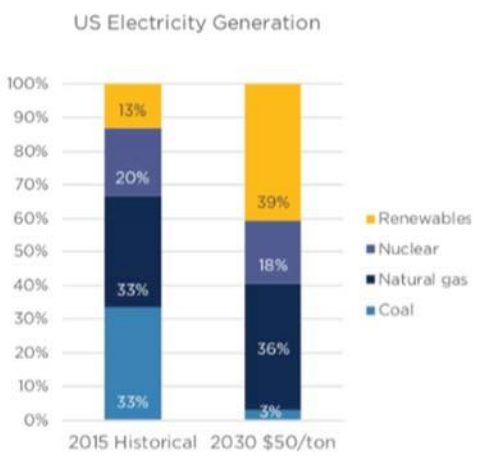
Unfairness because of Excessive Fuel Price Increases? Some critics are concerned that the rise in fuel prices might prevent the passage of a carbon tax. There is understandable concern that rural areas and farmers would be especially harmed. They would have to continue using their existing equipment including trucks, automobiles, tractors, and combines for work and transportation. There are currently no alternative means of transportation in rural areas. This will change as renewable fuels along with electric-powered farm implements become available. This concern has been further alleviated by the decline in diesel and gasoline prices.

The Columbia University Study depicted in Figure 11 below concludes that by 2030 fuel prices will rise only moderately because most transportation switching will not have taken place by 2030. Further, dividends will cover increased costs of automobile travel and help a small amount on farming costs. (Kaufman & Gordon, July 2018, p. 2)

Figure 11 - Selected Energy Prices in 2030 and a Historical Comparison

Selected Energy Prices in 2030 and Historical Comparison

	Gasoline (Price at pump) 2016 $/gal	Diesel (Price at pump) 2016 $/gal	Natural Gas (Delivered price) 2016 $/mmbtu	Electricity (Retail) 2016 cents/kWh	Coal (Power sector) 2016 $/short ton
2030 Average Price					
Current Policy	3.0	3.6	7.6	10.6	45
$14/ton	3.2	3.8	8.9	11.4	79
$50/ton	3.6	4.2	11.3	12.9	152
$73/ton	3.8	4.2	13.0	13.5	202
Historical Annual Average					
10-yr Low	2.3	2.3	5.1	10.3	39
10-yr High	3.9	4.2	12.1	11.0	49

