A National Energy Transition Plan for America:

Informing the Development of a Carbon Dividend Approach

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The time is now. The climate of our future is on our doorsteps. Expert studies show that the U.S. and other countries need to extensively reduce carbon emissions in the coming decades by as much as one half by 2030 and to near zero by 2050 if we are going to avoid the worst dangers of climate change. This report lays out new research on the benefits of a carbon dividend and tax plan as a key driver for a transition from fossil-fuel based energy to renewable alternatives. The proposed National Energy Transition Plan for America (NETP) is designed to be the most effective yet fair, and politically acceptable way of meeting these goals. This document describes the proposed NETP carbon dividend and tax approach as a *means to help inform the development and refinement of proposed carbon dividend plans being considered in the national debate and by Congress.* The intent of this work is to ensure the highest rate of success for a sound carbon dividend plan that shifts the U.S. from carbon-based energy to renewable alternatives and contributes to a national policy to address climate change. It is our hope that this work will prove useful as a resource to all those interested and engaged in creating an effective climate policy. The Appendix compares the NETP proposal with other pending plans, and with current research to help highlight elements important to a successful carbon dividend approach.

This report is produced as a public document for use by the public with appropriate reference.

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I. Summary and Purpose

In Summary: The proposed National Energy Transition Plan (NETP) is 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 in this proposed plan 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 towards purchasing renewable, non-fossil fuel energy while the equal dividends to all adults will compensate people for the increased cost of fossil fuel energy.

Why this approach? The market will do the major transition work through increasing the price differential between fossil 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 to no basis or opportunity for special interests or corporate manipulation to corrupt or derail the process.

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 are penalized by the tax. As consumers reduce fossil fuel use and thus carbon taxes paid, they keep more of their dividend. The plan favors energy efficiency, conservation, and the use of alternative energy. The U.S. Treasury Department would ensure there is no misuse of the carbon tax funds.

Purpose of this Proposal: This proposal aims to accelerate efforts to transition the U.S. economy away from carbon-based energy and towards renewable alternatives. The analysis, as described herein and in the Appendix, concludes that the Energy Innovation and Carbon Dividend Act, HR 763 (referred to herein as the Deutch Plan), and the Citizens' Climate Lobby Carbon Fee and Dividend Plan (referred to herein as the CCL Plan) are the most powerful current plans available to reduce U.S. carbon emissions by 50% by 2030. Since our analysis was completed, CCL has withdrawn their plan to fully support the Deutch Plan. We have left CCL's earlier proposal in our analysis, so the CCL plan is now the Deutch Plan. Analysis of the NETP can inform the further development and refinement of these plans by highlighting the criteria essential for a successful plan (described in Section IX), 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 X. 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 issues should be covered in complementary policy initiatives. At the same time, other studies have shown that a switch to alternative energy sources should result in more jobs than they displace.

II. Climate Situation: Why A Transition Plan is Needed

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 divided into two volumes: Volume I on the science of climate change (available at science2017.global

change.gov) and Volume II on the impacts and economic implications of climate change (available at NCA2018.globalchange.gov).

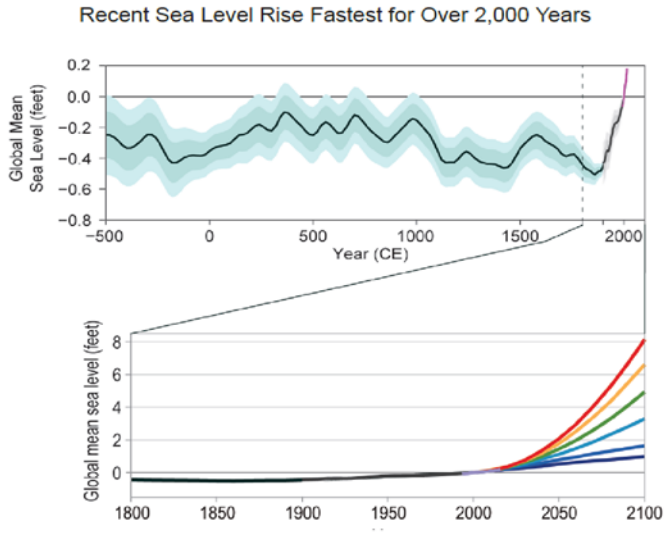
The *Fourth National Climate Assessment* finds that climate change is happening now, that it is happening very rapidly, and that it is greatly impacting the United States. Such assessments of the science and resulting impacts, and those internationally by the United Nations Intergovernmental Panel on 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 reached 410 parts per million, a level that last occurred about 3 million years ago. Continued growth in CO_2 emissions would lead to CO_2 levels not experienced in tens to hundreds of million 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 greater than the global average. Tidal flooding is accelerating significantly in more than 25 Atlantic and Gulf Coast cities.

- The world's oceans are currently absorbing more than a quarter of the atmospheric emissions of CO2, making the oceans 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 surprises.

- 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 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).*

III. Supporting the U.S. Energy Transition by calling for a National Carbon Dividend and Tax

Why a Dividend and Tax Approach? As the IPCC *Special Report Global Warming of 1.5˚C* stated, it is critical that carbon emissions are sharply reduced as quickly as possible to slow the effects of climate change. The Paris Accord has initiated international policy, but it has not yet received the commitments needed to hold the temperature increase to 2˚C, much less the desired limit of 1.5˚C. (Metcalf, 2019, p.2) To reach a 50% reduction by 2030, within the next 11 years, there is a need for a fresh approach based on two principles: first, persuade consumers to eschew fossil energy in favor of sustainable energy (e.g. wind, solar and storage), and second, turn over the task of emissions reduction and creation of energy replacements to industry.

By placing a tax on all fossil fuel energy produced, and raising the tax rate every year until 2030, the NETP will promote the transition to sustainable replacement energy. We need to give industry the assurance that the tax will indeed rise yearly so they can plan their new infrastructure investment.

Next, the NETP proposes to use the carbon tax revenue to return an equal-amount dividend to all adult citizens. Those who pollute the most pay the most tax and those who pollute the least receive a net cash dividend. Forty-five leading economists endorse such a tax and dividend policy. (Columbia University SIPA, October 2018)

IV. Historic Experience with Carbon Taxes and Regulations

This section looks at prior experience with similar carbon tax concepts to help create a path forward. Analysis of these past efforts informs a set of critical criteria for choosing a successful energy transition plan for the United States.

Sweden passed a carbon tax in 1991 of $139/metric ton, a very high rate especially for 1991. The Oxford Martin School at Oxford University released an article on July 30, 2018 confirming the importance of carbon taxes, stating:

> "*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 CO_2, 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 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 p. 2)"

Canada's new Carbon Dividend and Tax plan started in April 2019. It is similar to the NETP and the Deutch Plan with a 100% distribution of carbon tax revenue. It will apply 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.

Historically, it is notable that the earlier Cap and Trade Plan failed to do the job in Europe because the plan was not tamper-proof. Major interests gained exceptions and the plan had little effect. 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. President Macron sought to combat climate change with a carbon tax in France without a dividend in 2018. The result was the revolt of the working-class, "les gilets jaunes", decrying the additional tax burden without wage increases.

