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Getting The Greenhouse Garden To Weed Itself

A look at a greenhouse emission tax

Contents

[Greenhouse Affect 2](#_Toc448246899)

[Greenhouse Gasses 3](file:///C:\Users\felix_000\Desktop\Energy-Economics\GETTING%20THE%20CARBON%20GARDEN%20TO%20WEED%20ITSELF12.docx#_Toc448246900)

[Carbon Dioxide (C 02) 4](#_Toc448246901)

[Methane (C H4 ) 5](#_Toc448246902)

[Nitrous-oxide (N2 O) 6](#_Toc448246903)

[US Greenhouse Gas Emissions By Economic Field (2013) 7](file:///C:\Users\felix_000\Desktop\Energy-Economics\GETTING%20THE%20CARBON%20GARDEN%20TO%20WEED%20ITSELF12.docx#_Toc448246904)

[Electricity and Heat Production 7](#_Toc448246905)

[Transportation 8](#_Toc448246906)

[Industry 8](#_Toc448246907)

[Commercial and Residential 8](#_Toc448246908)

[Carbon Tax 9](#_Toc448246909)

[Cap-And-Trade 10](#_Toc448246910)

[Current Carbon Emissions Laws 11](#_Toc448246911)

[Kyoto Protocol 11](#_Toc448246912)

[European Union Emissions Trading Scheme 12](#_Toc448246913)

[California Cap and Trade (CARB) 13](#_Toc448246914)

[Regional Greenhouse Initiative (RGGI) 13](#_Toc448246915)

[The British Columbia Carbon Tax 13](#_Toc448246916)

[How Greenhouse Gasses Are Managed 14](#_Toc448246917)

[Cap-And-Trade Vs Carbon Tax 15](#_Toc448246918)

[What should be done with Revenues from Greenhouse Emissions Taxes 16](#_Toc448246919)

[Models 17](#_Toc448246920)

[Carbon Dioxide 17](#_Toc448246921)

[Table Two Methane 18](#_Toc448246922)

[Table Three Nitrous Oxide 18](#_Toc448246923)

[Table Four Total Revenues 19](#_Toc448246924)

[Table Five Revenues and Programs 19](#_Toc448246925)

[Table Six Estimated Rise Fuel Increase 19](#_Toc448246926)

[Table Seven Estimated Rise in Diary and Beef 19](#_Toc448246927)

[Results 20](#_Toc448246928)

[Epilogue 21](#_Toc448246929)

[1. References 24](#_Toc448246930)

**Abstract**: *Countless studies and scientific observations in many science disciplines have shown man-made global warming is occurring at a fast pace. From biologist observing the changing migrations of species due to temperature change, to geologists observing huge temperature fluctuations in today’s ice and sea core samples not observed in past till now. The evidence of global warming is overwhelming, and humanity can no longer afford to embed its head in the sand of global warming denialism. The narrative pushed by climate deniers of an economic destruction is a proven falsehood. By making carbon taxes revenue neutral, it eviscerates claims of distress on the economy.*

# Greenhouse Affect

Many gasses can be referred to as greenhouse gasses, they be both natural and man-made compounds. The chemical property that unites them is the ability to trap heat from the sun that would usually be reflected into outer space. The ability for a chemical compound (chemical compounds are substances made up of multiple atoms) or a single atom to absorb energy is called its thermal property and varies with each atom or compound.

The greenhouse effect can be observed in nature; one such example in our Solar System is the planet Venus. Even though it is the second planet from the Sun, it still is the hottest planet in our Solar System. The explanation for this is called a “runaway greenhouse effect” which is mostly caused by two factors: Venus’s atmosphere composition (mostly made of up carbon-dioxide and sulfuric acid two very potent greenhouse gasses), and its thick atmospheres density (90 times thicker than Earth’s). (NASA, 2016)[[1]](#footnote-1). This causes the temperatures on Venus to be hot enough to melt lead.

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There are many different types of greenhouse gasses. As shown in the chart the three biggest artificial releases are carbon-dioxide, methane, and nitrous oxide.

http://www3.epa.gov/climatechange/kids/references.html#ref-10

# Greenhouse Gasses

For this report, we will only be calculating those three greenhouse gasses. For back ground information, we will take a quick look at the other gasses that cause global warming.