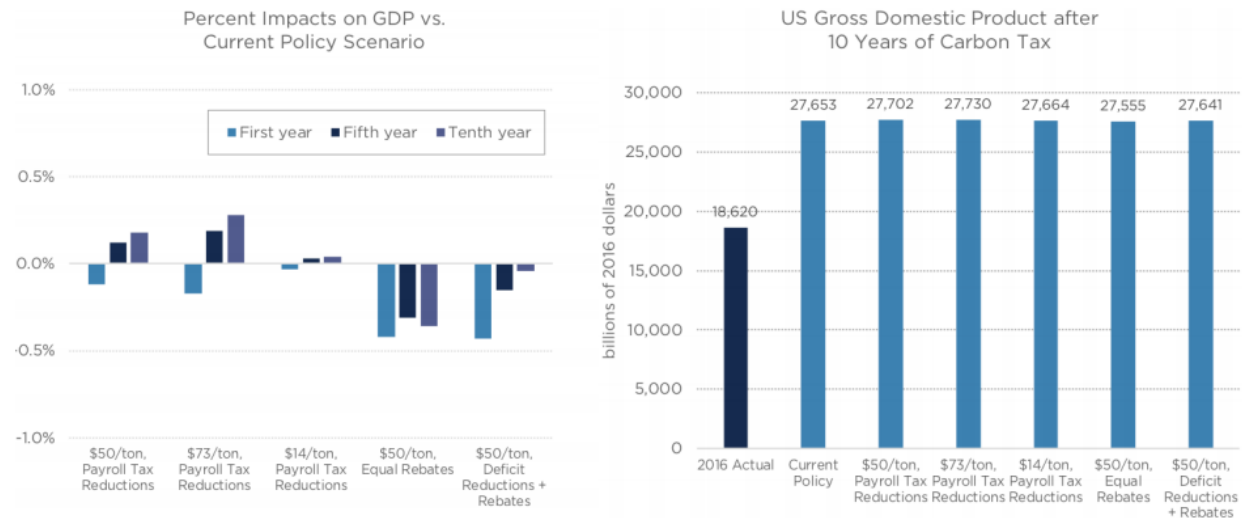


Source: (Kaufman and Gordon 2018)

This study shows that prices of gasoline, diesel, and electricity, the major concerns in rural areas, would rise about 20% during an energy transition based on estimates before the pandemic-caused sharp fall in petroleum prices.

Unfairness by Slowing Economic Growth Some policy analysts argue that climate policy goals should also include maintaining or increasing economic growth during the energy transition. They say that a carbon tax could cause GDP growth to decline. A Columbia University study concludes that at least for the next decade there are readily available sources of renewable energy which should make the energy transition relatively smooth with little disruption of economic growth (Kaufman & Gordon, July 2018).

Figure 12 - Projected Impacts on GDP growth of 4 Tax plans with Different Uses of Tax Revenue



Source: (Kaufman & Gordon, July 2018, p. 4). For corroboration of this conclusion please see "An Employment Addendum to the NETP"

Even if these growth studies turn out to be wrong, economic growth should be rejected as a parallel goal with the energy transition itself for two reasons. First, it is imperative to achieve the energy transition. Damage to growth is a secondary consideration and even a diversion from reaching the primary goal.

Second, the economic growth rate during the restructuring of the economy can only be roughly estimated. The above study shows small growth differences among the plans. But the overall impact on growth cannot be reliably predicted, nor can the climate impact itself.

Summary: The preceding analysis evaluated how dividends and taxes balance each other to create fairness. Only NETP/Deutch/CLC meet the fairness criterion

e. Criterion Five – Tamper Proof

The fifth criterion for a successful plan states that after passage the plan must not be vulnerable to changes through the political process. The ideal sought is *all hands-on deck* to support the energy transition and no partisan struggles to derail the effort, similar to the model of bipartisanship during the Second World War and the Cold War. Bipartisan support for U.S. policy was vital then and will be so now.

Tamper proof for an energy transition means a number of things. Foremost, the law should state that Congress delegates the free market to carry out the energy transition following the set tax

schedule. The law also should declare that tax rates can only be changed by the Climate Council. These foundation elements must be iron-clad to the extent possible.

The reasons for this exceptional restriction in the law are straightforward. The unprecedented investment in new industrial infrastructure will not be forthcoming if corporations and investment firms a) cannot make future profit projections based on knowledge of future tax rates, and b) are assured that future rate changes will not be based on political decisions. Uncertainty is the nemesis of long-term business investment.

The contradiction between "set-in-stone" and adjustable rates is partly resolved if Congress stipulates that the future schedule of rates will not be changed by the Congress, but only by experts in a quasi-governmental Climate Council. Furthermore, if the Climate Compact follows the suggested data-driven adjustment process of Kaufman et al. (2020) this would give Congress further assurance of a non-political adjustment of the carbon tax.

Of course, there is no such thing as a tamper proof law in our democratic society where one Congress can never fully bind a future Congress. Nevertheless, the proposed NETP Plan is designed to come as close as possible to this last, but vital, criterion.

The dividends provide a degree of insurance against later changes and cancellation of the law. Politicians talk about revoking Medicare but know the voters would rebel. Similarly, the dividends provide both a degree of fairness as well as a modicum of insurance against change or repeal of the plan.