The Essential Criteria for Choosing an Energy Transition Plan.
Given the world climate situation described above and the need for quick action, a good 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 or three years (no later than 2022). This timetable requires a bipartisan bill broadly acceptable to most political factions.

Effective in Achieving Set Emissions Goals: It must have a high probability of reaching the emission reduction targets.

Escalating and Adjustable Rate: It must include an escalating rate, secured with a non-political mechanism for mid-course adjustment to keep the plan on track to meet the

emissions goal.

Fair: It should deal with increased carbon tax costs by balancing: a) placing the most tax on those who pollute the most; and b) ensuring 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.

V. The NETP Carbon Dividend and Tax Proposal

The following are the key elements of the NETP Carbon Dividend and Tax Proposal:

1. A tax is placed on each equivalent 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 will collect the tax revenue and place it in the Treasury's Climate Fund. The tax will start at $25/metric ton, increasing each year thereafter for ten years or more by $10/ metric ton to reach $125/ metric ton by 2030. This represents a starting tax of $0.25/gallon and reaching $1.25/gallon by 2030.

2. Each quarter, a dividend check will be paid to each U.S. adult citizen of an equal amount. 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, the plan calls for a first estimated payment of dividends one quarter prior to commencing the carbon tax.

3. Congress commits in the bill that the rates set forth in the bill cannot be changed by Congress. The 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.

4. This proposal is an all-America plan with no exceptions for any economic sectors. (Metcalf, 2019, p.112)

VI. 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, April 24, 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 further supporting 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 the Appendix Figure 4, p.13).

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 decrease carbon energy consumption, but some not enough. The various studies indicate that a yearly rising rate commencing at $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 to imported fossil fuels and products from countries that do not have an equivalent tax on carbon. This would prevent countries without carbon taxes from undercutting U.S. goods and services and would push all trading partners to adopt the same carbon levy prevailing in the U.S.

The Cost of the NETP. The enormous costs of transforming the energy base of our economy 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. It is possible that 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.

VII. The Economic Mechanisms of the Plan

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. The 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 success of the NETP rests on the ability of the supply side of the economy to produce replacement products fast enough at attractive prices to supply the new 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, July 2018, p.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. 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. 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 a product that is causing social harm.

How the Dividends Work. By paying a quarterly dividend to all adults, the NETP is founded on our nation's abiding democratic principles. 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.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 tax they pay based on their carbon 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.

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 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 4 in the Appendix, page 13. Therefore, dividends are essential to protect the poor and working-class consumers from paying for a problem caused more by others than themselves.

In addition, the dividends provide everyone an incentive to conserve or switch. Everyone gets to keep an additional dollar of their dividends for every dollar of carbon tax no longer spent on fossil energy products.

Technology is the Driver. Fortuitously, technology has brought the cost of producing solar and wind energy down by 60 to 80% over the last decades and also made energy storage less expensive. (Jacobson, 2017, p.108 – 121) (IRENA, 2018) As a result, the tax plus declining renewable energy costs creates 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. No other entity, including the government, could manage such an overwhelming task as the energy transition at the least cost possible. It is true that the poor and minority populations often bear the brunt of pollution, but it is also true that transforming our energy base from carbon to sustainable energy sources will remove many of the now preponderant and harmful pollutants. This itself will markedly improve the health of all Americans. If the energy transition were not being carried out to slow climate change, it would still be worth doing to improve American's health. The decisive argument, however, is that if we do not task the free market with making the energy transition happen, it will not happen. There is no other quick way to do it.

VIII. 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 the social cost of CO_2 emissions. (Nordhaus, 2017, pg.1518-1523) 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 the Appendix.

Assume there are three citizens:

a) Joan is poor, lives in urban Chicago, has no car, and income in 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%.

Citizens	**Joan**	**Jose**	**Emil**
Tons of Carbon Emitted	4	10	21
Carbon Tax Paid/yr	$866	$2,250	$4,738
Dividend/year to all*	$2,237	$2,237	$2,237
Net Benefit = Dividend Cash Kept	$1,371	In balance at zero $0	-$2,501
Net Benefit for Family of Three for a Year	$ 4,113	$0	-$7,503

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

The above data are for the U.S. and are annual figures for an individual unless noted otherwise. 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 as everyone of $2,237, pays carbon taxes of $4,738, leaving him a net tax payment of $2,501. This shows clearly 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.

IX. Criteria for Choosing a Good Energy Transition Plan

This proposal for the NETP is analyzed by comparing the NETP to the five criteria essential to a successful energy transition plan.

A. Start Soon

The Plan must be started soon. Both the *Fourth National Climate Assessment* and IPCC report say that time is short to decrease emissions by one-half before 2030. Starting soon requires broad political acceptability of the plan. The NETP, as proposed, should garner broad bipartisan support.

The NETP speaks to ideals and values important to various political factions in the US. Conservatives should be attracted to the free market approach that will not require an expansion of government or the operation of various regulations or bureaucratic supervision. The government is a tax collector and dividend distributor only, and the program is fully transparent. Independents should like the plan because it emphasizes action and is based in careful logic and research. Further, they would like the democratic nature of the plan wherein all classes work together in the transition effort. Finally, Liberals and Progressives should welcome the aggressive approach to acting on climate change. The shared cost with an equal dividend to all would address social justice concerns. Those who cause the greatest harm, pay the most tax and thereby compensate the poor whose lives are most affected by the tax and climate change.

B. Effective in Achieving Set Emissions Goals

The tax rate must be high enough to cause consumers and firms to switch away from or conserve use of fossil fuels to meet the emission reduction targets, but not so high that switching demand exceeds the emerging supply of low carbon product which could cause sector inflation. We anticipate a starting rate in the range of $25/metric ton to $50/metric ton.

C. Escalating and Adjustable Rate

The tax rate must escalate and be adjustable in a manner spelled out in the legislation so that mid-course corrections can be made to keep the energy transition on track. The NETP makes clear that a rate adjustment should be made only by qualified climate experts and economists, the Climate Council, not by Congress. See Section V.3 herein and Appendix p.9 for further discussion.

D. Fairness

There must be balance between a) those who pay the most because they pollute the most, and b) protection of the poor and working class to whom the carbon tax is a hardship. As discussed earlier, the sharing of the carbon tax revenue equally among all adults in the NETP accomplishes this fairness balance. Paying dividends only to adults increases the size of the dividends and simplifies greatly the identification of the eligible population and leaves little room for fraud.

E. Tamper Proof

Businesses cannot make long-run investment decisions if there is uncertainty about future carbon taxes, that is, if the future price of fossil fuel energy is uncertain because Congress may change the legislation. The future rate schedule in the legislation is also the potential profit schedule for investors and businesses.

On the other hand, one Congress cannot bind the hand of a future Congress. Nevertheless, two factors work in favor of the durability of the NETP. If climate harm accelerates, it will be increasingly difficult for Congress to vote against our national climate lifeline. Moreover, the attractiveness of receiving cash dividends should have considerable appeal to everyone and this popular appeal should dissuade Congress from terminating or weakening the program.

