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Policy Research Shop

A New Hampshire State Carbon Tax

An Analysis of the Economic and Social Implications

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EXECUTIVE SUMMARY

There is currently an ongoing debate in the United States Congress over the Environmental Protection Agency's jurisdiction in regulating greenhouse gas emissions. Due to competing interests, a federal policy regulating the emissions has yet to pass through Congress. Many experts believe that it is the responsibility of individual states to pass climate policies, often with the hope that state policies will spark a national interest in controlling greenhouse gas emissions. Furthermore, the United States and the state of New Hampshire are currently facing budget deficits. One method to achieve a reduction in greenhouse gas emissions, as well as possibly reduce budget deficits, is to implement a state tax on emissions of carbon dioxide, an unregulated gas that is considered a significant contributor to climate change. This report examines the feasibility and implications of implementing a carbon tax in New Hampshire, and uses several examples of existing carbon taxes to describe various implementation strategies. New Hampshire's current energy consumption patterns, fuel sources and climate policies provide favorable conditions for the incorporation of a carbon tax. However, the research has revealed several concerns regarding a carbon tax, mostly pertaining to the regressive nature of the tax. The effects of these concerns may be minimized through strategic tax design. Several options for revenue allocation and investment strategies are included in an analysis of a carbon tax in New Hampshire. This report describes several implementation options, but in order for policymakers to select an appropriate design for the state, they must first determine if the intention of the tax is to generate revenue or offset other taxes as a revenue neutral tax.



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1. INTRODUCTION

States throughout the country have participated in a growing movement to implement policies aimed at reducing greenhouse gas emissions that exceed federal government standards in their strictness. This report explores a tax on carbon dioxide emissions. Carbon dioxide, which is generated through energy production among other processes, is the most common of greenhouse gases that contribute to climate change. Carbon atoms are present in every fossil fuel: coal, oil and natural gas.¹ Of all mainstream energy generation tactics, burning coal emits the most carbon per unit, followed by oil, and then natural gas. Carbon dioxide from burning fossil fuels accounts for 42 percent of global greenhouse gas emissions.² When carbon dioxide is released into the atmosphere it remains there, trapping heat radiated from the earth's surface. Anthropogenic emissions of carbon dioxide (in addition to other greenhouse gases) are believed to be the primary cause of global climate change. Climate change can result in severe weather patterns, inundation of coastal areas, disease spread, forced migrations, and international conflict.³

Supporters of a carbon tax contend that if necessary procedures are not taken to enforce reductions in carbon emissions, our current emission levels (primarily resulting from current energy consumption) could bring irreversible effects in the global climate.⁴ A carbon tax can reduce carbon emissions, namely through incentivizing reduced consumption by placing a cost on carbon emissions—in effect, putting a price on the social and environmental impacts of fossil fuel consumption or activities that result in greenhouse gas emissions.⁵ Carbon tax proponents hope this cost will incentivize individuals and industries to decrease consumption or production of emitting fossil fuels—as well as use cleaner fuels and alternative energy sources. Proponents also contend that putting a cost on emissions can raise significant revenues for government: in 2008, New Hampshire produced 19 million tons of carbon dioxide emissions, which would raise \$95,000,000 in tax revenue if every ton of carbon was taxed at a flat rate of \$5.⁶ Studies of a national carbon tax have proposed tax rates as high as \$100 per ton, making \$5 per ton appear quite modest in comparison. These revenues could be valuable sources of funds for government, and could be reinvested into green technology, used to fund other programs, or distributed back to the citizens of New Hampshire.⁷ Moreover, carbon taxes are economically transparent, meaning the costs are directly related to use and can also be implemented quickly.⁸ Furthermore, carbon tax advocates also note that a carbon tax would reduce dependence on foreign natural resources, like oil.⁹

Opponents argue that a carbon tax represents too great a burden for the general public. They contend that currently, no available affordable alternatives to using fossil fuels exist, and without such preexisting alternatives, it is unfair to put a carbon tax into place. Additionally, they assert that carbon taxes can be inequitable and regressive, meaning they have the highest impact on the poorest residents. Moreover, a carbon tax makes it more expensive for companies to do business as usual, with increased costs for the



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average consumer if there is no change in practices. This is because, to compensate for increased costs of emitting carbon, businesses will likely raise the price of the products they sell, passing the cost to consumers, who therefore, pay a significant portion of a carbon tax.¹⁰

The debate over the ultimate efficacy of a carbon tax has yet to be conclusively resolved. In the following sections, this report examines aspects of the debate by looking at the feasibility and implications of implementing a carbon tax in New Hampshire. Moreover, by using several examples of existing carbon taxes in the U.S. to describe potential implementation strategies, some of the claims made by both sides of the debate are examined empirically, ultimately providing insight into the question of a New Hampshire carbon tax.

2. CURRENT NEW HAMPSHIRE ENERGY CONSUMPTION AND POLICIES

2.1 Current New Hampshire State Energy Consumption

When considering whether to implement a state carbon tax with the goal of reducing greenhouse gas emissions, it is important to examine what fuel sources are used in a state and determine the amount of energy each of those sources provides. This is because fuel sources have different carbon contents, with greater intensity of carbon in a fuel leading to greater carbon dioxide emissions and higher costs, given the hypothetical implementation of a carbon tax. Because of this, it is necessary to analyze the consumption of each fuel source used in New Hampshire in order to approximate where the burden of a carbon tax would fall, in terms of the residential, industrial, transportation sectors, and more. For most states, the majority of carbon emissions come from the burning of fossil fuels for the generation of electricity, with coal being the most carbon-intensive fossil fuel.¹¹ However, for New Hampshire, this is not the case. This is in part because of the Seabrook Station Nuclear Power plant, which makes the carbon intensity of New Hampshire's electricity generation is one of the lowest in the country, as seen in Table 1. The state of New Hampshire also generates more electricity than it consumes, making the state a net electricity exporter.¹²

Table 1: Carbon Intensity of In-state Electricity Generation, 2007 (mT CO₂/MWh)

Highest Intensity		Lowest Intensity	
North Dakota	1.02	Vermont	0.09
Wyoming	0.99	Washington	0.13
Kentucky	0.96	Idaho	0.18
Indiana	0.95	Oregon	0.21
Delaware	0.92	California	0.31
West Virginia	0.90	Connecticut	0.33
New Mexico	0.88	New Jersey	0.33
Utah	0.88	New Hampshire	0.36
Missouri	0.85	New York	0.37
Ohio	0.84	Rhode Island	0.42

Source: U.S. Energy Information Administration (2010b) state data tables, U.S. Census Bureau (2009) ACS 2008 data, http://factfinder.census.gov/home/saff/main.html?_lang=en; and Hodges and Rahmani (2009), <http://edis.ifas.ufl.edu/fe796>.