Finally, that the operational control of the plan is in the hands of business provides some additional insurance that the carbon plan would be tamper proof. Interest groups thrive on "choke points" where they can intervene and alter legislation and policies, Since the free market is the transforming mechanism of energy transition, there are no "choke points". The decision makers are the millions of business leaders and portfolio managers. This is possibly the real tamper proof secret of the Plan.

Summary: Based on our analysis, only the NETP meets the Tamper Proof criterion, by establishing the Climate Council to manage the plan.

III. Conclusion – Evaluation of Plans Against Criteria?

The NETP met all criteria. The **Deutch**/CLC met all criteria except for Criterion 5, creating both tamper proof measures and a non-political method for adjusting tax rates. The **Curbelo and Whitehouse** plans failed on the effectiveness criteria to meet the 50% reduction goal and on the fairness standard. Finally, only the NETP incorporates all the four enhancements deemed important

for a successful energy transition plan: no economic sectors exempted, dividend payments to adults, no export subsidies, and midcourse rate adjustments made outside the political process.

Will the National Energy Transition Plan work? Our nation is late in starting to limit climate change. No one knows how difficult it will be to replace the old energy infrastructure that took almost 150 years to build with one based on sustainable energy. We also don't know whether climate calamities will upset the smooth workings of our current economy or the global economy. This is a complex nexus of uncertainties for this carbon dividend and tax plan to tackle. However, when the NETP is coupled with the US-Led Global Climate Compact, Part TWO of this proposal, this two-part plan has a better chance than any other alternative of meeting the dire climate challenge before us.

Appendix B – Achieving a Global Price of Carbon: Testing the Club/Compact Approach

The Compact is the most promising way to enlist countries in extensive global carbon reductions. Part Two, "Placing a Global Price on Carbon", explains how and why the club approach is superior to the failed agreements so far. The technical aspects of the model are described in detail in Nordhaus (2015). Here both the cost/benefit design and the model results are presented.

Model. A simulation of the world economy is created using 2011 data, including country GDP, trade, carbon emissions, climate, and other statistics for 15 countries and regions which encompass the whole world. Nordhaus uses the C-DICE international model loaded with cost and benefit functions relating to how joining or not joining the Compact would affect a country's GDP. Each country makes a decision of whether to join, stay or leave the compact based on which option most increases the GDP. Each of the 15 countries must make 44 decisions, one for each of the 44 regimes presented to it consisting of four target world carbon prices (equal to four possible social costs of carbon) of $12.50, $25, $50 and $100 and 11 tariff rates from zero percent to 10%. There are 44 choices based on 44 regimes for each of the 15 countries/regions.

If a specific regime raises the country's GDP more by joining than by not joining, then the country joins. If the calculation shows GDP is enhanced if the country leaves or does not join the Compact, then so be it. There is no altruism built into the model related to "benefit" to the whole world, etc. Each country decides for itself based on each of the 44 regime alternatives whether to join, stay or leave the compact.

Table 5 - Countries & Regions of the World in Model

Region	Percent of regimes participating
Mideast	75
Japan	73
Latin America	73
Southeast Asia	73
Sub-Saharan Africa	70
United States	70
ROW	70
Russia	63
China	63
Brazil	60
Eurasia	60
India	53
South Africa	45
All regions	68

Source: (Nordhaus, 2015)

The 15 countries and regions in the model are listed above along with the percentage of times that the country or region joined the compact among all the regimes tested.

The components of the model are as follows. The originating Compact members set their target global price on carbon and the penalty tariff rate to be imposed on all exports from non-Compact countries.

a) **The target global price on carbon per tonne**[15] is set at one of four prices which equal the World Marginal Social Cost of Carbon (SCC): $12.50, $25, $50 or $100 per ton. The SCC represents the economists' typical method of measuring value, the cost or benefit of the next item produced or sold, or the next unit of pollution or effluent discharged.