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

The NETP is designed to gain public trust. It is conceived as a seamless whole, where all pieces fit and work together as an efficient mechanism to transition to a renewable energy economy. It should be understood that the disruption this plan will cause in restructuring our economy will be mild compared to the coming worldwide devastation caused by unrestricted climate change.

There are two foundational themes that underlie and tie together both the plan itself and the four proposed enhancements. First, keep the plan simple and universal with total transparency. The plan should be uncomplicated and without sector boundaries so as 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 - *Arguments for the enhancements proposed in the NETP which are not included in other pending plans*

No Economic Sectors Exempted. A national effort requires national participation. Sharing sacrifices requires trust that everyone else is also working and sacrificing for the same goal.

People 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. In this situation, left out means left behind. Those continuing business as usual will ultimately be left behind with old and high cost fossil fuel technology and no ability to sell their products in the new energy world. The carbon tax is needed to prod energy producers into the new energy economy and the new reality of climate change; all-in and all together.

Exempting the military and agriculture sectors means their emissions will continue. 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 and 12.6 million gallons of fuel daily. (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. Greenhouse Gas 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. (EPA, 2019 p 2-32) An effective energy transition plan aimed at reducing emissions must incorporate the military and agriculture sectors.

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 Bagdad in 2003, "Unleash us from the tether of fuel!"

Petrol and water resupply convoy in Afghanistan. (Conca, 2019; US Army)

"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, March 12, 2019)

The military are already field testing solar and small nuclear reactors as sustainable energy sources for supporting combat operations. "These reactors are safer to the troops and civilians than the fossil fuels they will replace." (Conca, March 12, 2019) Over the years, the DOD has been first in proclaiming the danger of climate change to our national security and a pioneer in technological discovery. Most likely the military will welcome the carbon tax to spur innovation.

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. As stated in the ELPC report *An Assessment of the Impacts of Climate Change on the Great Lakes,* "in rural areas, increased flooding will also cause soil erosion. In combination with more unpredictable precipitation and warmer temperatures, these effects could seriously curtail Midwestern agricultural production." (ELPC, 2019, p.23) Given the future risks and uncertainties, agriculture's ability to adapt with agility and effectiveness will be crucial. Agriculture will need a toolbox which includes sustainable energy sources to adapt agricultural practices to a new climate world. Change will be forced on farming and ranching largely through market forces stemming from climate and population shifts. No doubt, agriculture will require special regulations and perhaps transitional financial assistance from the farm 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 administration of the plan. Payments to children can make a simple plan complex and contentious; experience with tax refunds and entitlements based on custody arrangements is evidence of this. Dividend recipients must be easily and correctly identified. Payments only to adults will mean larger dividend checks and simplified administration.

No Export Subsidies. The argument against export subsidies is fourfold. First, the stagnant technology argument advanced in the No Exempted Sectors section applies here. Assured of an export subsidy equal to the carbon tax, exporters would be tempted to keep exporting under past practices with associated carbon emissions. 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 simple plan complex and open to fraud. Finally, the US can hardly become a world climate leader if it encourages carbon-emissions.

Midcourse Tax Adjustments Midcourse rate adjustments may be necessary in order to meet the emission reduction goal. 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 declines in alternative energy

investments, and regression back to fossil energy. As mentioned previously, the crucial management of the plan and its rates over time should be made by a panel of climate scientists and economists, not through the political process. A Federal Reserve-like Climate Council should be created to make rate adjustments in terms of target fulfillment and not political tactics.

XI. Conclusion

The NETP provides a helpful benchmark by which to compare the current carbon dividend and tax 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 a high success rate: 1. Start soon; 2. Effective in achieving set goals; 3. Escalating and Adjustable Rate; 4. Fair; 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 X 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 Plan and the CCL Plan are the best suited plans available to reduce U.S. carbon emissions by 50% by 2030. It is recommended that these plans be further developed and refined with the suggestions herein to accelerate policy action that transitions the economy 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.

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Appendix

Analysis of the National Energy Transition Plan: A National Carbon Dividend and Tax Plan in Comparison with other Potential Dividend and Tax Plans

Dr. Roy Wehrle and Dr. Don Wuebbles

May 31, 2019

The proposed National Energy Transition Plan (NETP) is comparable to the Energy Innovation and Carbon Dividend Act, HR 763 (herein referred to as the Deutch Plan), the Citizens' Climate Lobby Carbon Fee and Dividend Plan (CCL Plan), and the Climate Leadership Council Plan (Baker/Schultz Plan). All have similar carbon tax rates and 100% dividend distributions. These four plans, because they are similar, will be compared to the other plans which are described later. The Appendix explores the following: a) comparison of these four plans with other contending plans 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:

1. **Start Soon**
2. **Effective In Achieving Set Emissions Goals**
3. **Escalating and Adjustable Rate**
4. **Fair**
5. **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): sequestering massive amounts of CO_2 in land and forest through soil management, stopping deforestation and commencing reforestation, and starting the difficult process of withdrawing CO_2 from the atmosphere.

I. Key Elements of Plans

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

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. A quarterly dividend prepayment would be made to citizens before the tax commences. Plan is 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. https://www.govtrack.us/congress/bills/116/hr763

CCL, Citizens Climate Lobby – same as the Deutch Plan.

Baker/Schultz, Climate Leadership Council –Rate starts at $40/metric ton, with small yearly increases to $50/metric ton. Existing regulations on CO_2 and methane may be cancelled and corporations are exempted from corporate tort liability. Plan is bipartisan. 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. http://news.mit.edu/2017/addressing-americas-climate-future-senator-sheldon-whitehouse-esi-1122

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. https://www.govtrack.us/congress/bills/116/hr763

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. https://citizensclimatelobby.org/canada-adopts-carbon-fee-and-dividend-to-rein-in-climate-change/

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

Table 1- Summary Comparison of Carbon Dividend and Tax Plans – Rates, Yearly Increase in Rates, CO_2 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	$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 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 three plans would be at the $50/metric ton rate used in Figure 2 on page 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. Only a carbon tax policy is proposed because the approach by regulation has repeatedly failed to lower emissions[1].

Criterion One: Start Soon

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

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, CCL, and Deutch Plans 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. The Baker/Schultz Plan will likely be contentious as it removes corporate tort liability, resulting in difficulty with getting it to "start soon".

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

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 CCL have the required tax rates and rising rates that are the most likely to meet the 50% reduction goal.

Summary of research and analysis Tables and Figures:

Table 2: Both the $50 and $73 per metric ton rates come close to the goal at 39% and 41%; page 4.
Figure 1: Shows sharply rising rates for Deutch Plan, and also describes the NETP and CCL plans whose rate trajectories tracks the Deutch increases closely; page 5.
Figure 2: $14 rate reduces 27% by 2030; $50 rate reduces 39 to 44% by 2030; page 6.
Figure 3: Depicts the Reductions by Four Plans; Page 7.
Table 3: Describes Regulations maintained and removed by the various Plans; page 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 & 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 percentage response of supply or demand quantities to a given percentage change in price. Here the price change is the increase in the tax rates.