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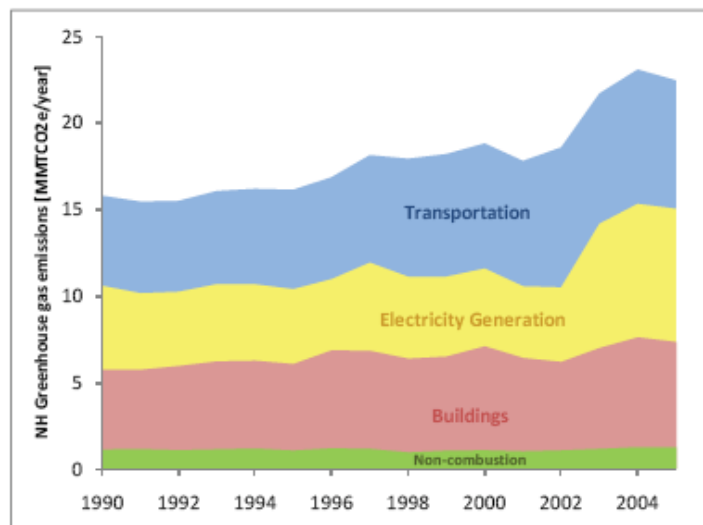


Figure 1: Historical Emissions in New Hampshire, by Sector¹³

The majority of carbon emissions in New Hampshire come from the transportation and non-electricity sectors of energy use, as seen in Figure 1.¹⁴ Non-electricity and transportation fuels are mainly petroleum-based fuels, such as oil or natural gas for heating and gasoline for cars, respectively. Moreover, high consumption in the transportation and non-electricity sectors can be attributed to two main factors in New Hampshire: low population density and a high number of heating days per year, due to the state's northern geographical location.¹⁵ Low population density requires that citizens drive greater distances, thereby consuming more fuel with vehicles, and a relatively high number of heating days translates to the need for a high amount of fuel consumed to heat homes and businesses, particularly during the winter months.

In addition to examining the breakdown of fuel sources and energy use, it is important to consider the price elasticity of the energy sources. Price elasticity refers to the change in consumption patterns that results from a change in price. In regards to a carbon tax, this is important because “[d]emand elasticities are the central parameters needed to estimate the deadweight burden of carbon taxes.”¹⁶ A good is “inelastic” if consumption does not change with a change in price, and a good is “elastic” if a change in price results in a change in consumption patterns. In New Hampshire, the demand for non-electricity generating fuels (such as heating fuels) is fairly inelastic because, as Ackerman 2010 states, “residents of states with the highest heating degree days will tend to have an inelastic demand for heating fuel—using less just isn’t an option for most families.”¹⁷ Similarly, given the relatively low population density in New Hampshire, the price of gasoline is also fairly inelastic, for citizens will likely not be deterred from driving, despite rises in gasoline prices.



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The importance of these determinations in regards to a carbon tax can be summarized as such: if a carbon tax were implemented in New Hampshire, its high amount of inelastic fuel consumption will make it difficult to find an equitable tax that will serve its purpose of generating revenue while lowering carbon emissions. Because non-electricity fuels amount to the majority of New Hampshire's fossil fuel consumption and the demand for these fuels is relatively inelastic, new efficiency measures would need to be coupled with carbon tax—or the tax revenues will have to be used to fund efficiency measures—in order for carbon emission levels to drop.

2.2 Current New Hampshire State Climate Policies

In 2009, New Hampshire's Department of Environmental Services prepared a report that outlined a new "State Climate Action Plan."¹⁸ While a carbon tax was not included in the plan's recommendations, it called for drastic reductions in greenhouse gas emissions over the next 40 years.¹⁹ In the plan, "the greatest reductions would come from improvements in the building sector, followed by the transportation and the electric generation sectors."²⁰ Along with the New Hampshire State Climate Action Plan, the state of New Hampshire entered the Regional Greenhouse Gas Initiative (RGGI) in 2009. RGGI is a regional effort by ten Northeastern and Mid-Atlantic states to reduce emissions of greenhouse gases from the electric power sector.²¹ The initiative creates a market for emissions allowances through a regional cap-and-trade program for greenhouse gas emissions from area power plants. Through the RGGI initiative, New Hampshire emissions allowances are sold at quarterly auctions, with the proceeds going to fund the Greenhouse Gas Emissions Reduction Fund (GHGERF). These funds support energy efficiency, conservation, and demand response programs in order to reduce greenhouse gas emissions generated in New Hampshire. As of June 2010 the GHGERF has seen revenue of \$24.3 million. Ten percent of RGGI [auction] funds are set aside to help low-income residential customers reduce their energy use and the remainder of the funds is distributed through competitive grants or adjudicative proceedings.²²

New Hampshire has put itself in a strong position to implement a carbon tax by demonstrating its efforts to reduce greenhouse gas emissions through its adoption of a Climate Action Plan and participating in RGGI. "States that have made larger investments in renewable energy, public transportation, and conservation measures are likely to find that their residents have a more elastic response to a carbon price, and therefore experience less of an economic impact from climate policy."²³ It is likely that the recommendations made in the Climate Action Plan (such as improving energy efficiency, transitioning to more renewable resources, and reducing vehicle emissions) will make it easier for New Hampshire residents to begin to substitute their use of carbon-heavy fuels with cleaner options. While the Climate Action Plan estimates that its policies will generate revenues, "it would take some time for that positive return to be realized."²⁴ A carbon tax, on the other hand, could generate more short-term revenues



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because “it is thought that the establishment of such a tax would be relatively straightforward and that compliance would be high because it would be applied at the point of purchase of carbon-based energy sources.”²⁵

3. IMPACTS OF A CARBON TAX ON NEW HAMPSHIRE RESIDENTS

3.1 Financial Burden on Households

A carbon tax would likely take the form of a flat tax on carbon emissions generally, and such a tax would be inherently regressive; meaning that the tax rate decreases as the amount subject to taxation increases, as seen in Figure 2.²⁶ The disproportionate financial impact of proposed carbon taxes on low-income households raises equity and environmental justice concerns—concerns regarding the equitable treatment of people of all income levels, races, cultures, and education levels with respect to the development and enforcement of environmental laws, policies, and regulations. On the other hand, some contend that energy costs themselves are also regressive.²⁷

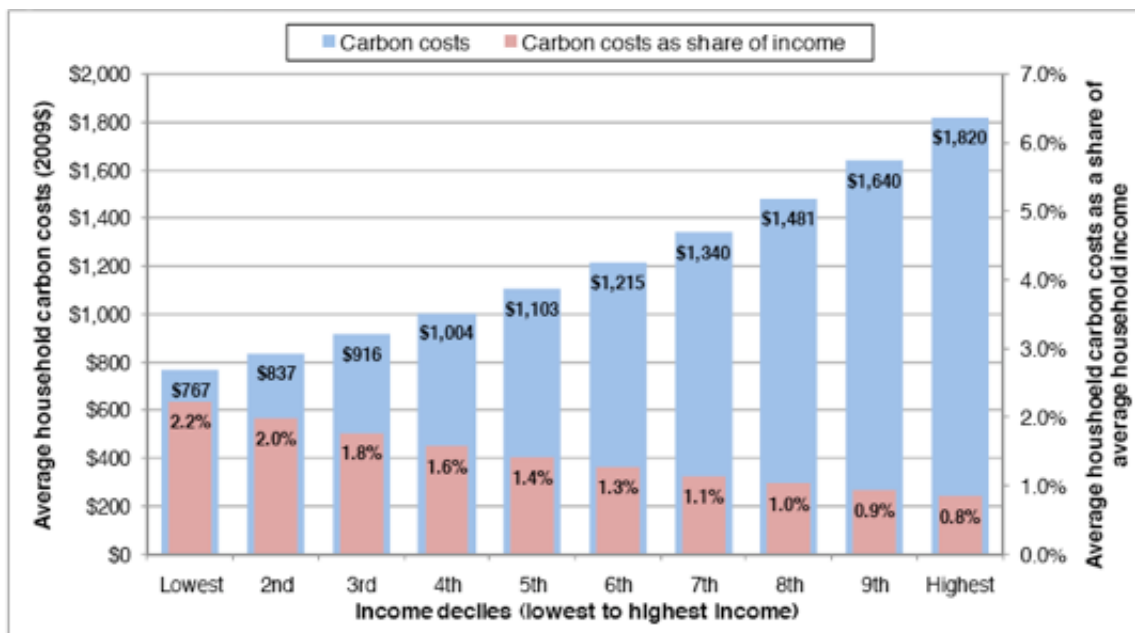


Figure 2: \$25/mT CO₂ in 2015: Carbon-cost distribution across U.S. Income deciles²⁸

Using annual carbon emissions data and U.S. economic structure data, Grainger and Kolstad estimated how a price on carbon would ultimately be distributed across income groups. They conclude that, “[t]he burden as a share of annual income for households earning \$7,500-\$9,999 is almost four times higher than the burden-to-income ratio for the highest income group shown in the data (\$200,000-\$250,000).”²⁹ This conclusion demonstrates the regressive nature of a flat carbon tax.