   Thus, the SCC in the model is an estimate of the dollar cost to society of adding one ton of carbon emissions to the atmosphere, or the dollar benefit to society of reducing emissions by one ton, thereby decreasing climate damage and avoiding damage and protection costs of floods and sea rise (Avoided Damage Costs). For example, If abatement reduces emissions by 40,000 tons, then society gains a benefit of 40,000 times the national SCC for that country, say $4/ton, or a $160,000 increase in the GDP because the abatement decreases the climate damage and hence avoids the cost of repairing the damage that the abatement prevented. These avoided damage costs are a net saving to the country and increase its GDP by the avoided cost[16]. To gain this avoided cost benefit, the country must incur abatement costs of shifting resources to less carbon intensive production.

   Conversely, if the emissions increase by 40,000 tons because the country stays out of the Compact and does not abate, the GDP would decline by $160,000, impacted by worsening climate damage. Instead of using a carbon tax, the Compact would also accept the equivalent carbon price achieved through a credits trading system as in Europe. In his model Nordhaus tests four different global carbon prices to show how countries would behave if the SCC were $12.50, $25, $50 and $100 per ton of CO_2, even though SCC cannot be calculated accurately under current uncertainty.

b) **The tariff penalty rate** is the key disciplining factor pushing countries into the Compact. Free riding crippled earlier agreements, as discussed in section IX. A key inducement for a country to join the compact is to avoid the tariff penalty on its exports.

[15] The spelling indicates metric ton.

[16] The national SCC is the cost or benefit of one ton produced or decreased in terms of its effect on that country whereas for the world it is the cost or benefit for the whole world. Adding together all the national SCCs around the world would make 100%, the world SCC of say $25.

The model confronts each of the 15 countries/regions with 44 choices: do not join and face tariffs or join and avoid tariffs on your exports to member countries. The zero tariff is a regime of no sanctions and voluntary action or inaction as in the Kyoto and Paris Agreements.

An Illustration of how the Model Functions. Nordhaus illustrates this in Table 5 (Nordhaus 2015, p1356) to show how the model's decision process functions for countries to make the 'join or don't join' decision in a $25 price and 4% tariff regime. Before looking at Table 6, we will walk through the decision process and review costs and benefits. If the reader is mostly interested in results rather than process, please see Section XII.

A Review of the Model Decision Process

Consider in the following discussion that you are inside the model deciding for your country whether to join or reject the Compact. There are two major cost and benefit areas: First, climate costs related to abatement and benefits from avoided climate damage; and second, trade costs and benefits related to trade tariffs.

A Regime of $25 Carbon Price and No Tariffs: To Join or Not To Join

A. **Climate Related Costs – Abatement Costs.** Countries either *join* and have adjustment and tax administration costs from restructuring their economy toward non-fossil fuels because of the carbon tax (i.e. abatement costs) or *do not join* and avoid paying for the restructuring abatement costs.

B. **Climate Related Benefits – Climate Improvement.** If your country does *not join,* then it does not have abatement costs, or very low costs. Nevertheless, your country benefits by receiving climate improvements that are a reward of the abatement carried out by the Compact Countries. Their abatement benefits the whole world by reducing climate damage, including in your country. This Avoided Damage Cost (which is a benefit to you) is a free-riding benefit from the compact to your country since your country does not have abatement costs. If your country *does abate*, then the climate related cost will be the net of Abatement Costs and Avoided Damage Benefits, causing GDP to change by that amount.

C. **Conclusion** – **Climate Related Costs:** Net Abatement Costs of (A – B) = C – determine whether you join when there are no sanctions. Generally, not joining is an easy choice because you get benefits and have no costs. The avoided damage costs (i.e. the benefit) will be greater than a country's minor abatement costs without a carbon tax[17]. Your country then also has the additional benefit that it can produce goods at a lower cost without the carbon tax. As long as other countries decrease emissions, you can accept the climate betterment they provide and be better off without incurring any abatement costs.

[17] This is because they will have a low tax or probably no carbon tax at all.