Four steps of analysis will demonstrate that the similar-rate Deutch/NETP/CCL plans are the most likely to meet the UN target of 50% reduction by 2030. (IPCC Special Report, October 2018)

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, 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 & Larsen, January 16, 2018, p.14)

Table 2 - Comparison of Three Tax Rate Scenarios over Twenty Years (Kaufman & Gordon, July 2018, p. 5)

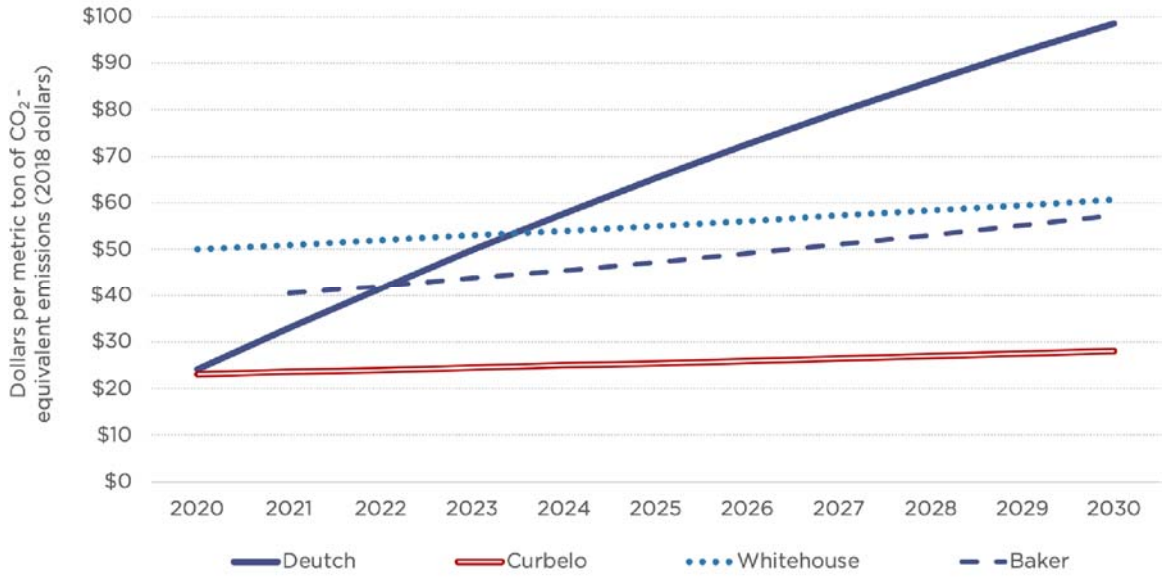
Three tax rates starting in 2020	Rate in 2030; yearly rate increase	Tax Revenue Raised Per Year	% Decrease from 2005 to 2030 of Emissions
$14/metric ton	$19, small yearly increases	$60 billion	27%
$50/metric ton	$61, small yearly increases	$180 billion	39%
$73/metric ton	$85, small yearly increases	$250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

Figure 1 below shows that only the Deutch Plan, of those included, has rapidly rising rates over the years. The NETP and CCL plans, not shown in Figure 1, also have 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. The CCL schedule of rates is identical to the Deutch Plan which is $10 per year less than the NETP Plan. Since the rates of these three plans are similar, they will be treated as one plan here for analysis.

The Baker/Schultz Plan does not in our view meet three of the criteria important for an effective energy transition plan: "start soon" (because it is controversial), effectiveness (because regulations are discarded), and fairness (because of dropping corporate tort liability). This plan is not considered here. It will be discussed further in the section on fairness.

Figure 2a indicates that a $50/metric ton rate is estimated to reduce emissions from 39% to 46%. This makes it clear that the Deutch/NETP/CCL 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 1- Starting Rates for Four Plans and Schedule of Annual Rate Increases
(Kaufman, November 2018, p.5)



STEP THREE The following studies indicate that the Deutch/NETP/CCL plan does a better job meeting the 50% reduction goal of this criterion than the other plans being considered. Figures 2a and 2b 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 2a – Emission Reductions from 2005 to 2030 for 3 Starting Rates w/ Innovation Estimate

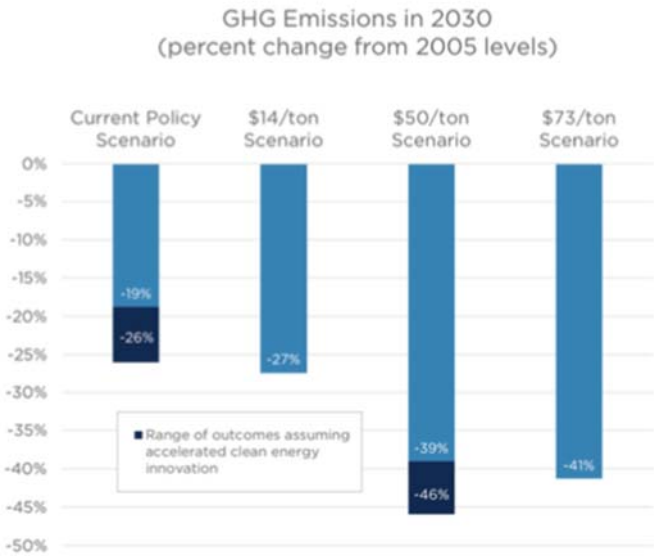
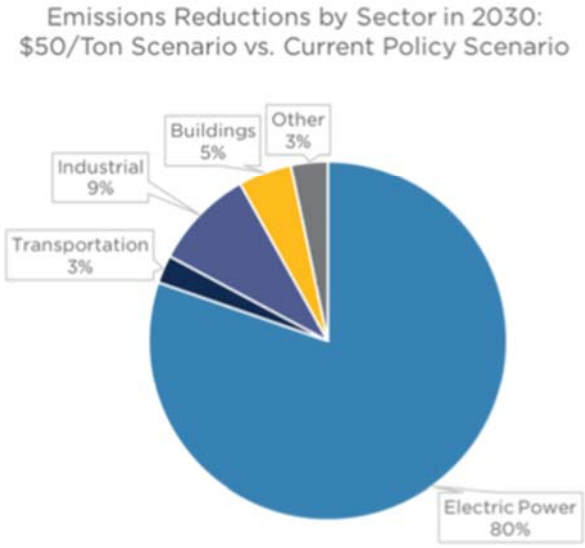