In the “other category” are a few substances, such as water vapor, ozone, halocarbons, and the soot. Because water vapor is so prevalent in the atmosphere, calculating how much is release by man is unnecessary. Water vapor is controlled by the weather, when more water is added to the atmosphere it increases the amount of rain that falls to the Earth.

**Ozone (-O3)** is three oxygen atoms with one single bond and one double bond, with one of the oxygens being a center of the compound. Due to its configuration, it is very unstable and reacts easily with other compounds and atoms. It is either a colorless gas or has a bluish tint to it and has a pungent odor (NCBI, PubChem, 2016)[[2]](#footnote-2). It usually has a life span for approximately thirty minutes in the atmosphere, so the effect it has on global warming is very fleeting.

**Soot** is the result of incomplete combustion of organic materials. This results in the release of black carbon that absorbs heat. It is the result of both man made sources like crude lanterns that give off incomplete combustion materials and natural sources such as wildfires. It causes the most problem when it lands on ice and starts absorbing sunlight that would usually have been deflected into outer space. When it does this it increases the temperature at which the ice will melt.

**Halocarbons** is a chemical compound family made up of a carbon covalently bonded with a fluorine, chlorine, bromine or iodine. Once used in refrigeration and aerosol cans, its damaging effect on the ozone layer caused it to be banned and cut back by the Montreal Protocol. Its level in the atmosphere has been decreasing through the years with the ozone level to be reach 1990’s levels by 2050 to 2070.

## Carbon Dioxide (C 02)

Carbon-dioxides a colorless and odorless inert (does not react with other substances) gas, that exists in small amounts in the Earth’s Atmosphere. It has a chemical make-up of two oxygens double bonded to a single carbons atom. It is water soluble (the ability of a substance to be dissolved in water) and when dissolved into water forms carbonic acid (H2CO3) (Information, 2016)[[3]](#footnote-3). This property is the reason why when it is diluted into it causes the acidification of bodies of waters on Earth.

http://www3.epa.gov/climatechange/ghgemissions/usinventoryreport.html

Once produced, carbon-dioxide tends to have a long life. It eventually is dissolved into the world’s bodies of water or sequestered by plants or plankton to be used in photosynthesis. This sequester of carbon is the basis for the natural creation of oil, and by burning derivatives of oil the previously sequestered carbon is released.

The biggest carbon dioxide emitter comes from the burning of fossil fuels to produce electricity, this accounts for thirty-seven percent of carbon-dioxide emissions. Transportation defined as diesel and gasoline vehicles account is the second biggest emitter with thirty-one percent of carbon-dioxide emissions.

## Methane (C H4 )

Methane is a gas which is a hydrocarbon (organic compounds made up of hydrogens and carbons), that is made up of one carbon singly bonded to four hydrogens. It has no natural smell (an artificial smell is sometimes added) and is highly flammable. It is lighter than air and has an estimated twelve-year lifespan in the atmosphere. Methane makes up the second largest amount of greenhouse gases in the atmosphere, it is twenty-five times more efficient at trapping heat than carbon-dioxide. (NCBI)[[4]](#footnote-4) It is produced naturally through life forms and geological activity. Human caused emissions come from both oil drilling and coal mining.

http://www3.epa.gov/climatechange/ghgemissions/usinventoryreport.html

The two biggest emitter’s of methane are industry and livestock production. The biggest one of the two is animal husbandry, which accounts for thirty-six percent of methane emissions. Animal husbandry emissions come from enteric fermentation and manure management. Enteric fermentation emissions are the result of the breakdown grains and grasses in herbivores stomachs. The biggest emitters of methane from animal husbandry is from beef and dairy production.

Industry emissions are mostly the result of the production of natural gas since methane makes up the majority of natural gas. The releases mainly happen with the production, distribution and storage of natural gas but giant releases like what we saw in California Aliso Canyon (also called the Porter Ranch Leak) do happen.