A Regime of $25 Carbon Tax and Trade Tariffs: Considerations if You Do or Do Not Join the Compact

Now there are two cost areas, Climate and Trade Related which equal Abatement and Tariffs.

D. Climate Related Abatement Costs and Benefits – same as those above without sanctions.

E. Trade Costs are the decrease in the GDP caused by the 4% tariff imposed by the Compact on your exports to member countries if you do *not join* the Compact. If the Compact contains the industrial countries which you export to, and if the membership of the Compact grows, then the tariff over time will punish your country more, as you pay tariffs to more and more countries, causing losses in employment, income, and GDP.

F. Trade Benefits are the new tariff revenue collected by your country if *you join* the Compact. Instead of paying tariffs you collect tariff revenues.

G. Net Trade Benefit or Cost = (F – E)

H. Overall Benefit or cost to join = (G – D) – If positive you join and if negative you do not join.

Conclusion: Overall Benefit or Cost:

Overall Benefit or Cost of H = Net Trade Cost G - Net Abatement Cost (D).

Your country's self-interest turns now on the overall net benefit of comparing net Abatement (C), with the net trade benefits F. The model showed that in most cases the tariff revenues will exceed the abatement costs encouraging the country to join the compact. The tariff penalties make the difference.

Table 6 - Effects of Participation in Numerical Example

	US is participant				US is not a participant				
Penalty tariff rate	Abatement	Damages	Trade	Net benefits	Abatement	Damages	Trade	Net benefits	Net effect of participation
0 percent	-11.9	10.7	0.0	-1.2	-0.3	7.3	0.0	7.0	-8.3
4 percent	-11.9	10.7	36.7	35.5	-0.3	7.3	-15.6	-8.6	44.1

Source: (Nordhaus 2015)

Notes: This table provides an illustration of the economic effects of participation for the US with and without a penalty tariff. The difference between the two lines is the impact of the penalty tariff. With a penalty tariff, the global externality is effectively internalized, giving incentives for self-interested countries to participate in the Climate Club. Figures in billions of 2011 US$ from the C-DICE model below for a global SCC of $25 per ton of CO_2.

Walking through Table 6.

No Tariffs & $25 carbon tax – top line: *Joining* brings abatement costs of -11.9 plus Avoided Damage Costs of 10.7, or net costs of -1.2 while *not joining* gives minimal abatement costs of only -0.3 and Avoided Damage Costs (Benefits) of 7.3 for net climate benefits of 7.0, giving an overall net benefit of positive 8.2 for not joining. Clearly the US does not join. The difference in Avoided Damage Costs between joining and not joining comes from the additional climate benefit when the US also abates.

Tariff of 4% & $25 carbon tax – second line: If the US joins, the Trade Impact of tariff revenue provides $36.7 plus the net Climate Costs of -1.2 providing a major inducement to join of $35.5. In terms of climate costs, the abatement costs and avoided damage costs nearly offset each other allowing the tariff revenue to dominate and provide an overall benefit for joining of 44.1. (figures are 2011 dollars in billion)

If the US does not join, its exports would face 4% tariffs when shipped to member countries causing a loss of export value of -15.6. Trade Related net Benefits would be -8.6, which creates, given the large tariff revenues, an overall benefit of joining of -8.6 plus 35.5, or 44.1.

Review of Model: Before presenting the model results, it is useful to review the overall architecture and terms in the analysis. The design structure of the analysis is:
Overall Goal – keep global warming to under a 2 C increase;
Means: By decreasing emissions meet the UN goals by 2030 and 2050;
Means: By creating a Global Climate Compact of nations pledged to accomplish the overall UN goal;
Testing through computer modeling to determine if the club design of a global carbon price and tariff penalties could do the job.
Key Model Components: Compact Members Decide:

a) Target World Price for Carbon – decided by the Compact.
b) Tariff Penalty Rate – imposed on nonmembers of the Compact.