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Indeed, economists estimate that the average household in the United States' lowest income quintile would pay \$325 annually for a \$15 per ton carbon dioxide tax, while the average household in the highest income quintile would pay \$1,140 per year. "Although wealthier households would pay more in absolute terms, lower income groups would bear a disproportionate share of the burden, as a percentage of their total annual income. Indeed, the poorest quintile's burden (as a share of annual income) is 3.2 times that of the wealthiest quintile's."³⁰ This conclusion underscores aspects of a flat carbon tax that many see to be objectionably inequitable, particularly for the most financially challenged sectors of the public.

3.2 Impact of Carbon Tax on New Hampshire Business

Another large concern surrounding the implementation of a state carbon tax is that increased energy prices will drive businesses out of the state and decrease the competitiveness of the state to attract business and industry. Because there is no comprehensive or national regulation that limits industrial and business carbon emissions, many fear that stricter environmental regulations in one state could encourage businesses to go elsewhere, for industries that rely heavily on fossil fuels in states without a carbon tax would have a competitive advantage over companies in more heavily taxed jurisdictions, due to ultimately lower compliance costs. Furthermore, increases in energy prices due to a state carbon tax could force energy intensive industries to cut employment. Looking at the general response of employment to an increase in energy prices, Kahn and Mansur 2010 found "primary metals, petroleum, textile mills, and wood products" to be the industries that would see the biggest decrease in employment.³¹ However, if a modest carbon tax were implemented (such as \$5-\$10 per ton of carbon dioxide), the effects may not be as dire as some contend. Hoerner and Muller 1994 concluded that industries would not see a change in costs that exceeds existing energy tax costs.³² For example, in New Hampshire, the primary metal manufacturing industry may see a negative impact from a carbon tax, but New Hampshire's manufacturing industry in general has been on the decline and is projected to continue declining while the service related industries are currently on the rise.³³

While a carbon tax could prove to be challenging to certain industries in New Hampshire, other industries could prosper. There is an existing base of environmental industries in the state that accounts for over 16,000 jobs and 3.2 percent of total employment.³⁴ A study on New Hampshire's "green economy," Gittell *et al.* 2009 stated, "reducing energy use and using new technologies in reducing the environmental impact of buildings, transportation, and business operations are already creating and can create more new business development and job opportunities throughout the nation and across the Granite State."³⁵ Ultimately, the overall effect that a carbon tax has on businesses in New Hampshire will depend on the size of the tax as well as where the revenues are directed.



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4. POLITICAL CONSIDERATIONS

4.1 Tax Rate and Base

As discussed above, an important component of designing a carbon tax is determining how heavily carbon emissions will be taxed and who will pay the tax. Specific examples are discussed in Section 5, but it is important to recognize the difficulties associated with these decisions. Muller and Hoerner 1994 state, “A carbon tax should be part of a broader array of policies...the effectiveness of a tax will depend on the overall combination of policies.”³⁶ Even a modest carbon tax has the potential to raise considerable revenues, but ultimately where policymakers choose to allocate the revenues can influence the tax rate. For example, if revenues are used for environmental investments, the tax rate could be lower because those investments also contribute to an emissions reduction.³⁷ Another option, discussed in more detail below, involves the redistribution of the revenues to offset disproportionate burdens.

It is also important to note that long-term revenues are not stable with a constant tax rate. Assuming the tax achieves a reduction in carbon dioxide emissions, state revenues will decrease over time if the tax rate is not adjusted.³⁸ There are two broad tax groups that can be burdened with a carbon tax: upstream groups and downstream groups—or producers and consumers, respectively. Placing the primary burden of a carbon tax on either of these two constituencies accomplishes some goals, addresses some concerns, and raises other issues. For example, taxing carbon producers upstream will encourage energy-intensive industries to reduce their emissions while taxing consumers downstream will encourage individuals to increase their fuel efficiency. These two different types of taxes are discussed in more detail in Section 5. However, before a hypothetical carbon tax rate or base can be determined, the goals of a state carbon tax must be defined. This is because a carbon tax enacted as part of a suite of policies (such as those aimed at improving national energy efficiency, fuel switching, and renewable energy technologies) is likely to be far more effective in meeting environmental and energy security goals and less burdensome to industry and consumers than a tax enacted as a stand-alone policy.

4.2 Ways to Mitigate Regressivity

4.2.1 Payroll Tax

A very commonly suggested option for curbing the regressivity of a carbon tax is to reduce the income tax burden imposed on individuals.³⁹ Many consider targeted tax cuts to be an effective use of tax revenue to make a carbon tax policy distributionally neutral.⁴⁰ Using carbon tax revenues to ease the financial burden of another regressive tax could mitigate the disproportionately unfavorable burdens for low-income households. Many economists consider financing cuts in the payroll a good way to compensate for the regressive nature of a carbon tax.⁴¹ For example, Mann stated, “Revenue recycling is the



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key to avoiding regressivity, and the key to building political support for the carbon tax.⁴²

While there is no direct equivalent to a payroll tax in New Hampshire, this concept can be applied to New Hampshire's business enterprise tax or business profits tax, an 8.5 percent tax assessed on income from conducting business activity within the state.⁴³ Models of a revenue-neutral, distributionally-neutral national carbon tax have been developed by reducing national payroll taxes.⁴⁴

4.2.2 Equal Dividends

Alternatively, New Hampshire could return revenues from the carbon tax equally to all state residents. By returning carbon tax revenues through equal dividends, "the vast majority of lower- and middle-income households would get back more in the dividends than they would pay in higher prices for carbon-intensive goods induced by the tax."⁴⁵ In the case of a national carbon tax, The Carbon Tax Center advocates for the return of all or nearly all carbon revenue to ensure that two thirds of households in the country see the financial benefits from the carbon tax.⁴⁶

Paying equal dividends to taxpayer could make the tax effectively progressive. Wealthier citizens typically use more energy: they drive more, fly more, have bigger houses and buy more products that require energy. As a result, most of the tax revenues will come from wealthier families. If the money generated from the tax were equally redistributed to all New Hampshire citizens, this would mean that lower income families would get back more carbon dividends than they pay in the carbon tax.⁴⁷ However, putting money directly back into the pockets of New Hampshire residents could counteract the incentives of the tax to reduce carbon dioxide emissions.