## Nitrous-oxide (N2 O)

Nitrous-oxide is a gas made up of one oxygen single bonded to nitrogen, and two nitrogens triply bonded to each other. It is a colorless and odorless gas that is an extreme oxidizer at high temperature (NCBI)[[5]](#footnote-5). The inhalation of it causes a euphoric feeling and is used as an anesthesia in dentistry and other health fields. Because of its strong oxidizing property, it is used in high-performance motors to increase their performance. It is estimated to be three hundred times more potent as a greenhouse gas than carbon-dioxide (EPA)[[6]](#footnote-6) and lasts for approximately one-hundred years in the atmosphere. The biggest emitter of nitrous oxide is from farming from the application of synthetic fertilizer derived from oil.

http://www3.epa.gov/climatechange/ghgemissions/usinventoryreport.html

# US Greenhouse Gas Emissions By Economic Field (2013)

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https://www.ipcc.ch/report/ar5/wg3/

Electricity and Heat Production

Thirty-one percent of greenhouse emissions are from electricity and heat production. In 2013, electricity production emitted 2059.4 million metric tons (MMT) tons of carbon dioxide, 2.1 MMT of methane and 18.2 MMT of nitrous oxide (EPA)[[7]](#footnote-7)

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## Transportation

Transportation emits twenty-seven percent of greenhouse gasses in the US. It consists of fossil fuels used by cars, trucks, trains, ships or any other vehicle that is used to transport freight or people. Transportation released 1,713 MMT of carbon-dioxide, 2.1 MMT of methane and 18.2 MMT nitrous oxide in 2013 (EPA)[[8]](#footnote-8).

## Industry

Industry emits twenty-one percent of greenhouse emissions. With industry, there are a lot of direct and indirect emission of greenhouse gas, some industries like aluminum are very energy intensive and require massive amounts of energy to produce. The energy production for the industry is added to electricity emissions of greenhouse gasses. Industry emits 812.2 MMT of carbon-dioxide, 1.5 MMT of methane and 2.4 MMT of nitrous-oxide (EPA­)[[9]](#footnote-9).

## Commercial and Residential

Commercial and residential greenhouse emissions are the result of the burning of materials for heat and the use of certain chemicals that release greenhouse gasses. The greenhouse emissions for commercial and residential is 482.2 MMT of carbon-dioxide, 6.5 MMT of methane and 1.3 of nitrous-oxide in 2013. (EPA)[[10]](#footnote-10)

# Carbon Tax

People usually define carbon tax in two ways, first is a tax on just carbon and other greenhouse gases emissions or a tax on carbon and other greenhouse gasses at the moment of production. Some people only count carbon dioxide, for this paper the assumption we make is that a carbon tax is a tax on carbon dioxide, methane and nitrous oxide, given that the reason for a carbon tax is to stop global warming.

Most carbon taxes are calculated from the time they are emitted. Since some greenhouse gasses cause more warming than others, the more potent ones can be priced at a higher rate.

A carbon tax does have some negative externalities aspects to it. For one, it is a regressive tax people in lower income brackets spend a greater percentage of their income on transportation cost, utilities and food than people in higher income brackets. This could be mitigated in several ways, such as decreasing registration fees for inexpensive vehicles, decreasing the payroll tax and increasing spending on social programs. While greenhouse gas taxes are definitely a regressive tax, the degree to which it has an effect on people in the lower bracket of income will decrease over time as human behaviors adapt to higher gas prices such by driving less, using more public transportation, riding a bike and buying more fuel-efficient cars.

Another negative externality that needs to be addressed by a carbon tax, is that it gives producers in countries with no carbon tax an advantage over domestically produced goods. This can be somewhat mitigated by making the revenue collected from a carbon tax revenue neutral by cutting the corporate tax. While losing some industries might be inevitable, attracting industries that are cleaner with a lower corporate tax might be more beneficial to the population.

While there is a few negative externalities to a carbon tax, there are many more positive externalities. Such as decrease levels of pollution, improved health in the area, decrease health cost, increase agriculture production, decrease dependence and oil imports of a country.

# Cap-And-Trade

Cap-and-trade is a system that gives pollution emitters a fixed amount of credits that allow them to release a certain amount of pollution in an amount defined by those credits. The credits are usually based on their average rate of emissions of the country the year the cap-and-trade is initiated. Not only are they allowed to use these credits, but they can trade and sell these credits on an open market to other emitters. One way for an emitter to get credits is by installing pollution controls in another emitters system to receive pollution credits from the decrease in pollution. In some cap-and-trade systems, emitters can implement certain programs and actions that sequester carbon to acquire credits. This could be the buying of forest to be set aside for non-development or the installation of solar panels in poorer regions to replace high pollution energy generation.