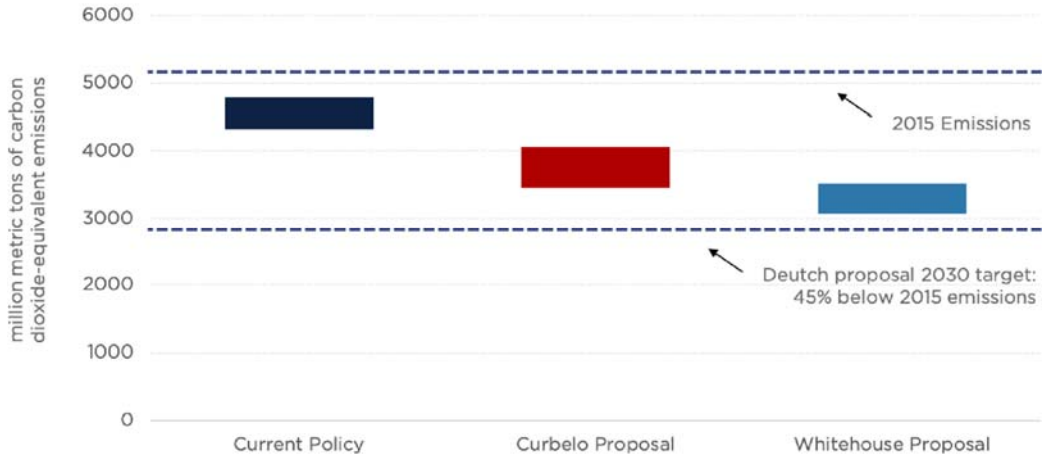
Figure 2b – Reduction by Sector
(Kaufman, July 2018, p.5)



The schedule of rates shown in Figure 1 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 3 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 starting rates with guaranteed yearly increases in rates. Figure 2b 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 3 - Emissions Reduction by 2030 for Current Obama Policy, Deutch, Curbelo Whitehouse Plans (Kaufman, November 2018, p. 9)



The results of the most recent Columbia University study in November 2018 are presented in Figure 3. Noah Kaufman states in reference to Figure 3, "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, Deutch and CCL to 2,500 mmt, a 52% reduction. (NETP and CCL are not shown on Figure 3).

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 demand switching? If supplies of renewable energy products are inadequate, there will be inflation in this sector which will choke off 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 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, 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 regulations are maintained, and reforestation, soil management and sequestration commence, along with a strong start in direct carbon capture from the air.

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

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, January 16, 2018). Declining costs will speed emissions reductions. Second, Noah Kaufman has questioned the assumption underlying price studies that all price changes are equal. (Kaufman, August 2018, 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 it 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 of a common undertaking is important 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. However, 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 Headline Statements from the Summary for Policymakers 2018 p. 3) Not only energy transition, but also other measures must be taken as mentioned earlier.

Table 3 – Regulations Kept and Removed for Various Plans (Kaufman, November 2018, p.7)

	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]

Table 3 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 CCL plans have the starting and rising tax rates which will meet the goal of a 50% emissions reduction by 2030. Baker/Schultz does not meet the effectiveness criterion because of the flat, non-rising tax rates along with cancellation of some existing regulations on carbon and methane.

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 in 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 & 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 for those successful.

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, 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.

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 CCL plans meet the Fairness criterion.

What is fair? This section explains how dividends and taxes balance each other to create fairness and evaluates the plans for fairness. The only plans that meet the fairness test are the NETP, Deutch, and CCL plans.

The NETP distributes dividends only to adult citizens. This makes administration more fool proof and transparent. See Plan: Section X for discussion.

Summary of research and analysis Tables and Figures:

Figure 4 – Carbon Tax Burden ; page 13
Figure 5 - Showing How Dividends Balance Taxes; page 14
Figure 6 – Impact of $50/ton Tax and Dividends on Income; page 16
Figure 7 – Impact of $50/ton tax on Demographic Groups; page 16
Figure 8 – Only NETP, Deutch, CCL & Baker/Schultz Fully Protect Working-Class; page 17
Figure 9 -- 60% of Americans with lowest income had stagnant Incomes; page 18
Figure 10 – Transition Impact on Fuel and Electricity Prices; page 19
Figure 11 – Transition Impact on Economic Growth; page 20

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 those to whom the atmosphere belongs.

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 regulated by a tax or law. Negative externalities should be taxed to raise the price and dissuade people from purchasing goods that harm the public and the environment. The revenue from taxation then theoretically raises the income of all the people by lowering their taxes. The NETP does exactly as called for by the externalities approach 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 adult citizens. The combination of "polluter pays" and equal dividends creates 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 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) * [times] (equivalent metric tons of CO_2 produced and taxed per month)

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

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

For individuals:

Net Cash Balance: equals zero when Dividends received equal Taxes Paid -- deciles 6 & 7 on Figure 5, p.14

Net Tax Paid: if Tax Paid is greater than Dividend received – orange shading for deciles 8, 9, and 10 on Figure 5, p.14

Net Cash Benefit Received: if Dividend of $2,237 is greater than Carbon Tax Paid – green shading for deciles 1 through 5, on Figure 5 p.14

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 -- tons taxed 1000 @ tax of $40 = $40,000 Revenue
second month -- tons taxed 900 @ tax of $50 = $45,000 = + $5,000
so change month to month =
A = -100 * $40 = -$4,000 = Negative Quantity Effect
B = +$10 * 900 = $9,000 Positive Price Effect,
$9,000 minus $4,000 = plus $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 plan is failing though dividends are increasing.

Thus, the life-cycle 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 really take off. The carbon dividend and tax 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, though the poor spend less dollars, they spend a higher proportion of their consumption dollar on necessities which are carbon intensive, and hence would rise in price. The tax causes their income to decrease (before receiving the dividends) more than for the rich. In contrast, the rich may hardly notice the increased spending caused by the carbon tax. This is shown in Figure 4 (p. 13) 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 & Paul, 2018, p.10)

Figure 4 – Carbon Tax Burden (Fremstad & Paul, 2018, p.10)