4.2.3 Low-Income Energy Efficiency Assistance

Citizens in lower income households may be subject to higher taxation due to the fact that they may drive inefficient cars, drive longer distances to work, have inefficient home heating systems, or have poorly insulated houses. Taking this into consideration, a portion of carbon tax revenues could be set aside to help reduce low-income household energy use.⁴⁸ Revenues could also be invested in programs to help the low-income households purchase more efficient products and help with weatherization of households.⁴⁹

4.2.4 Tax Reduction Alternatives

Alternatively, revenue generated from the tax could be put toward other programs so that existing taxes (such as the property tax, business enterprise tax, tobacco tax, or meals and rental tax) could be reduced. Some proponents of a carbon tax have recommended



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lowering sales taxes in order to implement a carbon tax—without causing excessive strain to low-income families.⁵⁰ However, this policy suggestion would be difficult to implement in New Hampshire, due to the absence of a sales tax on all goods. However, if tax reductions based on revenue from a carbon tax are implemented, it may make a carbon tax ultimately more attractive to business owners who are concerned about the financial burden of the tax. Essentially, by having a carbon tax as a source of revenue, preexisting taxes could be phased out.⁵¹

4.2.5 Technology Investment

The New Hampshire 10 Year State Energy Plan states:

“[I]t is now widely recognized that in order to continue building upon our state’s strengths, we should consider energy policies and programs that take advantage of new technologies, promote energy efficiency, encourage the development of cleaner, affordable alternative energy sources, utilize our plentiful renewable natural resources, and reduce our dependence on foreign oil.”⁵²

Environmentalists suggest that revenues could be invested in new, clean technologies for vehicles, electricity, and non-electric fuel sources.⁵³ With regard to vehicles, environmentalists suggest the state could invest in hybrid, electric or hydrogen powered cars. Regarding electricity generation and non-electric fuel sources, environmentalists suggest using revenue generated from a carbon tax to invest in basic practices such as insulating homes or solar power. They also recommend investing in both pre- and post-combustion capture. Revenue generated from a carbon tax could also be used for government research on climate change and ways to further reduce anthropomorphic greenhouse gas emissions.

5. IMPLEMENTATION OPTIONS

Many energy policies have been in place around the world for quite some time. In reality, “energy taxes have been used for almost a century and are far from a new phenomenon.”⁵⁴ In particular, European countries have utilized such taxes for over ninety years, such as Denmark’s 1917 and Sweden’s 1924 taxes on transport fuels. Sweden implemented an energy tax on non-transport energy products like mineral oils and coal as early as 1957. However, the root of energy taxes “was not based on environmental issues, but rather on fiscal issues,” and was instead a mechanism for raising revenues and controlling oil imports.⁵⁵ In 1980, the mindset shifted from a fiscal to an environmental focus, and several countries have now implemented environmentally-focused carbon



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taxes—although the incentives for implementing such a tax for revenue purposes still remain.⁵⁶

Analysts have had little to say about exactly how to design carbon taxes or how to set their rates to ideally serve multiple policy goals.⁵⁷ However, there are many different carbon taxes already in existence with varying successes that can be analyzed. In most places, different emitters and different fuel sources are taxed in different ways. An ideal carbon tax would be a tax on the actual release of carbon dioxide into the atmosphere, so as to directly respond to the issue of carbon dioxide released from anthropogenic sources into the atmosphere. However, a carbon tax is generally more broadly based (and raises more revenue at a given tax rate) than most existing state energy taxes. Following are overviews of the two main carbon taxes: the carbon emissions tax and the carbon consumption tax.

5.1 Carbon Emissions Tax

A carbon emissions tax would be a tax based on emissions from fuel directly used to produce electricity consumed in the state. This is a tax on the producers of the energy, not directly the consumers. Although this is not a carbon tax in its most traditional sense, the environmental goals and benefits of a carbon emissions tax are comparable, and this type of carbon tax has often been applied, due to its history of being more feasible to implement than other carbon tax systems. This type of carbon tax is generally applied to all fuels at a basic rate proportional to their energy content. The rate of tax for this system likely increases over time. This type of carbon tax is less effective at stimulating reductions in emissions of carbon dioxide and other air pollutants, but has proven to be successful in putting pressure on energy-intensive industries in particular in the following applications:⁵⁸

5.1.1 Montgomery County, Maryland

One key example of a carbon emissions tax is in Montgomery County, Maryland. In May 2010 Montgomery County, Maryland passed the nation's first county-level carbon tax. It is an electricity tax at a fixed rate per kilowatt-hour, a measure that depends on the implicit carbon content of the electricity, as measured by an annual determination of that utility's fuel mix. The fuel used to generate power purchased by the utility is treated as part of the utility's fuel consumption, even if purchased out-of-state, while electricity sold out-of-state is not taxed. "This mechanism is consistent with a carbon emissions tax if electricity is regarded as a form of fossil fuel transport."⁵⁹ Moreover:

The new legislation calls for payments of \$5 per ton of CO₂ emitted from any stationary source emitting more than



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a million tons a carbon dioxide during a calendar year. There is only one source of emissions fitting the criteria laid out by the council, an 850 megawatt coal-fired power plant owned by Mirant Corporation. The tax is expected to raise between \$10 million and \$15 million for the county which is facing a nearly \$1 billion budget gap.⁶⁰

The plan calls for half of the tax revenue to go toward creating a low interest loan plan for county residents to invest in residential energy efficiency upgrades. “The County’s energy supplier buys its energy at auction, so Mirant must continue to sell its energy at market value, which means no discernible increase in energy costs will be felt by the county’s residents.”[xvi] This was of particular importance in the passing of this policy, and the hope for continued low tax burden felt from this policy has helped mitigate some of the inherent regressivity of the tax.

5.1.2 Alberta, Canada

Another example to look closely at is Alberta, Canada, a province with the highest greenhouse gas emissions. The tax regulates companies emitting more than 100,000 tons of greenhouse gases annually to reduce their carbon dioxide emissions per barrel by 12 percent—or pay \$15 per ton into a technology fund or buy an offset in Alberta to apply against their total emissions. “The tax falls most heavily on oil sands companies and coal-fired electricity plants.” Alberta’s plan taxes only the highest carbon dioxide emitters in the province, which raises concerns regarding the effectiveness of the tax at producing behavioral changes among small energy producers.⁶¹

5.1.2 Germany

Another example of a carbon emissions tax is one that exists in Germany, which is an electricity tax with a rate that gradually increases to ensure a reliable stream of revenue over a long period of time. The money generated from the tax goes directly back to taxpayers in the form of employer and employee pension contributions. In keeping with the idea of constantly increasing rates, Germany’s pre-1999 tax rates look drastically different from their post-1999 rates. Since 1999, Germany has taxed heating fuel, petrol, natural gas, and electricity heavily. Germany is unique and deserves particular attention in that it provides a large amount of relief to this tax. There is a provision that states: “All companies in manufacturing, agriculture, fishing, and forestry are granted a tax relief of “40 percent of the standard energy tax rates for electricity, heating oil and natural gas...an effective tax rate of sixty percent of the standard rate.”⁶² Additionally, companies are eligible for a tax refund if the energy tax burden is greater than its tax relief from the reduction in the pension contributions payable by the company.⁶³ However, it is critical to note that a critique of this policy: Germany’s numerous exemptions and reduced rates have been criticized for their leniency. Germany’s carbon



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dioxide emission were “2-3% lower by 2005 than they would have been without a carbon tax.”⁶⁴

5.1.3 United Kingdom

The United Kingdom (U.K.), like Germany, provides many opportunities for tax discounts on their carbon emissions tax, the Fossil Fuel Levy. However, unlike Germany, with special tax treatment for industries based on statistical classification, the U.K. “takes into account energy intensity.”⁶⁵ Energy intensive companies are eligible for an 80 percent tax discount if they agree to stringent energy efficiency improvement targets. “These regulations have been introduced due to concerns over the loss of the United Kingdom’s industry’s international competitiveness,” and this policy gives conditional tax exemptions to energy intensive companies.⁶⁶

Generally speaking, “if a state’s nonenergy exports are produced using more fossil fuel than its nonenergy imports, a carbon emission tax will raise more revenue.”⁶⁷ A carbon emissions tax is more effective in reducing the local consumption of energy from fossil fuels, but high rates could drive more highly energy-intensive industries out of the state without inducing any net reduction in carbon emissions from those industries. This tax is advantageous for states whose goal is to combat emissions on a global scale.