There are some drawbacks from using the cap-and-trade system. The first one is pollution emitters’ intentionally emitting pollution when the average pollution levels are being calculated to get their cap set high or using decommissioned or soon to be decommissioned facilities to acquire carbon credits. This gaming the system could negate the whole cap-and-trade system, making it useless.

A second problem is the need for a central command and control system to regulate the cap-and-trade system. Since command and control systems adds a bureaucratic check to the system, it slows down the process, cutting efficiency and increasing resources spent on projects.

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# Current Carbon Emissions Laws

## Kyoto Protocol

The Kyoto Protocol a United Nations Treaty that was signed by 193 in Kyoto Japan on December 11, 1997, with implementation in 2005. (Nations, UN Treaties, 2016)[[11]](#footnote-11) The Protocol was an extension of a previous treaty called the United Nations Framework Convention on Climate Change from 1992. Its goal was to decrease the emissions of carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, and sulphur hexafluoride all around the world to 1990 levels. It did this by getting countries to sign a legally binding agreement to reduce their greenhouse emissions. It set forth a program to monitor the emissions of signatories of the treaty. It did this be addressing to mechanisms, the release of greenhouse gasses and the removal of “sinks” which included things like forests that sequestered carbon dioxide (Nations, Kyoto Agrement, 1997)[[12]](#footnote-12) Article 3 Section 3. It also set forth a greenhouse gas market that allowed the trading of emission credits from countries that emitted less than their agreed upon emissions. Some other things it attempted to do was set a council of experts that could make changes based on new technology and evidence. It also sought to set up a system to exchange technology, know-how, and give developing countries financing to combat global warming.

The major shortcoming to the Kyoto Protocol was the unwillingness for both the United States and Australia to sign the agreement. Since at the time, the United States was currently responsible for the majority of the greenhouse emissions, the Kyoto Protocol was hobbled from the beginning.

## European Union Emissions Trading Scheme

The European Union Emission Trading Scheme is the world’s first and largest cap-and-trade program, it was implemented by thirty European countries and Iceland. The program was to be implemented in three different phases. The first phase which went from 2005 to 2007, saw countries submit and publish their National Allocation Plans (NAPS)[[13]](#footnote-13). This was a plan to show how much pollution the country was going to emit, and what industries were responsible for it.

The second stage lasted from 2008 to 2012, and saw the NAP’s edited and resubmitted. When the NAPS were first submitted it was decided they were too complicated and needed to be simplified. On the surface, a cap-and-trade system seems simple, but implementing them has proven to be difficult.

The third stage had three goals, the first one was to cut emissions by twenty percent, the second was to have twenty percent of EU energy generation by renewables and the last one was a twenty percent in energy efficiency. For credit trading between countries and industry two marketplaces were set up, the first one was called European Energy Exchange (EEX) and was based in Leipzig Germany, and a second one called ICE Futures Europe (ICE) set in London England. Eighty-eight percent of the revenue goes to the European Member States when they verify their emissions. Ten percent goes to the least wealthy of the European Union States to modernize their pollution control. The leftovers go to European Nations, so that they may achieve their Kyoto Protocol emissions cut goals.

## California Cap and Trade (CARB)

The goal of California Cap-And-Trade is to lower greenhouse gas emissions to 1990 levels. One of the goals of California’s cap-and-trade program, is to replace old appliances for people in low income brackets decreasing energy use. It also sets a goal of having thirty-three percent of energy production done by renewables in California.

The auction for carbon credits are held quarterly, the auction sells two types of carbon credits, vintage, and future credits, the credits come in 1000 unit emission tons. This is done to stop from shock shortages from entities gaming the system by buying up credits and selling them in the future at a premium price. The auction itself is single-round sealed-bids format. The bid has a floor price level of $ 11.34[[14]](#footnote-14) which increases five percent each year. Revenue from the auction goes to reducing greenhouse gas emissions. In 2014, the amount raised by the CARB was six hundred and thirty-three million dollars (Fund, 2014)[[15]](#footnote-15).