Conditions: a) Sufficient countries join the compact to ensure it lasts and succeeds, and b) over time stable membership occurs with no members leaving or joining
Membership Decision Process – please see page 29.
Results of Model Testing: The key results for each regime are:

a) Number of members and nonmembers
b) Relationship of size of membership to carbon price and hence to the tons of carbon emissions reduced, the abatement.
c) Relationship of tariff rates to membership and carbon price

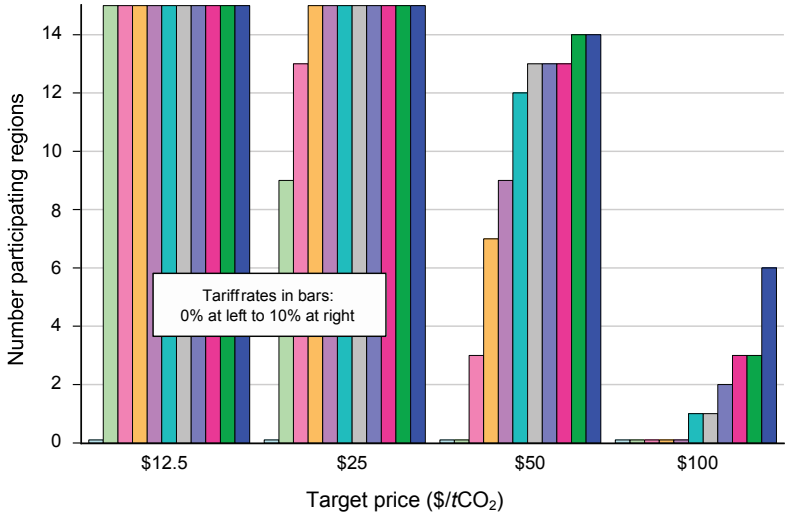
d) Conclusions of identifying which of the stable-membership regimes best meet the overall climate objectives of forestalling climate change through emission reductions to meet UN targets.

Regimes at Noncooperative Equilibria: A telling feature of the graphs is that all tariff rates from zero to 10% are shown stacked from left to right for each of the four prices. Thus, looking at the left most bar in all figures informs the reader how countries would behave if carbon reductions were voluntary and there were no tariffs at all. This represents the choice countries faced at Kyoto and Paris. The bars to the right show behavior for tariff rates from 1% to 10% at 4 carbon prices.

Two aspects of this Nordhaus model are important in judging the validity of the results. First, the model is effective in melding actual data into the C-DICE model for the 44 regimes tested. Second, the model is remarkably comprehensive in capturing the international interactions between and within countries of economic and climate variables.

Results as shown by Figures and Tables are reprinted from the Nordhaus article of 2015. Key results will be listed with alphabet designators beneath the figure shown.

Figure 13 - Number of Participating Regions by International Target Carbon Price and Tariff Rate



Notes: This and the following figures have the following structure. The four sets of bars are the model results for four different global SCCs, running from left to right as shown on the bottom. The 11 bars within each price set are the penalty tariff rates, running from 0 percent to 10 percent. Note that each set has zero participants for a 0 percent tariff. The vertical scale here is the number of participants, while the following graphs show other important results.

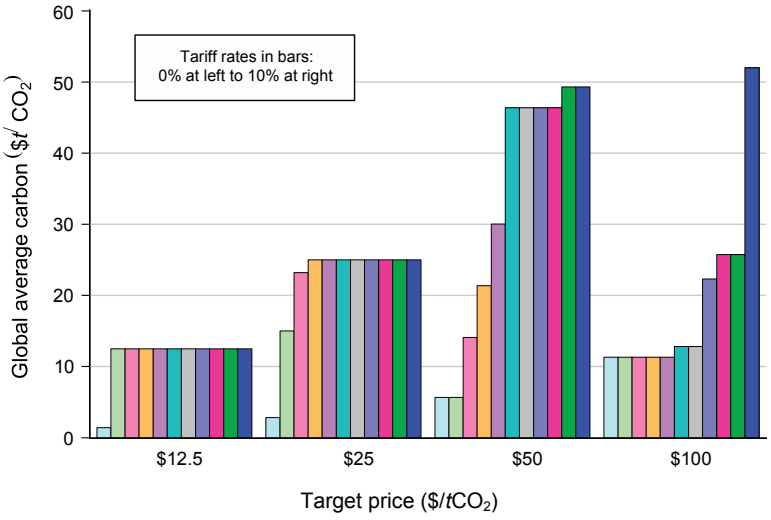
Participation in Compact related to Tariff Rate and Carbon Price/Tax Note that each individual colored bar plus one of the four prices is a regime. Each graph describes the country behavior in 44 regimes.