5.2 Carbon Consumption Tax

A carbon consumption tax would place the burden of the tax on the consumer, the end user. Generally, this is a tax on carbon emissions from domestic and in-state energy and industrial production, and would not reduce the competitiveness of a state’s energy-intensive industries because it taxes the carbon dioxide emissions from the user-end of the process. This tax is better for a focus on improving emissions within the state. Generally speaking, “A carbon consumption tax will raise more revenue if a state’s nonenergy imports are produced using more fossil fuels than its nonenergy exports.”⁶⁸

5.2.1 Denmark

An example of such a carbon tax is in Denmark, which taxes based on an emitter’s type of usage. Denmark’s tax charges \$14 per ton of carbon dioxide for business and \$7 for households.⁶⁹ While the carbon dioxide tax did not originally apply to industries, they are now taxed, in accordance with two principles: “the process the energy is used for, and whether or not the company has entered into a voluntary agreement to apply energy efficiency measures.”⁷⁰ This allows Denmark to provide incentives for companies to put in place more sustainable practices. Denmark offers tax refunds for energy efficiency improvements. The revenues raised from the energy and carbon dioxide taxes allow Denmark to reduce labor taxes and part of the revenues are used to provide investment grants for energy-saving measures. The efforts in Denmark have been extremely



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successful, and the implementation of these taxes have reduced emissions by 6 percent.⁷¹

5.2.2 Boulder, Colorado

Boulder, Colorado, implemented the U.S.' first tax on carbon consumption by implementing a carbon consumption tax on electricity in 2007. "Currently the tax is set at:

- \$0.0049 /Kilowatt hours (kWh) for residential users (which averages to \$21 per year); and
- \$0.0009 /kWh for commercial (avg. \$94 per year), and \$0.0003 /kWh for industrial (which averages \$9,600 per year)."⁷²

Therefore, the burden is not incredibly high on each individual energy-user. Households that use renewable energy receive an off-setting discount, because the tax would otherwise unfairly discount households and businesses that use cleanly-fueled energy.⁷³ Specifically, tax revenues get collected by Xcel Energy and are directed to the city's Office of Environmental Affairs to fund programs under Boulder's Climate Action Plan (CAP) to reduce greenhouse gas emissions. The goal is to reduce emissions in Boulder by 7 percent below 1990 levels by 2012. "The revenues from the tax are expected to decrease over time as businesses and residents reduce their energy use and begin to use more solar and wind power. The tax will expire on March 31, 2013."⁷⁴

5.2.3 San Francisco Bay Area

Another example of this type of carbon tax is in the San Francisco Bay Area, whose Air Quality Management District's board of directors voted in 2008 to charge area companies 4.4 cents for each ton of carbon dioxide they emit. These new rules impose fees on businesses for emitting greenhouse gasses, namely power plants and oil refineries. The top ten companies combined would pay more than \$820,000. It is estimated that the majority of businesses will pay less than \$1 overall. Revenues from the tax are estimated to generate \$1.1 million in the first year to help pay for programs to measure the region's emissions and develop ways to reduce them.⁷⁵

A recent poll shows that if a carbon tax were on individuals based on the amount of greenhouse gas emissions they generate, it is supported narrowly with 52 percent supportive and 43 percent opposed. However, support for the tax increased if the money from the tax was used solely to reduce greenhouse gas emissions. In this case, 65 percent of individuals would support the tax while 29 percent would be opposed. Additionally, a large majority initially favors a carbon tax on business with 72 percent supporting the proposition while 24 percent are opposed. However, if this were to lead to price increases only 53 percent would support the tax while 40 percent would oppose it. Granted, statewide, citizens support government regulations requiring business to reduce greenhouse gas emissions even if it does lead to increased prices. Without considering



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price 81 percent of respondents were supportive of government regulations to reduce greenhouse gases while only 15 percent were opposed. When price was taken into account 61 percent still desired some form of regulations while 31 percent were opposed.⁷⁶

5.3 Oregon: A New Hampshire Peer

According to Oregon State Representative Jules Bailey, the state of Oregon has reduction targets to achieve greenhouse gas levels that are 10 percent below 1990 levels by 2020. By 2050, Oregon's goal is to achieve greenhouse gas levels that are at least 75 percent below 1990 levels. These reduction targets are similar to those in New Hampshire, whose goal is to reduce emissions by 80 percent by 2050.⁷⁷ Although there is not a current plan for implementing a carbon tax, Oregon has created innovative implementation policies and programs, including Clean Energy Works Oregon for residential and commercial retrofits, and a solar feed-in tariff pilot. According to Representative Bailey, "Oregon will continue to innovate with policies like making the energy we save count like the energy we generate. However, like much of the rest of the nation, Oregon's budget is in crisis, and their efforts to incorporate more energy efficient measures in their state has provided aid in saving money where energy is no longer excessively consumed. As of 2008, an average of four energy upgrade measures were made per home and 63 percent of homes reduced their greenhouse gas emissions."⁷⁸

6. CONCLUSION

In order for a carbon tax to be successfully implemented in New Hampshire, policymakers would have to thoughtfully determine the goals and structure of the tax. A carbon tax that is used to generate revenue will be structured differently than one that is revenue-neutral. Carbon taxes can also be structured as a pollution tax. Pollution taxes in general are attractive to environmentalists and economists alike because they tax something undesirable rather than something sought-after such as income.

While carbon taxes are inherently regressive, some of the disparate effects can be alleviated with a policy that allocates the revenues in a way that benefits those hit hardest by the tax. Furthermore, in order to maintain a friendly business environment, revenues could be used to offset existing taxes. However because the carbon content of the energy currently being consumed in New Hampshire is relatively low, and New Hampshire has already implemented other climate policies, the impacts of a modest carbon tax would not be extreme.

It is critical to note that a modest carbon tax would still generate significant revenues and help curb carbon dioxide emissions. Already establishing a commitment to reducing greenhouse gas emissions, New Hampshire could become a leader in environmental policies by implementing a state carbon tax. The challenge will be finding an agreeable



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tax that can achieve carbon emission reductions, alleviate disparities caused by the tax, and encourage environmental technology innovation within the state.