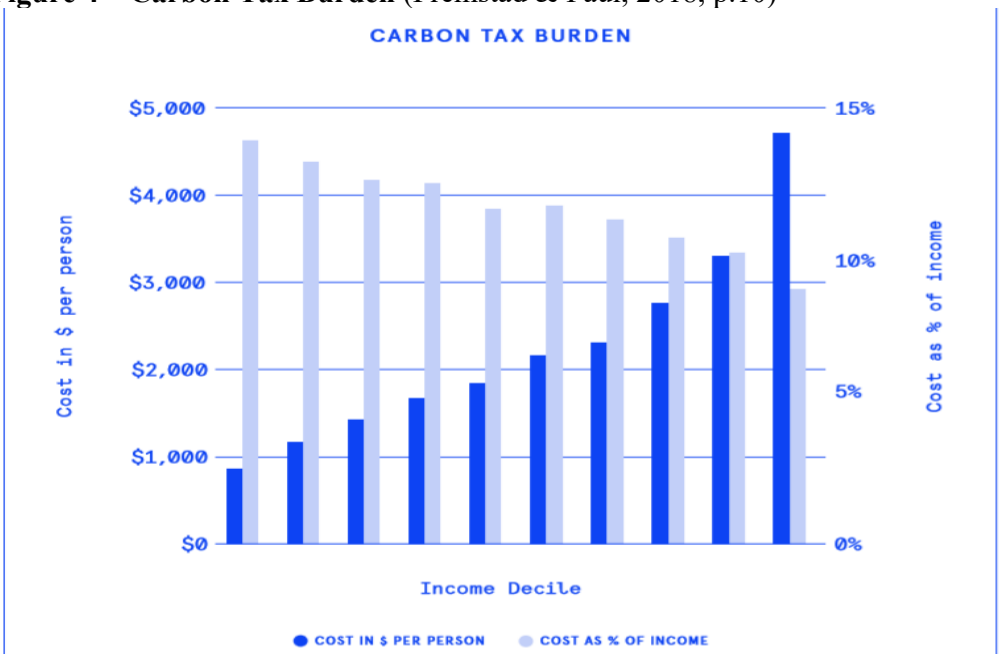


Figure 5 (p. 14) shows that the first five deciles (the persons in the bottom 50% of the income distribution) will receive a Net Cash Benefit (green) after the dividend payments, the next two deciles will roughly break even, and the persons in the top 30% of incomes will pay a Net Tax (orange). Though 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 5 (Fremstad & Paul, 2018). Dividends are $2,237 per adult per year, orange is net tax paid while green is net cash benefit. Though the dividend and tax amounts are high because the authors used the high tax rate of $230/metric ton promoted by William Nordhaus as the needed tax rate to keep the temperature rise to under 2.5˚C, the chart nevertheless accurately describes how the dividend offsets the increased energy costs placed on the poor and working class. (Nordhaus, 2017, p.1518 – 1523)

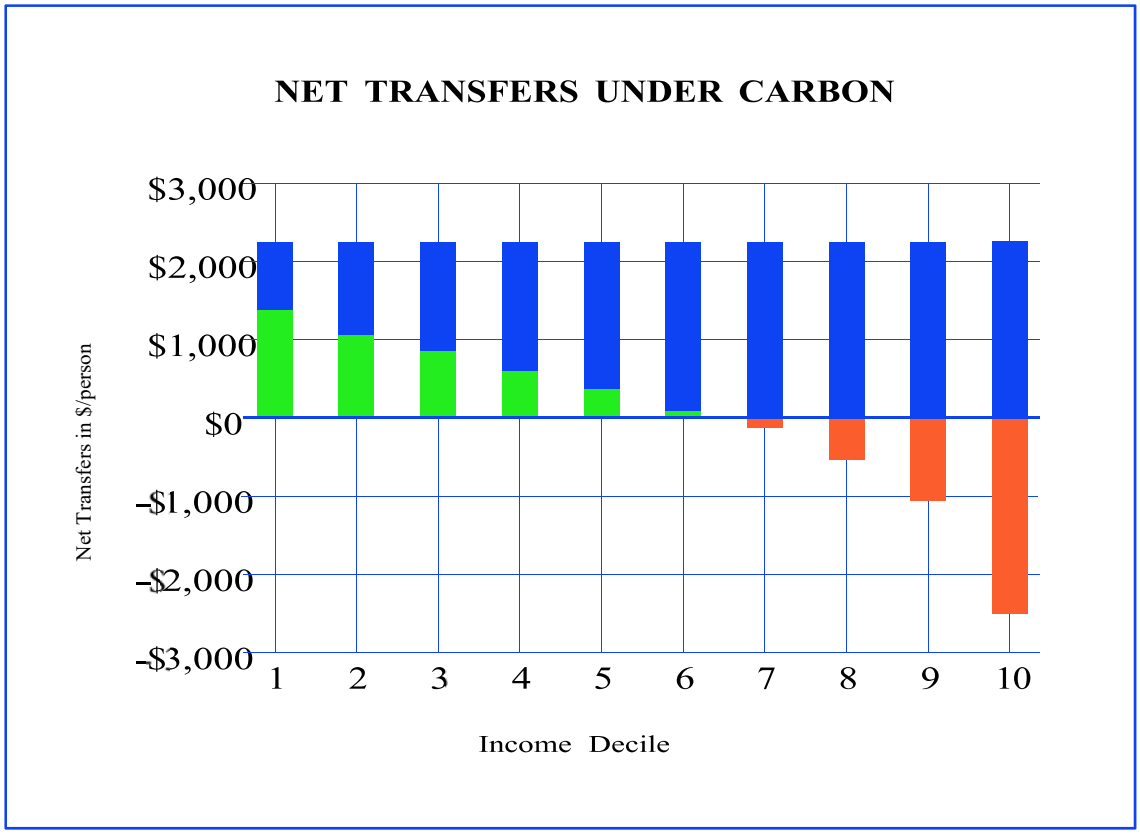
The sum of tax revenue equals the sum of dividends, that is, the sum of the orange bars (net taxes paid) equals the sum of green bars (net benefits received). For the lowest income decile: Net Cash Benefits equal the dividends of $2,237 per person minus taxes paid (blue portion) equals Net Cash Benefits 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. At some point as the economy transitions away from fossil fuels, the sum of orange starts to diminish therefore also the sum of the green. As this happens, the economy is coming closer and closer to a sustainable energy economy.

Figure 5 - Net Benefits and Net Taxes with a Carbon Tax of $230/metric ton (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. In the section on effectiveness (p.6) it was shown that a $50/metric ton tax was 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). 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 (this assumes two children per family on average). 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. 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 6 for income deciles and in Figure 7 (p.16) 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 6 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 7 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 8, p.17). These two charts demonstrate the effectiveness of the NETP in creating fairness in the impact of the carbon tax on the income distribution.

Figure 6 –Tax of $50/metric ton: Comparison Before and After Dividends by Deciles