A. **Stability of Membership:** 38 out of 44 regimes end up with a stable membership – with no country desiring to opt in or out.

B. **Sanctions:** No country joins when there are no sanctions (see left bar of tariffs just visible above zero in Figure 13). This matches the experience of the failure of prior international agreements when no penalties were present.

C. **Tariffs bring in Compact Members even when there is a Strong Carbon Price of $50/ton.** At tariff rates above 4% and a carbon price of $50/ton almost all countries join the compact. A strong price of $50 causes major economic adjustment costs in moving from fossil to non-fossil fuels, that is, large abatement costs. Nevertheless, countries join the compact because the tariff rates and costs to nonmembers are large enough to overcome the now higher abatement costs at a carbon price of $50/ton. In addition, the $50 carbon tax forces major carbon reductions by compact members. This large mitigation increases the avoided damage costs which turn out to rival or exceed the country's own abatement costs. This is an example of how the benefits and costs of mitigation are aligned to encourage joining the compact rather than sitting on the sidelines. At a $100 carbon price the country abatement costs are so high that very few countries join the compact, even at the high tariff rates.

Figure 14 - Globally Averaged Global Carbon Price by Target Carbon Price and Tariff Rate



Notes: This graph shows the global (weighted average) carbon price for each regime. Weights are actual 2011 industrial CO2 emissions. The far left bar for each set is the noncooperative carbon price.

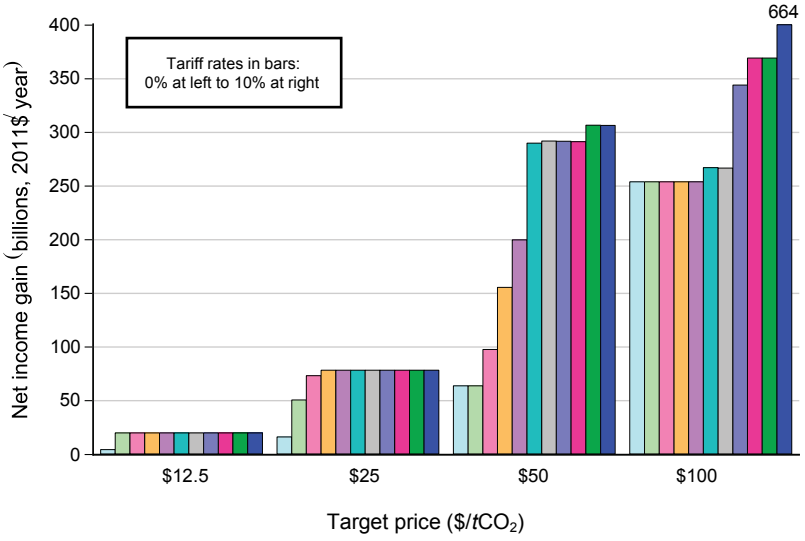
Global Carbon Price Attained compared with Target Price Set by the Compact Countries – This shows dramatically that to achieve higher global carbon prices, and hence mitigation, tariff rates above 4% are required to push reluctant reducers to join the compact at a $50 price. Sanctions work. Achieving a Global carbon price of $100 is not possible no matter the tariff rate as sufficient countries will not join the compact.