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BIBLIOGRAPHY

- Bailey, Jules. Interview by Lindsay Brewer, Marissa Greco, Alexi Pappas, Zach Schwartz. Hanover, NH: Dartmouth University. 3. November, 2010.
- “Best Practices for Energy Retrofit Program Design: Case Study Boulder, Colorado”. Home Performance Resource Center. (2010).
http://www.hprcenter.org/publications/best_practices_case_study_boulder.pdf.
- “Carbon Capture and Storage to Combat Global Warming Examined”. ScienceDaily. 12. June, 2007.
<<http://www.sciencedaily.com/releases/2007/06/070611153957.htm>>.
- Carbon Tax Center: Pricing Carbon Efficiently and effectively: “CTC Slide Show 2007”. New York, NY. Last revised 5 September 2007.
<<http://www.slideshare.net/kea/ctc-slide-show-5-sept-2007>>.
- Carbon Tax Center: Pricing Carbon Efficiently and Effectively. “Introduction”. New York, NY. Last revised 3. March 2010. <<http://www.carbontax.org/introduction>>.
- “Climate Action Plan Tax.” City of Boulder, Colorado. Last updates Sept 24, 2010.
http://www.bouldercolorado.gov/index.php?option=com_content&task=view&id=7698&Itemid=2844.
- “Enviro-Tab: Enhanced Fuel Conditioner, transport pollution solution”. Last modified 2008
<http://www.envirotab.com/Information.htm>.
- “Frequently Asked Questions,” Carbon Tax Center. Last modified October 15, 2008, <http://www.carbontax.org/faq/>
- Gittell, Ross, James R. Carter, Matt Magnusson, and Matt Shump. January 2009. *New hampshire’s green economy and industries: Current employment and future opportunities*. Whittemore School of Business & Economics, (accessed 1/31/11).
- Grainger, Corbett A. and Charles D. Kolstad, “Who Pays for a Carbon Tax?” *Environmental Resource Economics* 46 (2010): 359-376. Accessed November 4, 2010. doi: 10.1086/599247.
- Howarth, Richard. Interview by Lindsay Brewer, Marissa Greco, Alexi Pappas, Zach Schwartz. Hanover, NH: Dartmouth University. 3. November, 2010.



Policy Research Shop

- Hughes, Brian. "Montgomery Poised for Carbon Tax to Fight Global Warming." Washington Examiner. (2010).
<http://www.washingtonexaminer.com/local/Montgomery-poised-to-tax-carbon-to-fight-global-warming-94204419.html>
- "India Taking on Climate Change." Ministry of Environment and Forests. (2010). 1-8.
<http://www.indiaenvironmentportal.org.in/files/India%20Taking%20on%20Climate%20Change.pdf>
- Integrated Gasification Combined Cycle (IGCC) System. General Electric Company. Last modified 2010. <<http://www.ecomagination.com/technologies/integrated-gasification-combined-cycle-igcc-system>>.
- Kelley, Katie. "City Approves 'Carbon Tax' in Effort to Reduce Gas Emissions." New York Times. (November 18, 2006).
"http://www.nytimes.com/2006/11/18/us/18carbon.html?ex=1321506000&en=0394a8cb65f3bd09&ei=5088
- "Low Emission Technology". Last modified 2010. <<http://www.global-greenhouse-warming.com/low-emission-technology.html>> .
- "Managing Impacts," Carbon Tax Center, last modified July 6, 2010,
<http://www.carbontax.org/issues/softening-the-impact-of-carbon-taxes/>
- McGowan, Elizabeth. "Maryland County Carbon Tax Law Could Set Example for Rest of Country." Solve Climate News. (2010).
<http://solveclimate.com/blog/20100525/maryland-county-carbon-tax-law-could-set-example-rest-country>
- Metcalf, Gilbert and Weisbach, David. "The Design of A Carbon Tax". Harvard Environmental Law Review. 33 (1991): 1-58.
<http://www.law.harvard.edu/students/orgs/elr/vol33_2/Metcalf%20Weisbach.pdf>.
- Milne, Janet. "The Reality of Carbon Taxes in the 21st Century." Vermont Journal of Environmental Law. 1-114.
- Muller, Frank et al., "Greening State Energy Taxes: Carbon Taxes for Revenue and the Environment," 14-15 Pace Env'tl. L. Rev. 5 (1994) Available at:
<http://digitalcommons.pace.edu/pelr/vol12/iss1/2>
- New Hampshire Climate Change Policy Task Force. "The New Hampshire Climate Action Plan: A Plan for New Hampshire's Energy, Environmental and Economic



Policy Research Shop

- Development Future.” New Hampshire Department of Environmental Services. (2009): 1-74.
<http://des.nh.gov/organization/divisions/air/tsb/tps/climate/action_plan/nh_climate_action_plan.htm>
- New Hampshire Employment Security. May 2010. *New hampshire employment projections by industry and occupation base year 2008 to projected year 2018*. New Hampshire Employment Security, Economic and Labor Market Information Bureau, .
- New Hampshire Office of Energy and Planning: New Hampshire’s 10 Year State Energy Plan. “Executive Summary”. Governor’s Office of Energy and Community Services. (2002). <<http://www.nh.gov/oep/programs/energy/StateEnergyPlan.htm>>
- “Overview of New Hampshire Taxes,” last modified in 2007, <http://www.nh.gov/revenue/faq/gti-rev.htm>
- Pappas, John. Interview by Lindsay Brewer, Marissa Greco, Alexi Pappas, Zach Schwartz. Hanover, NH: Dartmouth College. 6. November, 2010.
- Parliament of Australia: Parliamentary Library. “Carbon Taxes”. Last revised 16 February, 2010.
<<http://www.aph.gov.au/library/pubs/ClimateChange/responses/economic/carbontax.htm>>.
- Pearce, David. ”The role of Carbon Taxes in Adjusting Global Warming”. The Economic Journal. 101 (1991): 938-948. < <http://www.jstor.org/stable/2233865>>.
- Poterba, James. “Tax Policy to Combat Global Warming: On Designing a Carbon Tax”, in *Global Warming: Economic Policy Responses*, ed. Rudiger Dornbusch et al. (Cambridge: MIT Press, 1991), 71-98.
<<http://dspace.mit.edu/bitstream/handle/1721.1/50159/28596145.pdf?sequence=1>>.
- Rabe, Barry G. “States on Steroids: The Intergovernmental Odyssey of American Climate Policy.” *Review of Policy Research* 25 (2008): 105-128. DOI: 10.1111/j.1541-1338.2007.00314.x
- Reuven S. Avi-Yonah and David M. Uhlmann, “Combatting Global Climate Change: Why A Carbon Tax is a Better Response to Global Warming than Cap and Trade,” *University of Michigan Law School Public Law and Legal Theory Working Paper Series*. 42.



Policy Research Shop

- Roberta F. Mann, “The Case for the Carbon Tax.: How to Overcome Politics and Find Our Green Destiny,” *Environmental Law Reporter* 30 ELR 10125
Accessed November 2, 2010.
- “S.F Bay Area Passes Carbon Tax”. *Environmental Leader: Energy and News for Business*. 22, May 2008. <http://www.environmentalleader.com/2008/05/22/sf-bay-area-passes-carbon-tax/>.
- Shackleton, Robert et al. *The efficiency values of carbon Tax revenues*. U.S. Environmental Protection Agency, Washington D.C. (1992).
- Simpson, Jeffery. “Many Albertans agree: A carbon tax was the best solution.” *The Globe and Mail*. (2010). <http://www.theglobeandmail.com/news/opinions/many-albertans-agree-a-carbon-tax-was-the-best-solution/article1441309/>
- Snead, Mark C and Amy A. Jones. 2010. Are U.S. states equally prepared for a carbon-constrained world? *Federal Reserve Bank of Kansas City Economic Review* Fourth Quarter 2010 : 67.
- Stanton, Elizabeth A., and Frank Ackerman. “Emission Reduction, Interstate Equity, and the Price of Carbon.” *Economics for Equity and the Environment Network and Stockholm Environmental Institute – U.S. Center* (2010): 1-118.
<http://www.e3network.org/papers.html>
- Tindale, Stephen. “Carbon and Energy taxes in Europe.” *Climate Answers*.
[tp://climateanswers.info/2010/07/carbon-and-energy-taxes-in-europe/](http://climateanswers.info/2010/07/carbon-and-energy-taxes-in-europe/)
- Wilkinson, Michael et al. *CO2 Capture via Oxyfuel Firing: Optimization of a Retrofit Design Concept for a Refinery Power Station Boiler*. Washington DC. (2001).