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

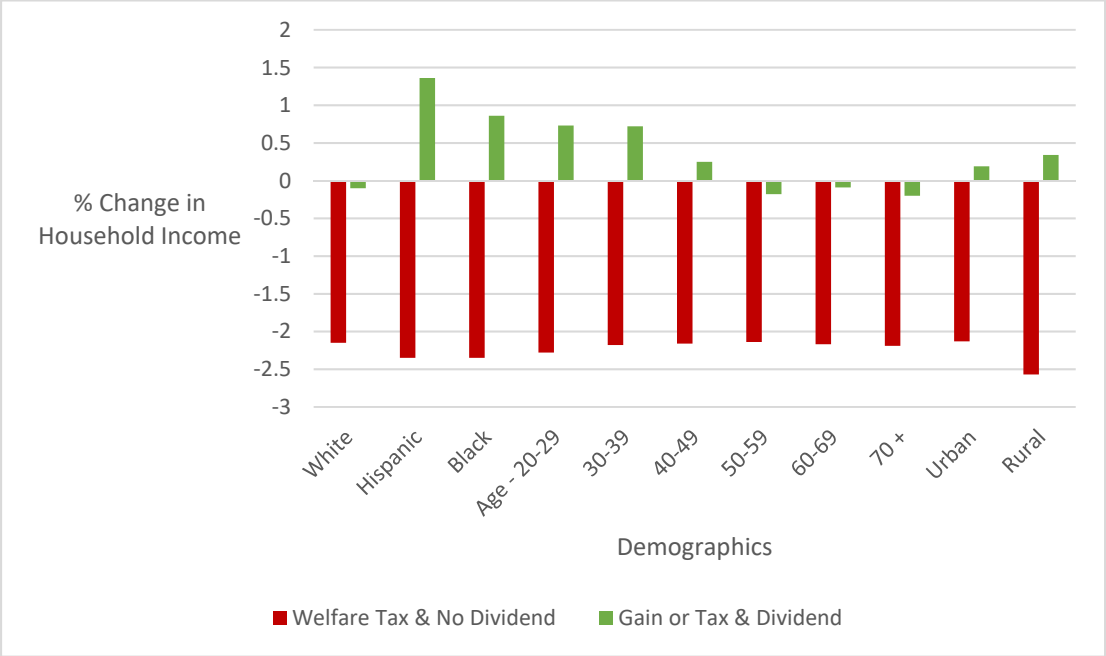
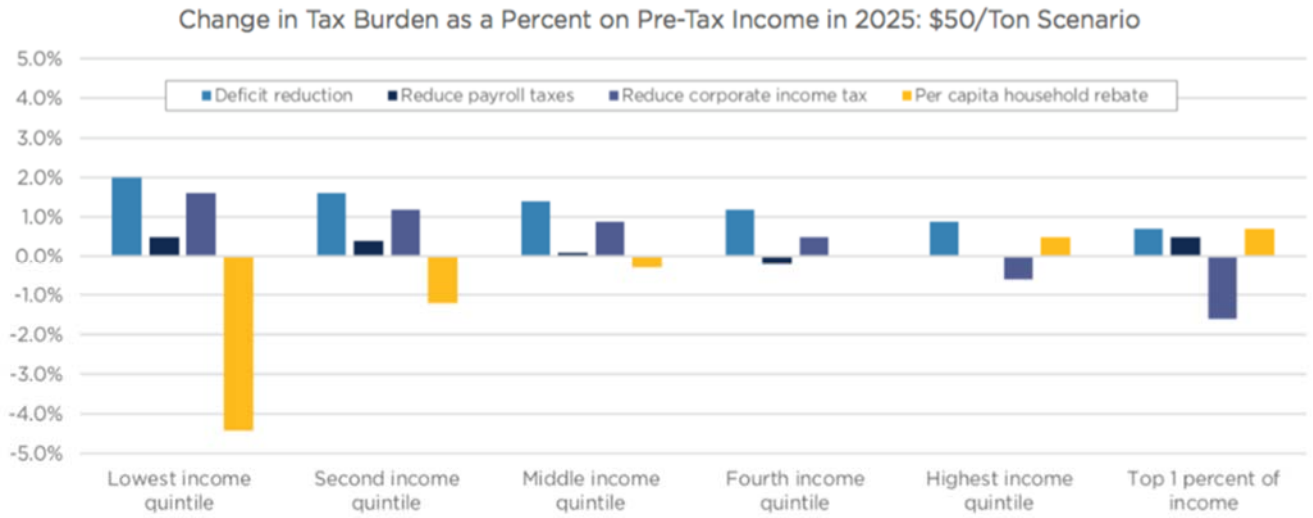


Figure 8 substantiates, as do Figures 5, 6, and 7 that adding the 100% dividend distribution to the Deutch/NETP/CCL Plan changes its impact on the income distribution from regressive to progressive, and further, as Figure 8, demonstrates none of the other uses shown for the tax revenue turn the regressivity into progressivity. See Endnote 2 for further support in the Resources for the Future study of the 100% dividend.

Figure 8 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 8 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/CCL 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 8 - Changes in Individual Income Tax Caused by Different Uses of Dividends
(Kaufman & Gordon, July 2018, p. 3)



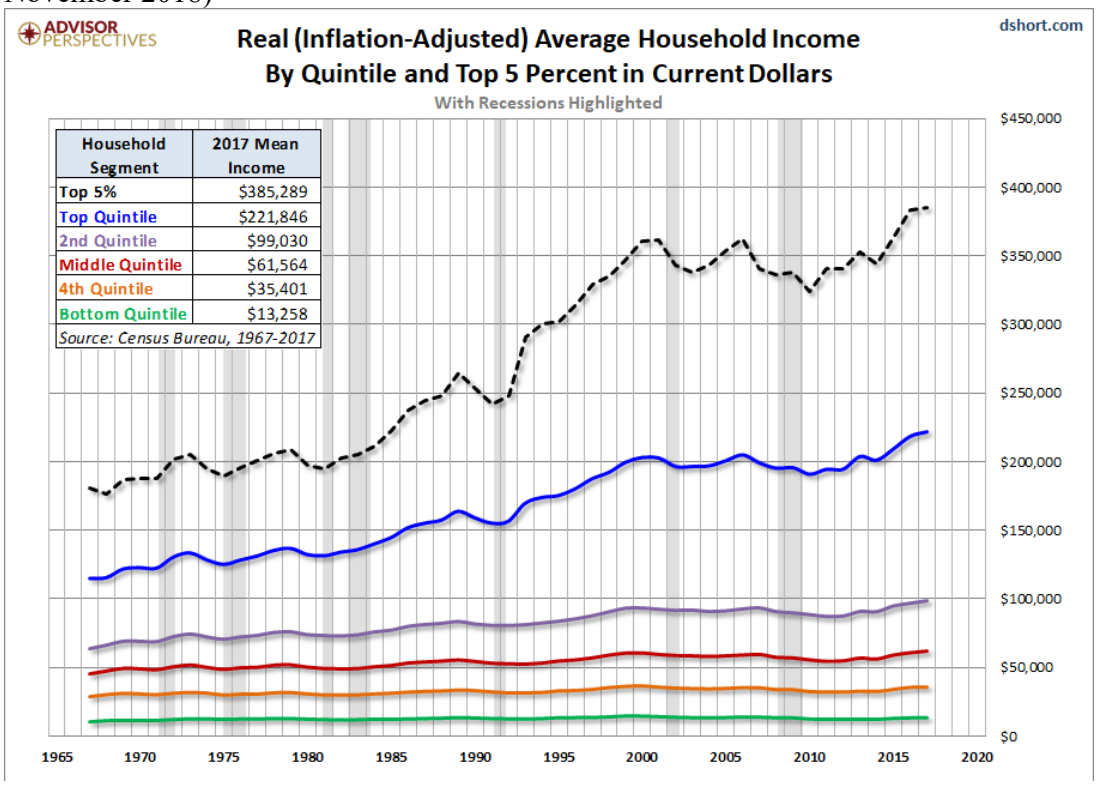
As illustrated by the yellow bar in Figure 8, only the four plans, the NETP, Deutch, Baker/Schultz and CCL return all tax revenue to the people. These plans meet the fairness criterion, while the others do not. The dividends ensure that the costs of the energy transition plan are not placed unduly on 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 6 (p.16). 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 in these areas 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 9 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 9 - U.S. Income Distribution 1965 to 2018 (US Bureau of Labor Statistics, November 2018)



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

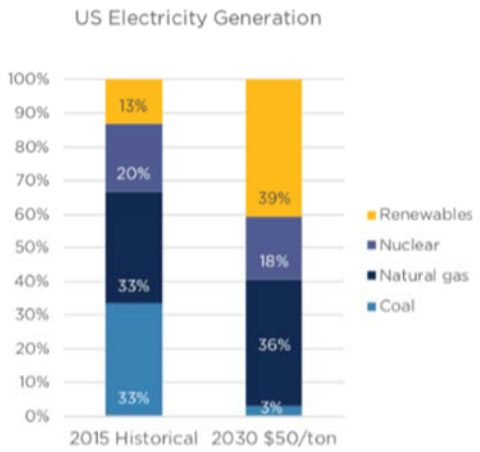
continue using their existing equipment including trucks, automobiles, tractors, and combines for work and transportation. There are currently no alternative means of transportation in rural areas. This will change as renewable fuels along with electric-powered farm implements become available.