D. Tariffs. Higher Tariffs attract more compact members who agree to higher carbon prices which create greater mitigation. At a carbon price of $25/ton, all tariff rates above 1% bring in enough members to attain a world price of $25/ton. Even at a tax of $50/ton, all tariff rates above 4% will bring in enough members to reach a world price of $50. The tariff rate and carbon price work together to increase the reduction of carbon emissions.

E. Relationship between Carbon Prices and Percentage emission Reductions. Nordhaus describes the effectiveness of carbon taxes in reducing emissions as follows:

"While the analysis focuses on carbon prices, it is useful to translate these into emissions reductions. Assuming 100 percent participation, the emissions reductions for the four target carbon prices ($12.5, $25, $50, and $100) are 9 percent, 18 percent, 36 percent, and 72 percent of baseline emissions. It is relatively easy to attain emissions reduction rates of 50 percent with a Climate Club at 2011 levels of income and emissions." (Nordhaus 2015)

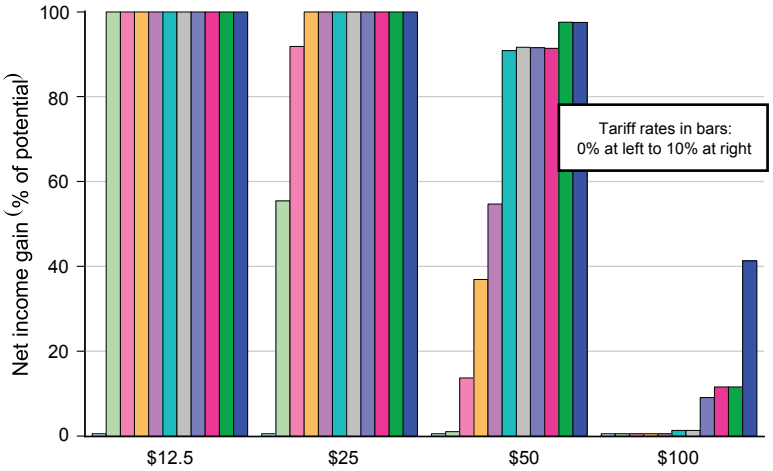
Figure 15 - Net Economic Gains from Different Regimes



Gain in National Income with Compact Compared to No Compact and No Penalty. Net economic gains are achieved by using tariffs to bring in new compact members at higher carbon prices. The gain in GDP between the no tariff situation and various tariff rates is expressed in 2011 dollars. Figure 16 measures the gain in GDP between the no sanctions and no cooperation case and the dollar gains in National Income when there are higher carbon prices and tariff rates.

F. Tariffs put the world to work in reducing carbon. Moreover, this chart shows that the $50 and $100 carbon prices, which are very effective in mitigating climate change, also give big boosts to GDP. It is incorrect to argue that a carbon tax is detrimental to economic growth. Quite the opposite.

Figure 16 - Percent of Potential Gains from Cooperation Achieved by Different Regimes



Net Income Gain as a percentage of the Potential Gain moving from the no tariff, no Cooperation regimes to Compact-Driven Regimes.

Measure of the gain in Net Income as a Percent of the possible gain moving from non-cooperation to cooperation. As Nordhaus states, "Bars show the global gain in each regime relative to the noncooperative outcome as a percent of the difference between the 100 percent cooperative and the noncooperative result."

G. Cooperation among countries brings major income gains in sharing the costs of mitigation and imposing tariff penalties. Only at a price of $100 do mitigation costs discourage membership.

Conclusion: With Covid-19 as a wakeup call, nations may realize that the Climate Compact can foster the collaboration needed to slow climate change before it reaches a run-away stage. Both international experience and the dramatic results of the extensive modeling give a clarion call to the world that creating inducements for countries to work together coupled with penalties for sitting on the bench might be the long-sought ticket to dramatic climate policy action. What has been tried has failed. The Global Climate Compact represents a new and promising opportunity.