Policy Research Shop

ENDNOTES

¹ James Poterba. "Tax Policy to Combat Global Warming: On Designing a Carbon Tax", in *Global Warming: Economic Policy Responses*, ed. Rudiger Dornbusch et al. (Cambridge: MIT Press, 1991), 71-98.

<<http://dspace.mit.edu/bitstream/handle/1721.1/50159/28596145.pdf?sequence=1>>.

² *Ibid.*

³ Richard Howarth. Interview by Lindsay Brewer, Marissa Greco, Alexi Pappas, Zach Schwartz. Hanover, NH: Dartmouth University. 3. November, 2010.

⁴ David Pearce. "The role of Carbon Taxes in Adjusting Global Warming". *The Economic Journal*. 101 (1991): 938-948. < <http://www.jstor.org/stable/2233865>>.

⁵ Gilbert Metcalf and David Weisbach. "The Design of A Carbon Tax". *Harvard Environmental Law Review*. 33 (1991): 1-58.

<http://www.law.harvard.edu/students/orgs/elr/vol33_2/Metcalf%20Weisbach.pdf>.

⁶ Mark C. Snead, Amy A. Jones. 2010. Are U.S. states equally prepared for a carbon-constrained world? *Federal Reserve Bank of Kansas City Economic Review Fourth Quarter 2010* : 67.

⁷ Frank Muller and J. Andrew Hoerner, "Greening State Energy Taxes: Carbon Taxes for Revenue and the Environment," *12 Pace Env'tl. L. Rev.* 5 (1994) Available at: <http://digitalcommons.pace.edu/pelr/vol12/iss1/2>

⁸ "Climate Action Plan Tax." City of Boulder, Colorado. Last updates Sept 24, 2010. http://www.bouldercolorado.gov/index.php?option=com_content&task=view&id=7698&Itemid=2844.

⁹ Katie Kelley. "City Approves 'Carbon Tax' in Effort to Reduce Gas Emissions." *New York Times*. (November 18, 2006). <<http://www.nytimes.com/2006/11/18/us/18carbon.html?ex=1321506000&en=0394a8cb65f3bd09&ei=5088>>

¹⁰ Carbon Tax Center: Pricing Carbon Efficiently and Effectively. "Introduction". New York, NY. Last revised 3. March 2010. <<http://www.carbontax.org/introduction>>.

¹¹ Elizabeth A Stanton, and Frank Ackerman. "Emission Reduction, Interstate Equity, and the Price of Carbon." *Economics for Equity and the Environment Network and Stockholm Environmental Institute – U.S. Center* (2010): 50.

<http://www.e3network.org/papers.html>

¹² New Hampshire Climate Change Policy Task Force. "The New Hampshire Climate Action Plan: A Plan for New Hampshire's Energy, Environmental and Economic Development Future." *New Hampshire Department of Environmental Services*. (2009): 14.

<http://des.nh.gov/organization/divisions/air/tsb/tps/climate/action_plan/nh_climate_action_plan.htm>

¹³ *Ibid.* 14

¹⁴ *Ibid.* 14

¹⁵ Elizabeth A Stanton, and Frank Ackerman. "Emission Reduction, Interstate Equity, and the Price of Carbon." *Economics for Equity and the Environment Network and*



Policy Research Shop

Stockholm Environmental Institute – U.S. Center (2010): 50.

<http://www.e3network.org/papers.html>

¹⁶ James Poterba. “Tax Policy to Combat Global Warming: On Designing a Carbon Tax”, in *Global Warming: Economic Policy Responses*, ed. Rudiger Dornbusch et al. (Cambridge: MIT Press, 1991), 85.

<<http://dspace.mit.edu/bitstream/handle/1721.1/50159/28596145.pdf?sequence=1>>.

¹⁷ Stanton, Elizabeth A., and Frank Ackerman. “Emission Reduction, Interstate Equity, and the Price of Carbon.” *Economics for Equity and the Environment Network and Stockholm Environmental Institute – U.S. Center* (2010): 50.

<http://www.e3network.org/papers.html>

¹⁸ New Hampshire Climate Change Policy Task Force. “The New Hampshire Climate Action Plan: A Plan for New Hampshire’s Energy, Environmental and Economic Development Future.” New Hampshire Department of Environmental Services. (2009): 1-74.

<http://des.nh.gov/organization/divisions/air/tsb/tps/climate/action_plan/nh_climate_action_plan.htm>

¹⁹ *Ibid.* 13

²⁰ *Ibid.* 2

²¹ Regional Greenhouse Gas Initiative, <<http://www.rggi.org/home>>.

²² “Greenhouse Gas Emissions Reduction Fund.” New Hampshire Public Utilities Commission, accessed October 31, 2010,

<http://www.puc.nh.gov/Sustainable%20Energy/GHGERF.htm>

²³ Elizabeth A Stanton, and Frank Ackerman. “Emission Reduction, Interstate Equity, and the Price of Carbon.” *Economics for Equity and the Environment Network and Stockholm Environmental Institute – U.S. Center* (2010): 37.

<http://www.e3network.org/papers.html>

²⁴ New Hampshire Climate Change Policy Task Force. “The New Hampshire Climate Action Plan: A Plan for New Hampshire’s Energy, Environmental and Economic Development Future.” New Hampshire Department of Environmental Services. (2009): 35.

<http://des.nh.gov/organization/divisions/air/tsb/tps/climate/action_plan/nh_climate_action_plan.htm>

²⁵ Barry G. Rabe, “States on Steroids: The Intergovernmental Odyssey of American Climate Policy.” *Review of Policy Research* 25 (2008): 117. DOI: 10.1111/j.1541-1338.2007.00314.x

²⁶ “Frequently Asked Questions,” Carbon Tax Center. Last modified October 15, 2008, <http://www.carbontax.org/faq>

²⁷ John Pappas. Interview by Lindsay Brewer, Marissa Greco, Alexi Pappas, Zach Schwartz. Hanover, NH: Dartmouth College. 6. November, 2010.