## Regional Greenhouse Initiative (RGGI)

RGGI was founded in 2003, it is made up of nine North-Eastern states, and observed by several providences in Canada. In 2012 a cap of ninety-one million ton was set, with a goal of reducing two and half percent per year. The auction is very similar to CARB with revenues going to energy efficiency programs and renewable energy stimulus programs. (Inc., 2008)[[16]](#footnote-16)

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## The British Columbia Carbon Tax

On July 2008, the Canadian province of British Columbia initiated a tax on carbon. The tax was revenue neutral, with revenues going to cuts in the personal and corporate income taxes by five percent. Because of this, British Columbia had one of the lowest corporate tax levels in Canada.

The tax was first set at 10 Canadian Dollars (7.30 U.S dollars)per tonne[[17]](#footnote-17), and would increase five dollars Canadian Dollars (3.65 US dollars) per year till it reached 30 Canadian Dollars (21.90 U.S dollars). For the average consumer this 30 Canadian Dollars a tonne2, would be approximately 7 cents per liter or approximately .19 (U.S dollar) per gallon.

After four years a study commissioned by the Canadian Public Policy (McClay, 2013)[[18]](#footnote-18) found a decline of 18.8 percent (BC consumption of fuel fell by 17.4, while the rest of Canada increased by 1.5) greenhouse emissions more than the rest of Canada when compared to the same time period. While at the same time, there was no difference in the rise or fall of GDP in British Columbia when compared to the rest of Canada. The study concluded there was no negative effect on the British Columbia economy but whether it was a positive effect or what will happen in the future needs to be studied more.

# How Greenhouse Gasses Are Managed

There are many independent variables to take into account when calculating the cost of greenhouse gasses. Some examples are the time the gas stays in Earth’s atmosphere, the degree at which it warms the atmosphere, and whether the industries that produce those gasses can be easily replaced. An important factor is the actual number of carbon atoms that is in the gases emitted, while having materials that don’t reach full combustions is inefficient, it does lower the carbon emitted. It is my belief that the best greenhouse tax amount, is the one which has the greatest ratio between dollars taxed and greenhouse gasses cost. It also depends on the goal, cuts to methane could be emphasized over cuts to carbon dioxide for short term reduction in the effect of global warming since methane has a lot shorter atmosphere life than carbon dioxide.

For cap-and-trade, the caps are usually the amount of pollution that is emitted the year before the cap is put in place. Unfortunately, this strategy does allow gaming of the system in the beginning by emitters purposely emitting excess greenhouse gasses to get the extra credits. But if the goal of the cap is to bring greenhouse emissions to a certain previous year measurement, it somewhat negates the ability of emitters to game the system.

For the carbon auctions that occur in California, the going price was $ 10.09 per metric ton in 2013 (Administration).[[19]](#footnote-19) This is only ten cents above the set floor price for a ton of carbon, which means more than likely the cap was set to low.

# Cap-And-Trade Vs Carbon Tax

In my opinion a carbon tax is preferable over a cap-and-trade at least for a country system for two main reasons. The first is the need of a large command and control to administer the cap-and-trade program, the second is that it can become a tool to preserve monopolies by allowing older companies to control the greenhouse gas emissions credits.

An example of a way companies can game the system would be by buying forest land to be set aside in trust for carbon credits, even if the land was never to be developed. Not only are the credits obtained in a border-line fraudulent way, by having an apparatus devoted to cheating the system, the emitters are wasting resources.

A second problem with having a command and control is that it slows down the system. The need to do studies and calculations is both time and resource consuming. By increasing the drag on the system you create inefficiencies in the system.

The way a cap-and-trade system can become a tool to preserve monopolies is the cap part of it. By having a set amount of pollution credits, established industries can buy these credits up and keep developing industries from acquiring them. This smothers innovation and competition, which leads to a decrease in quality and amount of goods that consumers can access.

In the decision between a cap-and-trade and a carbon tax, depends on whether it’s for a national or global level. On the national level, a carbon tax in my opinion is the preferred option. With its lack of command and control it’s more nimble and efficient. Prices can be increased to cut down on the emissions, with only the loss of industries that are not desired or unnecessary.