The Columbia University Study depicted in Figure 10 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 10 - Selected Energy Prices in 2030 and a Historical Comparison

Selected Energy Prices in 2030 and Historical Comparison

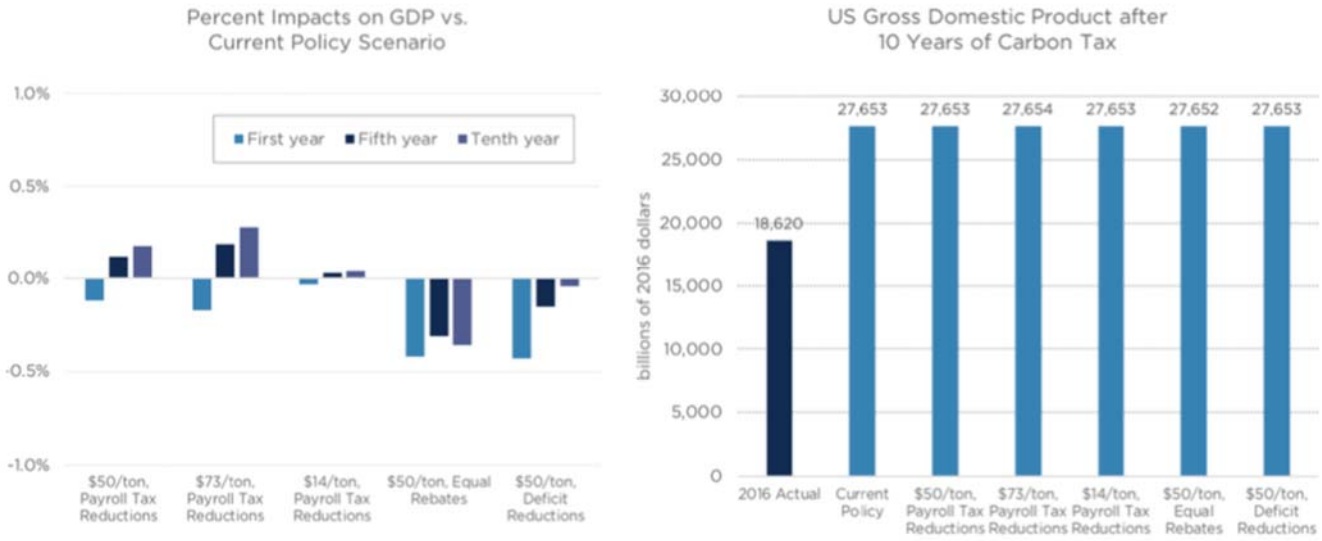
	Gasoline (Price at pump) 2016 $/gal	**Diesel** (Price at pump) 2016 $/gal	**Natural Gas** (Delivered price) 2016 $/mmbtu	**Electricity** (Retail) 2016 cents/kWh	**Coal** (Power sector) 2016 $/short ton
2030 Average Price					
Current Policy	3.0	3.6	7.6	10.6	45
$14/ton	3.2	3.8	8.9	11.4	79
$50/ton	3.6	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



This study shows that prices of gasoline, diesel, and electricity, the major concerns in rural areas, would rise about 20% during an energy transition.

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 11 - Projected Impacts on GDP growth of Four Tax plans with Different Uses of Tax Revenue (Kaufman & Gordon, July 2018, p. 4)



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. Certainly, economic growth, inflation and unemployment must be kept under control. To some extent this can be done by adjusting the tax rate.

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 because such a transformation has never been attempted even during the Second World War and because the timing and severity of climate change impact on the world economy is unknown.

Summary: The preceding analysis evaluated how dividends and taxes balance each other to create fairness. Only NETP/Deutch/CCL meet the fairness criterion. The Baker/Schultz Plan will be contentious because it removes corporate tort liability which probably will prevent a quick start and will be viewed as unfair.

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 few 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 so that Congress cannot change the tax rates or the dividends.

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 not assured of the non-political process by which future rates will be changed. Uncertainty is the nemesis of long-term business investment.

The contradiction between "set-in-stone" and adjustable rates is 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.

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. In the NETP Tamper Proof means: a) enacting legislation which specifies the starting tax rate as well as the set schedule of rates through 2030, including to the extent possible, securing these rates from future congressional change, b) turning over all operational aspects of the transition to business and the free market, and c) specifying that future changes in the schedule of tax rates be made only by the independent Climate Council to ensure the plan stays on track to meet emission goals.

The dividends provide a degree of insurance against later 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 who will steer the economy in a new direction. Envisaged and actual profits and losses will determine actions, not government officials and other interests. 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** and the **Citizen's Climate Lobby Plans**, met all criteria except for Criterion 5, creating both tamper proof measures and a non-political method for adjusting tax rates. **Curbelo and Whitehouse** failed on the effectiveness

criteria to meet the 50% reduction goal and on the fairness standard. The **Baker/Schultz Plan** failed on effectiveness by removing needed regulations, and on "start soon" as well as "tamper proof." The plan split on fairness by doing well on the 100% dividend distribution to citizens but removing tort corporate liability. Finally, only the NETP incorporates all the four enhancements deemed important for a successful energy tranisition 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 try to limit climate change. No one knows how difficult it will be to replace the old energy infrastructure that took 200 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. Nevertheless, based on the foregoing assessment of the various plans we conclude that the NETP has the best chance to succeed.

IV. End Notes –

1. **Why Not Regulation and Why use Capitalism?** The regulatory approach to carbon control was not examined here because historically it has failed and does not meet the "tamper proof" criterion. Given the litigation brought against President Obama's Clean Power Act, as well as subsequent presidential cancellations, it is manifest that regulatory approaches are vulnerable to dismemberment and endless litigation. The current political threat over automobile mileage standards is an example of long-term planning placed in jeopardy under uncertainty. Even the Cap and Trade law in Europe was full of holes where special interests could enter and eviscerate the law making it impotent. Business cannot stride forward under such uncertainty.

   The proposed plan is put forward as the indispensable mechanism to transform our economy from dependency on fossil fuels. But as stated earlier, climate scientists argue persuasively that the dividend/tax approach cannot do the job by itself without assistance from other major policies as described earlier.

   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 and water contaminated by noxious wastes spewed from plants in their neighborhoods. 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 many. Nevertheless, the profit system must be disciplined and regulated. 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 Lawrence Goulder et al. (see References) is both comprehensive and gives measurement 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.

The Resources for the Future tax rate schedule is hard to compare with the NETP 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, Page 6 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.

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" 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 don't 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.

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