²⁸ Stanton E.A. "Emission Reduction, Interstate Equity, and the Price of Carbon" p. 27 *Economics for Equity and Environment*.

http://www.e3network.org/papers/Emissions_States_Carbon_081710.pdf



Policy Research Shop

- ²⁹ Corbett A. Grainger and Charles D. Kolstad, "Who Pays for a Carbon Tax?" *Environmental Resource Economics* 46 (2010): 361. Accessed November 4, 2010. doi: 10.1086/599247
- ³⁰ *Ibid.* 368
- ³¹ Kahn, Matthew and Erin Mansur. How Do Energy Prices, and Labor and Environmental Regulations Affect Local Manufacturing Employment Dynamics? A Regression Discontinuity Approach" *National Bureau of Economic Research*. November 2010. 19. <http://www.nber.org/papers/w16538>
- ³² Frank Muller and J. Andrew Hoerner, "Greening State Energy Taxes: Carbon Taxes for Revenue and the Environment," 18 *Pace Envtl. L. Rev.* 5 (1994) Available at: <http://digitalcommons.pace.edu/pelr/vol12/iss1/2>
- ³³ New Hampshire Employment Security. May 2010. *New hampshire employment projections by industry and occupation base year 2008 to projected year 2018*. New Hampshire Employment Security, Economic and Labor Market Information Bureau
- ³⁴ Gittell, Ross, Matt Magnusson and Matt Shump. "New Hampshire's Green Economy and Industries: Current employment and future opportunities." University of New Hampshire. January 2009. 16. http://carbonsolutionsne.org/resources/reports/pdf/green_jobs_report_final.pdf
- ³⁵ *Ibid* 29
- ³⁶ Frank Muller and J. Andrew Hoerner, "Greening State Energy Taxes: Carbon Taxes for Revenue and the Environment," 14-15 *Pace Envtl. L. Rev.* 5 (1994) Available at: <http://digitalcommons.pace.edu/pelr/vol12/iss1/2>
- ³⁷ *Ibid.* 15
- ³⁸ *Ibid.* 22
- ³⁹ Corbett A. Grainger and Charles D. Kolstad, "Who Pays for a Carbon Tax?" *Environmental Resource Economics* 46 (2010): 371. Accessed November 4, 2010. doi: 10.1086/599247
- ⁴⁰ *Ibid.* 373
- ⁴¹ *Ibid.* 372
- ⁴² Roberta F. Mann, "The Case for the Carbon Tax.: How to Overcome Politics and Find Our Green Destiny," *Environmental Law Reporter* 30 ELR 10125 Accessed November 2, 2010.
- ⁴³ "Overview of New Hampshire Taxes," last modified in 2007, <http://www.nh.gov/revenue/faq/gti-rev.htm>
- ⁴⁴ Gilbert E. Metcalf, "A Green Employment Tax Swap: Using a Carbon Tax to Finance Payroll Tax Relief," *Tax Reform, Energy and the Environment* http://pdf.wri.org/Brookings-WRI_GreenTaxSwap.pdf
- ⁴⁵ "Managing Impacts," Carbon Tax Center, last modified July 6, 2010, <http://www.carbontax.org/issues/softening-the-impact-of-carbon-taxes/>
- ⁴⁶ *Ibid.*
- ⁴⁷ Carbon Tax Center: Pricing Carbon Efficiently and Effectively. "Introduction". New York, NY. 2009. <http://www.carbontax.org/introduction/>.



Policy Research Shop

⁴⁸ *Ibid.*

⁴⁹ see section 5.3

⁵⁰ “Managing Impacts,” Carbon Tax Center, last modified July 6, 2010, <http://www.carbontax.org/issues/softening-the-impact-of-carbon-taxes/>

⁵¹ *Ibid.*

⁵² New Hampshire Office of Energy and Planning: New Hampshire’s 10 Year State Energy Plan. “Executive Summary”. Governor’s Office of Energy and Community Services. (2002). < <http://www.nh.gov/oep/programs/energy/StateEnergyPlan.htm>>

⁵³ “Low Emission Technology”. Last modified 2010. <<http://www.global-greenhouse-warming.com/low-emission-technology.html>>.

⁵⁴ Milne, Janet. “The Reality of Carbon Taxes in the 21st Century.” *Vermont Journal of Environmental I Law*. 1-114.

⁵⁵ *Ibid.*

⁵⁶ *ibid.*

⁵⁷ Frank Muller and J. Andrew Hoerner, "Greening State Energy Taxes: Carbon Taxes for Revenue and the Environment," 14-15 *Pace Envtl. L. Rev.* 5 (1994) Available at: <http://digitalcommons.pace.edu/pelr/vol12/iss1/2>

⁵⁸ *ibid.*

⁵⁹ *ibid.*

⁶⁰ Hughes, Brian. “Montgomery Poised for Carbon Tax to Fight Global Warming.” *Washington Examiner*. (2010). <http://www.washingtonexaminer.com/local/Montgomery-poised-to-tax-carbon-to-fight-global-warming-94204419.html>

⁶¹ Simpson, Jeffery. “Many Albertans agree: A carbon tax was the best solution.” *The Globe and Mail*. (2010). <http://www.theglobeandmail.com/news/opinions/many-albertans-agree-a-carbon-tax-was-the-best-solution/article1441309/>

⁶² *Ibid.*

⁶³ *Ibid.*

⁶⁴ Tindale, Stephen. “Carbon and Energy taxes in Europe.” *Climate Answers*. [tp://climateanswers.info/2010/07/carbon-and-energy-taxes-in-europe/](http://climateanswers.info/2010/07/carbon-and-energy-taxes-in-europe/)

⁶⁵ Milne, Janet. “The Reality of Carbon Taxes in the 21st Century.” *Vermont Journal of Environmental I Law*. 1-114.

⁶⁶ Tindale, Stephen. “Carbon and Energy taxes in Europe.” *Climate Answers*. <<http://climateanswers.info/2010/07/carbon-and-energy-taxes-in-europe/>>.

⁶⁷ Frank Muller and J. Andrew Hoerner, "Greening State Energy Taxes: Carbon Taxes for Revenue and the Environment," 14-15 *Pace Envtl. L. Rev.* 5 (1994) Available at: <http://digitalcommons.pace.edu/pelr/vol12/iss1/2>

⁶⁸ *ibid.*

⁶⁹ David Morris. “Green Taxes.” *Institute for Local Self Reliance* (1994). <<http://www.ilsr.org/ecotax/greentax.html>>.

⁷⁰ *Ibid.*

⁷¹ Milne, Janet. “The Reality of Carbon Taxes in the 21st Century.” *Vermont Journal of Environmental Law*. 1-114.



Policy Research Shop

⁷² “Climate Action Plan Tax.” *City of Boulder, Colorado*. Last updates Sept 24, 2010. http://www.bouldercolorado.gov/index.php?option=com_content&task=view&id=7698&Itemid=2844.

⁷³ Kelley, Katie. “City Approves ‘Carbon Tax’ in Effort to Reduce Gas Emissions.” *New York Times*. (November 18, 2006).

“<http://www.nytimes.com/2006/11/18/us/18carbon.html?ex=1321506000&en=0394a8cb65f3bd09&ei=5088>”

⁷⁴ “Climate Action Plan Tax.” *City of Boulder, Colorado*. Last updates Sept 24, 2010. http://www.bouldercolorado.gov/index.php?option=com_content&task=view&id=7698&Itemid=2844.

⁷⁵ “S.F Bay Area Passes Carbon Tax”. *Environmental Leader: Energy and News for Business*. 22, May 2008. <http://www.environmentalleader.com/2008/05/22/sf-bay-area-passes-carbon-tax/>.

⁷⁶ *Ibid.*

⁷⁷ “Climate Action Plan Tax.” *City of Boulder, Colorado*. Last updated Sept 24, 2010. http://www.bouldercolorado.gov/index.php?option=com_content&task=view&id=7698&Itemid=2844.

⁷⁸ “Best Practices for Energy Retrofit Program Design: Case Study Boulder, Colorado”. Home Performance Resource Center. (2010). http://www.hprcenter.org/publications/best_practices_case_study_boulder.pdf.