On a global scale having a big command and control might be worth the cost. Countries based in the First World would have a motivation to invest in developing countries pollution controls to acquire carbon credits. A cap-and-trade is preferable when there is a huge difference in pollution mitigating technology and infrastructure between regions.

## What should be done with Revenues from Greenhouse Emissions Taxes

Most revenues from greenhouse gas revenues usually go to cutting the payroll tax or cutting the corporate tax. Cutting the payroll tax especially for people in low income is a good way to mitigate the regressive nature of a greenhouse gas tax. While cutting the corporate tax is a good way to stimulate investment, foreign investment and consumption (Åsa)[[20]](#footnote-20).

Other ways the revenues can be used to mitigate their regressive nature is by using them to cut Social Security and Medicare Payments. The revenue could be used to make Social Security solvent without the need to cut benefits or increase the age at which benefits are paid.

Some other sources the revenue is used for is the buying of energy efficient devices. You see this with the California Tax-and-Trade revenues that are used to purchase energy efficient devices for low income people. Also the revenues can be used to finance green energy projects like windmills and solar.

# Models

## Carbon Dioxide

Source: https://www3.epa.gov/climatechange/ghgemissions/gases/co2.html

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Carbon Dioxide Source** | *Percentage Released* | *CO2 Gas Emitted in tons* | *Total Low(billions)* | *Total Average (billions)* | *Total High(billions)* |
| Other Non-Fuel Emissions | 6% | 309456000 | $ 12.38 | $ 40.23 | $ 68.08 |
| Electricity | 38% | 1959888000 | $ 78.40 | $ 254.79 | $ 431.18 |
| Transportation | 31% | 1598856000 | $ 63.95 | $ 207.85 | $ 351.75 |
| Industry | 15% | 773640000 | $ 30.95 | $ 100.57 | $ 170.20 |
| Residential Commercial | 10% | 515760000 | $ 20.63 | $ 67.05 | $ 113.47 |
| Total CO2 Released | 5157600000 | Totals | $ 206.30 | $ 670.49 | $ 1,134.67 |
| Cost per ton low | $ 40.00 | per ton |  |  |  |
| Cost of Average Per Ton | $ 130.00 | per ton |  |  |  |
| Cost of High Per Ton | $ 220.00 | per ton |  |  |  |

## Table Two Methane

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Methane Sources** |  | Methane released in tons | Cost Per Ton Low (billions) | Cost Per Ton Average (billions) | Cost Per Ton High (billions) |
| Industry | 28% | 197120000 | $ 8.87 | $ 828.40 | $ 1,647.92 |
| Coal Mining | 10% | 70400000 | $ 3.17 | $ 295.86 | $ 588.54 |
| Other | 8% | 56320000 | $ 2.53 | $ 236.68 | $ 470.84 |
| Enteric Fermentation | 26% | 183040000 | $ 8.24 | $ 769.23 | $ 1,530.21 |
| Land Fills | 18% | 126720000 | $ 5.70 | $ 532.54 | $ 1,059.38 |
| Manure Management | 10% | 70400000 | $ 3.17 | $ 295.86 | $ 588.54 |
| Total Methane Released in tons | 704000000 | Totals | $ 31.68 | $ 2,958.56 | $ 5,885.44 |
| Cost per ton low | $ 45.00 | per ton |  |  |  |
| Cost per ton Average | $ 4,202.50 | per ton |  |  |  |
| Cost Per Ton High | $ 8,360.00 | per ton |  |  |  |

Source: https://www3.epa.gov/climatechange/ghgemissions/gases/ch4.html

## Table Three Nitrous Oxide

Source: https://www3.epa.gov/climatechange/ghgemissions/gases/n2o.html

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Nitrous Oxide Sources** | Percentage Released | Nitrous Oxide Released in tons | Cost Per Ton Low (billions) | Cost Per Ton Average (billions) | | Cost Per Ton High (billions) |
| Transportation | 5% | 20,475,000.00 | $ 1.02 | $ 671.68 | $ 1,342.34 | |
| Other | 4% | 16,380,000.00 | $ 0.82 | $ 537.35 | $ 1,073.87 | |
| Stationary Combustion | 6% | 24,570,000.00 | $ 1.23 | $ 806.02 | $ 1,610.81 | |
| Industry o Chemical Production | 5% | 20,475,000.00 | $ 1.02 | $ 671.68 | $ 1,342.34 | |
| Ag soil and Management | 75% | 307,125,000.00 | $ 15.36 | $ 10,075.24 | $ 20,135.12 | |
| Manure Management | 5% | 20,475,000.00 | $ 1.02 | $ 671.68 | $ 1,342.34 | |
| Total Nitrous Oxide Released | 409500000 | Totals | $ 20.48 | $ 13,433.65 | $ 26,846.82 | |
| Cost per ton low | $ 50.00 | per ton |  |  |  | |
| Cost per ton average | $ 32,805.00 | per ton |  |  |  | |
| Cost per ton high | $ 65,560.00 | per ton |  |  |  | |

## Table Four Total Revenues

|  |  |  |  |
| --- | --- | --- | --- |
| **Emission Type Totals** | Low | Average | High |
| Carbon Dioxide | $ 66,945,648,000.00 | $ 600,808,824,000.00 | $ 113,467,200,000.00 |
| Methane | $ 2,675,200,000.00 | $ 5,885,440,000,000.00 | $ 2,956,096,000,000.00 |
| Nitrous Oxide | $ 6,506,955,000.00 | $ 13,426,663,477,500.00 | $ 26,846,820,000,000.00 |
| Totals | $ 76,127,803,000.00 | $ 19,912,912,301,500.00 | $ 29,916,383,200,000.00 |

## Table Five Revenues and Programs

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **PrName** | **Total 2013 in billions dollars** | **Percentage added** | **Percentage added** | **Percentage added** |
| Social Security | 763 | 10% | 2610% | 3921% |
| Medicare | 234 | 33% | 8510% | 12785% |
|  | Total Corporate Tax Collected in 2013 | Corporate Tax Rate | Corporate Tax Rate | Corporate Tax Rate |
| Corporate Tax collected 33% (all gov.) | $ 242,000,000,000.00 | 0.23 % | -2682% | -4047% |

## Table Six Estimated Rise Fuel Increase

|  |  |  |
| --- | --- | --- |
| Fuel Increase Low | Fuel Cost Increase Average | Fuel Increase Cost High |
| $ 0.12 | $ 3.87 | $ 7.62 |

## Table Seven Estimated Rise in Diary and Beef

|  |  |  |  |
| --- | --- | --- | --- |
|  | Low | Average | High |
| Beef Increase (per lbs.) | $ 0.25 | $ 32.27 | $ 64.29 |
| Diary Increase (per gallon) | $ 1.85 | $ 172.45 | $ 343.05 |

# Results

Table One, Table Two, and Table Three are the estimated amount of revenue generated from a carbon tax. All carbon emissions are sorted into five different categories, electricity generation, transportation, industry, residential commercial and others. The main input is the tax price per ton of carbon emitted, this is divided into three categories low, average and high. For the low the price was taken from the California Cap and Trade Auction (California, 2016)[[21]](#footnote-21). The high was taken from a study that calculated the damage of a ton of carbon does, which estimated it to be two-hundred and twenty dollars per ton (Than, 2015)[[22]](#footnote-22). While the average is the high and low averages.

For the low of cost per ton of methane emitted thirty-eight dollars per don was used, this was taken from a study done by Synapse (Patrick Luckow, 2015)[[23]](#footnote-23). The high was calculated by multiplying two-hundred and twenty dollar (price of carbon according to (Than, 2015)[[24]](#footnote-24) by thirty-eight, since methane is thirty-eight times more potent of a greenhouse gas than carbon dioxide.

The low cost of emitting a ton of nitrous oxide was taken from an unsourced pdf document. To acquire the high two-hundred and twenty dollars was multiplied by three-hundred and ninety-eight, since nitrous oxide is three-hundred and ninety-eight times more potent of a greenhouse gas than carbon dioxide.

Table Four is the total revenue generated by the low, average and high greenhouse emission tax.

With a total revenue of 76,127,803,000.00 the low carbon tax estimate is .004 percentage of the 16.7 trillion dollars of the (Bank, 2016) American Gross Domestic Product (GDP) in 2013. The average carbon tax is 1.15 times the amount of GDP while the high is 1.73 times the GDP of the United States. It is pretty easy to see that the average and high are not economically viable, while the low might be too low.

Table Five, row two and three are the percentages increase in Social Security and Medicare separately generated by a greenhouse gas emission tax. While five is the corporate tax rate would be if a greenhouse emission tax was made revenue neutral with a cut in the US Corporate tax.

Table Six is the cost increase in a gallon of fuel (diesel, airplane and gasoline). The low would increase a gallon of fuel by .12 cents. In 2013 the average cost of a gallon of gasoline was $ 3.65 (Administration, Today in Energy, 2016)[[25]](#footnote-25). The low greenhouse gas emission would be a three percent increase in the price of a gallon of gas. While the average would increase a gallon of gasoline by $ 3.87 which is 1.06 percent of the price of gallon gasoline. The high tax of greenhouse would increase a gallon of gasoline by $ 7.63 which is 2.08 percent of gasoline price in 2013.

Table Seven is the estimated rise of diary and beef. The low greenhouse emission would cause an increase of .23 per pound of beef. The average price of beef in 2014 was 4.708 (BLS)[[26]](#footnote-26), when adjusted for 2013 CPI has the purchasing power of $ 4.63, the percentage increase in the price of beef would be approximately .05 increase in the price of an average pound of beef. While the average greenhouse gas emission would increase a pound of beef by $ 32.35 which is 6.9 increase in price while the high would increase it by $ 64.29 which would increase the average cost of beef by 13.9.

# Epilogue

Neither of the amount suggested is a good fit. The low is to low and the average and high are too high. Even though there is logic behind having carbon dioxide set at two-hundred and twenty dollars a ton, if you price methane and nitrous oxide with the same logic, it ends up being more than the GDP of American, making it economically unviable.

The 250 dollar amount for a price of carbon was taken from a book called Climate Change and Policy by Louis Rosen (Rosen, 1991)[[27]](#footnote-27). The problem with using this amount, is that it treats all carbon emissions the same. This is not true, emissions after a certain saturation level cause damage (Ulph, 1994)[[28]](#footnote-28). Understanding this concept is key when estimating the price on greenhouse gas emissions.

There is also the problem that at least in the short term, a greenhouse emission tax is a regressive tax. Especially a greenhouse gas tax on methane and nitrous oxide, since most of the tax for the two is leveled against food production, which makes up a greater percentage of take home income for people in low income brackets. With the tax on carbon dioxide there are ways to avoid it like buying a fuel efficient car, making less trips in a car, taking public transportation and living closer to work.

A better fit would be to have carbon dioxide set at forty dollars per ton, methane at forty-five dollars per ton and nitrous oxide at fifty dollars per ton. This would raise two hundred and twenty-nine billion dollars in revenue which is one percent of GPD which is easily swallowed by the economy. It would cause a .36 rise in a price of a gallon of fuel, a .25 raise in the price of beef and a 1.85 rise in a gallon of milk.

It would be a good idea to make the revenues made from a greenhouse emission tax revenue neutral with the US corporate tax. This would make the United States more competitive with countries like Ireland who has a corporate tax rate of twelve point five percent (Minutes, 2013)[[29]](#footnote-29) versus the US corporate tax rate of thirty-four to thirty-three percent. It is estimated that US companies keep 2.1 trillion (Alexander, 2015)[[30]](#footnote-30) dollars overseas because of the high tax rate in the United States. By cutting the corporate tax in half you could create a short time windfall of up to thirty-six billion for government coffers and encourage job growth at home.

Another reason to take more revenue from a greenhouse emission tax than a corporate tax is that there is less gaming of the system by businesses for a greenhouse gas emission tax. With companies not spending resources on gaming the system, the economy as a whole becomes more efficient, resource that were previously used to game the system is spent else ware.

The greenhouse emission tax and other resource consumption taxes are more than likely the taxes of the future. They carry out two important functions; first they encourage consumers to buy goods that cost no or little resources to make, such as an eBook over a paper book. It also encourages innovation in the production and design of goods to use less materials. Second it cuts down on the gaming and defrauding of the system. There is no “lying” on ones taxes, since the tax is paid when the object is bought. These taxes are steps we can take to combat the growing danger of climate change.

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